

AGRONOMY

Agron. 1.1 : Agricultural Heritage

(1+0)

Theory

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

Agron. 2.2 : Fundamentals of Agronomy

(3+1)

Theory

Agronomy and its scope, seeds and sowing, tillage, land configuration and sub soiling, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency. Growth and development of crops. Agro-climatic zones of India and Gujarat. Classification of field crops and Factors affecting on crop production. Drought – definition – types of drought – effect of drought on crops – management of drought. Cropping systems – mono-cropping – definition and principles of crop rotation – mixed cropping – intercropping – relay cropping – multistoried cropping – sole cropping. Soil fertility and soil productivity – fertility losses – maintenance of soil fertility – soil organic matter. Irrigation – Introduction, Importance, Definition and Objectives. Physical classification and Biological classification of water. Irrigation efficiency and water use efficiency, conjunctive use of water. Approaches for scheduling of irrigation; Methods of irrigation including micro irrigation system. Quality of irrigation water, water logging. Weeds: definition, classification and characteristics

Practical

- Identification of crops, seeds, fertilizers, pesticides and tillage implements
- Lay out and types of seed bed preparation
- Practice of different methods of sowing
- Study of yield contributing characters and yield estimation of major crops
- Seed germination and viability test
- Numerical exercises on plant population and seed rate
- Use of tillage implements-reversible plough, one way plough, harrow and leveller
- Study of sowing implements/equipment
- Measurement of field capacity, bulk density and infiltration rate
- Field layout of various irrigation methods
- To work out the labour unit and unit of work for various field operations

Agron. 3.3 : Crop Production Technology-I (Kharif Crops)

(1+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Kharif* crops. Cereals: Rice, Maize, Sorghum, Pearl millet, Vari (Little millet), Kodo millet and Finger Millet; Pulses: Pigeon pea, Green gram, Black gram and Cluster bean; Oilseeds: Groundnut, Castor, Sesame and Soybean; Fiber crops: Cotton and Jute; Forage crops: Sorghum, Cowpea and Napier hybrid and Fodder maize; Cash crop: Bidi tobacco; Green manure Crops: Sunhemp and Dhaincha.

Practical

- Identification of crops and seed
- Field lay-out of different method of rice nursery including /SRI
- Seed treatment and sowing of major crops

- Effect of seed size on germination and seedling vigour of kharif crops
- Effect of sowing depth and methods on germination crops
- To study various methods of fertilizer application
- Study of growth and yield contributing characters
- Visit to the agronomic and forage experiments
- Numerical exercises on fertilizer, seed requirement and plant population
- To work out the cost of cultivation

Agron. 4.4 : Crop Production Technology-II (Rabi Crops)

(1+1)

Theory

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; Cereals: Wheat and Barley; Pulses: Chickpea and Peas; Oilseed: Rapeseed, Mustard, Linseed and Sunflower; Sugar crops: Sugarcane and Sugar beet; Medicinal and Aromatic crops: Mentha (mint), Lemon grass, Isabgul and Citronella; Forage crops: Oat, Lucerne and Berseem, Spice crops: Coriander, Fennel, Dill seed, Ajwain, Fenugreek and Cumin; Commercial crop: Chicory.

Practical

- Identification of crops and seed
- Sowing methods of wheat and sugarcane
- Seed treatment of different rabi crops
- Effect of sowing depth and methods on germination crops
- Study of growth and yield contributing characters
- Visit to the agronomic and forage experiments
- Numerical exercises on fertilizer, seed requirement, plant population and seed index
- Judging the maturity and harvesting techniques
- To work out the cost of cultivation

Agron. 4.5 : Weed Management

(2+1)

Theory

Introduction, definition, losses, utilization, characteristics of weeds. Classification, reproduction and dissemination of weeds. Weed persistency and biology. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture. Concept of herbicide mixture and utility in agriculture. Integration of herbicides with non-chemical methods of weed management. Herbicide Resistance and its management.

Practical

- Weed identification and their losses study
- Biology of important weeds
- Techniques of weed preservation
- Herbicide label information and precautions in use of herbicides
- Study of herbicide formulations and mixture of herbicide
- Shifting of weed flora study in long term experiments
- Study of methods of herbicide application and spraying equipments
- Calculations of herbicide doses, weed control efficiency and weed index
- Weed control in non-cropped areas
- Study of aquatic and parasitic weeds
- Bio assay study for detection of herbicide residues in succeeding crops

Agron. 5.6 : Farming System and Sustainable Agriculture**(1+0)****Theory**

Farming System-scope, importance, concept and effects of modern agriculture System, Systems approach, Farming system, Farming systems concept, Principles of farming system, Characteristics and objective of farming system. Farming system components and their maintenance. Cropping system and pattern, multiple cropping system. Allied enterprises and their importance. Tools for determining production and efficiencies in cropping and farming system. Conservation agriculture strategies in agriculture HEIA 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

Agron. 5.7 : Geo-informatics and Precision Farming**(1+1)****Theory**

Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; 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; STCR approach for precision agriculture;

Practical

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

Agron. 5.8 : Practical Crop Production- I (Kharif Crops)**(0+1)****Practical**

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying, winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

Agron. 6.9 : Principles of Organic Farming**(1+1)****Theory**

Organic farming, principles and its scope in India; Components of organic farming, 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, packaging, labelling, economic considerations and marketing and export potential of organic products.

Practical

- Preparation of enrich compost, vermin-compost, bio-fertilizers/bio-inoculants
- Indigenous technology knowledge (ITK) for nutrient management
- Non chemical approach for insect, pest disease and weed management
- Cost of organic production system
- Post-harvest management; Quality aspect, grading, packaging and handling.
- Certification procedure for organic production
- Visit of organic farms to study the various components and their utilization

Agron. 6.10 : 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.

Practical

- Studies on climate classification
- Studies on rainfall pattern in rainfed areas of the country and pattern of onset and withdrawal of monsoons
- Studies on cropping pattern of different rainfed areas in the country
- Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops
- Studies on cultural practices for mitigating moisture stress
- Field demonstration on soil & moisture conservation measures
- Field demonstration on construction of water harvesting and recharging structures.
- Visit to rainfed research station/watershed

Agron. 6.11 : Practical Crop Production-II (Rabi Crops)

(0+1)

Practical

Crop planning, raising field crops in multiple cropping systems: Field preparation, seed, treatment, nursery raising, sowing, nutrient, water and weed management and management of insect-pests diseases of crops, harvesting, threshing, drying, winnowing, storage and marketing of produce. The emphasis will be given to seed production, mechanization, resource conservation and integrated nutrient, insect-pest and disease management technologies. Preparation of balance sheet including cost of cultivation, net returns per student as well as per team of 8-10 students.

AGRIL CHEMISTRY AND SOIL SCIENCE**Ag. Chem. 1.1 : 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- Methods of particle size analysis, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition; source, amount and flow of heat in soil; soil temperature and plant growth; Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and microorganisms, their beneficial and harmful effects.

Practical

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

Ag. Chem. 2.2 : Manures, Fertilizers and Soil Fertility Management**(2+1)****Theory**

Classification and importance of organic manures, properties and methods of preparation of bulky manures. Green/leaf manuring. Transformation reactions of organic manures in soil and importance of C:N ratio in rate of decomposition. 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.

Practical

Determination of moisture and organic matter content from manures samples. Estimation of N, P, K & S from manure sample. Determination of N from urea fertilizers. Determination of $\text{NH}_4\text{-N}$, $\text{NO}_3\text{-N}$ from nitrogenous fertilizers. Determination of P from phosphatic fertilizer. Determination of K from potassic fertilizer. Determination of S from sulphur fertilizer. Estimation of available N, P, K, S and micro nutrient (Fe, Mn, Zn, Cu) from soil sample.

Ag. Chem. 3.3 : Problematic Soils and their Management**(2+1)****Theory**

Soil quality and health, Distribution of Waste land and problematic soils in Gujarat and India. Their categorization based on properties. Reclamation and management of Saline and sodic soils, Acid soils, Acid Sulphate soils, Eroded and Compacted soils, Flooded soils, Polluted soils. Irrigation water – quality and standards, utilization of saline water in agriculture. Remote sensing and GIS in diagnosis and management of problematic soils. Multipurpose tree species, bio remediation through MPTs of soils, land capability and classification, land suitability classification. Problematic soils under different Agro-climatic zones of Gujarat.

Practical

Preparation of saturated paste of problematic soil. Determination of pHs and ECe of saturation extract of problematic soil. Estimation of water soluble and exchangeable cations in soil and computation of SAR and ESP and characterization of problematic soil. Determination of Gypsum requirement of alkali / sodic soil. Determination of lime requirement of acidic soil. Determination of quality of irrigation water (pH, EC, Ca, Mg, Na, CO₃, HCO₃, Cl, SAR and RSC).

AGRIL. ECONOMICS

Ag. Econ. 2.1 : Fundamentals of Agricultural Economics

(2+0)

Theory

Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macroeconomics, 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. Agricultural planning and development in the country. *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, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. *Laws of returns*: Law of variable proportions and law of returns to scale. Cost: Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply. 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. *Economic systems*: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning. Forms of business organizations, international trade and balance of payments. GST and its implication on Indian economy.

Ag. Econ. 3.2 : Agricultural Finance and Co-Operation

(2+1)

Theory

Agricultural Finance- meaning, scope and significance, credit needs and its role in Indian agriculture. Agricultural credit: meaning, definition, need, classification. Credit analysis: 4 R's, and 3C's of credits. Sources of agricultural finance; institutional and non-institutional sources, commercial banks, social control and nationalization of commercial banks, Micro financing including KCC. Lead bank scheme, RRBs, Scale of finance and unit cost. An introduction to higher financing institutions – RBI, NABARD, ADB, IMF, World Bank, Insurance and Credit Guarantee Corporation of India. Cost of credit. Recent development in agricultural credit. Preparation and analysis of financial statements – Balance Sheet and Income Statement. Basic guidelines for preparation of project reports- Bank norms – SWOT analysis. Agricultural Cooperation – Meaning, brief history of cooperative development in India, objectives, principles of cooperation, significance of cooperatives in Indian agriculture. Agricultural Cooperation in India- credit, marketing, consumer and multi-purpose cooperatives, farmers' service cooperative societies, processing cooperatives, farming cooperatives, cooperative warehousing; role of ICA, NCUI, NCDRC, NAFED. 3 R's, 5 C's and 7 P's of credit. Crop insurance; its scope, significance and limitations and the potential of the newly launched 'Pradhan Mantri Fasal Bima Yojana' (Prime Minister's Crop Insurance Scheme). Successful cooperative systems in Gujarat (AMUL), Tamil Nadu (Aavin), Karnataka (Nandini), Maharashtra and Punjab.

Practical

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

Ag. Econ. 4.3 : 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; demand, supply and producer's surplus of agri-commodities: nature and determinants of demand and supply of farm products, producer's surplus – meaning and its types, marketable and marketed surplus, factors affecting marketable surplus of agri-commodities; pricing and promotion strategies: pricing considerations and approaches – cost based and competition based pricing; market promotion – advertising, personal selling, sales promotion and publicity – their meaning and merits & demerits; marketing process and functions: Marketing process-concentration, dispersion and equalization; exchange functions – buying and selling; physical functions – storage, transport and processing; facilitating functions – packaging, branding, grading, quality control and labeling (Agmark); Market functionaries and marketing channels: Types and importance of agencies involved in agricultural marketing; meaning and definition of marketing channel; number of channel levels; marketing channels for different farm products; Integration, efficiency, costs and price spread: Meaning, definition and types of market integration; marketing efficiency; marketing costs, margins and price spread; factors affecting cost of marketing; reasons for higher marketing costs of farm commodities; ways of reducing marketing costs; Role of Govt. in agricultural marketing: Public sector institutions- CWC, SWC, FCI, CACP & DMI – their objectives and functions; cooperative marketing in India; Risk in marketing: Types of risk in marketing; speculation & hedging; an overview of futures trading; Agricultural prices and policy: Meaning and functions of price; administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR. Role of government in agricultural marketing. Role of APMC and its relevance in the present day context.

Practical

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

Ag. Econ. 6.4 : Farm Management, Production and Resource Economics (2+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; concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, 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. appraisal of farm resources, selection of crops and livestock's enterprises. Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation. Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources. Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

Practical

Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. Collection and analysis of data on various resources in India.

AGRIL. ENGINEERING**Ag. Engg. 2.1 : 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. 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. Surveying: Field area calculation. Machineries required for land levelling

Practical

General status of soil conservation in India. Calculation of erosion index. Estimation of soil loss. Measurement of soil loss. Preparation of contour maps. of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problem on wind erosion. Water lifting pump capacity, power calculation required

Ag. Engg. 3.2 : 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, Criteria for write selection of tractor and machine implements

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.

Practical

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

Ag. Engg. 4.3 : Renewable Energy and Green Technology (1+1)**Theory**

Classification of energy sources, contribution of these 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. Availability of bio mass and their application in different places

Practical

Familiarization with renewable energy gadgets. To study biogas plants, To study gasifier, To study the production process of biodiesel, To study briquetting machine, To study the production process of bio-fuels. Familiarization with different solar energy gadgets. To study solar photovoltaic system: solar light, solar pumping, solar fencing. To study solar cooker, To study solar drying system. To study solar distillation and solar pond. Solar Wind hybrid system. Field visit to Solar –Wind farm.

Ag. Engg. 5.4 : 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, recirculatory dryer and solar dryer). Material handling equipment; conveyer and elevators, their principle, working and selection.

Practical

Study of different type of greenhouses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside greenhouse. Study of greenhouse equipments. Visit to various Post Harvest Laboratories. Determination of Moisture content of various grains by oven drying & infrared moisture methods. Determination of engineering properties (shape and size, bulk density and porosity of biomaterials).Determination of Moisture content of various grains by moisture meter. Field visit to seed processing plant. Storage structure

AGRIL. ENTOMOLOGY

Ag. Ento. 3.1 : Fundamentals of Entomology Credit ours

(2+1)

Theory

Part – I: History of Entomology in India. Factors for insect's abundance. Major points related to dominance of Insecta in Animal kingdom. Classification of phylum Arthropoda up to classes. Relationship of class Insecta with other classes of Arthropoda. Harmful and useful insects.

Part–II: Morphology: Structure and functions of insect cuticle, moulting and body segmentation. Structure of Head, thorax and abdomen. Structure and modifications of insect antennae, mouth parts, legs, wing venation, modifications and wing coupling apparatus. Metamorphosis and diapause in insects. Types of larvae and pupae.

Part–III: Structure of male and female genital organs. Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive systems in insects. Types of reproduction in insects. Major sensory organs

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

Practical

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

Ag. Ento. 4.2 : Principles of Integrated Pest Management

(1+1)

Theory

Part-I: 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 agro-ecosystem

Part-II: Categories of insect pests, IPM: Introduction, history, 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) and chemical control (Importance, hazards and limitations)] Classification of insecticides, toxicity of insecticides and formulations of insecticides, Insecticides Act 1968-Important provisions. Application techniques of spray fluids. Phytotoxicity of insecticides. Symptoms of poisoning,

first aid and antidotes. Introduction to conventional pesticides for the insect pest's management. Implementation and impact of IPM (IPM module for Insect pests. Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes.

Part-III: Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation, transgenic, nano technology as well as genetic control. Practices, scope and limitations of IPM.

Part-IV: Economic importance of insect pests. Methods of detection and diagnosis of insect pest. Importance of Economic threshold level. Ecological management of crop environment. Pest surveillance and pest forecasting.

Practical

Methods of diagnosis and detection of various insect pests. Methods of insect pest sampling. Assessment of crop yield losses. Calculations based on economics of IPM (ICBR/ NICBR/ CBR). Identification of biocontrol agents, Crop (agro-ecosystem) dynamics of a selected insect pests. Plan & assess preventive strategies (IPM module) and decision making. Crop monitoring attacked by insect pests. Awareness campaign at farmers' fields. Pesticide formulations and calculation of spray fluid and doses.

Ag. Ento. 4.3 : Management of Beneficial Insects

(1+1)

Theory

Part-I: Importance of beneficial Insects, Beekeeping, pollinating plant and their cycle, bee biology, species of honey bees, commercial methods of rearing, equipment used, seasonal management, bee enemies and diseases. Bee pasturage, bee foraging and communication. Division and uniting of honey bee boxes. Toxicity of pesticides to honey bees.

Part-II: Types of silkworm, voltinism and biology of silkworm. Mulberry/castor cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing and mounting larvae and harvesting of cocoons. Pest and diseases of silkworm and management. Rearing appliances of mulberry silkworm and methods of disinfection.

Part-III: Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. Enemies of lac insects.

Part-IV: Identification of major parasitoids and predators commonly being used in biological control. 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.

Practical

Honey bee species, castes of bees. Beekeeping appliances and seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Division and uniting of honey bee boxes. Migration of honeybee boxes. Types of silkworm, voltinism and biology of silkworm. Mulberry/castor cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of other important pollinators, weed killers and scavengers. Insect orders bearing predators and parasitoids used in pest control and their mass multiplication techniques. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies.

Ag. Ento 5.4 : Pests of Field Crops Stored Grains and their Management

(1+1)

Theory

General account on nature and types of damage by different arthropods pests. scientific name, order, family, host range, distribution, biology and bionomics, nature of damage and management of insect and non-insect pests of paddy, sorghum, maize, pearl millet, ragi (Eleusine coracana), wheat, sugarcane, cotton, sunnhemp, pulses, groundnut, castor, sesame (gingerly), safflower, sunflower, mustard, soybean and Narcotics (tobacco). Common

phytophagous mites, rodents, snail, slug, crab and bird pests. Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods.

Practical

Identification, damage symptoms and management of pests of paddy, pearl millet, sorghum, maize, wheat, sugarcane, cotton, pulses, tobacco, groundnut, sesame (gingerly), sunflower, castor, mustard, soybean and safflower; identification of common phytophagous mites and their morphological characters; Identification of rodents and bird pests. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food, Delhi/ Visit to nearest FCI/ civil supplies godowns.

Ag. Ento 6.5 : Pests of Horticultural Crops and their Management

(1+1)

Theory

Distribution, biology, nature and symptoms of damage and management strategies of insect and non-insect pests of vegetable crops viz., brinjal, okra, tomato, potato, cruciferous and cucurbitaceous vegetables; pulse vegetables; leafy vegetables (spinach, amaranthus); sweet potato, elephant foot, yam, colacasia, moringa; spices crops (chilies, onion, turmeric, garlic, ginger, coriander, cumin, fennel, fenugreek and curry neem leaf); fruit trees (mango, sapota, citrus, banana, cashew, pomegranate, custard apple, aonla, ber, guava, papaya and grape vine) and plantation crops (coconut, arecanut and date palm and ornamental plants). Plant protection in protected cultivation.

Practical

Identification and nature of damage of pests of solanaceous vegetables; malvaceous vegetables; cruciferous crops; cucurbitaceous crops; chilies, onion and garlic; turmeric, ginger and colacasia; curry neem leaf, pulse vegetable, leafy vegetables; spinach, amaranthus and coriander, cumin, fennel, fenugreek; mango and sapota; guava, pomegranate and custard apple; citrus, ber, papaya, grape vine, moringa and aonla; coconut, areca nut and date palm; banana and cashew; ornamental plants.

AGRIL. EXTENSION

Ag. Ext. 3.1 : Fundamentals of Agricultural Extension Education

(2+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 planning. Extension systems in India (TOT). Extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, CDP, NES etc.) various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, IVLP, ORP, ND, NATP, NAIP, etc. Name, Year with Important Remarks) Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India viz. Panchayat Raj System, Rashtriya Krishi Vikas Yojana, Antyodaya Anna Yojana, Deendayal Upadhyaya Gramin Koushalya Yojana, Deendayal Disable Rehabilitation Scheme, Gramin Bandharan Yojana, Rural Housing (Indira Awas Yojana) Integrated Child Development Scheme, Integrated Rural Development Programme, Livestock Insurance Scheme, Mahatma Gandhi National Rural Employment Guarantee Act, National Food Security Mission, National rural Livelihood mission, pradhanmantri Awas Yojana, Swarnjayanti Gram Swarozgara Yojana (Name, Year with Important Remarks). New trends in agriculture extension: KVK, ATMA, ATIC in detail , Brief about privatization extension, cyber extension/e-extension, market-led-extension, farmer-led -extension, expert systems, etc. Monitoring and evaluation- concept and definition, monitoring and evaluation of extension programmes. Transfer of Technology- Concept and models

Practical

A visit to understand the problems being encountered by the villagers/farmers. Preparation of Interview Schedule and data analysis for farmers. Study the organization and functioning of Gram Panchayat. Study the organization and functioning of Cooperative. Study the organization and functioning of NGO. To visit and study of KVK. To visit and study of SSK. To visit and study of ATIC. PRA techniques and its application in planning of village development activities.

Ag. Ext. 4.2 : Rural Sociology and Educational Psychology

(2+0)

Theory

Sociology and Rural sociology: Definition and scope, its significance in agriculture extension, Rural society, Social Groups, Social Stratification, Culture concept, Social Institution, Social Change & Development. Educational psychology: Meaning & its importance in agriculture extension. Behavior: Cognitive, affective, psychomotor domain, Personality, perception, Instincts, Emotion, Frustration

Motivation, Theories of Motivation, Types, Classification of Motives, Techniques of motivation and Role of Motivation in Agricultural Extension. Teaching-Learning: Meaning, Definition, Learning process, Learning experience and Learning situation its elements and characteristics. Rural Leadership: concept and definition, types of leaders in rural context, methods of identifying the leader.

Ag. Ext. 5.3 : Communication Skills and Personality Development

(1+1)

Theory

Communication: meaning, definition and importance. Models of communication process with its key elements. Principles, Functions and level of Communication. Fidelity and barriers in communication. Communication skill- definition and types of communication skills.

Extension teaching methods: meaning, classification, individual, group and mass contact methods. Transfer of technology: concept and models. Training centers (MANGE, EEI, SAMETI, KVK) for capacity building of extension personnel. ICT Application in TOT (New and Social Media), media mix strategies. Agriculture Journalism. Importance and advantages. Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories. Personality: definition, meaning and nature. Importance of personality, Traits, Types and characteristics of personality. Factors influencing the growth and development of personality. Methods of measuring personality. Advantages and disadvantages of personality.

Practical

Acquaint with university extension system. Organizing the Group Discussion. Handling and use of audio-visual equipments.(Digital camera and LCD Projector).Preparation and use of audio-visual aids. Preparation of extension literatures (Leaflet, Booklet, Folder, Pamphlet, News and Success stories). Skill exercise on preparing of ppt for effective presentation. Exposure visit to mass media station (Community radio and television studio for understanding the process of programmes production).Script writing for print and electronic medias (Developing script for print, radio and television). Skills for facing an interview

Ag. Ext. 6.4 : 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. Role of economic reforms viz. Agri-clinics, Agribusiness/Agri-enterprises, Entrepreneurial Development. 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. Extension administration: meaning and concept, principles and functions.

Practical

Assessing entrepreneurial traits of entrepreneur. Exercise on problem solving skills. Exercise on managerial skills. Exercise on achievement motivation. Collection of traditional wisdom in agricultural field. Time audit through planning, monitoring and supervision (PERT). Identification and selection of business idea. Preparation of business plan and proposal writing. Exposure to entrepreneurship development institution (GDI, Gandhinagar) and Successful entrepreneurs (Input Dealers/ Bio-pesticide/ Vermi-compost). Exposure of NABARD, GFSC etc.

AGRIL STATISTICS

Ag. Stat. 1.1 : Agricultural Informatics

(2+1)

Theory

- Introduction to Computers
- Anatomy of Computers
- Memory Concepts, Units of Memory
- Operating System, definition and types
- Applications of MS-Office for creating, Editing and Formatting a document
- Data presentation, tabulation and graph creation, statistical analysis, mathematical expressions
- Database, concepts and types, creating database, uses of DBMS in Agriculture
- Internet and World Wide Web (WWW), Concepts and components
- e-Agriculture, concepts, design and development
- Application of innovative ways to use information and communication technologies (IT) in Agriculture
- Computer Models in Agriculture: statistical, weather analysis and crop simulation models, concepts, structure, inputs-outputs files, limitation, advantages and application of models for understanding plant processes, sensitivity, verification, calibration and validation
- IT application for computation of water and nutrient requirement of crops
- Computer-controlled devices (automated systems) for Agri-input management
- Smartphone mobile apps in Agriculture for farm advises, market price, postharvest management etc.
- Geospatial technology, concepts, techniques, components and uses for generating valuable agri-information
- Decision support systems, concepts, components and applications in Agriculture
- Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions
- Preparation of contingent crop-planning and crop calendars using IT tools

Practical

- Study of Computer Components, accessories, practice of important DOS Commands
- Introduction of different operating systems such as windows, Unix/ Linux, Creating, Files & Folders, File Management
- Use of MS-WORD and MS Power-point for creating, editing and presenting a scientific Document
- MS-EXCEL - Creating a spreadsheet, use of statistical tools, writing expressions, creating graphs, analysis of scientific data, handling macros
- MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system
- Introduction to World Wide Web (WWW) and its components. Hands on practice on Crop Simulation Models (CSM), DSSAT/Crop-Info/Crop Syst/ Wofost
- Preparation of Inputs file for CSM and study of model outputs, computation of water and nutrient requirements of crop using CSM and IT tools
- Use of smart phones and other devices in agro-advisory and dissemination of market information
- Introduction of Geospatial Technology, for generating information important for Agriculture.
- Hands on practice on preparation of Decision Support System. Preparation of contingent crop planning

Ag. Stat. 2.2 : Statistical Methods**(2+1)****Theory**

Introduction to Statistics and its applications in Agriculture. Graphical representation of data, Measures of central tendency & dispersion. Definition of probability, addition and multiplication theorem (without proof). Simple problems based on probability. Normal distribution. Definition of correlation, scatter diagram. Karl Pearson's coefficient of correlation linear regression equations. Introduction to test of significance, one sample & two sample test t for means, Large sample test (Z test), Chi-square test of independence of attributes in 2×2 contingency table. Introduction to analysis of variance, principle of experimental designs, analysis of one way classification (CRD and RBD). Introduction to sampling methods, Sampling versus complete enumeration, simple random sampling with and without replacement, use of random number tables for selection of simple random sample.

Practical

Graphical representation of data. Measures of central tendency (Ungrouped data) with calculation of quartiles, Deciles & percentiles. Measures of central tendency (Grouped data) with calculation of quartiles, Deciles & percentiles. Measures of dispersion (Ungrouped Data). Measures of dispersion (Grouped Data). Moments, measures of skewness & kurtosis (Ungrouped Data). Moments, measures of skewness & kurtosis (Grouped Data). Correlation & regression analysis. Application of one sample t-test. Application of two sample fisher's t-test. Chi-square test of goodness of fit. Chi-Square test of independence of attributes for 2×2 contingency table. Analysis of variance one way classification. Selection of random sample using simple random sampling.

BIO-CHEMISTRY**Biochem. 2.1 : Fundamentals of Plant Biochemistry****(2+1)****Theory**

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Introduction to secondary metabolites, Enzymes: General properties; Classification; Introduction to allosteric enzymes. Applications of enzymes. Vitamins and mineral nutrition for human health. Nucleic acids: Importance and classification; Chemical and physical properties of nucleic acids. Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Pentose phosphate pathway, Glyoxylate cycle, Electron transport chain. Substrate level and photo phosphorylation reaction, Metabolism of lipids: Beta oxidation, Transamination reaction

Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Quantitative analysis of DNA and RNA Estimation of ascorbic acid and calcium by titration method Estimation of total phenols/plant pigments/total alkaloids.

Biotech 5.1 : Introductory Biotechnology**(1+1)****Theory**

History of Biotechnology, Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Concept of central dogma; DNA replication, Transcription and Translation, Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

Practical

Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration of isolation and quantification of nucleic acids. Demonstration of gel electrophoresis techniques and DNA finger printing.

GENETICS AND PLANT BREEDING

GPB 1.1 : Introductory Biology

(1+1)

Theory

Introduction to the living world, diversity and characteristics of life, origin of life, Evolution and Eugenics. Introduction and characteristics of plant, Binomial nomenclature and classification Cell and cell division. Morphology and Micro-morphology of flowering plants. Seed and seed germination. Introduction to plant taxonomy and plant systematic. Role of animals in agriculture.

Practical

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

GPB 2.2 : Fundamentals of Genetics

(2+1)

Theory

Introduction to genetics; Cell division: mitosis and meiosis; Mendelian principles of heredity; Study of chromosome structure; Multiple alleles, pleiotropism and pseudoalleles and blood group genetics; Linkage and its estimation, crossing over mechanisms, chromosome mapping; Sex determination and sex linkage, sex limited and sex influenced traits; Qualitative and quantitative traits, polygenes and continuous variations, multiple factor hypothesis; Cytoplasmic inheritance; Mutation- classification, Methods of inducing mutation and CIB technique, mutagenic agents and induction of mutation; Structural and numerical changes in chromosome; Nature, structure and replication of genetic material; Protein synthesis- transcription and translational mechanism of genetic material; Gene concept- gene structure and functions; Gene regulation- Lac and Trp operons.

Practical

Study of Microscope; Study of cell structure and functions; Practice on mitotic and meiotic cell division; Experiments on monohybrid, dihybrid, trihybrid, back cross and test cross; Chi-square test; Epistatic interactions; Determination of linkage and cross over analysis (through two point test cross and three point test cross data)

GPB 3.3 : Fundamentals of Plant Breeding

(2+1)

Theory

Historical development, concept, nature and role of plant breeding, major achievements; Modes of reproduction and apomixes; Self- incompatibility and male sterility- genetic consequences and cultivar options. Domestication, acclimatization, introduction; Centre of origin/diversity, Genetic basis and breeding methods in self- pollinated crops- mass selection and pure line selection, hybridization techniques and handling of segregating population (pedigree, bulk, SSD and back cross methods); Multiline concept; Genetic basis and methods of breeding cross-pollinated crops; 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.

Practical

Plant Breeder's kit; Study of germplasm of various crops (plant genetic resources, gene pool and its conservation); Mode of pollination; To work out the mode of pollination in a given crop and extent of natural out crossing; Consequences of inbreeding on genetic structure of resulting populations; Emasculation and hybridization techniques in self and cross pollinated

crops; Concepts of population genetics and Hardy-Weinberg Law; Estimation of heterosis and inbreeding depression; Methods of calculating mean, range, variance, standard deviation; Designs used in plant breeding experiments; Analysis of Randomized Block Design; Component of genetic variation- heritability and genetic advance. Prediction of performance of double cross hybrids.

GPB 4.4 : Principles of Seed Technology

(2+1)

Theory

Seed and seed technology: introduction, definition and importance; Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, characters of good quality seed and different classes of seed; Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables; Seed certification, phases of certification, procedure for seed certification, field inspection; Seed Act and Seed Act enforcement, Duty and powers of seed inspector, offences and penalties, Seeds control order 1983; Varietal identification through grow out test and electrophoresis, molecular and biochemical test; Detection of genetically modified crops, transgene contamination in non-GM crops, GM crops and organic seed production; Seed drying, processing and their steps; Seed testing for quality assessment; Seed treatment, its importance, method of application and seed packing; Seed storage- general principles, stages and factors affecting seed longevity during storage, measures for pest and disease control during storage; Seed marketing-structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, role of WTO and OECD in seed marketing.

Practical

Seed production in major cereals- wheat, rice, maize, sorghum and bajra; Seed production in major pulses- pigeonpea, green gram, black gram, chickpea; Seed production in major oilseeds- groundnut, sesame, soybean, mustard, castor; Seed production in cotton; Seed production in vegetable crops- tomato, brinjal, chillies and okra. Seed sampling and physical purity test; Germination and viability test; Seedling vigour test; Genetic purity test-grow out test and electrophoresis. Procedure of seed certification; Field inspection and preparation of field inspection report. Visit to seed production farms; Visit to seed testing laboratories; Visit to seed processing plant.

GPB 4.5 : Intellectual Property Rights

(1+0)

Theory

Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO; Treaties for IPR protection- Madrid protocol, Berne Convention, Budapest treaty, etc.; Types of Intellectual Property and legislations covering IPR in India- Patents, Copyrights, Trademark, Industrial design, Geographical indications, Integrated circuits, Trade secrets; Patents Act 1970 and patent system in India, patentability, process and product patent, filing of patent, patent specification, patent claims, patent opposition and revocation, infringement, compulsory licensing, Patent Cooperation Treaty, patent search and patent database; Origin 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 and farmer's rights. Registration of plant varieties under PPV&FR Act 2001, Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing. International treaty on plant genetic resources for food and agriculture (ITPGRFA).

GPB 5.6 : Crop Improvement – I (*Kharif* Crops)**(1+1)****Theory**

Botanical Name, family, chromosome number, centre of origin, nature of pollination, list of wild relatives (donor parents for different characters), distributions of species of 18 selected crops (rice, maize, sorghum, pearl millet, pigeonpea, mungbean, soybean, groundnut, sesame, castor, cotton, tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber); Floral biology as well as study of genetics of qualitative and quantitative characters of rice, maize, sorghum, pearl millet, pigeonpea, mungbean, soybean, groundnut, sesame, castor, cotton, tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber; Breeding methods of rice, maize, sorghum, pearl millet, pigeonpea, mungbean, soybean, groundnut, sesame, castor, cotton, tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber; Major breeding objectives (including quality parameters) of rice, maize, sorghum, pearl millet, pigeonpea, mungbean, soybean, groundnut, sesame, castor, cotton, and tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber; Ideotype concept for Rice, Pigeonpea, and Cotton. International, National and State level research station and varieties/hybrids released of rice, maize, sorghum, pearl millet, pigeonpea, mungbean, soybean, groundnut, sesame, castor, cotton, tobacco, okra, bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber.

Practical

Emasculation and hybridization techniques rice, maize, sorghum, pearl millet; Emasculation and hybridization techniques in pigeonpea and mungbean; Emasculation and hybridization techniques in soybean, groundnut, sesame, castor, cotton; Emasculation and hybridization techniques in tobacco and okra; Emasculation and hybridization techniques in bottle gourd, bitter gourd, ridge gourd, smooth gourd and cucumber; Maintenance breeding of different *kharif* crops; Detailed procedure of hybrid seed production of maize, pearl millet and cotton and castor etc.; Visit to seed production plots and submission of report; Visit to AICRP plots of different field crops and submission of report.

GPB 6.7 : Crop Improvement – II (*Rabi* Crops)**(1+1)****Theory**

Botanical Name, family, chromosome number, centre of origin, nature of pollination, list of wild relatives (donor parents for different characters), distributions of species of 14 selected crops (wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander); Floral biology as well as study of genetics of qualitative and quantitative characters of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander; Breeding methods of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander; Major breeding objectives (including quality parameters) of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander; Ideotype concept for wheat, mustard and tomato; Climate resilient crop varieties for future. e.g short-duration crops and high temperature tolerance in wheat and chickpea; International, National and State level research station and varieties/hybrids released of wheat, chickpea, mustard, sunflower, potato, lucerne, sugarcane, tomato, brinjal, chilies, onion, garlic, cumin and coriander.

Practical

Emasculation and hybridization techniques wheat; Emasculation and hybridization techniques in chickpea; Emasculation and hybridization techniques in mustard and sunflower; Emasculation and hybridization techniques in potato and sugarcane; Emasculation and hybridization techniques in Lucerne; Emasculation and hybridization techniques in tomato, brinjal and chilies; Emasculation and hybridization techniques in onion and garlic; Emasculation and hybridization techniques in cumin and coriander; Maintenance breeding of different *rabi* crops; Detailed procedure of hybrid seed production of mustard, sunflower, and onion; Visit to seed production plots and submission of report; Visit to AICRP plots of different field crops and submission of report

HORTICULTURE

Hort. 1.1 : Fundamentals of Horticulture

(1+1)

Theory

Horticulture-Its definition and branches, importance and scope; horticultural and botanical classification; climate and soil for horticultural crops; Plant propagation-methods and propagating structures; principles of orchard establishment; Principles and methods of training and pruning, bahar treatment, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; kitchen gardening; garden types and parts; lawn making; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity.

Practical

Identification of garden tools. Identification of horticultural crops. Preparation of seed bed/nursery bed. Practice of sexual and asexual methods of propagation. Layout and planting of orchard plants. Training and pruning of fruit trees. Transplanting and care of vegetable seedlings. Making of herbaceous and shrubby borders. Preparation of potting mixture, potting and repotting. Fertilizer application in different crops. Visits to commercial nurseries/orchard.

Hort. 2.2 : Production Technology for Fruit and Plantation Crops

(1+1)

Theory

Importance and scope of fruit and plantation crop industry in India; High density planting; Use of rootstocks; Production technologies for the cultivation of major fruits-mango, banana, citrus, grape, guava, papaya, apple, pomegranate, Sapota, Custard apple minor fruits: jackfruit, strawberry, pineapple, Ber and Jamunplantation crops- major coconut, arecanut, cashew minor :, tea, coffee & rubber.

Practical

Description and identification of important varieties of fruit and plantation crops. Seed propagation .Scarification and stratification of seeds. Propagation methods for fruit and plantation crops including Micro-propagation. Description and identification of fruit. Preparation of plant bio regulators and their uses, and physiological disorders of above fruit and plantation crops, Visit to commercial orchard.

Hort. 3.3 : Production Technology for Vegetable and Spices

(1+1)

Theory

Importance of vegetables & spices in human nutrition and national economy, brief about origin, area, production, improved varieties and cultivation practices such as time of sowing, sowing method, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting, storage, physiological disorders, disease and pest control and seed production of important vegetable and spices.

Major crops: Fruit vegetables : Brinjal, Tomato, Chilli, Okra Cucurbits : Bottle gourd, , Water melon Cole crops : Cabbage and cauliflower Tuber : Potato Spices : Turmeric, Ginger, Cardamom, Black paper, Clove Minor crops: Cucurbits : Cucumber, Ridge gourd, bitter gourd, Pointed gourd, Musk melon Legumes: Pea, Cluster bean, Cowpea Root vegetables : Radish, Carrot, Beet root Tuber : and Sweet potato Leafy vegetables : Palak and Amaranthus Bulb crops : Onion, Garlic Spices: Fennel, Cumin, Fenugreek, Coriander

Practical

Identification of vegetables & spices crops and their seeds. Types of vegetable garden, Kitchen garden, Direct seed sowing and transplanting. Fertilizers applications. Raising of nursery of vegetables & spices. Vegetables & spices seed extraction. Harvesting & preparation for market.

Hort. 4.4 : Production Technology for Ornamental Crops, MAPs and Landscaping**(1+1)****Theory**

Importance and scope of ornamental crops, medicinal and aromatic plants and landscaping. Principles of landscaping. Landscape uses of trees, shrubs and climbers. Production technology of important flower crops major- rose, gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers major like marigold, jasmine, gaillardia and spider lily under open conditions. Production technology of major medicinal plants like ashwagandha, isabgol, guggule and senna with minor like asparagus, aloe, periwinkle, and major aromatic plants like rose with minor like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce

Practical

Identification of ornamental plants. seasonal annuals, Identification of medicinal and aromatic Plants. Garden adornments & features, Training and pruning of ornamental plants. Planning and layout of garden. Special practices of ornamental plants, Intercultural operations in flowers and MAP. Harvesting and post-harvest handling of cut and loose flowers. Processing of MAP. Visit to commercial flower/MAP unit

Hort. 5.5 : Landscaping**(2+1)****Theory**

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

Practical

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

Hort. 6.6 : Post-harvest Management and Value Addition of Fruits and Vegetables**(1+1)****Theory**

Importance 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; Role of ethylene; Post harvest disease and disorders; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; Intermediate moisture food- Jam, jelly, marmalade, preserve, candy - Concepts and Standards; Fermented and non-fermented beverages. Tomato products- Concepts and

Standards; Drying/ Dehydration of fruits and vegetables - Concept and methods, osmotic drying. Canning — Concepts and Standards, packaging of products

Practical

Applications of different types of packaging containers for shelf life extension. Effect of temperature on shelf life and quality of produce. Demonstration of heat, chilling and freezing injury in vegetables and fruits. Extraction and preservation of pulps and juices. Preparation of jam, jelly, RTS, nectar, squash, osmotically dried products, fruit bar and candy and tomato products, canned products. Quality evaluation of products — physico-chemical and sensory. Visit to processing unit/ industry.

PLANT PATHOLOGY

PI. Path. 1.1 : 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. Causes and factors affecting disease development: Disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms (different groups): fungi, bacteria, phytoplasma, spiroplasma, viruses, viroids, algae, protozoa and phanerogamic plant parasites with example of diseases caused by them. Diseases and symptoms due to abiotic causes. Pathogenesis, Role of enzymes, toxins and growth regulators in disease development. Defence mechanism in plants. Epidemiology: Factors affecting disease development. Fungi: General characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes. Bacteria and mollicutes: General morphological characters. Basic methods of classification and reproduction. Viruses: Nature, architecture, multiplication and transmission. Growth and reproduction of plant pathogens. Liberation, dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens.

Practical

Acquaintance with various laboratory equipments and microscopy. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

PI. Path. 2.2 : Introductory Plant Nematology

(1+1)

Theory

Introduction, History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes up to family level with emphasis on groups containing economically important genera. Classification of plant parasitic nematodes based on feeding habits. Identification of economically important plant nematodes up to 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 solarization, hot water treatment). Biological methods, chemical methods (fumigants, non-fumigants), Resistant varieties, IPM.

Practical

Methods of survey- sampling methods, collection of soil and samples, Extraction of nematodes from soil and plant tissues following combined Cobb's sieving technique 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. Experimental techniques used in pathogenicity studies with root-knot nematode. Studies of Nematicides and their formulations. Methods of Nematicides application and their safe use. Calculation of Nematicides application concentrations.

Pl. Path. 4.3 : Principles of Integrated Disease Management**(1+1)****Theory**

Categories of diseases, IPM: Introduction, history, importance, concepts, principles and tools of IPM. Economic importance of diseases and pest risk analysis. Methods of detection and diagnosis of diseases. Calculation and dynamics of economic injury level and importance of Economic threshold level. Methods of control: Host plant resistance, cultural, mechanical, physical, legislative, biological and chemical control. Principles and methods of plant disease management. Ecological management of crop environment. Introduction to conventional pesticides for the disease management. Survey surveillance and forecasting of diseases. Development and validation of IPM module. Implementation and impact of IPM (IPM module for disease). Safety issues in pesticide uses. Political, social and legal implication of IPM. Case histories of important IPM programmes. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

Practical

Methods of diagnosis and detection of various plant diseases. Methods of plant disease measurement, Assessment of crop yield losses calculations based on economics of IPM. Identification of biocontrol agents. Mass multiplication of *Trichoderma*, *Pseudomonas*, etc. Identification and nature of damage of important diseases and their management. Crop (agro-ecosystem) dynamics of selected diseases. Planning & assessment of preventive strategies (IPM module) and decision making. Crop monitoring attacked by diseases. Awareness campaign at farmers' fields.

Pl. Path. 5.4 : Diseases of Field and Horticultural Crops and Their Management-I (2+1)**Theory**

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

Field Crops: Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro; Maize: stalk rots, downy mildew, leaf spots; Sorghum: smuts, grain mold and anthracnose, Bajra :downy mildew, smut and ergot; Groundnut: early and late leaf spots, collar rot, stem and pod rot, bud necrosis, Afla rot; Sesamum: Phyllody, stem rot and leaf spot; Soybean: Rhizoctonia blight and mosaic; Pigeonpea: Phytophthora blight, wilt and sterility mosaic; Finger millet: Blast and leaf spot; Black & green gram: Cercospora leaf spot and anthracnose, powdery mildew and yellow mosaic; Castor: Wilt and root rot; Tobacco: Damping off, black shank, frog eye, leaf curl and mosaic.

Horticultural Crops: Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top; Papaya: foot rot, leaf curl and mosaic, Pomegranate: bacterial blight and leaf spot; Brinjal: Phomopsis blight and fruit rot and little leaf; Tomato: early and late blight, buck eye rot and leaf curl and tomato spotted wilt; Okra: Yellow Vein Mosaic and root knot nematode; Beans: anthracnose and bacterial blight; Colocasia: Phytophthora blight; Coconut: wilt, stem bleeding and bud rot; Tea: blister blight; Coffee: rust; Cluster bean: powdery mildew, bacterial blight and bean common mosaic.

Practical

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

Pl. Path. 6.5 : Diseases of Field and Horticultural Crops and Their Management-II (2+1)

Theory

Symptoms, etiology, disease cycle and management of following diseases:

Field Crops: Wheat: rusts, loose smut, karnal bunt, powdery mildew, alternaria blight, and ear cockle; Sugarcane: red rot, smut, wilt, grassy shoot and ratoon stunting; Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew, powdery mildew and Sclerotinia stem rot; Gram: wilt, root rot and Ascochyta blight; Lentil: rust and wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildew and rust.

Horticultural Crops: Mango: anthracnose, malformation, powdery mildew and red rust; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Guava: wilt and anthracnose; Ber: powdery mildew; Apple: scab, powdery mildew, fire blight; Peach: leaf curl; Strawberry: leaf spot; Sapota: leaf spot; Potato: early and late blight, black scurf, bacterial brown rot, scab, leaf roll, and mosaic; Cucurbits: downy mildew, powdery mildew, wilt; Onion and garlic: purple blotch, and Stemphylium blight; Chillies: anthracnose and fruit rot, wilt and leaf curl; Ginger: soft rot; Turmeric: leaf spots; Fenugreek: powdery mildew; Cumin: Alternaria blight, powdery mildew and wilt; Fennel: Ramularia blight, stem rot; Coriander: stem gall and powdery mildew; Cruciferous vegetables: Alternaria leaf spot and black rot; Marigold: blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. Field visit for the diagnosis of field problems. Collection and preservation of plant diseased specimens for herbarium.

BASIC SCIENCE

Ag. Micro. 1.1 : Agricultural Microbiology**(1+1)**Theory

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

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

Practical

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

Pl. Phy. 3.1 : Fundamentals of Crop Physiology**(2+1)**Theory

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C3, C4 and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity. Absorption of water, ascent of sap and antitranspirants. Photoperiodism and Vernalization. Tanslocaton of solutes.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, separation of photosynthetic pigments through paper chromatography, rate of transpiration, photosynthesis, respiration, Tissue test for mineral nutrients, Estimation of relative water content, Measurement of absorption spectrum of chlorophyll.

Envs. 5.1 : Environmental Studies and Disaster Management**(2+1)**Theory

Multidisciplinary nature of environmental studies, Definition, scope and importance. Natural Resources: Renewable and non-renewable resources. Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man

induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles. Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Environmental Pollution: definition, cause, effects and control measures of: a. Air pollution b. Water pollution c. Soil pollution d. Marine pollution e. Noise pollution f. Thermal pollution g. Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting and watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation. Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act. Issues involved in enforcement of environmental legislation. Public awareness. Human Population and the Environment: population growth, variation among nations, population explosion, Family Welfare Programme. Environment and human health: Human Rights, Value Education, HIV/AIDS. Women and Child Welfare. Role of Information Technology in Environment and human health.

DISASTER MANAGEMENT

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

Practical

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

Ag. Micro. 6.2 : Bio-pesticides & Bio-fertilizers**(2+1)****Theory**

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

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

Practical

Isolation and purification of important biopesticides: *Trichoderma pseudomonas*, *Bacillus*, *Metarhizium* etc. and its production. Identification of important botanicals. Visit to biopesticide laboratory in nearby area. Field visit to explore naturally infected cadavers. Identification of entomopathogenic entities in field condition. Quality control of biopesticides. Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium*, P-solubilizers and cyanobacteria. Mass multiplication and inoculums production of biofertilizers. Isolation of AM fungi -Wet sieving method and sucrose gradient method. Mass production of AM inoculants.

OTHER ALLIED COURSES

Eng. 1.1 Comprehension and Communication Skills in English**(1+1)**Theory

Selected Short Stories of eminent writers from India and abroad: Rabindranath Tagore, Mulk Raj Anand, Premchand, R K Narayan, Isaac Asimov (Science Fiction), Sudha Murthy, Leo Tolstoy, O Henry, Anton Chekhov, Guy De Maupassant, K A Abbas

Basic Grammar: Articles, Prepositions, Concord, Transformation, Synthesis, Reported Speech, Active- Passive Voice

Practical

Reading Comprehension Practice in reading short paragraphs, notices, announcements, advertisements, newspaper articles, reports, etc. Writing Skills: Writing experimental reports and journals, Writing informal letters, leave applications, Writing short notices, announcements, Filling simple forms for different purposes, Short Notes Listening Comprehension: Listening to announcements at public places like Railway Station, Bus Station, Airports, Malls, etc., Listening to short conversations on basic language functions, Listening to short speeches and lectures, Listening to news on TV & Radio Speaking: Introduction, Greeting people on different occasions, Carrying out basic language functions like Asking for Permission, Asking and Showing directions, Describing people and places, Reporting ongoing events, etc.

Maths 1.1 : Elementary Mathematics**(2+0)**Theory

Differential Calculus: Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of x^n , e^x , $\sin x$ & $\cos x$ from first principle, Derivatives of sum, difference, product and quotient of two functions, Differentiation of functions of functions (Simple problem based on it), Logarithmic differentiation (Simple problem based on it), Maxima and Minima of the functions of the form $y=f(x)$ (Simple problems based on it).

Integral Calculus: Integration of simple functions, Integration of Product of two functions, Definite Integral (simple problems based on it), Area under simple well-known curves (simple problems based on it)

Matrices and Determinants: Definition of Matrices, Addition, Subtraction, Multiplication, Transpose and Inverse up to 3rd order, Properties of determinants up to 3rd order and their evaluation

Ag. Met. 1.1 : Introductory Agro meteorology & 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, cyclone, anticyclone, Land breeze and sea breeze; Atmospheric temperature, Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification: 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 Weather forecasting – types of weather forecast and their uses. Climate change, global warming, causes of climate change and its impact on regional and national Agriculture.

Practical

- Measurement of Bright sunshine hours, total, shortwave and long wave radiation
- Measurement of maximum, minimum air temperatures and soil temperature
- Measurement of wind speed and wind direction, preparation of wind rose
- Determination of vapor pressure and relative humidity
- Measurement of rainfall
- Analysis of rainfall data for climatological studies
- Measurement of Pressure
- Estimation of heat indices
- Measurement of open pan evaporation
- Computation of PET and AET

LPM 5.1 : Ruminant Production and management**(2+1)****Theory**

Role of livestock in the national economy. Reproduction in farm animals(Ruminants), Housing principles, space requirements for different species of livestock (Ruminants), Management of calves, growing heifers, dry and pregnant animals and milch animals. Management of sheep, goat, Important Indian and exotic breeds of cattle, buffalo, sheep, goat, Improvement of farm animals(Ruminants), Digestion in ruminants, Classification of feed stuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients and ration for livestock, Feed supplements and feed additives. Feeding of livestock, Introduction of livestock diseases, Prevention (including vaccination schedule) and control of important diseases of livestock. Preparation of milk products.

Practical

External body parts of cattle, buffalo, sheep, goat, Handling and restraining of livestock. Identification methods of farm animals, Visit to IDF to study breeds of livestock and daily routine farm operations and farm records. Judging of cattle, buffalo, Culling of livestock, Planning and layout of housing for different types of livestock. Computation of rations for livestock. Formulation of concentrate mixtures. Clean milk production, milking methods. Economics of cattle, buffalo, sheep, goat. Sampling and testing of milk.

LPM 6.2 : Poultry Production and Management**(1+1)****Theory**

Role of poultry in the national economy.. Housing principles, space requirements for different classes of poultry birds poultry. Incubation, hatching and brooding. Management of growers and layers and broilers. Formation of egg. Important Indian and exotic breeds of poultry. Improvement of poultry Digestion and Reproduction in poultry . Feed ingredients for ration, Feed supplements and feed additives. Feeding and nutrition of different classes of poultry. Prevention (including vaccination schedule) and control of important diseases of poultry.

Practical

External body parts and points of poultry. Identification methods poultry. Visit to IPF to study daily routine farm operations and farm records. Judging of poultry. Culling of poultry. Planning and layout of housing for different types of poultry. Formulation of concentrate mixtures. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Debeaking, dubbing and vaccination. Economics of poultry production preservation of eggs.

STUDENT READY PROGRAMME

The Student READY programme is to be implemented in fourth year of under graduation. It consists of **Rural Awareness Works Experience (RAWE)** and **Agro-Industrial Attachment (AIA)** during **seventh semester** and **Experiential Learning Programme (ELP)** during **eighth semester**. The semester-wise detail of the programme is as under.

STUDENT READY - I : RAWE + AIA

Rural Awareness Works Experience(RAWE) and Agro-Industrial Attachment(AIA) is to be under taken by the students in this semester for a total duration of 20 weeks with weightage of 0+20 credit hours. Credit hours are allotted on the basis of duration of each phase of the program. RAWE and AIA program consists of six phases. The detail is as under

PHASE-WISE DISTRIBUTION OF WORKING DAYS IN RAWE

SN	Course No.	Credit	P1	P2	P3	P4	P5	P6	Total
1	Agron.7.12	0+2	1	4	4	2	-	2	13
2	Ag.Chem.7.5	0+2	1	4	4	2	-	2	13
3	GPB.7.9	0+2	1	4	4	2	-	2	13
4	Pl.Path.7.6	0+2	1	4	4	2	-	2	13
5	Ag.Ento.7.6	0+2	1	4	4	2	-	2	13
6	Hort.7.7	0+2	1	4	4	2	-	2	13
7	Ag.Extn.7.5	0+2	1	4	4	2	-	2	13
8	Ag.Econ.7.5	0+1	1	1	1	1	-	1	5
9	Ag.Stat.7.3	0+1	0.5	1	1	1.5	-	1	5
10	Ag.Engg.7.5	0+1	1	1	1	1	-	1	5
11	LPM.7.3	0+1	0.5	1	1	1.5	-	1	5
12	ET.7.1*	0+2	0	0	0	0	14	0	14
Total working days		0+20	10	32	32	19	14	18	125
Total Saturday for missed & Extra work			2	5	5	4	-	4	20
Holiday			1	4	4	3	-	3	15
Total Days			13	41	41	26	14	25	160

* Non-gradual courses

P1= Orientation Phase

P2= On Campus Training and Research Station Phase

P3= Village and KVK Attachment Phase

P4= Agro Industrial Attachment (AIA)

P5= Exposure Tour

P6 =Project Report Preparation / Presentation Phase

STUDENT READY - II : ELP

Experiential Learning Programme (ELP) is to be under taken by the students in this semester for a total duration of 24 weeks with weightage of 0+20 credit hours.

Sr. No.	Title of module	Credit
1	ELP module - 1	0+10
2	ELP module - 2	0+10
Total		0+20

The students has to register for any two modules of 0+10 credit hours each listed below.

No.	Title of the module	Credits
1	Production Technology for Bio-agents and Bio-fertilizer	0+10
2	Seed Production and Technology/ Plant Tissue Culture Technology	0+10
3	Mushroom Cultivation Technology	0+10
4	Soil, Plant, Water and Seed Testing	0+10
5	Commercial Beekeeping	0+10
6	Poultry Production Technology	0+10
7	Commercial Horticulture	0+10
8	Floriculture and Landscaping	0+10
9	Food Processing	0+10
10	Agriculture Waste Management	0+10
11	Organic Production Technology	0+10
12	Commercial Sericulture	0+10

At present the facility available at the College of Agriculture, JAU, Junagadh, the following six modules has been implemented from the academic year 2016-17. On the basis of merit in each module equal number of students is to be allotted.

No.	Title of the module	Module Code	Credits
1	Quality Seed Production of Field Crops	ELP.8.1	0+10
2	Soil, Water, Plant & Seed Testing	ELP.8.2	0+10
3	Commercial Bio-Agent Production	ELP.8.3	0+10
4	Production Technology for Bio-Fertilizer & Bio-Agent.	ELP.8.4	0+10
5	Plant Tissue Culture Technology	ELP.8.5	0+10
6	Nursery Management & Protected Cultivation	ELP.8.6	0+10

The SAU is free to select the module based on the availability of the facilities at respective University in future. The distribution of 100 marks is as under for each of the two modules end of the ELP module.

NON-GRADIAL COURSES

Details of Physical Education & Yoga Practices / NSS / NCC

(A) PHYSICAL EDUCATION AND YOGA PRACTICES

PE 2.1 Physical Education and Yoga Practices (First Year Activities)

- Teaching of skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
- Teaching of different skills of Football – demonstration, practice of the skills, correction, involvement in game situation (For girls teaching of Tennikoit)
- Teaching of advance skills of Football – involvement of all the skills in game situation with teaching of rules of the game
- Teaching of skills of Basketball – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of skills of Basketball – demonstration, practice of the skills, involvement in game situation
- Teaching of skills of Basketball – involvement of all the skills in game situation with teaching of rule of the game
- Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of skills of Kabaddi – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of advance skills of Kabaddi – involvement of all the skills in game situation with teaching of rule of the game
- Teaching of skills of Ball Badminton – demonstration, practice of the skills, correction of skills, involvement in game situation
- Teaching of skills of Ball Badminton – involvement of all the skills in game situation with teaching of rule of the game
- Teaching of some of Asanas – demonstration, practice, correction and practice
- Teaching of some more of Asanas – demonstration, practice, correction and practice
- Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
- Teaching of skills of Table Tennis – demonstration, practice of skills, correction and practice and involvement in game situation
- Teaching of skills of Table Tennis – involvement of all the skills in game situation with teaching of rule of the game
- Teaching – Meaning, Scope and importance of Physical Education
- Teaching – Definition, Type of Tournaments
- Teaching – Physical Fitness and Health Education
- Construction and laying out of the track and field (*The girls will have Tennikoit and Throw Ball).

PE 4.2 Physical Education and Yoga Practices (Second Year Activities)

- Teaching of skills of Hockey – demonstration practice of the skills and correction.
- Teaching of skills of Hockey – demonstration practice of the skills and correction. And involvement of skills in games situation
- Teaching of advance skills of Hockey – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
- Teaching of skills of Kho-Kho – demonstration practice of the skills and correction.

- Teaching of skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of the skills in games situation
- Teaching of advance skills of Kho-Kho – demonstration practice of the skills and correction. Involvement of all the skills in games situation with teaching of rules of the game
- Teaching of different track events – demonstration practice of the skills and correction.
- Teaching of different track events – demonstration practice of the skills and correction.
- Teaching of different track events – demonstration practice of the skills and correction with competition among them.
- Teaching of different field events – demonstration practice of the skills and correction.
- Teaching of different field events – demonstration practice of the skills and correction.
- Teaching of different field events – demonstration practice of the skills and correction.
- Teaching of different field events – demonstration practice of the skills and correction with competition among them.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of different asanas – demonstration practice and correction.
- Teaching of weight training – demonstration practice and correction.
- Teaching of circuit training – demonstration practice and correction.
- Teaching of calisthenics – demonstration practice and correction.

Note: 1) Compulsory Uniform: Half pants, Tee Shirts, Shoes and socks all white (Girls will have white Tee Shirt and Track pants) 2) The games mentioned in the practical may be inter changed depending on the season and facilities

(B) NATIONAL SERVICE SCHEME

Theory

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skillful in executing democratic leadership, developing skill in programme development to be able for self-employment, reducing gap between educated and uneducated, increasing awareness and desire to help sections of society.

Following activities are to be taken up under the NSS course:

- Introduction and basic components of NSS: Orientation
- NSS programmes and activities
- Understanding youth
- Community mobilisation
- Social harmony and national integration
- Volunteerism and shramdan
- Citizenship, constitution and human rights
- Family and society
- Importance and role of youth leadership
- Life competencies
- Youth development programmes
- Health, hygiene and sanitation
- Youth health, lifestyle, HIV AIDS and first aid
- Youth and yoga
- Vocational skill development
- Issues related environment
- Disaster management
- Entrepreneurship development

- Formulation of production oriented project
- Documentation and data reporting
- Resource mobilization
- Additional life skills
- Activities directed by the Central and State Government

All the activities related to the National Service Scheme course is distributed under four different courses viz., National Service Scheme I, National Service Scheme II, National Service Scheme III and National Service Scheme IV each having **one credit load**. The entire four courses should be offered continuously for two years. A student enrolled in NSS course should put in at least **60 hours of social work** in different activities in a semester other than five regular one day camp in a year and one special camp for duration of 7 days at any semester break period in the two year. Different activities will include orientation lectures and practical works. Activities directed by the Central and State Government have to be performed by all the volunteers of NSS as per direction.

B-1 National Service Scheme I (First Semester)

Introduction and basic components of NSS:

Orientation: history, objectives, principles, symbol, badge; regular programmes under NSS, organizational structure of NSS, code of conduct for NSS volunteers, points to be considered by NSS volunteers awareness about health

NSS programmes and activities

Concept of regular activities, special camping, day camps, basis of adoption of village/slums, conducting survey, analysing guiding financial patterns of scheme, youth programme/ schemes of GOI, coordination with different agencies and maintenance of diary

Understanding youth

Definition, profile, categories, issues and challenges of youth; and opportunities for youth who is agent of the social change

Community mobilisation

Mapping of community stakeholders, designing the message as per problems and their culture; identifying methods of mobilisation involving youth-adult partnership

Social harmony and national integration

Indian history and culture, role of youth in nation building, conflict resolution and peace-building

Volunteerism and shramdan

Indian tradition of volunteerism, its need, importance, motivation and constraints; shramdan as part of volunteerism

Citizenship, constitution and human rights

Basic features of constitution of India, fundamental rights and duties, human rights, consumer awareness and rights and rights to information

Family and society

Concept of family, community (PRIs and other community based organisations) and society

B-2 National Service Scheme II (Second Semester)

Importance and role of youth leadership

Meaning, types and traits of leadership, qualities of good leaders; importance and roles of youth leadership

Life competencies

Definition and importance of life competencies, problem-solving and decision-making, inter personal communication

Youth development programmes

Development of youth programmes and policy at the national level, state level and voluntary sector; youth-focused and youth-led organisations

Health, hygiene and sanitation

Definition needs and scope of health education; role of food, nutrition, safe drinking water, water born diseases and sanitation (Swachh Bharat Abhiyan) for health; national health programmes and reproductive health.

Youth health, lifestyle, HIV AIDS and first aid

Healthy lifestyles, HIV AIDS, drugs and substance abuse, home nursing and first aid

Youth and yoga

History, philosophy, concept, myths and misconceptions about yoga; yoga traditions and its impacts, yoga as a tool for healthy lifestyle, preventive and curative method

B-3 National Service Scheme III (Third Semester)

Vocational skill development

To enhance the employment potential and to set up small business enterprises skills of volunteers, a list of 12 to 15 vocational skills will be drawn up based on the local conditions and opportunities. Each volunteer will have the option to select two skill-areas out of this list

Issues related environment

Environmental conservation, enrichment and sustainability, climatic change, natural resource management (rain water harvesting, energy conservation, forestation, waste land development and soil conservations) and waste management

Disaster management

Introduction and classification of disaster, rehabilitation and management after disaster; role of NSS volunteers in disaster management.

Entrepreneurship development

Definition, meaning and quality of entrepreneur; steps in opening of an enterprise and role of financial and support service institution.

Formulation of production oriented project

Planning, implementation, management and impact assessment of project

Documentation and data reporting

Collection and analysis of data, documentation and dissemination of project reports

B-4 National Service Scheme IV (Fourth Semester)

Youth and crime

Sociological and psychological factors influencing youth crime, cybercrime, peer mentoring in preventing crime and awareness for juvenile justice

Civil/self defense

Civil defense services, aims and objectives of civil defense; needs and training of self defense

Resource mobilization

Writing a project proposal of self-fund units (SFUs) and its establishment

Additional life skills

Positive thinking, self-confidence and esteem, setting life goals and working to achieve them, management of stress including time management.

(C) NATIONAL CADET CORPS

C-1 National Cadet Corps (First Semester)

- Aims, objectives, organization of NCC and NCC song. DG's cardinals of discipline.
- Drill- aim, general words of command, attention, stands at ease, stand easy and turning.
- Sizing, numbering, forming in three ranks, open and close order march and dressing.
- Saluting at the halt, getting on parade, dismissing and falling out.
- Marching, length of pace, and time of marching in quick/slow time and halt. Side pace, pace forward and to the rear.

- Turning on the march and wheeling. Saluting on the march.
- Marking time, forward march and halt.
- Changing step, formation of squad and squad drill.
- Command and control, organization, badges of rank, honours and awards
- Nation Building- cultural heritage, religions, traditions and customs of India. National integration.
- Values and ethics, perception, communication, motivation, decision making, discipline and duties of good citizen.
- Leadership traits, types of leadership. Character/personality development.
- Civil defense organization, types of emergencies, firefighting, protection,
- Maintenance of essential services, disaster management, aid during development projects.
- Basics of social service, weaker sections of society and their needs, NGO's and their contribution, contribution of youth towards social welfare and family planning.
- Structure and function of human body, diet and exercise, hygiene and sanitation.
- Preventable diseases including AIDS, safe blood donation, first aid, physical and mental health.
- Adventure activities
- Basic principles of ecology, environmental conservation, pollution and its control.
- Precaution and general behaviour of girl cadets, prevention of untoward incidents, vulnerable parts of the body, self-defense.

C-2 National Cadet Corps (Second Semester)

- Arms Drill- Attention, stand at ease, stand easy. Getting on parade. Dismissing and falling out. Ground/take up arms, examine arms.
- Shoulder from the order and vice-versa, present from the order and vice-versa.
- Saluting at the shoulder at the halt and on the march. Short/long trail from the order and vice-versa.
- Guard mounting, guard of honour, Platoon/Coy Drill.
- Characteristics of rifle (.22/.303/SLR), ammunition, fire power, stripping, assembling, care, cleaning and sight setting.
- Loading, cocking and unloading. The lying position and holding.
- Trigger control and firing a shot. Range Procedure and safety precautions. Aiming and alteration of sight.
- Theory of groups and snap shooting. Firing at moving targets. Miniature range firing.
- Characteristics of Carbine and LMG.
- Introduction to map, scales and conventional signs. Topographical forms and technical terms.
- The grid system. Relief, contours and gradients. Cardinal points and finding north. Types of bearings and use of service protractor.
- Prismatic compass and its use. Setting a map, finding north and own position. Map to ground and ground to map.
- Knots and lashings, Camouflage and concealment, Explosives and IEDs.
- Field defenses obstacles, mines and mine lying. Bridging, watermanship
- Field water supplies, tracks and their construction.
- Nuclear, Chemical and Biological Warfare (NCBW)
- Judging distance. Description of ground and indication of landmarks.
- Recognition and description of target. Observation and concealment. Field signals. Section formations.

- Fire control orders. Fire and movement. Movement with/without arms. Section battle drill.
- Types of communication, media, latest trends and developments.

HVE 2.1 Human Value and Ethics (SECOND SEMESTER)

(1+0)

Theory

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

ET 7.1: Educational Tour (Seventh Semester)

(0+2)

Educational tour will be conducted in break between VII and VIII Semester of 14 days period.

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