Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya-224229

INDEX

Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya-224229

College of Horticulture and Forestry

Employability details of Courses

STAT-111(H)- Elementary Statistics and Computer Application 3(2+1)

Theory: Introduction to statistics, limitations of statistics. Basic concepts: Variable statistics, types and sources of data, classification and tabulation of data, construction of frequency distribution, tables, graphic representation of data, simple, multiple component and percentage, bar diagram, pie diagram, histogram, frequency polygon and frequency curve average and measures of location, mean, mode, median, geometric mean, harmonic mean, percentiles for raw and grouped data. Dispersion: Range, standard deviation, variance, coefficient of variation for raw and grouped data. Probability: Basic concept, additive and multiplicative laws. Theoretical distributions, binominal, poison and normal distributions, sampling, basic concepts, sampling vs. complete enumeration parameter and statistic. Tests of Significance: Basic concepts, tests for equality of means, and independent and paired t-tests, chi-square test for application of attributes and test for goodness of fit of Mendalian ratios. Correlation: Scatter diagram, correlation co-efficient and its properties, regression, fitting of simple linear regression, test of significance of correlation and regression coefficient. Experimental designs: Basic concepts, completely randomized design, randomized block design, latin square designs. Introduction to computers and personal computers, basic concepts, operating system, DOS and Windows, MS Word- Features of word processing, creating document and tables and printing of document, MS Excel-Concept of electronic spreadsheet, creating, editing and saving of spreadsheet, inbuilt statistical functions and formula bar.

Practical: Construction of frequency distribution table and its graphical representation, histogram, frequency polygon, frequency curve, bar chart, simple, multiple, component and percentage bar charts, pie chart, mean, mode for row and grouped data, percentiles, quadrille, and median for row and grouped data, coefficient of variation, 't' test for independent, will equal and unequal variants, paired 't' test, chi-square test for contingency tables and theoretical ratios, correlation and linear regression. MS Office, Excel.

SS-111(H)- Fundamentals of Soil Science 2(1+1)

Theory: Composition of earth's crust, soil as a natural body – major components. Eluviations and alleviations formation of various soils. Physical parameters; texture – definition, methods of textural analysis, stock's law, assumption, limitations, textural classes, use of textural triangle; absolute specific gravity/particle density, definition, apparent specific gravity/bulk density – factors influencing, field bulk density. Relation between BD (bulk density), AD – practical problems. Pore space – definition, factors affecting capillary and non-capillary porosity, soil colour – definition, its significance, colour variable, value hue and chroma. Munsellcolour chart, factors influencing, parent material, soil moisture, organic matter, soil structure, definition, classification, clay prism like structure, factors influencing genesis of soil structure, soil consistency, plasticity, Atterberg's constants. Soil air, air capacity, composition, factors influencing, amount of air space, soil air renewal, soil temperature, sources and distribution of heat, factors influencing, measurement, chemical

properties, soil colloids, organic, humus, inorganic, secondary silicate, clay, hydrous oxides. Ion exchange, cation-anion importance, soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy concepts, PF scale, measurement, gravimetric – electric and tensiometer methods – pressure plate and pressure membrane apparatus – Neutron probe – soil water movement – classification – aerial photography – satellite of soil features – their interpretation; soil orders; land capability classification; soil of different eco-systems and their properties, Rock & Minerals classification, Pedogenic process. Objectives of soil science research institute in India (NBSS&LUP, ISSS, LTFE & NSSTL). Management of Soil Crusting, Soil Compaction and Soil Compression. Soil Biology benefits and harmful effects. Methods and objective of soil survey, Remote sensing application in soil and plant Studies, Soil degradation.

Practical: Collection and preparation of soil samples, estimation of moisture, EC, pH and bulk density. Textural analysis of soil by Robinson's pipette method. Description of soil profile in the field. Quantification of minerals and their abundance. Determination of Soil colour using Munsell Chart. Estimation of water holding capacity and hydraulic conductivity of soils. Estimation of Infiltration rate using double ring infiltrometer method. Estimation of soil moisture using gypsum block and neutron probe method. Soil compaction measurement with Pentrometer. Determination of pore space of soil. Determination of filed capacity and permanent wilting point of soil. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus. Aggregate size distribution analysis of soil. Air capacity of soil by field method.

AE-111(H)- Economics and Marketing **3(2+1)**

Theory: Nature and scope of economics, definition and concepts, divisions of economics, economic systems, approaches to the study of economics. Consumption – theory of consumer behaviour, laws of consumption, classification of goods. Wants – their characteristics and classification, utility and its measurement, cardinal and ordinal, law of diminishing marginal utility, law of equi-marginal utility, indifference curve and its properties, consumer equilibrium. Theory of demand, demand schedule and curve, market demand. Price, income and cross elasticities, Engil's law of family expenditure – consumer's surplus. Theory of firm, factors of production – land and its characteristics, labour and division of labour, theories of population. Capital and its characteristics – classification and capital formation. Enterprises – forms of business organization – merits and demerits. Laws or return – law of diminishing marginal return – cost concepts. Law of supply – supply schedule and curve elasticities. Market equilibrium, distribution – theories of rent, wage, interest and profit. Price determination and forecasting under various market structures. Marketing- definition – Marketing Process – Need for marketing – Role of marketing — Marketing functions – Classification of markets – Marketing of various channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural produce. Market intelligence – Basic guidelines for preparation of project reports- Bank norms – Insurance – SWOT analysis – Crisis management.

Practical: Techno-economic parameters for preparation of projects. Preparation of Bankable projects for various agricultural products and its value added products. Identification of marketing channel– Calculation of Price Spread – Identification of Market Structure – Visit to different Markets.

BIOCHEM-111(H)- Elementary Plant Biochemistry **2(1+1)**

Theory: Carbohydrates: Occurrence, classification and structure, physical and chemical properties of carbohydrates, isomerism, optical activity, reducing property, reaction with acids and alkalis, ozone formation. Lipids: Classification, important fatty acids and triglycerides, essential fatty acids. Physical and chemical pr0perties of oils, their rancidity, phospholipids, types and importance. Plant pigments – structure and function of chlorophyll and carotenoids, sterols, basic structure, role of phyto sterols in plants. Proteins: Classification, function and solubility, amino acids – classification and structure, essential amino acids, properties of amino acids, colour reactions, amphoteric nature and isomerism; structure of proteins –primary, secondary tertiary and quaternary properties and reaction of proteins. Enzymes: Classification and factors affecting enzyme action, co-factors and coenzymes. Vitamins and minerals as co-enzymes/co-factors. Carbohydrate metabolism – glycolysis and TCA-cycle; metabolism of lipids, fatty acid oxidation, biosynthesis of fatty acids, electron transport chain, bioenergetics of glucose and fatty acids, structure and function of nucleic acid replication, biological significance of nucleic acid.

Practical: Preparation of standard solutions and reagents; Carbohydrates: Qualitative reactions; Estimation of starch; Estimation of reducing and non reducing sugars from fruits; Amino acids: Reactions of amino acids; Proteins: Estimation of proteins by Lowry's method; Fatty acids: Estimation of free fatty acids; Determination of iodine number of vegetable oils; Vitamins: Estimation of Ascorbic acid; Techniques: Paper chromatography, Thin layer chromatography; Electrophoresis of pigments extracted from flowers, Extraction of oil from oil seeds; Enzymes: Enzyme assay, Enzyme Immobilization.

CP-111(H)- Introductory Crop Physiology 2(1+1)

Theory: Water Relations in Plants: Role of water in plant metabolism, osmosis inhibition, diffusion, water potential and its components, measurement of water potential in plants, absorption of water, mechanism of absorption and ascent of sap. Stomata: Structure, distribution, classification, mechanism of opening and closing of stomata. Osmotic pressure, guttation, stem bleeding; transpiration methods and mechanism and factors affecting transpiration. Drought: Different types of stresses; water, heat and cold tolerance; mechanism of tolerance. Plant Nutrition: Essentiality, mechanism of absorption and its role in plant metabolism. Biological Nitrogen Fixation Photosynthesis, structure and function of chloroplast, dark and light reactions, cyclic and non-cyclic electron transfer, CO_2 fixation – C3, C4 and CA metabolism, advantages of C4 pathway. Photorespiration and its implications, factors affecting photosynthesis. Mode of herbicide action, Secondary metabolites and plant defence.

Practical: Measurement of water potential, osmosis, root pressure, structure of the stomata, distribution, opening and closing of the stomata, measurement, transpiration and calculation of transpirational pull demonstration. Importance of light and chlorophyll in photosynthesis, pigment identification in horticultural crops, measurement of relative water content (RWC), studying plant movements.

FS-111(H)- Fundamentals of Horticulture 3 (2+1)

Theory: Scope and importance, classification of horticultural crops and nutritive value, area and production, exports and imports, fruit and vegetable zones of India and of different states, nursery techniques and their management, soil and climate, vegetable gardens, nutrition and kitchen garden and other types of gardens – principles, planning and layout, management of orchards, planting systems and planting densities. Production and practices for fruit, vegetable and floriculture crops. Principles objectives, types and methods of pruning and training of fruit crops, types and use of growth regulators in horticulture, water

management–irrigation methods, merits and demerits, weed management, fertility management in horticultural crops-manures and fertilizers, different methods of application, cropping systems, intercropping, multi-tier cropping, mulching–objectives, types merits and demerits, Classification of bearing habits of fruit trees, factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, principles of organic farming, market chain management.

Practical: Features of orchard, planning and layout of orchard, tools and implements, identification of various horticultural crops, layout of nutrition garden, preparation of nursery beds for sowing of vegetable seeds, digging of pits for fruit plants, planting systems, training and pruning of orchard trees, preparation of fertilizer mixtures and field application, preparation and application of growth regulators, layout of different irrigation systems, identification and management of nutritional disorder in fruits, assessment of bearing habits, maturity standards, harvesting, grading, packaging and storage.

FLS-111(H)- Principles of Landscape Architecture 1(0 +1)

Practical: Study of garden equipment. Identification of planting material for landscape Study of Graphic language, Use of drawing equipment, graphic symbols and notations in landscaping designing, Study and designing of different styles of gardens, Study and designing of gardens based on different themes, Designing gardens for home, traffic islands, schools and colleges, public buildings, factories, railway stations, air ports, temples, churches, play grounds, corporate buildings/ malls. Designing and planting of avenues for state and National highways, Design and establishment of Japanese, English and Mughal gardens. Visit to public, institutional and botanical gardens.

GPB-111(H)- Principles of Genetics and Cytogenetics 3(2+1)

Theory: Historical background of genetics, theories and hypothesis. Physical basis of heredity, cell reproduction, mitosis, meiosis and its significance. Gametogenesis and syngamy in plants. Mendelian genetics–Mendel's principles of heredity, deviation from Mendelian inheritance, pleiotropy, threshold characters, co-dominance, penetrance and expressivity. Chromosome theory of inheritance, gene interaction. Modification of monohybrid and dihybrid rations. Multiple alleles, quantitative inheritance linkage and crossing over, sex linked inheritance and characters. Cytoplasmic inheritance and maternal effects. Chemical basis of heredity, structure of DNA and its replication. Evidence to prove DNA and RNA – as genetic material. Mutations and their classification. Chromosomal aberrations, changes in chromosome structure and number.

Practical: Study of fixatives and stains. Squash and smear techniques. Demonstrations of permanent slides and cell division, illustration in plant cells, pollen fertility and viability, determination of gametes, Solving problems of monohybrid, dihybrid, and test cross ratios using chi-square test, gene interactions, estimation of linkages using three point test cross from F_2 data and construction of linkage maps. Genetics variation in pea.

MICROB-111(H)- Introductory Microbiology 2(1+1)

Theory: History and Scope of Microbiology: The discovery of micro-organism, spontaneous generation conflict, germ theory of diseases, microbial effect on organic and inorganic matter. Development of microbiology in India and composition of microbial world. Microscopy and Specimen Preparation: The bright field microscope, fixation, dyes and simple staining, differential staining. Difference between prokaryotic and eukaryotic cells. Prokaryotic cell structure and functions. Types of culture media and pre-culture

techniques. Microbial growth in models of bacterial, yeast and mycelia growth curve. Measurement of bacterial growth. General properties of viruses and brief description of bacteriophages. DNA as genetic material. Antibiosis, symbiosis, intra-microbial and extra-microbial association. Sterilization methods – Physical and chemical, Isolation of pure cultures and preservation of cultures, Plant growth promoting microorganisms and mushrooms – Economical importance, Industrially important microorganisms in large scale production and common microbial fermentations. Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques.

Practical: Examination of natural infusion and living bacteria; examination of stained cells by simple staining and Gram staining. Methods for sterilization and nutrient agar preparation. Broth culture, agar slopes, streak plates and pour plats, turbid metric estimation of microbial growth, mushroom culture- Spawn production, Culture and production techniques, harvesting, packing and storage.

ENG-111(H)- Communication Skills and Personality Development 2(1+1)

Theory: Structural Grammar: Introduction of Word Classes; Structure of Verb in English; Uses of Tenses; Study of Voice; Study of Conjunctions and Prepositions; Sentence Patterns in English. Spoken English: Conversations of different situations in everyday life. Direct and indirect narration. Reading and comprehension of general and technical articles, précis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical: Structural Grammar: Exercises in word classes, identification and study of verbs in sentences, application of tenses and voice, exercises in conjunctions and prepositions, other structural grammar exercises, report writing, letter writing (different types of letters). Spoken English: Conversations of everyday life, preparing and address.

PE-111(H)- National Service Scheme (NSS) (NC) 1(0+1)

Practical: NSS: Orientation of students in national problems, study of philosophy of NSS, fundamentals rights, directive principles of state policy, socio-economic structure of Indian society, population problems, brief of five year plan. Functional literacy, non-formal education of rural youth, eradication of social evils, awareness programmes, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition.

FS-121(H)- Tropical and Sub-Tropical Fruits 3 (2+1)

Theory: Horticultural classification of fruits including genome classification. Horticultural zones of India, detailed study of area, production and export potential, varieties, climate and soil requirements, propagation techniques, planting density and systems, after care, training and pruning. Management of water, nutrient and weeds, special horticultural techniques including plant growth regulators, their solution preparation and use in commercial orchards. Physiological disorders. Post-harvest technology, harvest indices, harvesting methods, grading, packaging and storage of the following crops. Mango, , banana, grapes, citrus, papaya, sapota, guava, pomegranate, bael, ber, amla, anona, fig, pineapple, jackfruit, avocado, mangosteen, litchi, carambola, durian, rambutan, bilimbi, loquat, rose apple breadfruit and passion fruit. Bearing in mango and citrus, causes and control measures of special production problems, alternate and irregular bearing overcome, control measures. Seediness and kokkan disease in banana, citrus decline and casual factors and their

management. Bud forecasting in grapes, sex expression and seed production in papaya, latex extraction and crude papain production, economic of production.
Practical: Description and identification of varieties based on flower and fruit morphology in above crops. Training and pruning of grapes, mango, guava and citrus. Selection of site and planting system, pre-treatment of banana suckers, desuckering in banana, sex forms in papaya. Use of plastics in fruit production. Visit to commercial orchards and diagnosis of maladies. Manure and fertilizer application including bio-fertilizer in fruit crops, preparation and application of growth regulators in banana, grapes and mango. Seed production in papaya, latex extraction and preparation of crude papain. Ripening of fruits, grading and packaging, production economics for tropical and sub-tropical fruits. Mapping of arid and semi-arid zones of India. Botanical description and identification of ber, fig, jamun, pomegranate, carissa, phalsa, wood apple, West Indian cherry, tamarind, aonla, bael and annona.

VS-121(H)- Tropical and Sub-tropical Vegetable Crops 3(2+1)

Theory: Area, production, economic importance and export potential of tropical and sub-tropical vegetable crops. Description of varieties and hybrid, climate and soil requirements, seed rate, preparation of field, nursery practices; transplanting of vegetable crops and planting for directly sown/transplanted vegetable crops. Spacing, planting systems, water and weed management; nutrient management and deficiencies, use of chemicals and growth regulators. Cropping systems, harvest, yield, post-harvest handling, economics and marketing of tropical and sub-tropical vegetable crops such as tomato, brinjal, chillies, capsicum, okra, amaranthus, cluster beans, cowpea, lab-lab, snap bean, cucurbits, moringa, curry leaf, portulaca, basella, sorrel and roselle.
Practical: Identification and description of tropical and sub-tropical vegetable crops; nursery practices and transplanting, preparation of field and sowing/planting for direct sown and planted vegetable crops. Herbicide use in vegetable culture; top dressing of fertilizers and intercultural; use of growth regulators; identification of nutrient deficiencies. Physiological disorder. Harvest indices and maturity standards, post-harvest handling and storage, marketing, seed extraction (cost of cultivation for tropical and sub-tropical vegetable crops), project preparation for commercial cultivation.

GPB-121(H)- Principles of Plant Breeding 3(2+1)

Theory: Plant breeding as a dynamic science, genetic basis of Plant Breeding – classical, quantitative and molecular, Plant Breeding in India – limitations, major achievements, goal setting for future. Sexual reproduction (cross and self-pollination), asexual reproduction, pollination control mechanism (incompatibility and sterility and implications of reproductive systems on population structure). Genetic components of polygenic variation and breeding strategies, selection as a basis of crop breeding and marker assisted selection Hybridization and selection – goals of hybridization, selection of plants; population developed by hybridization – simple crosses, bulk crosses and complex crosses. General and special breeding techniques. Heterosis – concepts, estimation and its genetic basis. Calculation of heterosis, heterobeltosis, GCA, SCA, inbreeding depression, heritability and genetic advance. Emasculation, pollination techniques in important horticultural crops. Breeding for resistance of biotic and abiotic stresses. Polyploidy breeding. Mutation breeding.
Practical: Breeding objectives and techniques in important horticultural crops. Floral biology – its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material, segregating generations (pedigree, bulk and back cross methods), Field layout, and

maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques. Hardy Weinberg Law and calculation, male sterility and incompatibility studies in horticultural crops calculation of inbreeding depression, heterosis, heterobeltioses, GCA, SCA, GA, heritability.

SS-121(H)- Soil Fertility and Nutrient Management 2(1+1)

Theory: Introduction to soil fertility and productivity- factors affecting. Essential plant nutrient elements- functions, deficiency systems, transformations and availability. Acid, calcareous and salt affected soils – characteristics and management. Soil organic matter, Role of microorganisms in organic matter- decomposition – humus formation. Importance of C:N ratio and pH in plant nutrition, soil buffering capacity. Integrated plant nutrient management. Soil fertility evaluation methods, critical limits of plant nutrient elements and hunger signs. NPK fertilizers: composition and application methodology, luxury consumption, nutrient interactions, deficiency symptoms, visual diagnosis. Plant nutrient toxicity symptoms and remedies measures. Soil test crop response and targeted yield concept. Biofertilizer. Nutrient use efficiency and management. Secondary and micronutrient fertilizer. Fertilizer control order. Manures and fertilizers classification and manufacturing process. Properties and fate of major and micronutrient in soils. Fertilizer use efficiency and management. Effect of potential toxic elements in soil productivity.

Practical: Analysis of soil for organic matter, available N,P,K and Micronutrients and interpretations. Gypsum requirement of saline and alkali soils. Lime requirement of acid soils. Estimation of organic carbon content in soil. Determination of Boron and chlorine content In soil. Determination of Calcium, Magnesium and Sulphur in soil. Sampling of organic manure and fertilizer for chemical analysis. Physical properties of organic manure and fertilizers. Total nitrogen in urea and farmyard manure. Estimation of ammonical nitrogen and nitrate nitrogen in ammonical fertilizer. Estimation of water soluble P_2O_5, Ca and S in SSP, Lime and Gypsum. Estimation of Potassium in MOP/SOP and Zinc in zinc sulphate. Visiting of fertilizer testing laboratory.

AGRON-121(H)- Water Management in Horticultural Crops 2(1+1)

Theory: Importance of water, water resources in India. Area of different crops under irrigation, function of water for plant growth, effect of moisture stress on crop growth. Available and unavailable soil moisture – distribution of soil moisture – water budgeting – rooting characteristics – moisture extraction pattern. Water requirement of horticultural crops – lysimeter studies – Plant water potential climatological approach – use of pan evaporimeter – factor for crop growth stages – critical stages of crop growth for irrigation. Irrigation scheduling – different approaches – methods of irrigation – surface and sub-surface pressurized methods viz., sprinkler and drip irrigation, their suitability, merits and limitations, fertigation, economic use of irrigation water. Water management problem, soils quality of irrigation water, irrigation management practices for different soils and crops. Layout of different irrigation systems, drip, sprinkler. Layout of underground pipeline system.

Practical: Measurements of irrigation water by using water measuring devices, use of common formula in irrigation practices, practicing of land leveling and land shaping implements, layout for different methods of irrigation. Estimation of soil moisture constants and soil moisture by using different, methods and instruments, scheduling of irrigation,

different approaches, practicing use of instruments, estimation of irrigation efficiency and water requirements of horticultural crops, irrigation planning and scheduling, soil moisture conservation practices.

FS-122(H)- Plant Propagation and Nursery Management 2 (1+1)

Theory: Propagation: Need and potentialities for plant multiplication, sexual and asexual methods of propagation, advantages and disadvantages. Seed dormancy types of dormancy (scarification & stratification) internal and external factors, nursery techniques nursery management, apomixes – mono-embrony, polyembrony, chimera& bud sport. Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery (tools and implements), use of growth regulators in seed, types and stages of seed germination with examples and vegetative propagation, methods and techniques of division-stolons, pseudobulbs, offsets, runners, cutting, layering, grafting, formation of graft union, factor affecting, healing of graftage and budding physiological & bio chemical basis of rooting, factors influencing rooting of cuttings and layering, graft incompatibility. Anatomical studies of bud union, selection and maintenance of mother trees, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification, techniques of propagation through specialized organs, corm, runners, suckers. Micrografting, meristem culture, callus culture, anther culture, organogenesis, somaclonal variation hardening of plants in nurseries. Nursery registration act. Insect/pest/disease control in nursery, Cost of establishment of propagation structures.

Practical: Media for propagation of plants in nursery beds, potting and repotting. Preparation of nursery beds and sowing of seeds. Raising of rootstock. Seed treatments for breaking dormancy and inducing vigorous seedling growth. Preparation of plant material for potting. Hardening plants in the nursery. Practicing different types of cuttings, layering, graftings and buddings including opacity and grafting, top grafting and bridge grafting etc. Use of mist chamber in propagation and hardening of plants. Preparation of plant growth regulators for seed germination and vegetative propagation. Visit to a tissue culture laboratory. Digging, labelling and packing of nursery fruit plants. Maintenance of nursery records. Use of different types of nursery tools and implements for general nursery and virus tested plant material in the nursery. Cost of establishment of a mist chamber, greenhouse, glasshouse, polyhouse and their maintenance. Nutrient and plant protection applications during nursery.

FEE-121(H)- Environmental Studies and Disaster Management 3(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. 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. 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. Biodiversity at global, National and local levels, 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 - Air, Water, Soil, Marine, Noise and Thermal pollution and Nuclear hazards. Solid Waste Management: causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust dies. Wasteland reclamation, 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. Role of Information Technology in Environment and human health. 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. 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: Visit to local areas - river/forest/ grassland/catchment etc. to document components of ecosystem. Study of common plants, insects, birds and animals. Visit to industries to study pollution abatement techniques and case studies - solid waste management, Human population and the Environment.

CP-121(H)- Growth and Development of Horticultural Crops 2(1+1)

Theory: Growth and development-definitions, components, photosynthetic productivity, Canopy photosynthesis and productivity, leaf area index (LAI) - optimum LAI in horticultural crops, canopy development; different stages of growth, growth curves, Crop development and dynamics (Case studies of annual/perennial horticultural crops), growth analysis in horticultural crops. Plant bio-regulators- auxin, gibberellin, cytokinin, ethylene inhibitors and retardants, basic functions, biosynthesis, role in crop growth and development, propagation, flowering, fruit setting, fruit thinning, fruit development, fruit drop, and fruit ripening. Flowering-factors affecting flowering, physiology of flowering, photoperiodism-

long day, short day and day neutral plants, vernalisation and its application in horticulture, pruning and training physiological basis of training and pruning-source and sink relationship, translocation of assimilates. Physiology of seed development and maturation, seed dormancy and bud dormancy, causes and breaking methods in horticultural crops. Physiology of fruit growth and development, fruit setting, factors affecting fruit set and development, physiology of ripening of fruits-climatic and non-climacteric fruits. Physiology of fruits under post-harvest storage.

Practical: Estimation of photosynthetic potential of horticultural crops, leaf area index, growth analysis parameters including harvest index, bioassay of plant hormones, identification of synthetic plant hormones and growth retardants, preparations of hormonal solution and induction of rooting in cuttings, ripening of fruits and control of flower and fruit drop. Important physiological disorders and their remedial measures in fruits and vegetables, seed dormancy, seed germination and breaking seed dormancy with chemicals and growth regulators.

PE-121(H)- Physical and Health Education (NC) 1(0+1)

Practical: Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules are regulations of important games, skill development in any one of the games – football, hockey, cricket, volleyball, ball badminton, throw ball, tennikoit. Participation in one of the indoor games – shuttle badminton, chess and table tennis. Rules and regulations of athletic events, participation in any one of the athletic events – broad jump, high jump, triple jump, javelin throw, discuss throw, shot put, short and long distance running, Safety education, movement education, effective way of doing day-today activities. First-aid training, coaching for major games and indoor games. Asans and indigenous ways for physical fitness and curative exercises. Exercises and games for leisure time, use and experience. Importance of Asanas and Surya namaskar. Free hand exercises and Yoga. Recreation: definition, agencies promoting recreation, camping and recreation. Note: Warming up and conditioning exercises are compulsory before the commencement of each class.

STAT-121(H)- Information and Communication Technology (NC) 2(1+1)

Theory: IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; programming-algorithms and flowcharts; Operating systems (OS) - definition, basic concepts, introduction to WINDOWS and LINUX Operating Systems; Local area network (LAN), Wide area network(WAN), Internet and World Wide Web, HTML and IP; Introduction to MS Office - Word, Excel, Power Point. Audio visual aids - definition, advantages, classification and choice of A.V aids.

Practical: Exercises on binary number system, algorithm and flow chart; MS Word; MS Excel; MS Power Point; Internet applications: Web Browsing, Creation and operation of Email account; Analysis of data using MS Excel. Handling of audio visual equipments. Planning, preparation, presentation of posters, charts, overhead transparencies and slides. Organization of an audio visual programme.

PP-211(H)- Fundamentals of Plant Pathology 3(2+1)

Theory: Introduction to the science of phytopathology, its objectives, scope and historical background. Classification of plant diseases, symptoms, signs, and related terminology.

Parasitic causes of plant diseases (fungi, bacteria, viruses, phytoplasma, protozoa, algae and flowering parasitic plants), their characteristics and classification. Non-parasitic causes of plant diseases. Infection process. Survival and dispersal of plant pathogens. Plant disease epidemiology, forecasting and disease assessment. Principles and methods of plant disease management. Integrated plant disease management. Fungicides classification based on chemical nature, Commonly used fungicides, bactericides and nematicides.

Practical: Familiarity with general plant pathological laboratory and field equipments. Study of disease symptoms and signs and host parasite relationship. Identification and isolation of plant pathogens. Koch's postulates. Preparation of fungicidal solutions, slurries, pastes and their applications.

ENT-211(H)- Fundamentals of Entomology 3(2+1)

Theory: Introduction to phylum arthropoda. Importance of class Insecta. Insect dominance. History of entomology in India, Importance of entomology in different fields. Definition, division and scope of entomology. Comparative account of external morphonology-types of mouth parts, antennae, legs, wings and genetalia. Structure, function of cuticle & moulting and body segmentation, Anatomy of digestive, Circulatory, Sensory, respiratory, glandular, excretory, nervous and reproductive systems. Types of reproduction. Postembryonic development-eclosion. Matamorphosis. Types of egg larvae and pupa. Classification of insects upto orders, sub-order and families of economic importance and their distinguished characters. Plant mites – morphological features, important families with examples.

Practical: Insect collection and preservation. Identification of important insects. General body organization of insects. Study on morphology of grasshopper or cockroach. Preparation of permanent mounts of mouth parts, antennae, legs and wings. Dissection of grasshopper and caterpillar for study of internal morphology. Observations on metamorphosis of larvae and pupae. Dissection of cockroaches.

VS-211(H)- Temperate Vegetable Crops 2(1+1)

Theory: Importance of cool season vegetable crops in nutrition and national economy. Area, production, export potential, description of varieties and hybrids, origin, climate and soil, production technologies, post-harvest technology and Marketing of cabbage, cauliflower, knol-khol, sprouting broccoli, Brussels' sprout, lettuce, palak, Chinese cabbage, spinach, garlic, onion, leek, radish, carrot, turnip, beet root, peas, broad beans, rhubarb, asparagus, globe artichoke, Vegetable kale.

Practical: Identification and description of varieties/hybrids; propagation methods, nursery management; preparation of field, sowing/transplanting; identification of physiological and nutritional disorders and their corrections; post-harvest handling; cost of cultivation and field visits to commercial farms.

NEM-211(H)- Nematode Pests of Horticultural Crops and their Management 2(1+1)

Theory: History and development of nematology - definition, economic importance. General characters of plant parasitic nematodes, their morphology, taxonomy, classification, biology, symptomatology and control of important plant parasitic nematodes of fruits – (tropical, sub-tropical and temperate) vegetables, tuber, ornamental, spice and plantation crops. Role of nematodes in plant disease complex. Integrated nematode management.

Practical: Methods of sampling and extraction of nematodes from soil and plant parts, killing, fixing and preparation of temporary and permanent nematode mounts. Nematicides and their use. Collection and preservation of 20 plant species/parts damaged by plant parasitic nematodes.

PP-212(H)- Diseases of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)

Theory: Etiology, symptoms, mode of spread, epidemiology and integrated management of the diseases of fruits, plantation, medicinal and aromatic crops *viz* mango, banana, grape, citrus, guava, sapota, papaya, jack fruit, pineapple, pomegranate, ber, apple, pear, peach, plum, almond, walnut, strawberry, areca nut, coconut, oil palm, coffee, tea, cocoa, cashew, rubber, betel vine senna, neem, hemp, belladonna, pyrethrum, camphor, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and Tephrosia. Important post-harvest diseases of fruit, plantation and medicinal and aromatic crops and their management.

Practical: Observations of disease symptoms, identification of casual organisms and host parasite relationship of important diseases. Examination of scrapings and cultures of important pathogens of fruits, plantation, medicinal and aromatic crops.

BIOCHEM/FT-211(H)- Fundamentals of Food Technology 2(1+1)

Theory: Food and its function, physico-chemical properties of foods, food preparation techniques, nutrition, relation of nutrition of good health. Characteristics of well and malnourished population. Energy, definition, determination of energy requirements, food energy, total energy needs of the body. Mineral nutrition: macro and micro-minerals (Ca, Fe and P), function, utilization, requirements, sources, effects of deficiency. Vitamins: functions, sources, effects of deficiency, requirements of water soluble and fat-soluble vitamins. Balanced Diet: recommended dietary allowances for various age groups, assessment of nutritional status of the population.

Practical: Methods of measuring food ingredients, effect of cooking on volume and weight, determination of percentage of edible portion. Browning reactions of fruits and vegetables. Microscopic examination of starches, estimation of energy, value proteins and fats of foods. Planning diet for various age groups.

FS-211(H)- Temperate Fruit Crops 2 (1+1)

Theory: Classification of temperate fruits, detailed study of areas, production, varieties, climate and soil requirements, propagation, planting density, cropping systems, after care training and pruning, self-incompatibility and pollinisers, use of growth regulators, nutrient and weed management, harvesting, post-harvest handling and storage of apple, pear, peach, apricot, plum, cherry, persimmon, strawberry, kiwi, Queens land nut (Mecademia nut), almond, walnut, pecan nut, hazel nut and chest nut. Re-plant problem, rejuvenation and special production problems like pre-mature leaf fall, physiological disorders, important insect – pests and diseases and their control measures. Special production problems like alternate bearing problem and their remedies.

Practical: Nursery management practices, description and identification of varieties of above crops, manuring and fertilization, planting systems, preparation and use of growth

regulators, training and pruning in apple, pear, plum, peach and nut crops. Visit to private orchards to diagnose maladies. Working out economics for apple, pear, plum and peach.

AGRON-211(H)- Weed Management in Horticultural Crops 2 (1+1)

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

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

FLS-211(H)- Commercial Floriculture 3 (2+1)

Theory: Scope and importance of commercial floriculture in India, production techniques of commercial flower crops like rose, marigold, chrysanthemum, orchid, carnation, gladiolus, jasmine, crossandra, anthurium, dahlia, tuberose, bird of paradise, china aster and gerbera for domestic and export market, production techniques of flowers and foliage filler materials growing of flowers under protected environments such as glass house, plastic house etc., postharvest technology of cut flowers in respect of commercial flower crops, dehydration technique for drying of flowers, production techniques for bulbous.

Practical: Identification of commercially important floricultural crops. Propagation practices in chrysanthemum, sowing of seeds and raising of seedlings of annuals. Propagation by cutting, layering, budding and grafting Training and pruning of roses Use of chemicals and other compounds for prolonging the vase life of cut flowers Drying and preservation of flowers. Flower arrangement practices.

BIOTECH-211(H)- Elementary Plant Biotechnology 2(1+1)

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

DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop improvement. Nanotechnology: introduction and application.

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

SS-221(H)- Soil, Water and Plant Analysis 2(1+1)

Theory: Methods of soil and plant sampling and processing for analysis. Characterization of hydraulic mobility – diffusion and mass flow. Renewal of gases in soil and their abundance. Methods of estimation of oxygen diffusion rate and redox potential. Use of radio tracer techniques in soil fertility evaluation. Soil micro-organisms and their importance. Saline, alkali, acid, waterlogged and sandy soils, their appraisal and management. Chemical and mineral composition of horticultural crops. Leaf analysis standards, index tissue, interpretation of leaf analysis values Quality of irrigation water. Radio tracer technology application in plant nutrient studies. Rapid tissue tests for soil and plant. Management of poor quality irrigation water in crop management. Soil and Water pollution.

Practical: Introduction to analytical chemistry, Collection and preparation of soil, water and plant samples for analysis. Determination of pH, electrical conductivity, sodium adsorption ratio and exchangeable sodium percentage of soils. Estimation of available macro and micronutrient elements in soils and their contents in plants. Irrigation water quality analysis. Determination of pH and EC in irrigation water samples, Determination of Carbonates and bicarbonates in soil and irrigation water, Determination of Calcium and Magnesium in soil and irrigation water. Determination of N, P, K, Ca, Mg, Sand micronutrients in plant samples. Determination of Sodium, Potassium, Chlorine and Boron in irrigation water.

VS-221(H)- Spices and Condiments 3(2+1)

Theory: History, scope and importance, Present status, area and production, uses, export potential and role in national economy. Classification, soil and climate, propagation-seed, vegetative and micropropagation systems and methods of planting. Nutritional management, irrigation practices, weed control, mulching and cover cropping. Training and pruning practices, role of growth regulators, shade crops and shade regulation. Harvesting, post-harvest technology, packaging, storage, value added products, methods of extraction of essential oil and oleoresins. Economics of cultivation, role of Spice Board and Pepper. Export Promotion Council, institutions and research centers in R&D. Crops: Cardamom, pepper, betel vine ginger, turmeric, clove, nutmeg, cinnamon, all spice, curry leaf, coriander, fenugreek, fennel, cumin, dill, celery, bishops weed, saffron, vanilla, thyme and rosemary.
Practical: Identification of varieties: propagation, seed treatment – sowing; layout, planting; hoeing and earthing up; manuring and use of weedicides, training and pruning; fixing maturity standards, harvesting, curing, processing, grading and extraction of essential oils and oleoresins. Visit to commercial plantations.

FLS-221(H) - Ornamental Horticulture 3(2+1)

Theory: History, definitions, scope of ornamental horticulture, aesthetic values, Floriculture industry, Importance, area and production, industrial importance of ornamental plants and flowers. Importance, classification, design values and general cultivation aspects for ornamental plants *viz*. Annuals, biennales herbaceous perennials, grasses and bulbous ornamentals. shrubs, climbers, trees, indoor plants, palms and cycads, ferns and sellagenellas, cacti and succulents, Importance, design and establishment of garden features/components viz. hedge, edge, borders, flower beds, bridges, paths, drives, fences, garden walls, gates, carpet bed, arbour, Patio, decking, retaining walls, shade garden, sunken garden, roof garden, terrace garden, pebble garden, rockery, pools, waterfalls, fountains, bog garden, avenue planting and children garden. Lawn types, establishment and maintenance. Importance of Garden adornments viz. floral clock, bird bath, statutes, sculptures, lanterns, water basins, garden benches etc.. Importance of flower arrangement, Ikebana, techniques, types, suitable flowers and cut foliage, uses of vertical garden, bottle garden, terrariums, art of making bonsai, culture of bonsai and maintenance.

Practical: Identification and description of annuals, biennials, herbaceous perennials, climbers, shrubs, trees, indoor plants, ferns and sellagenellas, Palms and cycads and Cacti and succulents. Planning and designing and establishment of garden features viz. lawn, hedge and edge, rockery, water garden, carpet bedding, shade garden, roof garden, Study and creation of terrariums, vertical garden, study and practice of different types of flower arrangements, preparation of floral bouquets, preparation of floral rangoli, veni etc., Study of Bonsai techniques, Bonsai practicing and training. Visit to nurseries and floriculture units.

FS-221(H)- Plantation Crops 3 (2+1)

Theory: History and development, scope and importance, area and production, export and import potential, role in national and state economy, uses, industrial importance, by products utilization, soil and climate, varieties, propagation: principles and practices of seed, vegetative and micro-propagation, planting systems and method, gap filling, systems of cultivation, mulching, shade regulation, weed and water management, training, pruning and handling, nutrition, foliar feeding, role of growth regulators, soil management, liming practices, tipping practices, top working, physiological disorders, harvesting, post-harvest handling and processing, packaging and marketing, yield and economics of coconut, arecanut, oil palm, palmyrah palm, cacao, cashew nut, coffee, tea, Date palm and rubber.

Practical: Description and identification of coconut varieties, selection of coconut and arecanut mother palm and seed nut, planting of seed nuts in nursery, layout and planting of coconut, arecanut, oil palm, cashew nut, cacao gardens, manuring, irrigation; mulching, raising masonry nursery for palm, nursery management in cacao. Description and identification of species and varieties in coffee, harvesting, grading, pulping, fermenting, washing, drying and packing of coffee, seed berry collection, seed extraction, treatment and sowing of coffee, epicotyle, softwood, grafting and top working in cashew, working out the economics and project preparation for coconut, arecanut, oil palm, cashew nut, cacao, etc. Mother plant selection, preparation of cuttings and rooting of tea under specialized structure, training, centering, pruning, tipping and harvesting of tea.

FS-222(H)- Breeding of Fruit and Plantation Crops 3 (2+1)

Theory: Fruit breeding - History, importance in fruit production, distribution, domestication and adaptation of commercially important fruits, variability for economic traits, breeding strategies, clonal selection, bud mutations, mutagenesis and its application in crop improvement–policy manipulations – *in vitro* breeding tools (important fruit and plantation crops).
Practical: Exercises on floral biology, pollen viability; emasculation and pollination procedures; hybrid seed germination; raising and evaluation of segregating populations; use of mutagens to induce mutations and polyploidy in major crops like Mango, Banana, Citrus, Grapes, Guava, Sapota, Papaya, Custard apple, Aonla, Ber, Litchi, Pomegranate, Jamun, Arecanut, Coconut, Pistachionut, Apple, Pear, Plum, Peach, Apricut and Strawberry.

AENG-221(H)- Farm Power and Machinery 2(1+1)

Theory: Basic concepts of various forms of energy, unit and dimensions of force energy and power, calculations with realistic examples. IC Engines: Basic principles of operation of compression, ignition and spark ignition engines, two stroke and four stroke engines, cooling and lubrication system, power transmission system, broad understanding of performance and efficiency, tractors, power tillers and their types and uses. Electric motors: types, construction and performance comparison. Tillage: objectives, method of ploughing. Primary tillage implements: construction and function of indigenous ploughs, improved indigenous ploughs, mould board ploughs, disc and rotary ploughs. Secondary tillage implements: construction and function of tillers, harrows, levelers, ridgers and bund formers. Sowing and transplanting equipment: seed drills, potato planters, seedling transplanter. Grafting, pruning and training tools and equipment. Inter-culture equipment: sweep. Junior hoe, weeders, long handle weeders. Crop harvesting equipments: potato diggers, fruit pluckers, tapioca puller and hoists.

Practical: Calculation on force, power and energy. IC engines – showing the components of dismantled engines and motors. Primary and secondary tillage implements, hitching, adjustments and operations. Spraying equipment, calibration and operation. Plant protection equipment, calculation of dilution ratio and operation.

ENT-221(H)- Insect Pests of Fruit, Plantation, Medicinal and Aromatic Crops 3(2+1)

Theory: General – economic classification of insects; Bio-ecology and insect-pest management with reference to fruit, plantation, medicinal and aromatic crops; pest surveillance. Distribution, host range, bio-ecology, injury, integrated management of important insect pests affecting tropical, sub-tropical and temperate fruits, plantation, medicinal and aromatic crops like coconut, areca nut, oil palm, cashew, cacao, tea, coffee, cinchona, rubber, betel vine senna, neem, belladonna, pyrethrum, costus, crotalaria, datura, dioscorea, mint, opium, *Solanum khasianum* and. Storage insects – distribution, host range, bio-ecology, injury, integrated management of important insect pests attacking stored fruits, plantation, medicinal and aromatic crops and their processed products. Insecticide residue problems in fruit, plantation, medicinal and aromatic crops and their maximum residue limits (MRLs).
Practical: Study of symptoms of damage, collection, identification, preservation, assessment of damage and population of important insect – pests affecting fruits, plantation, medicinal and aromatic crops in field and storage.

VS-222(H)- Precision Farming and Protected Cultivation 3(2+1)

Theory: Precision farming – laser leveling, mechanized direct seed sowing; seedling and sapling transplanting, mapping of soils and plant attributes, site specific input application, weed management, insect pests and disease management, yield mapping in horticultural crops. Green house technology, Introduction, Types of Green Houses; Plant response to Greenhouse environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes Green house equipment, materials of construction for traditional and low cost green houses Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air greenhouse heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics.

Practical: Study of different types of greenhouses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial green houses; Economics of protected cultivation.

FS-223(H)- Dryland Horticulture 2(1+1)

Theory: Definition, importance and limitation of dry land horticulture, present status and future scope. Constraints encounter in dry lands. Agro-climatic features in rain shadow areas, scarse water resources, high temperature, soil erosion, run-off losses etc. Techniques and management of dry land horticulture. watershed development, soil and water conservation methods-terraces, contour bunds, etc. Methods of control and impounding of run-off water-farm ponds, trenches, macro catch pits, etc, *in-situ* water harvesting methods, micro catchment, different types of tree basins etc. Methods of reducing evapotranspiration, use of shelter belts, mulches, antitranspirants, growth regulators, etc. water use efficiency-need based, economic and conjunctive use of water, micro systems of irrigation etc. Selection of plants having drought resistance. Special techniques, planting and after care-use of seedling races, root stocks, *in-situ* grafting, deep pitting/planting, canopy management etc. Characters and special adaptation of crops: ber, aonla, annona, jamun, wood apple, bael, pomegranate, carissa, date palm, phalsa, fig, west Indian cherry and tamarind.

Practical: Study of rainfall patterns. Contour bunding/trenching, micro catchments, soil erosion and its control. Study of evapotranspiration, mulches and micro irrigation systems. Special techniques of planting and aftercare in dry lands. Study of morphological and anatomical features of drought tolerant fruit crops.

AGRON-311(H)- Organic Farming 3(2+1)

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

Practical: Raising of vegetable crops organically through nutrient, diseases and pest management; vermicomposting; vegetable and ornamental nursery raising; macro quality analysis, grading, packaging, postharvest management.

AGRON-312(H)- Introduction to Major Field Crops 2(1+1)

Theory: Classification and distribution of field crops, definitions and concept of multiple cropping, mixed cropping, intercropping, relay and alley cropping, cultural practices for raising major cereals, pulses, oil seeds and fodder crops, green manuring, crop rotation.

Practical: Identification of crop plants, seeds and weeds. Preparation of cropping scheme. Application of herbicides in field crops.

MAP-311(H)- Medicinal and Aromatic Crops 3(2+1)

Theory: History, scope, opportunities and constraints in the cultivation and maintenance of medicinal and aromatic plants in India. Importance, origin, distribution, area, production, climatic and soil requirements, propagation and nursery techniques, planting and after care, cultural practices, training and pruning, nutritional and water requirements. Plant protection, harvesting and processing of under mentioned important medicinal and aromatic plants. Study of chemical composition of a few important medicinal and aromatic plants, extraction, use and economics of drugs and essential oils in medicinal and aromatic plants. Therapeutic and pharmaceutical uses of important species. Storage techniques of essential oils. Medicinal Plants: *Withania*, periwinkle, Rauvolfia, Dioscorea, Isabgol, opium poppy *Ammi majus*, Belladonna, Cinchona, Pyrethrum and other species relevant to local conditions. Aromatic Plants: Citronella grass, khus grass, flag (baje), lavender, geranium, patchouli, bursera, menthe, musk, occimum and other species relevant to the local conditions. Marketing.

Practical: Collection of medicinal and aromatic plants from their natural habitat and study their morphological description, nursery techniques, harvesting, curing and processing techniques and extraction of essential oil.

AF-311(H)- Introductory Agro-forestry 2(1+1)

Theory: Agroforestry – definition, objectives and potential. Distinction between agroforestry and social forestry. Status of Indian forests and role in India farming systems. Agroforestry system, sub-system and practice: agri-silviculture, silvipastoral, horti-silviculture, horti-silvipastoral, shifting cultivation, taungya, home gardens, alley cropping, intercropping, wind breaks, shelterbelts and energy plantations. Selection of tree crop species for agro-forestry. MPTS – their management practices, economics of cultivation – nursery and planting (*Acacia catechu*, *Dalbergiasissoo*, Tectona, Populus, Eucalyptus, and bamboo, neem etc.).

Practical: Identification and seeds and seedlings of multipurpose tree species. Nursery practices for poplar, *Dalbergia sissoo*, robinia, leucaena etc. Visit to agro-forestry fields to study the compatibility of MPTS with agricultural crops: silvipastoral, alley cropping, horti-

silviculture, agro-silvipasture, fuel and fodder blocks. Visit to social forestry plantations – railway line plantations, canal plantations, roadside plantations, industrial plantations and shelterbelts. Rapid assessment of farmers needs for green manure, fodder, fuel wood in selected villages. Economics and marketing of products raised in agro-forestry systems.

VS-311(H)- Breeding of Vegetable, Tuber and Spice Crops 3(2+1)

Theory: Breeding objectives and important concepts of breeding self-pollinated, cross pollinated and vegetatively propagated crops. Plant genetic resources, their conservation and utilization in crop improvement Breeding for insect resistance, breeding for disease resistance, breeding for abiotic resistance, male sterility and incompatibility and their utilization in development of hybrids Origin, distribution of species, wild relatives and forms of vegetable crops Tomato, Brinjal, Bhendi, Capsicum, Chilli, Cucurbits, Cabbage, Cauliflower, Tuber crops, Potato, Carrot, Radish, Spice crops (Ginger, Turmeric).Breeding procedures for development of hybrids/varieties in various crops. Genetic basis of adoptability and stability

Practical: Floral biology and pollination mechanism in self and cross pollinated vegetables, tuber crops and spices. Working out phenotypic and genotypic heritability, genetic advance GCA, SCA combining ability heterosis, heterobeltosis standard heterosis GxE interactions (stability analysis) Preparation and uses of chemical and physical mutagens Polyploidy breeding and chromosomal studies Techniques of F1 hybrid seed production. Maintenance of breeding records.

VS-312(H) - Potato and Tuber Crops 2(1+1)

Theory: Origin, area, production, economic importance and export potential of potato and tropical, sub-tropical and temperate tuber crops; description of varieties and hybrids. Climate and soil requirement, season; seed rate; preparation of field; planting practices; spacing; water, nutrient and weed management; nutrient deficiencies. Use of chemicals and growth regulators; cropping systems Harvesting practices, yield; economic of cultivation. Post-harvest handling and storage, field and seed standards, marketing Crops to be covered – potato, sweet potato, arrow root, cassava, colocasia, xanthosoma, amorphophallus, dioscorea, Jerusalem artichoke, horse radish and other under exploited tuber crops.

Practical: Identification and description of potato and tropical, sub-tropical and temperate tuber crops; planting systems and practices; field preparation and sowing/planting. Top dressing of fertilizers and interculture and use of herbicides and growth regulators; identification of nutrient deficiencies, physiological disorders; harvest indices and maturity standards, post-harvest handling and storage, marketing. Seed collection, working out cost of cultivation, project preparation of commercial cultivation

PP-311(H)- Diseases of Vegetable, Ornamental and Spice Crops 3(2+1)

Theory: Etiology, symptoms, mode of spread, epidemiology and integrated management of diseases of the following vegetables, ornamental and spice crops: tomato, brinjal, chilli, bhindi, cabbage, cauliflower, radish, knol-khol, pea, beans, beet root, onion, garlic, fenugreek, ginger, potato, turmeric, pepper, cumin, cardamom, nutmeg, coriander, clove, cinnamon, jasmine, rose, crossandra, tuberose, gerebera, anthurium, geranium. Important post-harvest diseases of vegetables and ornamental crops and their management.

Practical: Observations of symptoms, causal organisms and host parasitic relationship of important diseases, examination of cultures of important pathogens of vegetables, ornamental and spice crops in field as well as in protected cultivation.

FS-311(H)- Orchard and Estate Management 2(1+1)

Theory: Orchard &estate management, importance, objectives, merits and demerits, clean cultivation, sod culture, Sod mulch, herbicides and inorganic and organic mulches. Tropical, sub-tropical and temperate horticultural systems, competitive and complimentary effect of root and shoot systems. Biological efficiency of cropping systems in horticulture, systems of irrigation. Soil management in relation to nutrient and water uptake and their effect on soil environment, moisture, organisms and soil properties. Factors influencing the fruitfulness and unfruitfulness. Rejuvenation of old orchards, top working, frame working, Integrated nutrient and pest management. Utilization of resources constraints in existing systems. Crop model and crop regulation in relation to cropping systems. Climate aberrations and mitigation measures of Horticultural crops.
Practical: Layout of different systems of orchard and estate, soil management, clean, inter, cover and mixed cropping, fillers. Use of mulch materials, organic and inorganic, moisture conservation, weed control. Layout of various irrigation systems.

AGM-311(H)- Agro-meteorology and Climate Change 2(1+1)
Theory: Agricultural Meteorology- Introduction, definition of meteorology, scope and practical utility of Agricultural meteorology. Composition and structure of atmosphere and definition of weather and climate, aspects involved in weather and climate, atmospheric temperature, soil temperature, solar radiation, atmospheric pressure, atmospheric humidity, evaporation and transpiration, monsoons, rainfall, clouds, drought, weather disasters and their management atmospheric pollution and role of meteorology. Basics of weather forecasting. Climate change-causes. Global warming-causes and remote sensing.Effect of climate change on horticulturePast and future changes in greenhouse gases within the atmosphere. Sources and sinks for greenhouse gases. Atmospheric chemistry. Plants sense and respond to changes in CO2 concentration. Measurement of short-term effects and mechanisms underlying the observed responses in C3 and C4 species. plant development affected by growth in elevated CO2. Physiology of rising CO2 on nitrogen use and soil fertility, its implication for production. Increased temperature and plants in tropical/sub-tropical climates- effect on growing season, timing of flowering, duration of fruit development and impacts on crop yields and potential species ranges, interaction of temperature with other abiotic/biotic stress. Mitigation strategies and prospects for genetic manipulation of crops to maximize production in the future atmosphere.
Practical: Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of sunshine duration and solar radiation; Measurement ofwind direction and speed and relative humidity; Study of weather forecasting and synoptic charts. Visit to Meteorological observatory, Visit to IMD meteorological observatory-Lay out planof standard meteorological observatory. Recording of air and soil temperature. Measurement of radiation and components, Measurement of rainfall-different types of raingauges, Measurement of wind speed and direction and atmospheric humidity, Recording of evaporation. Synoptic charts and weather reports, symbols, *etc*.

ENT-321(H)- Apiculture, Sericulture and Lac Culture 2(1+1)

Theory: Introduction to beneficial insects. Importance and History of apiculture. Species of honey bees, Rock bee, Littlebee, Indian bee, European bee, Italian bee and Dammar bee, lifecycle and caste determination. Bee colony maintenance, bee colony activities,starting of new colony, location site, transferring colony, replacement of queen, combining colonies,

swarm prevention, colony management in different seasons, Equipment for apiary, types of bee hives and their description. Bee pasturage. Honey extraction, honey composition and value, bee wax and tissues.. Importance, History and development in India, silkworms kinds and their hosts, systematic position, distribution, lifecycles in brief, Silk glands. Mulberry silkworm-morphological features, races, rearing house and equipments, disinfection and hygiene. Grainage acid treatment, packing and transportation of eggs, Incubation, black boxing, hatching of eggs. Silkworm rearing young age /chawkirearing and old age rearing of silkworms. Feeding, spacing, environmental conditions and sanitation. Cocoon characters colour, shape, hardiness and shell ratio. Defective cocoons and stifling of cocoons. Uses of silk and by-products. Economics of silk production. Moriculture-Mulberry varieties, package of practices, Pests and diseases and their management. Lac growing areas in India, Lac insects, biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac-insects.

Practical: Honey bee colony, different bee hives and apiculture equipment. Summer and Wintermanagement of colony. Honey extraction and bottling. Study of pests and diseases of honeybees. Establishment of mulberry garden. Preparation of mulberry cuttings, planting methods under irrigated and rainfed conditions. Maintenance of mulberry garden-pruning, fertilization, irrigation and leaf harvest. Mulberry pests and diseases and their management and nutritional disorders. Study of different kinds of silkworms and mulberry silkworm morphology, silk glands. Sericulture equipment for silkworm rearing. Mulberry silkworm rearing room requirements. Rearing of silkworms-chalky rearing. Rearing of silkworms late age silkworm rearing and study of mountages. Study of silkworm pests and their management. Study of silkworm diseases and its management. Lac insects-biology, behaviour, lac cultivation, food plants, pruning, inoculation, cropping, kinds of lac. Enemies of lac insects.

ENT-322(H)- Insect Pests of Vegetable, Ornamental and Spice Crops 3(2+1)

Theory: Economic importance of insects in vegetable, ornamental and spice crops -ecology and pest management with reference to these crops. Pest surveillance in important vegetable, ornamental and spice crops. Distribution, host range, bio-ecology, injury, integrated management of important insect-pests affecting vegetable, ornamental and spice crops. Important storage insect-pests of vegetable, ornamental and spice crops, their host range, bio-ecology, injury and integrated management. Insect –pests of processed vegetables and ornamental crops, their host range, bio-ecology, injury and integrated management. Insecticidal residue problems in vegetables and ornamental crops, tolerance limits etc.

Practical: Study of symptoms, damage, collection, identification, preservation, assessment of damage/population of important insect-pests affecting vegetable, ornamental and spice crops in field and during storage.

PHT-321(H)- Postharvest Management of Horticultural Crops 3(2+1)

Theory: Importance of Postharvest Technology in horticultural crops. Maturity indices, harvesting, handling, grading of fruits, vegetables, cut flowers, plantation crops, spices, medicinal and aromatic plants. Pre-harvest factors affecting quality, factors responsible for deterioration of horticultural produce, physiological and bio-chemical changes, hardening and delaying ripening process. Postharvest treatments of horticultural crops. Quality parameters and specifications. Structure of fruits, vegetables and cut flowers related to

physiological changes after harvest. Methods of storage for local market and export. Pre-harvest treatment and pre-cooling, pre-storage treatments. Different systems of storage, packaging methods and types of packages, recent advances in packaging. Types of containers and cushioning materials, vacuum packaging, cold storage, poly shrink packaging, grape guard packing treatments. Modes of transport.

Practical: Practice in judging the maturity of various horticultural produce, determination of physiological loss in weight and quality. Grading of horticultural produce, post-harvest treatment of horticultural crops,physical and chemical methods. Packaging studies in fruits, vegetables, plantation crops, spices and cut flowers by using different packaging materials, methods of storage, post-harvest disorders in horticultural produce. Identification of storage pests and diseases in spices. Visit to markets, packing houses and cold storage units.

VS-321(H)- Seed Production of Vegetable, Tuber and Spice Crops 3(2+1)

Theory: Introduction and history of seed industry in India. Definition of seed, classes-types of seed Differences between grain and seed. Importance and scope of vegetable seed production in India Principles of vegetable seed production Role of temperature, humidity and light in vegetable seed production, land requirements, climate, season, planting time, nursery management, seed rate, rouging, seed extraction and storage of cole crops, root vegetables, solanaceous vegetables, cucurbits, okra, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis Field and seed standards Seed drying and extraction Seed legislation

Practical: Study of seed structure, colour size, shape and texture. Field inspection of seed crops Practices in rouging Harvesting and seed extraction Germination and purity analysis Methods of seed production, Seed certification in cole crops, root vegetables, bulb crops, solanaceous vegetables, cucurbits, okra, leafy vegetables, leguminous vegetables and exotic vegetables Seed processing machines Visit to seed production units.

FLS-321(H)- Breeding and Seed Production of Flower and Ornamental Crops 3(2+1)

Theory: History of improvements of ornamental plants, Centre of origin of flower crops and ornamental crops, objectives and techniques in ornamental plant breeding. Introduction, selection, hybridization, mutation and biotechnological technique for improvement of ornamental and flower crops *viz*., Rose, Jasmine, Chrysanthemum, Tuberose, Gerbera, Gladiolus, dahliaHeliconia, Lilium, Gaillardia, Petunia, *Hibiscus*, Bouganvillea, Zinnia, Cosmos, Dianthus, Snapdragon, Pansy,crossandra, marigold, , geranium, antirrhinium, china aster, orchids, anthurium, carnation, hibiscus etc. Breeding for disease resistance Development of promising cultivars of important ornamentals and flower crops Role of heterosis and its exploitation, production of F1 hybrids and utilization of male sterility, production of open pollinated seed.Harvesting processing and storage of seeds, seed certification

Practical: Study of floral biology and pollination in important species and cultivars. Techniques of inducing polyploidy and mutation Production of pure and hybrid seedsHarvesting, conditioning and testing of seeds. Practice in seed production methods.

PHT-322(H)- Processing of Horticultural Crops 3(1+2)

Theory: Importance and scope of fruit and vegetable preservation industry in India, food pipe line, losses in post-harvest operations, unit operations in food processing. Principles and guidelines for the location of processing units. Principles and methods of preservation by heat - pasteurization, canning, bottling. Methods of preparation of juices, squashes, syrups, cordials and fermented beverages. Jam, jelly and marmalade. Preservation by sugar and chemicals, candies, crystallized fruits, preserves chemical preservatives, preservation with salt and vinegar, pickling, chutneys and sauces, tomato and mushrooms, freezing preservation. Processing of plantation crops, products, spoilage in processed foods, quality control of processed products, Govt. policy on import and export of processed fruits. Food laws.

Practical: Equipments used in food processing units. Physico-chemical analysis of fruits and vegetables. Canning of fruits and vegetables, preparation of squash, RTS, cordial, syrup, jam, jelly, marmalade, candies, preserves, chutneys, sauces, pickles (hot and sweet). Dehydration of fruits and vegetables–tomato product dehydration, refrigeration and freezing, cut out analysis of processed foods. Processing of plantation crops. Visit to processing units.

AE-321(H)-Horti-Business Management 2(2+0)

Theory: Farm management - definition, nature, characteristics and scope. Farm management principles and decision making, production function, technical relationships, cost concepts, curves and functions – factors, product, relationship – factors relationship, product relationship, optimum conditions, principles of opportunity cost-equi-marginal returns and comparative advantages, time value of money, economic of scale, returns to scale, cost of cultivation and production, break even analysis, decision making under risk and uncertainty. Farming systems and types. Planning – meaning, steps and methods of planning, types of plan, characteristics of effective plans. Organizations – forms of business organizations, organizational principles, division of labour. Unity of command, scalar pattern, job design, span of control responsibility, power authority and accountability. Direction – guiding, leading, motivating, supervising, coordination – meaning, types and methods of controlling – evaluation, control systems and devices. Budgeting as a tool for planning and control. Record keeping as a tool of control. Functional areas of management – operations management – physical facilities, implementing the plan, scheduling the work, controlling production in terms of quantity and quality. Materials management – types of inventories, inventory costs, managing the inventories, economic order quantity (EOQ). Personnel management – recruitment, selection and training, job specialization. Marketing management – definitions, planning the marketing programmes, marketing mix and four P's. Financial management – financial statements and rations, capital budgeting. Project management – project preparation evaluation measures.

AE-322(H)- Entrepreneurship Development and Business Management 2(1+1)

Theory: Entrepreneurship Development: Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their implications for decision making by individual entrepreneurs. Globalization and the emerging business / entrepreneurial environment. Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; SWOT analysis, Generation, incubation and commercialization of ideas and innovations. Government

schemes and incentives for promotion of entrepreneurship. Government policy on Small and Medium Enterprises (SMEs) / SSIs. Export and Import Policies relevant to horticulture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Supply chain management and total quality management. Overview of horti inputs industry. Characteristics of Indian horticultural processing and export industry. Social Responsibility of Business. Communication Skills: meaning and process of communication, verbal and non-verbal communication; listening and note taking, writing skills, oral presentation skills developing organizational and managerial skills, problem solving skills. field diary and lab record; indexing, footnote and bibliographic procedures.

EXT-321(H)- Fundamentals of Extension Education (1+1)

Theory: Extension education: meaning, definition, nature, scope, objectives, principles, approaches and history. Horticulture extension: process, principles and selected programmes of leading national and international forest institutes. People's participation in Horticulture programmes. Motivation of Farmers, rural youth and voluntary organizations for Horticulture extension work Rural Development: meaning, definition, objectives and genesis. Transfer of technology programmes like lab to land programme (LLP) national demonstration (ND), front line demonstration (FLD) KrishiVigyanKendras (KVK), Technology Assessment and Refinement Programme (TARP) etc. of ICAR. Communication: meaning, definition, elements and selected models. Audio–visual aids: importance, classification and selection. Adoption and diffusion process, Teaching and learning-concepts and principles, Teaching steps, Programming planning process – meaning, scope, principles and steps. Evaluation: meaning, importance and methods. Scope and importance of Participatory Rural Appraisal (PRA) & Rapid Rural Appraisal (RRA). Management and administration: meaning, definition, principles and functions. Concepts of human resource development (HRD), rural leadership. ICT in Extension education, ICT use in rural India.

Practical: Visits to study structure, functions, linkages and extension programmes of ICFRE institutes/voluntary organizations/MahilaMandal, Village Panchayat, State Dept. of Horticulture /All India Radio (AIR). Exercises on distortion of message, script writing for farm broadcasts and telecasts, planning, preparation & use of NPVA like poster, chart, flash cards, folders etc. and AVA like OHP & 35 mm slide projector transparencies. Identification of local leaders to study their role in extension work. Evaluation of some selected case studies of forestry extension programmes. Preparation of Village Agricultural productions plan.

ELP-411(H) Module-I. Commercial Horticulture: Nursery production of fruit crops: Raising of rootstocks, grafting and budding of rootstocks, management of grafted plants, plant certification, packaging and marketing, quality control. Nursery production of ornamentals: Production of plantlets, production of potted plants, management and maintenance, sale and marketing. Protected cultivation of vegetables and flowers: Nursery raising/procurement and transplanting, management and maintenance of the crop, postharvest handling, quality control and marketing.

ELP-412(H) Module-II. Processing of fruits and vegetables for value addition: Planning and execution of a market survey, preparation of processing schedule, preparation of project

module based on market information, calculation of capital costs, source of finance, assessment of working capital requirements and other financial aspects, identification of sources for procurement of raw material, production and quality analysis of fruits and vegetables products at commercial scale, packaging, labelling, pricing and marketing of product.

RHWE-421(H) STUDENT READY- Placement in Industries (0+10)
RHWE-422(H) STUDENT READY- Placement in Village (0+10)

In one semester students will be working with horticulture farmers/horticulture based industries in collaboration with developmental departments, extension functionaries, input suppliers, marketing and procurement functionaries, processing industries.

Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya

College of Fisheries

Employability Details of UG Courses

1. Principles of Aquaculture 2(1+1)

Theory

Basics of aquaculture, definition and scope. History of aquaculture: Present global and national scenario. Aquaculture vs Agriculture. Systems of aquaculture - pond culture, pen culture, cage culture, running water culture and zero water exchange system. Extensive, semi-intensive, intensive and super intensive aquaculture in different types of water bodies viz., freshwater, brackish water inland saline and marine water. Principles of organic aquaculture. Pre-stocking and post stocking pond management. Carrying capacity of pond, factors influencing carrying capacity. Criteria for selection of candidate species for aquaculture. Major candidate species for aquaculture: freshwater, brackish-water and marine. Monoculture, polyculture and integrated culture systems. Water and soil quality in relation to fish production. Physical, chemical and biological factors affecting productivity of ponds.

Practicals

Aquaculture production statistics- world and India. Aquaculture resources of world and India. Components of Aquaculture farms. Estimation of carrying capacity. Practices on pre-stocking and post stocking management. Growth studies in aquaculture system. Study on waste accumulation in aquaculture system (NH_3, Organic matter, CO_2). Analysis of manure.

2. Taxonomy of Finfish 3(1+2)

Theory

Principles of taxonomy. Nomenclature, types. Classification and interrelationships. Criteria for generic and specific identification. Morphological, morphometric and meristic characteristics of taxonomic significance. Major taxa of inland and marine fishes up to family level. Commercially important freshwater and marine fishes of India and their morphological characteristics. Introduction to modern taxonomic tools: karyotaxonomy, DNA barcoding, protein analysis and DNA polymorphism.

Practicals

Collection and identification of commercially important inland and marine fishes. Study of their external morphology and diagnostic features. Modern taxonomic tools - Protein analysis and electrophoretic studies; Karyotaxonomy - chromosome preparation and identification. DNA barcoding, DNA polymorphism; Visit to fish landing centres to study commercially important fishes and catch composition.

3.Taxonomy of Shellfish 2(1+1)

Theory

Study of external morphology and meristic characteristics of crustacea and mollusca. Classification of crustacea and mollusca up to the level of species with examples of commercially important species.

Practicals

Study of external morphology. Collection, preservation and identification of commercially important prawns, shrimps, crabs, lobsters, bivalves, gastropods, cephalopods from natural habitats. Field visits for collection and study of commercially important shellfishes.

4. Meteorology, Climatology and Geography 2(1+1)

Theory

Nature of Atmosphere: weather and climate; composition of atmosphere; structure of atmosphere. Heat energy of atmosphere: process of heat transmission; heating of atmosphere; disposal of insulation; irregular heating of atmosphere. Temperature: Temperature instruments; periodic, horizontal and vertical temperature variations; effects of vertical air motion on temperature. Humidity and water vapour: relationship between temperature and humidity; distribution of water vapour in atmosphere; evaporation, humidity instruments and measurements. Condensation and precipitation: process of conditions of condensation, forms of condensation; precipitation; forms of precipitation, measurement of precipitation; rainfall in India. Clouds and thunderstorms: amount of cloudiness; ceiling; classification of clouds; conditions of cloud formation; reporting and identification of clouds; thunderstorms. Atmospheric pressure: meaning of atmospheric pressure; the laws of Gases; pressure units; pressure instruments; vertical, horizontal and periodic variations; isobars and pressure gradients. Wind: characteristics of wind motion; wind observation and measurement; wind representation; factors affecting wind motion. Terrestrial or planetary winds: ideal planetary wind system; planetary pressure belts. Planetary wind system; secondary winds; monsoon winds; land and sea breeze. Tropical cyclones: storm divisions; pressure and winds; vertical structure of storm centre; hurricane, sea, swell and surge; hurricane warning. Weather forecasting: forecasting process; forecasting from local indications; role of satellite in weather forecasting; synoptic weather charts. Effects of climate change on fisheries sector. Introductionto Geography: shape, size and structure of the earth; concepts of latitude, longitude and great circles; model globe, maps and different types of projections; cartography; landscape.

Practicals

Graphic representation of structure of atmosphere; physical layering and compositional layering. Temperature instruments: simple thermometers; Six's Max-Min Thermometer; thermograph. Isotherms: world mean temperatures-January to July. India mean temperatures - January to July. Humidity measurement: hygrometer; psychrometer; relative humidity; dew point. Condensation: observation and identification of various types of clouds. Depicting sky picture. Precipitation: measurement of rainfall using rain gauge. Mapping Indian monsoons: south-west monsoon and rainfall in June, North-east monsoon and rainfall in December;

isohyets. Atmospheric pressure measurement: fortin's mercurial barometer; Aneroid barometer. Isobars: India mean pressure - Jan to July. Wind observation and measurement: wind vane; cup anemometer. Ideal terrestrial/planetary pressure and wind systems: diagrammatic representation. Geography: The Earth: diagrammatic representation of shape, size, structure, zones, latitudes, longitudes and great circles. Typical landscape mapping; map reading. Geographical terms used in landscape.

5. Statistical Methods 3(2+1)

Theory

Definition of statistics, Concepts of population, sample, Census and sample surveys, Classification of data, frequency and cumulative frequency table. Diagrammatic and graphical representation of data - bar diagrams, pie-diagram, histogram, frequency polygon, frequency curve and Ogives. Important measures of central tendency - arithmetic mean median and mode. Relative merits and demerits of these measures. Important measures of dispersion, Range, Mean Deviation, Variance and Standard Deviation. Relative merits and demerits of these measures. Coefficient of variation; Normal Curve, Concepts of Skewness and kurtosis. Definitions of probability, mutually exclusive and independent events, conditional probability, addition and multiplication theorems. Random variable, concepts of theoretical distribution; Binomial, Poisson and Normal distributions and their use in fisheries. Basic concept of sampling distribution; standard error and central limit theorem. Introduction to statistical inference, general principles of testing of hypothesis, types of errors. Tests of significance based on Normal, t, and Chi-square distributions. Bivariate data, scatter diagram, simple linear correlation, measure and properties, linear regression, equation and fitting; relation between correlation and regression, Length weight relationship in fishes; applications of linear regression in fisheries. Methodology for estimation of marine fish landings in India, Estimation of inland fish production in India and problems encountered.

Practicals

Construction of questionnaires and schedules. Diagrams and frequency graphs. Calculation of arithmetic mean, median, mode, range, mean deviation, variance, standard deviation. Exercises on probability, Binomial and Poisson distributions, Area of normal curve ,confidence interval for population mean, Test of hypothesis based on normal, t, and chi-square. Computation of Simple correlation and regression. Fitting of length - weight relationship in fishes.

6.Fundamentals of Biochemistry 3(2+1)

Theory

A brief introduction to developments in biochemistry and its transformation to molecular biology. Cell structure, water and major molecules of life. Carbohydrate chemistry: Structure, classification, functions (mono, di and polysaccharides) isomerism and mutarotation. Metabolism of carbohydrates: glycolysis, gluconeogenesis, glycogenolysis, glycogenesis, TCA cycle, central role of TCA cycle in metabolism. Protein chemistry: classifications and functions. Classification, structure, function and properties of amino acids. Essential and non essential amino acids. Primary, secondary, tertiary and quaternary structure of proteins. Amphoteric property. Biuret reaction and xanthoproteic reaction. Digestion and absorption of proteins. Classification, structure, functions and properties of lipids. Essential fatty acids and phospholipids. Digestion and absorption of lipids. Lipid autooxidation. Significance of Omega-3 and Omega-6 fatty acids Enzymes: nomenclature; classification; specificity; mechanism of enzyme action; kinetics and regulation of enzyme activity. Steroid and peptide hormones- chemistry and function. Structure and functions of fat and water soluble vitamins. Vitamins – classification- functions. Minerals – classification – functions. Nucleic acids: Structure function and importance genetic code. Transcription and translation. Protein synthesis. Energy changes in chemical reactions, reversible and irreversible reactions in metabolism.

Practicals

Preparation of normal solution of acid and base, buffers and reagents. Qualitative determination of carbohydrates, proteins and lipids. Estimation of total nitrogen and crude protein of fish tissue. Estimation of carbohydrates in foods. Determination of specific gravity of oil. Extraction and estimation of total lipids in fish tissue. Determination of saponification value, iodine value and free fatty acid value.

7.Fundamentals of Microbiology 3(2+1)

Theory

Milestones in microbiology. Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Alexander Flemming, Joseph Lister, Winogrdasky. Microscopy- Principle and construction of brightfield, dark field, phase contrast, stereo, SEM and TEM. Microbial taxonomy – Bergy's and molecular taxonomy Types of Microorganisms: Prokaryotes– Morphology and ultrastructure of bacterial cell. General features, types and importance of viruses, cyanobacteria, actinomycetes, archae, mycoplasma, rickettsiae. Eukaryotes – Diagnostic features and importance of fungi and protozoa. Microbial Techniques - Types of media, types of sterilization - physical and chemical agents, cultivation of microorganisms, staining techniques – simple, differential, structural staining; enumeration of micro-organisms, culture preservation methods. Bacterial metabolism: Nutrient requirements, nutritional types, bacterial photosynthesis and their ecological significance. Microbial growth: Growth phases, measurement of cell growth, factors affecting growth- influence of physico-chemical factors - pH, temperature, moisture, light, osmotic pressure, fermentation - types and significance. Microbial genetics- general principles, genetic recombination, transformation, transduction and conjugation. Plasmids- types and their importance. Mutation –types and significance. Microbial ecology**:** Introduction and types of interaction, extremophiles and their significance Aquatic Microbiology:Introduction and **s**cope of aquatic microbiology, aquatic environment as habitat for microorganisms - bacteria, cyanobacteria, fungi, algae, parasites and viruses; distribution of microorganisms and their biomass in rivers, lakes, sea and sediment. Influence of physical, chemical and biological factors on aquatic microbes. Microbial biofilms. Role of microbes in the production and breakdown of organic matter. Role of microbes in sedimentation and mineralization process. Nutrient cycles-carbon, nitrogen, sulphur, phosphorus, iron, and manganese cycles. Sewage microbiology, self purification in natural

waters, sewage treatment, drinking water microbiology, sanitary quality of water for aquaculture, bioremediators. Economic significance of aquatic microbes.

Practicals

Handling of microscopes, Wet mount, smear and hanging drop preparations Micrometry-Determination of size of micro organisms (ocular, stage micrometers). Tools and techniques in sterilization methods:Filteration, dry heat, moist heat, chemical agents Cultivation technique: Media preparation, Isolation -pure culture, subculture. Observation of fungi, blue-green algae, and protozoans. Staining techniques for bacteria– simple, differential, structural and Biochemical tests: Indole, methyl red, Voges Proskauer, citrate test, oxidase test, catalase tests. Collection of water and sediment samples for microbiological analysis, Winogradsky cylinder, Isolation, identification and enumeration of various groups of microorganisms from different water bodies including aquaculture systems. Study of bacteria involved in nutrient cycles. Biofilms, water testing for potability, enumeration of coliform. Antibiotic sensitivity of bacteria - antibiotic sensitivity test – disc diffusion method.

8. Fish in Nutrition 1(1+0)

Theory

Composition of fish with emphasis on nutritional value. Concept of Biological value, Protein Efficiency ratio, Net protein utilization. Amino acids of fish and shellfishes and importance of essential amino acids. Fish lipids: fatty acids, nutritional quality. Role of fish lipids in human nutrition. Non-protein nitrogen substances in fishes. Vitamins in fish: water soluble, fat soluble, significance in human nutrition. Minerals in fish: micro- and macro-elements, trace elements, significance in human nutrition. Other functional bio-molecules in fish – peptides, collagen and squalene. Effect of different kinds of cooking fish ie. curry, frying, steaming, smoking, fermentation on nutrition value.

9. Swimming 1(0+1)

Practicals

History, hazards in water and safety precautions; pool maintenance and water quality control. Learning swimming, understanding and practice of ducking the head, kicking action, holding breath under water and various strokes (free style, breast stroke, butterfly, back stroke); competitive swimming-relays and medleys, lap time practice, swimming and floating aids and their uses; diving-styles of diving, rules, regulations and precautions. Methods of life saving in water; Boating, canoeing and sailing: types, maintenance, skill development, rules and regulations and practice.

10. Soil and Water Chemistry 3(2+1)

Theory

Analytical chemistry: principles, applications and types. Classical methods of analytical chemistry, volumetry and gravimetry. Solutions: Standard solutions, titration, indicators, dilute solutions, units of concentration: standard curve; nomograph. Chemistry of water: the water molecule, properties of pure water, fresh water and sea water. Composition of waters**:** surface water, ground water and sea water. Dissolved gasses: Factors affecting natural waters. Acid, base, salts: Hydrogen ions, modern concept of pH and buffer. Water analysis: collection and preservation of water samples. Measurement of temperature. transparency, turbidity, determination of pH, electrical conductivity, salinity, chlorinity, total solids (TDS, TSS, TVS, TVDS), dissolved oxygen, free carbon dioxide, total alkalinity, total hardness, Calcium, Magnesium, Inorganic Nitrogen (Ammonium and Nitrate) and phosphorus. Water quality criteria/ requirements for Aquaculture. Soil Chemistry: origin and nature of soils. Physical properties of soil; soil colour. texture, structure, pore size, bulk density, water holding capacity. Soil types and their distribution. Soil chemistry: soil colloids, cation exchange, organic carbon, Carbon - Nitrogen ratio, soil fertility. Soil reaction: acidity, alkalinity, conductivity, redox - potential. Submersed soils: wet lands, peat soils, fluxes between mud and water, methane and hydrogen sulphide formation. Saline soils, Alkali soils, acid sulphate soils, iron pyrites, soil reclamation. Soil analysis: collection and preparation of soil samples. Determination of soil texture, water holding capacity, pH, conductivity, organiccarbon, nitrogen, phosphorus, lime requirement. Soil and water amendments: lime manures, fertilizers, micronutrients, zeolites, alum, gypsum. Environmental ameliorative: chlorination, deodorizers, bacterial formulation. Soil quality criteria/ requirements for aquaculture.

Practicals

Principles of Titrimetry, Gravimetry, Potentiometry, Conductometry, Refractometry, Colourimetry, Turbidimetry, Spectrophotometry (UV, Visible, Flame, AAS), computerized instrument system. Demonstration: demonstration of laboratory glass wares and equipment used in water and soil analysis. Water analysis: measurement of temperature, turbidity, determination of pH and EC. Determination of salinity, Chlorinity, Total solids, Redox potential, DO, Free CO2. Determination of total alkalinity, hardness. Determination of

inorganic nitrogen, and phosphorus Soil analysis: Determination of soil texture, soil pH, conductivity, soil available nitrogen, available phosphorus, and organic carbon.

10. Fresh Water Aquaculture 3(2+1)

Theory

Major species cultured, production trends and prospect in different parts of the world. Freshwater aquaculture resources-ponds, tanks, lakes, reservoirs etc. Nursery, rearing and growout ponds preparation and management-control of aquatic weeds and algal blooms, predatory and weed fishes, liming, fertilization/manuring, use of biofertilizers, supplementary feeding. Water quality management. Selection, transportation and acclimatization of seed. Traits of important cultivable fish and shellfish and their culture methods-Indian major carps, exotic carps, air breathing fishes, cold water fishes, freshwater prawns, mussels. Wintering ponds, quarantine ponds and isolation ponds. Sewage-fed fish culture. Principles of organic cycling and detritus food chain. Use of agro-industrial waste and biofertilizer in aquaculture. Composite fish culture system of Indian and exotic carps-competition and compatibility. Exotic fish species introduced to India. Culture of other freshwater species. Medium and minor carps, catfish and murrels. Species of fish suitable for integrated aquaculture. Integration of aquaculture with agriculture/ horticulture. Integration of aquaculture with livestock. Cultivation of aquatic macrophytes with aquaculture (makahana). Paddy cum Fish/Shrimp Culture.

Practicals

Preparation and management of nursery, rearing and grow-out ponds. Study on effect of liming, manuring and fertilization on hydrobiology of ponds and growth of fish and shellfishes. Collection, identification and control of aquatic weeds, insects, predatory fishes, weed fishes and eggs and larval forms of fishes. Algal blooms and their control. Estimation of plankton and benthic biomass. Study of contribution of natural and supplementary feed to growth. Workout of economics of different culture practices. Estimation of live stock requirement / Unit in integrated aquaculture Design of paddy plot for paddy-cum-fish culture. Design of Fish and Shrimp Culture, livestock shed on pond embankment, Economics of different integrated farming systems.

11. Anatomy and Biology of Finfish 3(2+1)

Theory

Study of external and internal anatomy of important groups of finfish. Study of oral region and associated structures. Digestive system and associated digestive glands. Food and feeding habits of commercially important fishes. Qualitative and quantitative methods of analysis of gut contents. Circulatory system, respiratory system, nervous system, urino-genital system, endocrine system, skeletal systems and sensory organs. Reproductive biology – maturity stages, gonado-somatic index, ponderal index, fecundity, sex ratio and spawning. Eggs and larval stages and developmental biology. Age and growth determination by direct and indirect methods. Fish migration - type and significance. Tagging and marking.

Practicals

Study of internal organs – digestive, respiratory, circulatory, urino-genital system, nervous, skeletal systems and endocrine system. Study of food and feeding habits. Analysis of gut contents. Estimation of age and growth by direct and indirect methods. Classification of maturity stages. Estimation of fecundity. Study of developmental stages. Tagging and marking.

12. Limnology 3(2+1)

Theory

Introduction to limnology: inland water types, their characteristics and distribution; ponds and lakes; streams and rivers; dynamics of lentic and lotic environments. Lakes - their origin and diversity. Famous lakes of the world and India; nature of lake environment; morphometry, physical and chemical conditions and related phenomena; biological relations: influence ofphysical and chemical conditions on living organisms in inland waters. Plankton: planktonic organisms; classification of plankton; distribution of plankton: geographic, vertical, horizontal and seasonal distribution of phytoplankton and zooplankton; seasonal changes of body form in planktonic organisms; food of planktonic organisms; primary productivity: Aquatic plants: characterstics, classification, zonation, seasonal variations, quantity produced chemical composition distribution in different waters, limnological role. Nekton: composition, distribution, movements. Benthos: classification; periphyton; zonation; distribution; movements and migration; seasonal changes in benthos, profundal bottom fauna. Biological productivity: circulation of food material; classification of lakes based on productivity; laws of minimum; biotic potential and environmental resistance; quantitative relationships in a standing crop; trophic dynamics; successional phenomena; indices of productivity of lakes; artificial enrichment. Lotic environments: running waters in general; physical conditions; classification of lotic environments, biological conditions; productivity of lotic environments. influence of currents; plant growth; plankton; nekton; benthos; temporary and head waters streams; ecological succession.

Practicals

Morphometry of lakes, ponds and streams. Determination of physical characteristics of lentic water bodies. Determination of chemical characteristics of lentic water bodies. Determination of physical characteristics of lotic water bodies. Determination of chemical characteristics of lotic water bodies. Collection and identification of fresh water phytoplankton. Enumeration and biomass estimation of freshwater phytoplankton. Estimation of primary productivity in fresh water bodies. Collection and identification of fresh water zooplankton. Enumeration and biomass estimation of fresh water zooplankton. Collection and identification of benthos from lakes and ponds, streams and canals. Collection and identification of nekton/aquatic insects from freshwater bodies. Collection and identification of aquatic plants from different fresh water bodies. Field visit to lotic and lentic water bodies.

13. Marine Biology 3(2+1)

Theory

Introduction to Marine Biology: Divisions of marine environment- pelagic, benthic, euphotic, aphotic divisions and their subdivisions. Life in oceans - general account of major groups of phytoplankton, sea weeds, major zooplankton groups. Environmental factors affecting life in the oceans-salinity, temperature, light, currents, waves, tides, oxygen, and carbon dioxide. Vertical migration of zooplankton, Phytoplankton-Zooplankton relationship, geographical and seasonal variation in plankton production, plankton and fisheries. Inter tidal ecology: Rocky shore, sandy shore and mud flats, zonations, communities, and the adaptation. Mud banks: formation, characteristics. Estuaries: Classification, Physico-chemical factors, Biota and productivity, examples of some Indian Estuaries. Boring and fouling organisms. Nekton outline, composition of nekton, habitats of nekton. Bioluminescence and indicator species,Blooms, Red tides: cause and effects.

Practicals

Study of common instruments used for collection of phytoplankton, zooplankton and benthos. Collection, preservation and analysis of phytoplankton, zooplankton, sea weeds, Collection preservation and analysis of inter tidal organisms.

14. Inland Fisheries 3(2+1)

Theory

Freshwater fishery regions of the world and their major fish species composition. Global inland fish production data. Capture fishery resources of India. Potential of inland water bodies with reference to respective state. Problems in the estimation of inland fish catch data. Fishing crafts and gears. Major riverine and estuarine systems of India. Major brackish water lakes and their fisheries. Fisheries of major reservoirs / natural lakes of India. Flood-plain capture fishery present status of their exploitation and future prospects. Cold water fisheries of India.

Practicals

Analysis of species composition of commercial catches at landing and assembling centers, sampling and familiarization of commercially important groups. Observations and experimental operations of selected fishing crafts and gears in inland / estuarine waters. Maintenance of records on catch data. Visit to Dept. of fisheries, lakes and reservoirs, net making yards.

15. Food Chemistry 3(2+1)

Theory

Composition of food and nutritional value. Moisture in foods. Biological oxidation, electron transport chain, P/0 ratio; oxidative phosphorylation. Carbohydrates: Naturally occurring polysaccharides in foods. Seaweed polysaccharides – sources and uses. Browning reactions – enzymatic and non-enzymatic. Lipids: metabolism of lipids, oxidation of fatty acids, lipoproteins; VLDL and HDL and their importance. Proteins: metabolism, deamination, decarboxylation, metabolic fate of amino acids, nitrogen balance. Deamination reactions and nitrogen excretion with special reference to fish. Fish muscle proteins, chemical changes in muscle during contraction. Proteins in foods, role in hydration- native and denatured proteins, gel formation, functional properties of proteins, changes during heat treatment and processing, texturised proteins. Chemistry of taste, flavour and odour components in foods, flavour intensifiers, synthetic flavouring substances. The taste of fish and shellfish. Food additives - types and their chemical nature, emulsifiers and antimicrobial additives, sequestrants, flavour potentiators surface active agents; non-nutritive sweeteners, colour additives in food. Assessment of quality of food by instrumental and chemical methods. Nutritive value of foods. Energy value and energy requirements and their estimation. Water, electrolytic and acid-base balance. Nutritive value of proteins PER, BV digestibility coefficient, NPU values, pepsin digestibility. Role of fibre in human nutrition.

Practicals

Estimation of moisture, crude protein, fat, ash (including acid soluble) in fish sample. Determination of energy value of fish. Estimation of glucose and salt content in foods. Colorimetric method of estimation of proteins and carbohydrates. Use of pH meter. Estimation of freshness quality indices such as TVBN, TMA, alpha-amino nitrogen, PV, FFA, TBA value of fish. Estimation of fibre in foods.

16. Information and Communication Technology 2(1+1)

Theory

IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; word and character representation; features of machine language, assembly language, high-level language and their advantages and disadvantages; principles of programming- algorithms and flowcharts; Operating systems (OS) - definition, basic concepts, introduction to WINDOWS and LINUX Operating Systems; Local area network (LAN), Wide area network(WAN), Internet and World Wide Web, HTML and IP; Introduction to MS Office - Word, Excel, Power Point. Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing. Communication process, Berlo' s model, feedback and barriers to communication

Practicals

Exercises on binary number system, algorithm and flow chart; MS Word; MS Excel; MS Power Point; Internet applications: Web Browsing, Creation and operation of Email account; Analysis of fisheries data using MS Excel. Handling of audio visual equipments. Planning, preparation, presentation of posters, charts, overhead transparencies and slides. Organization of an audio visual programme.

17. Aquaculture in Reservoir 2(1+1)

Theory

Definition of reservoirs in India; nature and extent of reservoirs, topography and species diversity; importance of morpho-edaphic index in reservoir productivity and classification; factors influencing fish production; trophic phases in reservoir; pre-impoundment and post-impoundment stages and their significance in establishment of reservoirs fisheries. Salient features of reservoir limnology and their significance to fisheries development; management of small, medium and large reservoirs; present status and future prospects in reservoirs fish production. Fisheries of some important reservoirs; recent advances in reservoirs fisheries management; conservation measures in reservoir fisheries. Fish stocking in Reservoirs Role of cage and pen culture in enhancement of fish production from reservoirs; history of cage culture, advantages of cage culture; selection of suitable site of cage culture; cage materials, designs, shape, size and fabrication; cage frames and supporting system. Integration of cage culture with other farming systems. History of pen culture, pen materials, fabrication; breeding of fish in pen; rearing of spawn in pen; grow-out from pens. Suitable species for culture in cages and pens; constraints in cage and pen culture; economics of cage and pen culture.

Practicals

Preparation of charts on the present situation of reservoirs fisheries productivity; detailed case studies of selected reservoirs on the changing trends in capture fisheries profile; drawing inferences from the analysis of data; suggestions for the sustainable development of reservoirs fisheries. Case studies on cage and pen culture; field visit to cage and pen culture site to acquaint with construction details and operation.

18. Physical Education, First Aid & Yoga Practices 1(0+1)

Practicals

Introduction to physical education: definition, objectives, scope, history, development and importance; physical culture; Meaning and importance of Physical Fitness and Wellness; Physical fitness components -speed, strength, endurance, power, flexibility, agility, coordination and balance; Warming up - General & Specific & its Physiological basis; Test and measurement in physical education; Training and Coaching - Meaning & Concept; Methods of Training; aerobic and an aerobic exercises; Calisthenics, weight training, circuit training, interval training, Fartlek training; Effects of Exercise on Muscular, Respiratory, Circulatory & Digestive systems; Balanced Diet and Nutrition: Effects of Diet on Performance; Physiological changes due to ageing and role of regular exercise on ageing process; Personality, its dimensions and types; Role of sports in personality development; Motivation and Achievements in Sports; Learning and Theories of learning; Adolescent Problems & its Management; Posture; Postural Deformities; Exercises for good posture. Yoga; Introduction to - Asanas, Pranayam, Meditation and Yogic Kriyas; Role of yoga in sports; Governance of sport in India; Important national sporting events; Awards in Sports; History, latest rules, measurements of playfield, specifications of equipments, skill, technique, style and coaching of major games(Cricket, football, table Tennis, Badminton, Volleyball, Basketball, Kabaddi and Kho-Kho) and Athletics Need and requirement of first aid. First Aid equipments and up keep. Handling and transport of injured traumatized persons. Emergency procedure for suffocation, demonstration of artificial respiration. Treatment of injuries (wounds and bleeding)–methods of dressing and bandages; first-aid procedure for injured bones. Handling unconsciousness; Treatment of bums and scalds. Emergency procedure for poisoning with special references to snakebite. Injuries I accidents in fishing, fish processing factories, chemical laboratories and their treatments. Shock injuries to muscles and joints and treatments. Sports injuries and their treatments.

19. Aquaculture Engineering 3(2+1)

Theory

Fish Farm- Definition, objectives, types of farms; fresh water, brackish water and marine farms. Selection of site for aqua farm- site selection criteria, pre-investment survey viz., accessibility, physical features of the ground, detailed survey viz., site condition, topography, soil characteristics. Land Surveying- definition, principles of surveying, classification of surveying, instruments used for chaining, chaining on uneven or sloping ground and error due the incorrect chain length. Chain surveying- definitions, instruments used for setting out right angles, basic problems in chaining, cross staff survey. Compass surveying - definitions, bearing, meridians, whole circle bearing system, reduced bearing system, theory of magnetic compass, prismatic compass. Leveling - definitions, methods of leveling, leveling instruments, terms and abbreviations, types of spirit leveling. Plane table surveying- instruments required, working operation, methods. Contour surveying- definition, contour interval, characteristics of contour, contouring methods and uses of contour. Calculation of area of regular and irregular plane surfaces, Trapezoidal and Simpson's rule, volume of regular and irregular shape as applied to stacks and heaps, calculation of volume of pond. Earth work calculations- excavation, embankment, longitudinal slope and cross slope, calculation of volume of earth work as applied to roads and channels. Soil and its properties- classification of soil; soil sampling methods; three phase system of soil, definitions of soil properties andpermeability of soil. Ponds - classification of ponds; excavated ponds, embankment ponds, barrage and diversion ponds; rosary system and parallel system. Planning of fish ponds, layout planning, materials planning, manual planning, comparison of square and rectangular ponds, large and small ponds; Types of ponds; nursing ponds, rearing ponds and stocking ponds. Design of ponds, pond geometry; shape, size, bottom slope of pond *etc.*, construction ponds viz., marking, excavation etc., Dykes, types of dykes viz., peripheral dykes, secondary dyke, design of dykes, construction of dykes. Water distribution system- canal, types of canals; feeder canal, diversion canal etc.,Pipe line system, Water control structures- types of inlet and out let and their construction. Water budget equation, Pond drainage system; seepage and the methods used for seepage control, evaporation; factors affecting evaporation, erosion of soil in dykes and its control. Site selection, planning and construction of coastal aqua farms. Brackish water fish farms- tide fed, pump fed farms, site selection - topography, tidal amplitude, soil and water sources etc., Hatcheries- site

selection, infrastructural facilities; water supply system, main hatchery complex viz., Layout plan and design of hatcheries- brood stock ponds, artemia hatching tanks, sheds etc, Raceway culture system- site selection, layout plan, types of raceway culture system viz.,parallel system, series system etc., Aerators- principles, classification of aerators and placement aerators. Pumps purpose of pumping, types, selection of pump, total head, horse power calculation. Filters- types and constructions.

Practicals

Evaluation of potential site for aquaculture. Land survey – chain surveying, compass surveying, leveling, plane table surveying and contouring; soil analysis for farm construction. Design and layout plan of fresh water and brackish water farms and hatcheries. Design of farm structure: ponds, dykes and channels. Earth work calculations and water requirement calculation. Visit to different types of farms.

20. Physiology of Finfish and Shellfish 3(2+1)

Theory

Water as a biological medium. Gas exchange; Circulation; Excretion; Osmoregulation; Reproductive physiology; Muscle physiology; Sense organs; Energy and nutrient status of food; Nitrogen balance; Standard and active metabolism; Energy utilization; Effect of environmental factors on physiology of fin and shellfishes. Stress related physiological changes. Structure and functions of important endocrine glands.

Practicals

Estimation of oxygen consumption, Osmoregulation, ammonia excretion and carbondioxide output. Influence of temperature and salinity on metabolism. Haematology of fin and shellfishes. Histological techniques.

21. Fish Food Organisms 2(1+1)

Theory

Candidate species of phytoplankton and zoo-plankton as live food organisms of freshwater and marine species. Tropic potentials - proximate composition of live feed. Biology, culture requirements and methodology of important live food organisms; Green algae, blue-green algae, spirulina, diatoms, infusoria, rotifers, cladocerons, tubifex, brine shrimp, chironomids. Culture of earthworms, bait fish and forage fish.

Practicals

Methods of collection and identification of different live food organisms. Laboratory scale culture of selected live food organisms (green algae, spirulina, chetoceros, rotifer, Moina, copepod). Evaluation of live food organisms. Decapsulation and hatching method of brine shrimp cyst.

22.Fishery Oceanography 2(1+1)

Theory

Introduction to Oceanography: classification; expeditions national and international. Earth and the ocean basin, distribution of water and land; relief of sea floor; Major feature of topography and terminology; major divisions. Relief in Indian oceans. Ocean Waves: definition and terms; classification, Difference between surface and long waves; wave theories; surface wave generation; spreading growth; Beaufort Scale; spilling and breaking waves; long waves, Tsunamis, Seiches, internal waves. Ocean Tides: Definition; Tidal phenomenon, elementary tidal definition; tidal inequalities; tide producing forces types of tides tidal bores, tide prediction. Ocean Currents: Definitions and features; measurements of currents; direct and indirect methods forces acting on sea waters; drift currents Ekman spirals, upwelling, sinking, gradient currents; thermohaline circulation; characteristics; course; and significance of some major ocean currents of the world. El-Nino. Physical properties of sea water: Salinity and chlorinity; temperature; thermal properties of sea water; colligative and other properties of sea water; Residence time of constituents in seawater. Properties of sea ice; transmission of sound; absorption of radiation; eddy conductivity; diffusivity and viscosity. General distribution of temperature, salinity and density: Salinity and temperature of surface layer (SST), subsurface; distribution of temperature and salinity; The T-S diagram; water masses of Indian oceans. Chemistry of sea water: Constancy of composition; elements present in sea water; artificial sea water; dissolves gases in sea water; CO_2 system and alkalinity; inorganic agencies affecting composition of sea water distribution of phosphorus, nitrogen compounds, silicates and manganese in the oceans, factor influencing their distribution.

Practicals

Field visits and operation of oceanographic instruments- Nansen reversing water sampler, Bathythermograph, Grabs, Corers, Current meters, Tidal gauges, Echo-sounder. Measurement of temperature, Transparency, pH. Determination of DO, Salinity, Ammonia, Nitrate, Nitrite, Phosphate and Silicate in sea water

23. Ornamental Fish Production and Management 2(1+1)

Theory

World trade of ornamental fish and export potential. Different varieties of exotic and indigenous fishes. Principles of a balanced aquarium. Fabrication, setting up and maintenance of freshwater and marine aquarium. Water quality management. Water filtration system-biological, mechanical and chemical. Types of filters. Aquarium plants and their propagation methods. Lighting and aeration. Aquarium accessories and decorative. Aquarium fish feeds. Dry, wet and live feeds. Breeding and rearing of ornamental fishes. Brood stock management. Application of genetics and biotechnology for producing quality strains. Management practices of ornamental fish farms. Common diseases and their control. Conditioning, packing, transport and quarantine methods. Trade regulations and wild life act in relation to ornamental fishes.

Practicals

Identification of common ornamental fishes and plants. Fabrication of all-glass aquarium. Setting up and maintenance of Aquarium accessories and equipment. Conditioning and packing of ornamental fishes. Preparation of feed. Setting up of breeding tank for live bearers, barbs, goldfish, tetras, chiclids, gouramis, fighters and catfishes. Identification of ornamental fish diseases and prophylactic measures.

24. Freezing Technology 2(1+1)

Theory

Introduction to freezing technology; characteristics of fish and shellfish; changes in fish after death, spoilage of fish, spoilage and pathogenic microorganism. Handling of fresh fish; sanitation in processing plants. Principles of low temperature preservations. Chilling of fish – methods and equipment for chilling; icing – quality of ice, ice making; refrigerated or chilled sea water, chilling rate; spoilage of fish during chilled storage; use of antibiotics and chemicals. Freezing of fish fundamental aspects; heat units; freezing point depression, eutectic point; freezing rate; methods of freezing, freeze drying, physico– chemical changes that occur during freezing, mechanism of ice crystal formation; preparation of fish for freezing. Changes that occur during frozen storage – microbiological, physical and chemical changes, protein denaturation, fat oxidation, dehydration, drip; protective treatments – polyphosphate, glazing, antioxidants, packaging; thawing of frozen fish – methods of thawing. Transportation of frozen fish, cold chain, quality control, HACCP in freezing industry.

Practicals

Sanitation and plant housekeeping; chilling and freezing equipment, instruments; packages and product styles; methods of icing fish; cooling rate; preservation by chilled sea water; freezing and thawing curves; freezing of different varieties of fish and shellfish; estimation of drip; determination of quality changes during frozen storage; inspection of frozen fishery products; visits to ice plants, cold storages and freezing plants.

25. Genetics and Breeding 2(1+1)

Theory

Principles of genetics and breeding, Gene and chromosome as basis of inheritance, Mendel's law of inheritance – complete and incomplete dominance, monohybrid and dihybrid ratios. Gene interactions – dominant and recessive epistasis. Pleiotropism. Lethal genes. Mutation. Sex - linked genes, sex influenced and sex limited traits. Linkage and crossing over. Introduction to population genetics. Hardy- Weinberg law and its significance. Chromosomal structure and aberrations. Chromosome manipulation techniques - androgenesis, gynogenesis and polyploidy and identification of ploidy. Sex determination. Cross breeding (hybridization) – types of cross breeding, heterosis and design of cross breeding programmes, hybridization in different fishes. Quantitative genetics – quantitative traits, polygenic traits, heritability. History and present status of selective breeding programs in aquaculture. Selection methods and mating designs. Design for selective breeding. Inbreeding and its consequences. Domestication methods. Seed certification and quarantine procedures. Cryopreservation of gametes.

Practicals

Problems on Mendelian inheritance (qualitative genetics) - monohybrid and dihybrid ratios and epistasis. Problems on quantitative traits, response to selection and heritability. Estimation of rate of inbreeding and heterosis. Mitotic and meiotic chromosome preparation. Demonstration of protocol of androgenesis, gynogenesis and polyploidy. Problems on gene and genotypic frequency. Gamete cryopreservation protocols and quality evaluation of fish milt.

26. Fish Immunology 2(1+1)

Theory

Introduction, brief history to immunology. Types of immunity: Innate and adaptive immunity, cell mediated and humoral immunity, cells and organs of the immune system. Antigens – structure and types. epitopes, haptenes. Antibody – fine structure, classes with structure and functions, antigenic determinants on immunoglobulins. MHC complex – types, structure, and functions. Antigen-antibody interactions- principle, antigen recognition by B-cells and T cells**.** Antigen-antibody reaction - Precipittin reactions, agglutination reactions, Microorganisms associated with fishes in health and disease. Defense mechanism in finfish and shellfish- specific and non specific immune system. Pathogenicity and virulence.Sources of infection, transmission of disease producing organisms, portals of infection. Immunity to bacteria, fungi and parasites Role of stress and host defense mechanism in disease development. Vaccines - types of vaccines – whole cell vaccine, purified macromolecules, recombinant –vector, DNA vaccines and multivalent subunit vaccines, modes of vaccine administration. Serological methods in disease diagnosis. Immunostimulants –types, mechanism of action, modes of administration. Immunoassays, immunodiffusion, ELISA, immunofluorescence, neutralization, radioimmunoassay, serotyping.

Practicals

Collection, separation and identification of fish leucocytes. Separation of blood plasma and serum. Differential counting - RBC and WBC by Haemocytometer. Study of different types of leukocytes and isolation of macrophages. Precipitin reactions - Agglutination test,immunogel diffusion, double immuno diffusion, radial immuno diffusion assay, ELISA. Methods of vaccine preparation and techniques of fish immunization.

27. Fisheries Economics 3(2+1)

Theory

Introduction to fisheries economics, basic economic terminologies – micro and macroeconomics, positive and normative economics, environmental economics, resource, scarcity, farm-firm relationships, production Contribution of fisheries sector to the economic development of the country. Micro-economics: theories of demand, supply; market – equilibrium price, consumption, utility, Consumer surplus. Elasticity – price, income, cross, application of elasticity in fisheries managerial decision. Farm production economics – production functions in capture and culture fisheries; Costs and returns –breakeven analysis of fish production system; concepts of externalities and social cost;factors of production, marginal cost and return, law of diminishing marginal return, returns toscale, economies of scale and scope, revenue, profit maximization, measurement of technological change, farm planning and budgeting. Significance or importance of marginal cost. Macro-economics: Introduction to national income, accounting, measurement and determinants of national income, contribution of fisheries to GNP and employment; balance of payments, economic growth and sustainable development. Globalization: dimensions and driving Forces. Introduction to GATT and WTO. WTO Framework – Key Subjects – Agreement on Sanitary and Phytosanitary Measures (SPS), Seafood Export Regulations; Non-Tariff Barriers (NTBs) and Agreement on Anti-Dumping Procedures. Fisheries Subsidies and WTO. Fisheries Trade and Environment; protests against globalisation and WTO. Intellectual Property Rights (IPR) and different forms. Patents and patenting process, Agreement on TRIPS. Bio-piracy. GMOs in fisheries. Salient features of Indian Patent (Amendment) Act 2005. Overview of Patents in Indian fisheries sector.

Practicals

Demand and supply functions of fish market – determination of equilibrium price for fish and fisheries products, calculation of price, income and cross elasticities. Production function – production with one or two variable inputs. Shifting demand and surplus curve and its importance in fish price. Economic analysis on cost, return and breakeven of any two production units like fish farm / shrimp farm / seed production unit /fish processing plant / export unit.

28. Aquatic Mammals, reptiles and amphibians 1(1+0)

Theory

Selected aquatic mammal, reptile, amphibian and birds species of India relevant to fisheries: taxonomic status, identification characters, distribution, abundance, habitat, exploitation, threats and conservation. Biology of aquatic animals: Cetaceans (whales. dolphins, porpoises and narwal), Sirenia (manates and dugongs), Carnivora (seals, sea lions walruses, polar bear and otter), Sea turtles, tortoise, crocodiles, sea/freshwater snakes and amphibians. IUCN criteria – Red list, Wild Life (Protection) Act.

29. Coastal Aquaculture and Mariculture 3(2+1)

Theory

An overview of sea farming and shore-based aquaculture in different parts of the world. Resources for shore-based aquaculture and sea farming in India. Traits of important cultivable fish and shellfish (seabass, mullet, milkfish, grouper, cobia, snappers, ayu, pearlspot, tiger shrimp, white shrimp, mud crab, mussel, clam, oysters (edible and pearl oyster), lobster, seaweeds, Seed resources. Shore based aquaculture system: traditional (pokkali, bheries, gazanis, khazans), semi- intensive, intensive aquaculture practice of commercially important species of fish and shellfish. Methods of Shellfish Culture rafts, racks, cages, poles and ropes., Water and soil quality management. Estimation of growth, survival and pond productivity. Seaweed culture, Pearl culture, Sea ranching.

Practicals

Identification of important cultivable species. Collection and identification of commercially important seed of fish and shellfishes. Types of fertilizers - Pond preparation. Seed selection, quality and acclimatization. Water quality parameters. Estimation of seed survival. Pond biomass estimation. Material, apparatus and machinery for shore-based aquaculture and sea farming. Estimation of feed intake. Growth and health monitoring. Fouling organisms in cages and pens.

30. Therapeutics in Aquaculture 2(1+1)

Theory

Scope and current scenario of therapeutics in aquaculture. Chemotherapy: History, definition, terms used and classification of AMA. Antibacterial agents, mode of action, general principles, classification, Antibiotics, different classes and their mode of action, properties etc.Antibiotic resitance. Antiseptics and disinfectants. Antiparasiticides: Ectoparasites, Endoparasites and Protozoanes. Antibiotics used in aquaculture Biologics: Immuno-stimulants and Vaccines-Principles in preparation/formulation, mechanism of action. Drug formulation for aquaculture-Principles in preparation/formulation, mechanism of action, drug leaching, stabilizer, binders and dosage. Therapeutants in aquaculture: Classification, pesticides, fungicides/ algicides, hormones, anaesthetics, flesh color enhancers, Chemicals of therapeutic value, Law priority aquaculture drugs. Drugs used for structural material and substances for maintenance, substances connected with zoo technical practices, list of the drugs used in aquaculture with therapeutics

Practicals

Regulations of drug use. Introduction to antimicrobials, preparation of potassium permanganate solution, preparation of weak Tincture Iodine. Minimum inhibitory concentration(MIC). Five plate screening test for the detection of antibiotic residue. Calculation of different disinfectants dosage in treating fish ponds. Generic name, patent name, dosage and indications of various aquaculture drugs used in fish health.

31. Fish Nutrition and Feed Technology 3(2+1)

Theory

Fundamentals of fish nutrition and growth in fish. Principal nutrients and nutritional requirements of cultivable fish and shellfish. Nutritional energetics: definition and forms of energy partitioning. Methods of feed formulation and manufacturing. Forms of feeds: wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets. Feed additives: binders, antioxidants, enzymes, pigments, growth promoters, feed stimulants. Feed storage: use of preservatives and antioxidants. Feed evaluation: feed conversion ratio, feed efficiency ratio, protein efficiency ratio, net protein utilization and biological value. Feeding devices and methods. Nonconventional feed ingredients and anti-nutritional factors. Digestive enzymes, feed digestibility. Factors affecting digestibility. Nutrional deficiency diseases.

Practicals

Proximate composition analysis of feed ingredients and feeds. Preparation of artificial feeds using locally available feed ingredients. Determination of sinking rate and stability of feeds. Effect of storage on feed quality.

32. Fish Canning Technology 2(1+1)

Theory

Introduction to canning and its historical developments. Advantages of canning in relation to other preservation methods. Raw materials and sub materials, their characteristics and suitability for canning. Classification of foods based on pH, commercial sterility, Absolute sterility, pasteurisation and sterilization. Canning process, process flow steps involved HTST and aseptic canning. General steps in canning procedure and importance, preparation of raw material, packing, pre-cooking, exhausting, seaming, retorting, cooling labelling and storage. Principles of thermal processing. Heat resistance of micro organisms, heat penetration studies, mechanism of heat transfer. Cold spot and its importance, convection and conduction type of packs. Process calculation by general/ graphical methods, estimation of Fo value of the process (D-value, Z-Value TDT, F-value, lethal rate). Commercial sterilization, 12-D concept. Canning of commercially important fin fishes, shell fishes and cephalopods. Spoilage of canned foods, types, causes and preventive measures. Quality standards, plant layout, hygiene and sanitation and waste disposal. Types of packaging materials for canned foods, metal containers (Tin Plate, TFS, Aluminium cans) and retortable pouches.

Practicals

Types of cans, canning equipments and layout of cannery. Canning of different varieties of fish and shellfish. Cutout test of canned products. Examination of can double seam. Heat resistance of bacteria. Heat penetration in canned food, thermal process calculation by general method. Study of spoilage condition in canned products. Familiarization with various packaging materials and container for fish products.

33. Fish Packaging Technology 2(1+1)

Theory

Introduction to packaging, Importance of packaging in fish processing, functions, objectives and requirements. Packaging materials, basic and laminates, principles of their manufacture and their identification. Properties of packaging materials and their use in protective packaging with special reference to food. Printing for packaging and print identification. Closures of packaging, heat seals bottle closure. Principles of packaging fresh produce handling and transportation. Packaging for retail sale and storage. Packaging equipment and machinery. Package design, evaluation and testing. Flexible packaging materials, rigid containers, thermoform containers, glass containers, corrugated fiber boards, duplex cartons, edible packaging materials. Laminations and co-extrusions. Retort pouch packaging - advantages and disadvantages. Biodegradable films, vacuum packaging, active packaging, MAP, Polymeric Packaging. Packaging requirements of fresh fish, Frozen fish, Canned Fish. Transport worthiness of packaging materials, accelerated shelf testing. Materials and their safe use in food contact application. Safety and legislation aspects of packing. Labeling and bar coding.

Practicals

Determination of grammage of paper and board, bursting strength, burst factor, punctures resistance, water proofness, stiffness of the board, ring stiffness of paper and board, flat crush, tensile strength and elongation at break of plastic films, density of plastic films, breaking length, impact strength of plastic films, tearing strength of paper and plastic films, water vapour transmission rate, oxygen transmission rate, heat seal strength, suitability of plastic films for food contact applications, evaluation of retort pouch, identification of plastic films.

34. Fish and Shellfish Pathology 3(2+1)

Theory

Significance of finFish and Shellfish diseases in aquaculture. Host, Pathogen and Environment Interaction. Disease development process. Stress in aquaculture and its role in disease development. Pathological processes: Cellular response to injury, Inflammatory response to diseases, Pathogencity mechanism of parasite, bacteria, virus and fungus. Casehistory and clinical sign in disease diagnosis. Role of physical (injuries, health, cold) chemical (pH, salinity, toxins, ammonia, nitrogenous waste, endogenous chemicals and metabolites, free radicals, oxidants) soil and water parameters in fish health. Nutritional diseases . Non-infectious diseases.

Practicals

Live and post mortem examination of fish and shellfish. Pathology of organ systems. Histopathology of normal and diseases fish and shellfish, Diagnosis of abiotic fish diseases.

35. Fishing Craft Technology 2(1+1)

Theory

Introduction: History & development of fishing crafts. Traditional fishing crafts of India. Classification of fishing crafts based on fabrication dimension, nature of fishing, depth of operation. History & development of mechanization of fishing crafts. Basic geometric concepts and important terminologies of fishing vessel. Form coefficients, properties of irregular shapes Calculation of longitudinal and transverse sectional area of fishing craft by using Trapezoidal rule and Simpson's rules. State of equilibrium; Volume of displacement; centre of gravity (CG); centre of buoyancy (CB); vertical centre of gravity (VCB); longitudinal centre of gravity (LCB). Stability of fishing vessels- longitudinal and transverse. Various equilibrium of ships-stable, unstable and neutral; Light weight, Dead weight, Tonnage system; Gross Registered Tonnage (GRT), Net Registered Tonnage (NRT). Boat building materials: Choice of construction materials: Wood, properties, advantages and disadvantages. Deck fitting. Maintenance oif fishing vessels. Fouling and boring organisms; seasoning and preservation of wood. Constructional details of boat: Offset tables; Mould lofting; Backbone assembly of wooden boat. Constructional details of Steel, FRP, Ferro Cement and Aluminum boats. Introduction of Outboard and inboard engines.

Practicals

Studies on traditional fishing crafts; Introduction to drawing and drawing instruments; Lettering, Geometrical construction, Curves. Projections; Projection of points, planes and Projection of solids; lines plan drawing; Drawing of back bone assembly; U & V bottom hull of wood

36. Fisheries Extension Education 2(1+1)

Theory

Introduction to extension education and fisheries extension - concepts, objectives and principles; extension education, formal and informal education; History and role of fisheries extension in fisheries development. Fisheries extension methods- individual, group and mass contact methods and their effectiveness, factors influencing their selection and use; characteristics of technology, transfer of technology process; important TOT programs in fisheries; role of NGOs and SHGs in fisheries; Fisheries co-management; Adoption and diffusion of innovations, adoption and diffusion process, adopter categories and barriers in diffusion of fisheries innovations; Extension program planning and evaluation - steps and importance; participatory planning process. Basic concepts in rural sociology and psychology and their relevance in fisheries extension; social change, social control, social problems and conflicts in fisheries; gender issues in fisheries; theories of learning, learning experience, learning situation

Practicals

Collection of socio-economic data from fishing villages; study of social issues/problems through participatory and rapid rural appraisal techniques, stake holders analysis and needs assessment; assessment of development needs of community and role of formal and non – governmental organizations through stakeholder analysis; case studies on social/gender issues and social conflicts in fisheries. Case studies on extension programs and Success stories. Practical exercises on conducting fish farmers meet.

37. Shellfish Hatchery Management 2(1+1)

Theory

Natural seed resources, site selection and collection methods. Life cycle of important shellfish (*Penaeus monodon, P. indicus, Macrobrachium rosenbergii, P. Vannamei, Scylla serrata*, lobster, edible, oyster, pearl oyster, fresh water mussel, holothurians, horse-shoe carb, Sepia, Loligo, cray fish etc.). Sexual maturity and breeding seasons of different species. Maturation stages of *Macrobrachium rosenbergii* and *Penaeus monodon*. and *P. Vannamei*. Induced maturation in *Penaeus monodon* and *P. Vannamei P. Indicus* by eye stalk ablation. Reproductive physiology. Reproductive harmones in crustaceans. Brood stock management of *Penaeus monodon* and *Macrobrachium rosenbergii*. Breeding and hatchery management of *Penaeus monodon* and *Macrobrachium rosenbergii.* Breeding and hatchery management of crabslobster, mussel, edible and pearl oyster. Food and feeding of larval stages of important shellfishes. Health management in hatcheries.

Practicals

Identification of brood stock and maturity stages of important crustaceans and mollusks. Observations on gonadal maturation of *Penaeus monodon* and *Macrobrachium rosenbergii*. Breeding and larval rearing of *Macrobrachium rosenbergii* and *Penaeus monodon* P. Vannamei. Identification of larval stages of important crustaceans and mollusks. Demonstration of eyestalk ablation in *Penaeus monodon*. Collection, packing and transportation of shrimp/prawn seed and brood stock. Practice in the operation of shrimp and prawn hatcheries. Water treatment and management in shrimp and prawn hatcheries. Different chemicals and drugs used in shrimp/ prawn hatchery.

38. Communication Skills and Personality Development 1(0+1)

Practicals

Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precis writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

39. Finfish Hatchery Management 3(2+1)

Theory

Freshwater and marine fish seed resources. Natural breeding of finfishes. Selection of riverine spawn collection sites, gears used and methods of collection. Spawn quality and quantity indices. Advantages and disadvantages of riverine seed collection. Sexual maturity and breeding season of various cultivable species. Development of gametes in male and female. Fish egg and embryonic development. Methods of breeding; bundh breeding - wet and dry bundhs, collection and hatching of eggs, factors involved in bundh breeding, advantages and disadvantages of bundh breeding. Induced breeding of warmwater finfishes, environmental factors affecting spawning, sympathetic breeding. Hypophysation of fishes. Fish pituitary gland – its structure, collection, preservation and preparation of extract for injection, dosages and methods of injection. Brood-stock management and transportation of brood fish. Synthetic hormones used for induced breeding of carps. Different types of fish hatcheries-traditional, Chinese, glass jar and modern controlled hatcheries. Causes of mortalities of eggs and spawn and remedies. Spawn rearing techniques. Use of anesthetics in fish breeding and transport. Breeding techniques for Indian major carps, exotic carps, mahaseers, trouts, tilapias, catfishes, grey-mullets, milk fish, pearl spot, sea bass, sea hourse, groupers, pacu, cobia, pompanos and indigenous fishes, etc. Off-season andmultiple breeding of carps.

Practicals

Study of maturity stages in fishes. Collection and preservation of fish pituitary gland, preparation of PG extract, Hypophysation. Calculation of fecundity. Brood-stock maintenance and selection of breeders for injection. Histological studies of ovary and testes. Different fish hatchery systems, study of fish eggs and embryonic developmental stages. Identification of eggs, spawn, fry and fingerlings of different species. Preparation and management of fish nursery. Fish seed and brood-stock transportation, use of anesthetics, disinfectants and antibiotics in fish breeding. Water quality monitoring in fish hatcheries and nurseries. Breeding and larval rearing of common finfishes.

40. Anatomy and Biology of Shellfish 2(1+1)

Theory

Study of external and internal organization of commercially important crustaceans and molluscs. Digestive, respiratory, circulatory, nervous and reproductive systems. Food and feeding habits, growth, moulting, length – weight relationship. Reproductive biology, larval stages. Age and growth determination by direct and indirect methods.

Practicals

Study of Internal Organs commercially important crustaceans and mollusks. Study of Digestive, respiratory, circulatory, nervous and reproductive systems. Study of food and feeding habits - analysis of gut contents, age and growth, length - weight relationship and condition. Reproductive biology: maturity stages, spawning periodicity, fecundity and larval stages.

41. Pharmacology 3(2+1)

Theory

Introduction to Pharmacology: History, Importance, Terms and Definitions, Drug development, Screening and Nomenclature, Scope of pharmacology in fishes. Route of Administration and Method of application to fish. Source of Drugs. Pharmacolotherapeutic classification of drugs. Pharmacokinetics: Biological membrane, absorption, distribution, biotransformation and Excretion of drugs. Factors influencing drug metabolism. Pharmacodynamics: Principles of drug action, concept of drug receptor, nature, chemistry, classification. Functions of receptor. Transducer mechanism, second messenger, non receptor mediated action. Dose Response Relationship, half life withdrawal period, potency, efficacy, threshold dose, therapeutic dose, maximal dose, toxic dose, lethal dose. Factors modifying drug action, Adverse drug effects, drug interaction and Bioassay of drugs. Salient features in drug acting on digestive system, nervous system and cardiovascular system. Drugs used in fish transporation. Recent advances in Pharmacology, biostatistics in experimental Pharmacology, Pharmaceutical industry.

Practicals

Introduction to Pharmacy, Metrology, Prescription Writing, Preparation of drug solution, Source and chemical nature of drugs, Incompatability, Pharmacutical technology, Bioassay of drugs, Animal models in Pharmacological experiments, Methods of application of drugs in fish.

42. Fish Toxicology 2(1+1)

Theory

*General Toxicology:*Definitions, Branches of Toxicology, Historical developments, Classification of poison. Types of poisoning- Toxicity testing - Chronocity factor, Untoward effects, Common causes, Diagnosis of poisoning, Factors modifying toxicity, Toxicokinetics, Toxicodynamics, General approaches to diagnosis and treatment of poisoning. *Systemic Toxicology:*Toxicity caused by metal and non-metals, Phytotoxins- Toxic principles of various alkaloids and toxic plants, Drug toxicity and toxicity caused by agrochemicals. Mycotoxins, Bacterial toxins. Collections and dispatch of specimens in Toxicological cases, Toxicity of drugs in Aquaculture: Maximum Residual Limits (MRL) of various drugs and chemicals in fish Metabolism of toxic substances by aquatic organisms.

Practicals

Detection of heavy metal poisoning. Spot tests for metals. Group reaction for metals- Arsenic, Antimony, Lead (Pb), Mercury (Hg), Zinc (Zn), Barium (Ba), Iron (Fe_3 +), Copper (Cu), Ammonia (ammonium ions) NH_4 + Chloride (Cl-), Phosphate ($P0_4$) Sulphate ($S0_4$) Flouride (Fl-), Qualitative detection of Nitrite and Nitrate, Detection of hydrocyanic acid, Detection and Estimation of Mycotoxins, Test for detection of alkaloids, Estimation of LD_{5O} and ED_{5O} Demonstration of drug toxicity.

43. Marine Fisheries 3(2+1)

Theory

Classification and definition of fishery zones and fishery resources of world. Overview of marine fisheries resources of the world and India. Major exploited marine fisheries of India, their developmental history and present status. Important pelagic - demersal fish, shellfish and seaweed resources of India. Traditional, motorized and mechanized fisheries according to major gears. Potential marine fishery resources of the India's EEZ. GIS and Remote sensing in marine capture fishery.

Practicals

Visit to fish landing centres, Observation and analysis of catches by major crafts and gears. Field collection of fishes, crustaceans, molluscs and seaweeds and record keeping of relevant data. Participation in fishing cruises. GIS and remote sensing in marine capture fishery.

44. Fisheries Co-operatives and Marketing 2(1+1)

Theory

Principles and objectives of co-operation, co-operative movement in fisheries in India, structure, functions, status and problems of fisheries co-operatives management in relation to resources, production and marketing. Role of credit for fisheries development, credit requirements of fishers, source and type of credit/finance, micro-credit, indigenous and institutional finance, structure of institutional finance in fisheries; returns, risk bearing ability and recovery in fisheries sector; role of NABARD in fisheries development; role of insurance in fish and shrimp farming and industry. Basic accounting procedures, profit and loss account. Introduction to marketing management; core marketing concepts: market structure, functions and types, marketing channels and supply chain, marketing margins, marketing environment, marketing strategies, product development and product mix, consumer behavior and marketing research. Fish markets and marketing in India, demand and supply of fish, market structure and price formation in marine and inland fish markets; cold storage and other marketing infrastructure in India; export markets and marketing of fish and fishery products; Trade liberalization and fisheries markets. Integrated marketing approach in fisheries. Sea food export case study on product and market diversification- export and import policies (fisheries). New product development and market segmentation. Export and import policies relevant to fisheries sector.

Practicals

Developing questionnaire and conducting market surveys, analysis of primary and secondary market data. Exercises on equilibrium price for fish and fishery products; estimation of demand and supply using simple regression. Analysis of credit schemes of banks and the government. Case studies of cooperatives. Visit to co-operative societies, commercial banks and fish markets and organizations dealing with marketing of fish and fishery products. Pattern and Performance of India's Seafood Exports; Case studies on product and market diversification. Case studies on competitiveness of Indian fish and fish products.

45. Fishing Gear Technology 2(1+1)

Theory

Development fishing gears and Fishing Technology: Evolution of Fishing gears; Mechanization of Fishing; Basic classification of fishing gears- Principle, Subsidiary and Auxiliary gears. Classification of fishing gears and methods: FAO classification of fishing gear and methods of the world; International Standard Statistical Classification of Fishing gear (ISSCFG). Fishing gear materials: Natural materials and Synthetic netting materials and their classification. Types and important synthetic materials used in fishing gears. Raw-materials for synthetic material; Preparation of nylon (PA 6.66) material; Different types of fibres- continuous fibre; monofilament, staple and split fibers and production of single yarns. Identification of synthetic fishing gear materials: Visual observation, water test, solubility test, burning test and melting point test. Construction of twisted netting materials: Yarn, single yarns, folded yarns, netting twine, cable netting twine and cable netting twine of higher order; Construction of ropes and their higher order; construction of braided netting twines. Yarn numbering system - direct system: Tex system Denier system and calculation of resultant tex value. Indirect system : British count, metric count, runnage system and their conversion. Methods of Preparation of knotted and knotless webbing, advantage and disadvantages of knotted and knotless webbings. Shape of mesh: diamond; square hexagonal and their measurement. Properties of netting material: physical properties- Density, twist and amount of twist, Breaking strength-tenacity, & tensile strength, breaking length, abrasion resistance, elasticity, extensibility, water absorption &, shrinkage, sinking velacity, weather resistance, melting point and visibility. Chemical and Biological properties. Floats – buoys – its materials, types their properties; Classification of floats: based on shape and materials; calculation of buoyancy. Sinkers – types, materials, properties- negative buoyancy. Factors to be considered while designing /selection of fishing gears; Biological, Environmental, oceanographical, Vessel characteristics and mesh size regulation. Choice of netting materials for trawl, gillnet and purse seine. Classification of trawl gears. 2 seem trawl; 4 seam trawl and wing trawl. Design and construction of wing trawl. Rigging of trawl gear: Arrangements of bridles, sweep lines and attachment of ground gears: tickler chain, bobbins and rock hoppers and attachment of otter board

Practicals

Study of net making tools; Knots and hitches used in net making. Methods of net making: Hand braiding- Chain mesh method and loop methods of net making. Shaping of webbing: baiting, creasing and reducing mesh size step by step. Tailoring method : T and N direction of webbing; T-cuts, N-cuts, B-cuts and their combination. Joining of net pieces. Net mounting – hanging coefficient, hung depth and their calculation. Selvedging. Methods of net mounting: reeving, stapling and norselling. Mending and net shooter techniques.

46. Fish Population Dynamics and Stock Assessment 3(2+1)

Theory

The concept of population and unit stock. Biological structure of fisheries resource in space and time. Indicators of dynamics in a fishery resource. Characteristics of unit and mixed stock. Data requirements for stock assessment. Segregation of stocks. Principles of stock assessment. Population age structure. Theory of life tables. Von Bertalanffy growth parameters. Graphical models. Monte Cario simulation model and ECOPATH model. Estimation of total fishing and natural mortality. The concept of yield, yield in number and yield in weight, yield per recruit, yield curve. Yield models. The concept of Maximum Sustainable Yield and Maximum Economic Yield. Biological symptoms of under-fishing and over-fishing. Growth over-fishing and recruitment over-fishing. Eumetric fishing. Open access fisheries. Fisheries regulations. CPUE. Trawl selection and gillnet selection. Analytical models of fish stocks.

Practicals

Study of length – weight relationship, segregation of stock using direct methods. Study of analytical models: Beverton and Holt model. VBGF, Pauly's integrated methods, graphical models. Estimation of Z, F and M. estimation of net selectivity coefficient. Fitting of surplus production model: Schaeffer model, Fox model. Study of yield isopleth diagrams. Micro-computer packages ELEFAN, FISAT.

47. Coastal Zone Management 2(1+1)

Theory

Estuaries, Wet lands and Lagoons, Living resources – Non living resources. Principles of remote sensing: orbits, electromagnetic radiation, diffraction, electro-optical, and microwave systems. Data Input, Data Management, Data Quality. Remote Sensing for Coastal Management. Geographical Information System (GIS): Definition, Concepts, Data Acquisition and Data Management. Applications of GIS in aquatic resource identification. Coastal Regulation Zone (CRZ) Act, Coastal regulation zones for main land and islands – Environmental policies, planning, administrative and regulations. CRZ mapping. Integrated Coastal Zone Management (ICZM); concept, application and case studies. Communication, research, integration, institutional arrangements, regulations, stakeholder participation, the role of the private sector in ICZM. Impacts of human activities on coastal and ocean areas: Challenges related to climate change, expanding tourism, declining fisheries, intensive shipping and biodiversity protection. Problems related to sectors such as tourism and fisheries in the ICZM context; Analysis of multiple use management problems typical for the coastal areas with the maritime industry. Environmental Impact Assessment (EIA): Principles and process. EIA of coastal industries. Evaluation and Methodology; Social Impact Assessment and other developmental activities.

Practicals

Field visit to different coastal environments to study erosion of beaches, Identification of ecologically sensitive areas and protection, Study of CRZ, ICZM along the coastal belt, Study on implementation and violation of CRZ, Study of application of remote sensing and GIS, Project preparation of EIA.

48. Introduction to Biotechnology & Bioinformatics 2(1+1)

Theory

Biotechnology**:** Introduction to Biotechnology –scope and importance in fisheries/ aquaculture; Structural organization of prokaryotic and eukaryotic cell. Nucleic acids - structure, function and types, Concepts of gene and genetic code, transcription and translation, mutations and their implications. Post transcriptional modification and RNA processing. Gene regulation and expression in prokaryotes and eukaryotes; DNA sequencing, Operons. Genetic engineering- Restriction enzymes; Gene isolation; Cloning vectors; Probes; Recombinant DNA technology – vaccines. Transgenic fish and Gene transfer technology, Animal Cell Culture, Hybridoma technology. Molecular and immunological techniques – PCR; immunoblotting; ELISA; Principle of hybridization; Northern blotting; Western blotting; Southern blotting; DNA fingerprinting; Restriction fragment length polymorphism., Biosensors. Concept of bioremediation of water, bioprocess engineering and bioprospecting. Bioinformatics**:** Introduction to Bioinformatics; Biological Databases and tools : Introduction; Types of biological databases; Primary and secondary databases; PDB, NCBI, formats and contents; Sequence retrieval, manipulation; Primer design; Restriction mapping; ORF finding; EMBOSS, Molecular visualization Sequence analysis.

Practicals

Study of structure of prokaryot and Eukaoryt Cells. Study on Model of protein Synthesis, Study of models rDNA Technology, Cell Culture, Isolation of Nucleic Acids, Restriction enzymes, Gel Electrophorus, ELISA, DNA sequence analysis and comparison.

49. Refrigeration and Equipment Engineering 3(2+1)

Theory

Fundamentals: Force, work, power, energy, volume, pressure, temperature. Heat, specific heat,

sensible heat, latent heat, comparison between heat and work-A path function. Thermodynamics: Laws of Thermodynamics, Laws of perfect gases, Thermodynamic processes, Application of First and Second law of Thermodynamics in refrigeration, Thermodynamics cycle, entropy, enthalpy. Refrigeration: History of refrigeration, Definition, principle, classification, Types of refrigeration systems i.e., Air refrigeration, vapour absorption refrigeration system. Vapour compression refrigeration system. Refrigeration plant: Layout of refrigeration plant, Construction. Insulating materials used for the cold storage construction, Frozen product storage capacity of cold storage, usage of Anteroom. Refrigeration systems: Vapour compression refrigeration system advantages and disadvantages

as compared toother refrigeration systems, Types of Vapour compression refrigeration cycles i.e., Theoretical Vapour compression refrigeration cycle, Actual refrigeration cycle. Compressors: Definition, Types of compressor, construction, working principle advantages and disadvantages. Evaporator: Definition, Types of Evaporator, construction, working principle advantages and disadvantages. Condenser: Definition, Types of Condenser, Cooling Towers, construction, working principle, advantages and disadvantages. Expansion valve: Definition, Types of Expansion valve, construction, working principle advantages and disadvantages. Refrigerant: Primary refrigerant, secondary refrigerant, properties, ideal refrigerant, leakage detection. Study of auxiliary equipment: Receiver, oil charging, refrigerant charging, gas purging, oil draining, types of defrosting. Ice-plant: Ice plant planning Brine tank construction, preparation of brine ,Types of ice, Storing of ice, Equipments used in ice plants. Freezers: Definition, Design and construction of freezers i.e. Plate freezer, Blast freezer, Tunnel freezer, spray or immersion freezers, refrigerated fish rooms and fish hold. Alternative refrigeration technique arrangements used onboard the fishing vessel i.e., Refrigerated sea water (RSW), Chilled sea water (CSW). Refrigerated transport. Cooling load: Unit of refrigeration, coefficient of performance (C.O.P),Refrigeration effect, study and use of Psychometric chart. Cooling load estimation, introduction, components of cooling load, heat gain through walls, roofs, products,

occupants, lighting equipments. Theory of machines: Transmission of power, friction wheels, shaft , gears, belt and Chain drive. Study of equipments used in fish processing with particular reference to canning, sausage, freeze drying and irradiation. Maintenance: Definition, Types of maintenance, general maintenance of freezing plant, cold storage and ice plant.

Practicals

Drawing of Refrigeration and Fish processing machineries plant layout, Graphically represented symbols used in refrigeration, Handling and operation of compressors, condensers, evaporators expansion valves, low and high pressure switches. Study of auxiliary equipments: Receiver, oil charging, refrigerant charging, gas purging, oil draining, types of defrosting. Power transmission line diagram of different fish processing machineries. Visit to processing plant refrigeration plant, Visit to ice plant, Visit to fishing harbor to study the fish hold, refrigerated fish rooms. Calculation on refrigeration effect and cooling load.

50. Aquatic Pollution 2(1+1)

Theory

Introduction to aquatic pollution, the sources of pollutants, toxic organic compounds and their impacts in the aquatic organisms and the abiotic environment, Classification of pollution physical, chemical and biological classification of water pollution- description of terminologies. Sewage and domestic wastes- composition and pollution effects- sewage treatment and its reuse. Agricultural wastes- organic detritus, nutrients, Adverse effects of oxygen demanding wastes: importance of dissolved oxygen; Oxygen demand; BOD; COD; Oxygen budget; Biological effects of organic matter. Excessive plant nutrients: Eutrophication; Red tides and fish kills. Pesticide types and categories; inorganic pesticides, Organo-chlorine compounds, Organo-phosphorous compounds; Polychlorinated biphenyls (PCBs); Bioaccumulation and impact on aquatic fauna and human health; toxicology. Heavy metals: Interaction of heavy metals with water and aquatic organisms. Bioremediation and Phytoremediation. Oil pollution; Crude oil and its fractions; Sources of oil pollution; Treatment of oil spills at sea; Beach Cleaning; Toxicity of Petroleum Hydrocarbons; Ecological Impact of Oil pollution- Case studies. Microbial pollution: Types of aquatic microbes; autotrophs and heterotrophs; saprotrophs and necrotrophs; Sewage Fungus Complex; Transmission of Human Pathogenic Organisms; Zoonosis; Development of Antibiotic Resistance and its impact; Biofilms and Biocorrosion; Radioactivity and background radiation of earth: Radionuclide polluting, special effects of radioactive pollution. Thermal pollution and its effects, Physical and chemical nature of possible effluents from major industries in India. Monitoring and control of pollution: Biological indicators of pollution. Solid waste management.

Practicals

Physical characteristics of polluted waters; Colour, Odour, Turbidity. Determination of pH, salinity, alkalinity, hardness, BOD, COD, Hydrogen sulphide, Phosphates, Ammonia, Nitrates, Heavy metals and Oil and grease in water. Determination of pH, conductivity, organic carbon, nitrogen, phosphorus, heavy metals in sediments. Study of pathogenic and coliform bacteria. Bacteriological quality of water; Colliform tests, IMVIC test, standard plate count, methods of enumerating bacterial biomass in waters and waste waters. Pollution flora and fauna: indicator species- algae, protozoa and insect larva. Methods of pesticide residue analysis in waters and fish tissue; bioassay and toxicity study.

51. Fishing Technology 2(1+1)

Theory

Structure of various commercial fishing gears. Rigging of fishing gears: Bridles, sweep lines, otter boards, floats and ground gears arrangements. Otter door: Different types of otter doors. Behavior of otter doors in water: Angle of attack, angle of heel and angle of tilt. Fishing accessories – thimbles, shackles, C-links, rings, G-links, Kelly's eye, stopper, bottle screw, Deck layout of different fishing vessels. Trawling: Beam trawling; otter trawling; side trawling; twin trawling out rig trawling bull trawling and mid water trawling. Constructional details of single boat purse seine; two boat purse seine and method of operation. Types of gill net – constructional details of simple gill net, trammel gill net, stick held gillnet, frame gillnet and vertical line gillnet, Operation of gillnet: set gillnetting; drift gillnetting; bottom, mid water and pelagic gillnetting.

Line fishing: Types of hooks; structure and size of hooks. Constructional details of long line, tuna long line, vertical long line, pole & line and trolling line. Operation of long line: set and drift long lining: bottom, mid water and pelagic long lining; jigging. Operation of beach seine, boat seine and traps. Selectivity in fishing gear and by catch reducing devices. Deck equipments – types of winches, net haulers, line haulers, triple drum, gurdy, power blocks, fish pumps. Fishing equipment: Fish finder, GPS navigator, sonar, net sonde, gear monitoring equipment.

Practicals

Survey of fishing gears; Trawl; gillnet; long line and purse seine fishing gears. Rigging of trawl, purse seine, gillnet and hook & line. Commercial fishing techniques: Bottom trawling; purse seining; gillnetting and line fishing. Cast net fishing and trap fishing.

52. Fish Products and Value Addition 3(2+1)

Theory

Principle of fish preservation and processing. Processing of fish by traditional methods– salting, sun drying, smoking, marinading and fermentation. Theory of salting, methods of salting–wet salting and dry salting. Drying and dehydration- theory,importance of water activity in relation to microbial growth. Sun dr ying and artificial drying- solar dryer. Packaging and storage of salted and dried fish. Different types of spoilage in salt cured fish. Quality standard for salted and dry fish. Fish preservation by smoking-chemical composition of wood smoke and their role in preservation. Methods of smoking and equipments used for smoking. Carcinogenic compound in wood and method store move them. Hurdle technology in fish preservation and processing. Marinaded and fermented fish products–role of acid sin marinades, Fish and prawn pickles, fish sauce and Fish paste, traditional Indian fermented products. Fermented fish products of Southeast Asia. Principles and methods of preparation of various fish paste products like fish sausage, fish ham, surimi, fish cake, kamaboko etc. Fish muscle structure, myofibriller protein and their role in elasticity formation. Extruded products – theory of extrusion, equipments used, advantages of extruded products, methods of preparation of extruded products. Value addition. Diversified fish products: battered and braided products-fishfinger, fish cutlet, fish wafer, and fish soup powder etc. and imitation products. HACCP in safe products production.

Practicals

Preparation of salted fish, dried fish and smoked fish by different methods. Quality assessment

of salted, dried and smoked fish. Preparation of prawn & fish pickles. Preparation of fermented

fish sauce and marinaded products. Preparation of surimi and surimi based products. Preparation of diversified and value added fish products. Quality assessment of market sample of dried and fermented fish products.

53. Microbiology of Fish and Fishery Products 3(2+1)

Theory

Introduction and history of microorganisms in foods. Role and significance of microorganisms in nature and in foods. Sources and types of microorganisms in fish and fishery products. Factors (intrinsic and extrinsic) affecting the growth and survival of microorganisms in food. Enumeration of microorganisms in food by conventional and rapid techniques. Microbial principles of fish preservation and processing by application of low temperature, high temperature, drying, irradiation and chemicals. Microbiology and spoilage of fresh, semi processed and processed fish and fishery products. Indicators of microbiological quality of fish and fishery products. Food borne pathogens involved in infective and intoxication type of food poisoning – *Vibrio cholerae, Vibrio parahaemolyticus, E. coli, Salmonella, Listeria monocytogenes, Clostridium botulinum, C. perfringens, Campylobacter and Staphylococcus aureus* – their occurrence, growth, survival, pathogenicity and prevention. Other biological hazards associated with fish and fishery products- marine toxins-shellfish toxins, scombroid toxins, ciguatera toxins and puffer fish toxins; mycotoxins, parasites and viruses.

Practicals

Sampling and processing of samples for microbiological investigation. Enumeration of microorganisms associated with finfish, shellfish, water and ice. Testing of water for potability. Isolation and identification of pathogenic bacteria associated with fish and fishery products - *Vibrio cholerae, Vibrio parahaemolyticus,, E coli, Salmonella, Listeriamonocytogenes* and faecal streptococci. Biochemical tests for characterization of bacteria. Molecular methods for the detection of pathogenic microorganisms. Determination of MIC and MCC of chemical preservatives.

54. Navigation and Seamanship 2(1+1)

Theory

Principles of navigation –terms and definitions, finding positions and method of position fixing magnetic Compass-parts and functions, cardinal en boat; General view of boat; Drawing of sheer plan, body plan and half breadth plan; Types of marine engines and their installation of engines. Visit to boat building yard and dry dock, inter cardinal, three letter and lay points pelorus and azimuth mirror, method of observation. Sextant -parts and functions, finding adjustable and non adjustable errors and principles and use. Hand lead line –construction and markings and method of taking soundings. Types of speed logs –patent log, impeller log, Types of marine charts, Mercator and gnomonic projections great circles and rumba lines, chart collections and chart readings, chart observation and fixing positions. The IALA-buoy age systems, cardinal and lateral marks, meaning of shapes, colours and lights top marks and explanation of approaching, international code of signals, flag signals mars code and storm signals general system, brief system and extended system ,storm signals stations Indian coasts, Fog signals, types and methods. Distress signals, methods, types and communication international regulations for preventing collision at sea and recognition of lights and shapes at sea. Observation of radar and parts and functions of radar, aneroid barometer, parts and functions of echo sounder, and sonar, observation of GPS Principles of seamanship- Causes fire at sea, fire prevention on board the vessel and method of fire fighting at sea and recommended fire fighting appliances, Life saving appliances –life jackets, life buoys and method of operations and contents, SART and EPIRB. Observations of storms, formation of storms and method of locating the eye of the storms and method of escaping from the center of the storms as per buys ballet law. Preparing vessel to face heavy weather. Temporary repairs for leaks constructions of steering system and rigging emergency jury rudder .types of anchors and their applications. selection of suitable anchorage , procedure for anchoring anchor watch and procedure to combating dragging of anchor, method of standing moor and running moor, open moor berthing procedures, axial thrust , transverse thrust mooring and securing the vessel to the jetty rigging fenders and gangways , and method of leaving vessels from the birth.

Practicals

Anchoring, coming along side the berth and leaving, practicing the different types of knots and wire splices, use of magnetic compass, GPS, Echo-sounder. CHART WORK-Finding

positions by latitudes and longitudes by position lines by cross bearing, horizontal sextant, angles, vertical sextant angle and by running fix, finding position by speed, distance and time findings set and drift of current and findings course made good speed made good and steering course and finding position by counter acting the current observation of RADAR.

55. Fish By-Products and Waste Utilization 2(1+1)

Theory

Fish meal. Dry reduction and wet reduction methods – specification – packaging and storage. Fish oil – body oil – liver oil – extraction – purification – preservation – storage – application. Shrimp wastes – chitin – chitosan-production – uses. Fish protein concentrate. Fish hydrolysate, partially hydrolyzed and deodorized fish meat, functional fish protein concentrate and their incorporation to various products. Fish silage – acid silage – fermented silage – application. Fish maws, shark leather, fish glue, fish gelatin, isinglass, pearl essence, shark finrays, beach-de-mer. Biochemical and pharmaceutical products. Utilization of seaweeds: agar agar, algin, carrageenan.

Practicals

Preparation of fish meal, fish body oil, fish liver oil, fish maws, isinglass, fish silage, ensilage, fish glue, fish gelatin, fattice, pearl essence, chitin, chitosan and fish manure. Preparation of acid and fermented silage. Preparation of fish protein concentrate and fish hydrolysate.

56. Fisheries Business Management and Entrepreneurship Development 1(1+0)

Theory

Concept of entrepreneurship; entrepreneurial and managerial characteristics; managing an enterprise; motivation and entrepreneurship development; importance of planning, monitoring, evaluation and follow up; managing competition; entrepreneurship development programs; Generation, incubation and commercialization of ideas and innovations. Government schemes and incentives for promotion of entrepreneurship. Preparation of enterprise budget for integrated fish farming. Fiscal and monitory policies and its impact on entrepreneurship. Infrastructural and other financial requirement for fishery entrepreneurship Government policy on Small and Medium Enterprises (SMEs) / SSIs. Venture capital. Contract farming and joint ventures, public private partnerships. Overview of fisheries inputs industry. Characteristics of Indian fisheries processing and export industry. Introduction to fish business management- Concept of management, management process (planning, organising, staffing, leading and controlling), Organizational behaviour, human resource planning, new dimensions in fish business environment and policies. Accounting procedures of fish business entity. Emerging trends in fish production, processing, marketing and exports. Assessing overall business environment in the Indian economy. Overview of Indian social, political and economic systems and their decision making by individual entrepreneurs. Globalisation and the emerging business /entrepreneurial environment. Social Responsibility of Business.

57. Student READY Programme

This will include capacity building and skill development of the students in planning, development, formulation, monitoring and evaluation of project for entrepreneurial proficiency.

58. Student READY Experiential Module:

a) Skill Development (for one week):

Aquarium fabrication, Analysis of soil and water quality parameters, Preparation of Fish products or in any appropriate applied aspect of fisheries

b) Experiential Learning Programme:

A minimum of two areas should be decided by each university. Areas of specialization for Experiential Learning Programme are 1. Ornamental fish culture 2.Seed Production 3. Trade and export management 4. Aquaclinic 5. Post Harvest technology 6. Aqua farming.

A total of 12 credits are allotted for Experiential Learning Programme and the evaluation of the same will be conducted by the Committee appointed by the Dean of the respective college.

59. Microbial and Parasitic Diseases of Fish and Shellfish 3(2+1)

Theory

General characteristics, life cycle, diagnosis, prevention and treatment of parasitic, bacterial, fungal and viral diseases of finfish and shellfish. OIE listed diseases. Disease surveillance and reporting. Quarantine and health certification in aquaculture. Health management strategies in Aquaculture: Vaccines, Immuno-stimulants, Bioremediation, Probiotics, Crop rotation, Good and Best management practices. SPF and SPR stocks – development and application. Bio security principles, Sanitary and phytosanitary Agreement, Disease control through environmental management. Importance of Biofilm, Biofloc, Periphyton in aquatic Health Management, Zoonotic diseases. Principles of disease diagnosis, conventional, molecular and antibody based diagnostic methods, Rapid diagnostic methods.

Practicals

General procedure for disease diagnosis. Methods of sampling fish and shellfish for disease diagnosis. Taxonomy, lifecycle and identification of fish and shellfish parasites. Sampling, preparation of media and culture of pathogenic bacteria: Techniques for bacterial classification. Techniques in disease diagnosis: Microbiological, haematological, Histopathological, immunological, molecular techniques and Biochemical tests. Agglutination test; Challenge tests; purification of virus; Stress related study of fish and shellfish; Disease treatment.

60. Quality Assurance of Fish and Fishery Products 3(2+1)

Theory

Quality dimensions of seafood – sensory, intrinsic, quantitative and affective parameters. Preharvest and post harvest factors affecting quality. Assessment of quality changes in fresh and iced fish. Quality changes during processing. Importance of quality, definitions and terminologies. Application of HACCP concept in surveillance and quality assurance programmes for raw, frozen, canned, cured, irradiated, cooked and chilled, modified atmosphere packaged and freeze dried products. Risk assessment, principles of plant hygiene and sanitation, pest control, personnel hygiene, planning and layout, equipment construction and design. Food laws and standards, national and international legislation, mandatory and non mandatory standards. Role of export inspection council & export inspection agency and MPEDA in fish and fishery products. Executive instructions on fish and fishery products, Legislation for export quality assurance in India. Certification system for fish & fishery products. Legal basis for monitoring products related EU requirements. Scheme for approval and monitoring of establishments/factory vessels/ freezer vessels processing/storing fish & fishery products for export. Complaint handling procedure on fish and fishery products. Interpretation of test reports and limits on chemical residues. GOI notifications on fish and fishery products. General requirements for export of fish and fishery products to the EU. International regulatory framework for fish safety and quality. Prerequisites to HACCP, Labelling for product traceability and Labelling requirements- National and international, legislation on labelling, components of traceability code-nutrition facts and nutrition labelling, specific requirements of nutrition labelling, food meant for specific age group and convalescing people. EU legislation on traceability of fish and fish products, Assessment of food safety programmes, The HACCP for seafood industries and protection of food from adulterants. Standards for sea foods. FSSA, FDA, ISO. Use of additives in seafood processing as quality enhancers. Seafood safety, authenticity, traceability. Waste management in seafood processing.

Practicals

Assessment of quality of fresh fish by sensory, biochemical, and instrumental methods. Chlorination and Hardness estimations. Quality analysis of canned, frozen, cured and pickled fish products. Quality tests for tin and corrugated containers. Assessment of plant, equipment

sanitation and personnel hygiene. Detection of filth and extraneous matter in traditional processed products.

61. Project work:

Student will select relevant or interested area of specialization such as Fish pathology, Fish diagnosis, Fish pharmacology, Fish Toxicology, Fish nutrition, Fish immunology, Fish genetics and breeding, Ornamental fish production, Genomics in Aquaculture, Fish stock assessment, Aquatic pollution, Fish value addition, Fish in nutrition, Fish processing waste management, Quality control and quality assurance, Fish products and by-products etc.. He/she will prepare a research project plan and it will be presented in-front of committee appointed by the Dean of the respective college. Also, for each student, one advisor will be provided, who will guide the student in completion of proposed research plan.

A total of 2 credits are allotted for project work and 1 credit for (completed project work presentation) seminar. The evaluation for the same will be conducted by the committee appointed by the Dean of the respective college.

College of Community Science

Employability Related course content

Under Graduate Courses

1. NENG-111 General English 2(1+1)

Theory: Word, formation, prepositions, idiomatic, expressions, conditional, sentences and modal verbs. Synthesis and transformation; essay writing (5 topics to be discussed), precise writing. Study of Prose and short stories from brighter English (A book of short stories, plays, poems and essays by C.E. Eckersley, Orient Llongman, New Delhi, 1984) The Bachelor of Arts by R.K. Narayan

Practical: Based on lectures Language, work the prescribed lessons having a bearing on the topics covered in lectures. Identification of phonetic sounds and symbols Stress and intonation Listening comprehension. Conversation practice.

2. HECM-111 Extension and Rural Development 2 (2+0)

Theory : Extension Education- concept and importance, philosophy, principles and objectives. Evolution of extension education- glimpses of pre- and post-independence era. Community: Meaning and definition, types of communities, community and science, community mobilisationleadership, participation-PRA. Community development programmes- concept, objectives, organization, activities, achievement and failures. Sociology and Rural Sociology- meaning, scope, importance, concepts-structural and functional, differences between rural, urban and tribal societies. Rural development- concept, need, meaning, aim and functions of extension education for rural development. Panchayati Raj Institutions- concept, structure and function. Five year plans. Current rural development programmes/ Organisations- SGSY, MGNREGA, IAY, ICDS, Total sanitation schemes/ campaigns etc., DWMA, ATMA, ITDA, DRDA, KGMV. Role of ICAR, SAUs, KVKs, DAATTCs and NGOs in rural development.

3. NTSD-111 Textile Science and Fabric Care 3(2+1)

Theory: Textile definition, forms of textile, importance of textile industry in national economy Classification of textile fibres Properties of textile fibres; primary and secondary properties Molecular structure of textile fibres: Monomers, polymers and their types, polymerization and its types, degree of polymerization and orientation Cotton: Fibre production, fibre varieties and their grading, fibre morphology, physical, chemical and biological properties and end-uses Bast fibres: Flax, jute, hemp and ramie; Fibre production, fibre morphology, physical, chemical and biological properties and end-uses Other bastfibres (ramie, jute, hemp): Fibre production, fibre morphology and physical, chemical and biological properties and end-uses Wool: Fibre production, classification of wool and their labeling, fibre morphology, physical, chemical and biological properties and end-uses Silk: Fibre production and classification, fibre morphology, physical, chemical and biological properties and end-uses Chemical spinning: Wet, melt and dry spinning and common properties of man-made fibres Rayons: Viscose, cupramonium and High Wet Modulus rayons; fibre manufacturing, microscopic structure, physical, chemical and biological properties and end-uses

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Modified cellulosic fibres: Diacetate and triacetate; fibre manufacturing, fibre microscopic structure, physical, chemical and biological properties and end-uses Synthetic fibres: Nylon, polyester and acrylic; fibre manufacturing, fibre microscopic structure, physical, chemical and biological properties and end-uses Mechanical spinning: Ring spinning method Classification of yarn on the basis of structure- simple and novelty yarns, twist direction, twist amount, fibre length and end-uses Methods of fabric construction: Weaving, knitting, braiding, tufting, net, lace making, crocheting, macramé, stitch through fabrics, quilted fabrics, laminated fabrics, bonded fabrics, felt, nonwoven and films Stain removal: Classification of stains and methods of removing different stains Laundry: Definition, principles, equipments, laundry methods and dry cleaning Laundry agents: Water, soap, laundry auxiliary, stiffening agents, bleaches and blues Care of textiles: Labeling and labeling Act Labels and tags used in textiles Storage of clothes: Requirements of short term and long term storage, folding and packaging of clothes

Practical: Testing of textile fibres Microscopic view Burning test Solubility test Visual test Study and identification of different types of yarns in the market Study and identification of fabric samples of different construction in the market and thread count Removal of different stains from fabric surface Washing and finishing of garments made of following fibres: Cotton, Wool, Silk, Blends/ synthetic Visit to textile industry

4. NFSN-111 Principles of Human Nutrition 3(3+0)

Theory: Historical development of nutrition. Relationship of nutrition to health, growth and human welfare; Definitions of terms used in nutrition- Recommended dietary allowances; balanced diet; health; functional food; phytochemicals; nutraceuticals; dietary supplements. Energy- Units, sources and requirements, fuel value of foods, methods of measuring energy value of food, energy requirement of body, physical activity and thermogenic effect of food, BMR- methods of measurement, factors affecting BMR. Digestion and absorption of carbohydrates, fats and proteins. Carbohydrates- Types, functions, sources, requirement, health conditions affected by carbohydrates, significance of dietary fibre. Lipids- Types, functions, sources, requirement, health problems associated with lipids Proteins- types, functions, sources, requirement, quality evaluation, improvement, deficiency disorders and protein energy malnutrition. VitaminsClassification, functions, sources, requirement, deficiency and toxicity of the following- (i) Fat soluble vitamins-A, D, E, K; (ii) Water soluble vitamins – C, B Complex (thiamine, riboflavin, niacin, B2, B3 and folic acid). Minerals- Classification, functions, sources, requirements, deficiency and toxicity of calcium, phosphorus, iodine, fluorine, iron, sodium, potassium, chloride, copper and zinc; bioavailability and factors affecting calcium and iron. Water, Functions, sources, distribution in body,water and electrolight balance.

5. NFRM-111 Fundamentals of Art and Design 3(2+1)

Theory Introduction and objectives of interior decoration. Elements of art and their importance in interior decoration. Principles of design and their application to enrich the interiors Colour: sources of colour, properties of colour, emotional effect of colour, colour schemes, colour theories, colour plans for interiors Furniture – types of furniture, materials and finishes of furniture, factors affecting the selection of furniture, care and maintenance of furniture, furniture arrangement, paints to be considered while selecting the

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

furniture. Wall – classification, types of building walls,functional characteristics of walls, types of wall treatments, exterior and interior wall finishes. Floor importance, types of floor covering, care, maintenance and selection of floor covering. Windows – importance, its functional and decorative treatments. Accessories – classification, application of principles of design and decoration in the selection/development of accessories, and their placement. Lighting – importance, types of lighting and its application. Flower arrangement – materials used, principles involved, types, practical utility and care. Table setting – linens, tableware etc. required for table setting, table etiquettes.

Practical -Learning elements of art and principles of design. Development of motif and design through art principles. Colour – colour schemes, values and intensity scale, colour wheel. Furniture – care and arrangement of furniture. Accessories – preparation and placements of accessories. Flower arrangement. Learning different types of table setting and napkin folding. Window treatment. Lighting, fixtures and then utility. Market survey – different types of wall and floor coverings

6. HDFS-111 Fundamentals of Human Development 2(2+0)

Theory: Human development as a field of study. History of study of human development, scope and importance of study of human development from a life-span perspective. Relationship of the discipline of human development with other disciplines of study. Latest issues in human development. Growth and Development. Definition of growth and development difference between growth and development, determinants of human growth and development; principles of human growth and development Genetic basis and concepts associated with human life; stages of human development; domains of human development and its characteristics. Theories of human development: naturalism, environmentalism, maturational, need, ecological, ethological, cognitive, social, psychoanalytical, language and moral research involving humans. Definition of ethics and research, practical and ethical principles and concerns in research with human subjects. Ethical trends and challenges. Origins of scientific inquiry, research designs and methods of data collection- their merits and demerits, variables, hypothesis, sampling, operational definitions.

7. CC-111 Environmental Studies and Disaster Management 3(2+1)

Theory Multidisciplinary nature of environmental studies- Definition, scope and importance. Natural resources- Renewable and non-renewable resources and their associated problems. Forest resources- Use and over-exploitation, deforestation, timber extraction, mining, dams and their effects on forest and tribal people. Water resources- Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources- Use and exploitation, environmental effects of extracting and using mineral resources. Food resources- World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources- 584 585 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. 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

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

sustainable lifestyles. Ecosystems- Concept, 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 forest, grassland, desert and aquatic ecosystems. 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-sports of biodiversity. Threats to biodiversity- Habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India. In-situ and Ex-situ conservation of biodiversity. Environmental pollution- Definition, cause, effects and control measures of air, water, soil, marine, noise and thermal pollution and 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- Unsustainable to sustainable development, urban problems related to energy. Water conservation, rain water harvesting, watershed management. Environmental ethics- Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Environment protection actsAir (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. Role of Information Technology in environment and human health. Natural disasters- Meaning and nature, types (floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, heat and cold waves, global warming, sea level rise, ozone depletion) and effects. Man-made disasters- Nuclear, chemical, and biological disasters, building fire, coal fire, forest fire, oil fire, road accidents, rail accidents, air accidents, sea accidents. Disaster management- International strategy for disaster reduction at national and global levels; 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, police and other organizations. Feeding the people struck by the disaster, managing house and dress need during disaster.

Practical 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 i.e. pond, river, hill slopes, etc. Case-studies.

8. NSS-111 National Service Scheme 2(0+2)

The course aims at evoking social consciousness among students through various activities viz. working together, constructive and creative social work, increasing knowledge about self and community, contribution in solving social problems, to be skillful in executing democratic leadership, developing skill in programme development, to be able for self employment, reducing gap between educated and uneducated, arousing desire to help weaker sections of society.

9. NENG-121 Technical Writing (English) 2(1+1)

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Theory: Nature of technical style vs. general style, writing process (prewriting, drafting, rewriting and editing). Effect of diction, sentence- structure and paragraphs on style; manuscript form, numbers, abbreviation, hyphenation of compound terms, decimal system of numbering headings, equations, documentation, sentence correction. Paragraph writing- Definition, requirements of a good paragraph (Unity, coherence and emphasis), topic sentence, various orders to develop a paragraph (Inductive, deductive, question to answer, exposition, time order, comparison and contrast, enumeration, space order). Report writing- Definition and cardinal characteristics of report, analyzing the report. Report formats- Blank form, letter form, memorandum form and general survey report. Technical correspondence- General principles of technical correspondence, parts of a letter (Heading, address, salutation, body, complimentary closing, signature), type of letters (letters giving instructions, inquiries and answers to inquiries, complaints and adjustments, letter urging action, applications and resumes). Proposal writing- Definition and kinds of proposal, division of formal proposal (Front matter, letter of transmittal, title page, summary or abstract, table of contents, statement of request and body). Writing scientific and semi-technical articlesSource material, topic selection, literature review, tables, figures, footnotes, bibliography.

Practical: Exercise on identification of phonetic sounds, symbols, consonants, pyre vowels, diphthongs, organs of speech, place of articulation and manner of articulation (Voiceless and voiced sounds). Writing of a technical report, paragraph, formal correspondence, proposal and scientific and semi-technical articles.

10. MHECM-121 Women in Agriculture 2(2+0)

Theory: Evolution of agriculture in India, General agricultural production activities, Agricultural and allied sectors in rural India, role of women in agricultural and allied sectors, status of farm women -Social, economic and health status of women in agriculture, Women friendly tools and implements, Gender issues, Women in agriculture Policy, Programmes (government and nongovernment)and institutions for women in agriculture, Women empowerment in agriculture, Agripreneurship and training to farmwomen. Courses for Student Ready Programme

11. NBIOCHEM-121 Principles of Biochemistry 3(2+1)

Theory : Recapitulation of basic chemistry and biology Water, pH and buffers, Acid-base balance Cellular constituents, Structure and function : Amino acid and proteins Carbohydrates Lipids and bio membranes Nucleic acids Dissolved molecules – Vitamins and minerals Enzymes, function, properties, mechanism Metabolism of cellular constituents Basic concepts of Bioenergetics Carbohydrates metabolism Glycolysis and glycogenolysim HMP pathway TCA Cycle Electron transport chain Photosynthesis Gluconeogenesis Lipids metabolism Beta-oxidation Ketone bodies Fatty acid synthesis Amino acid metabolism General reactions of nitrogen assimilation and excretion Biosynthesis of DNA, RNA and Protein Replication Transcription Translation and genetic code Regulation of gene expression

Practicals: Preparation of buffers and pH determination; Preparation of colloids Qualitative and quantitative tests of carbohydrates, lipids and proteins Tests of enzyme action; Experiments on potato oxidase, urease, salivary amylase Paper chromatography of amino acids or carbohydrates ascending and descending Determination of starch, sugar, analysis of proximate constituents in food.

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

12. NIDFS-121 Life-Span Development 3 (2+1)

Theory: Prenatal, perinatal and postnatal stages- Issues and scientific concepts associated with conception, pregnancy, prenatal development, labour/ birth, postnatal life infancy- physical, motor, social, emotional, cognitive and language characteristes. Antecedent influences for infancy growth and development. Early Childhood- Physical, motor, social, emotional, cognitive and language characteristes. Antecedant influences for early years growth and development, Stimulating approaches for optimising development. Middle childhood- Physical, motor, social, emotional, cognitive and language characteristes. Antecedant influences for growth and development during middle childhood. Adolescence- Physical, motor, social, emotional, cognitive and language characteristes. Antecedant influences for growth and development during adolescence. Adulthood- Physical, motor, social, emotional, cognitive and language characteristes. Antecedant influences for growth and development during adulthood. Stimulating approaches for optimising development. Old age- Physical, motor, social, emotional, cognitive and language characteristes. Antecedant influences for growth and development during old age. Stimulating approaches for optimising development. Recent issues in growth and development from infancy to old age.

Practicals: Observational visits to well baby clinic to observe full term and preterm babies. Case study of individuals in different stages of development- Infancy, early childhood, school age, adolescence, adulthood and old age. Critical analysis of case study reports; preparation of resource files.

13. NHFSN-121 Food Science and Processing 3(2+1)

Theory: Food groups, food guide pyramid and its importance, foods as a source of nutrients Objectives of cooking, processing, preservation, methods of cooking with their merits and demerits. Effect of cooking and heat on nutritive value of foods. Cereals, millets and pulses: Composition and nutritive value, types, storage, processing. Cereal cookery. Gluten and factors affecting the gluten formation, cereal starch, gelatinization, dextrinisation. Pulse cookery. Effect of cooking, factors affecting cooking quality, toxic constituents in pulses. Nuts and oilseeds- Composition and nutritive value, types, storage, oil extraction, processing, toxic constituents and role in cookery. Milk and milk products: Composition and nutritive value, properties, processing and packaging, effect of heat, acid, enzymes, microbes, processed and indigenous milk products and their quality, role in cookery. Eggs- Structure, composition and nutritive value, storage, evaluation of quality of egg, role of egg in cookery. Flesh foods- Structure, composition and nutritive value, types, storage, evaluation of quality and selection of meat, fish and poultry, methods of cooking, brief description of ageing, tenderization and curing. Vegetables and fruits. Composition and nutritive value, types, storage, selection, post-harvest changes, effect of processing, preservation and cooking on different pigments of both fruits and vegetables. Sugar and its products: Composition and nutritive value, type, function, properties, stages in sugar cookery, role of sugar in cookery. Fat and oils. Composition, nutritive value, types, role in cookery and importance in daily diet. Spices and herbs. Types and its use. Beverages and appetizers. Classification, use in everyday lives with special reference to tea, coffee, cocoa and alcoholic drinks. Leavening agents, classification and functions. Processed and convenience foods. Ready to eat foods, frozen foods, dehydrated foods, instant food mixes.

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Practical: Laboratory conduct and responsibilities; knowledge of different food stuffs in English, Hindi and local language. Terms used in cookery, weights and measures; Identification and use of different kitchen items and equipments, Identification and listing of various food groups; market survey of processed and preserved foods. Cereal cookery. Preparation of plain rice (open and pressure cook), lime-rice, pulao, paratha, chapatti, upma and halwa. Pulse cookery. Preparation of plain dal, dal with green, pakoras, sambar. Preparation of cereal and pulse combined recipesIdlis, adai. Nuts and oilseeds. Preparation of chikki, til ladoos, thandai, fish in mustard paste Milk cookery. Preparation of curd and paneer. Egg cookery. Selection of egg, preparation of boiled egg, scrambled egg, pouched egg. Meat and fish cookery. Preparation of meat and fish based items. Fruits and vegetables cookery: Preparation of sauces, pickles, squash, chips. Sabjis and salad Sugar cookery. Preparation of fudge and fondent. Process of caramalization; demonstration of 1-thread and 2-thread consistency. Fats and oils. Preparation puris, cakes and biscuits. Appetizers. Preparation of red tea, white tea, coffee, egg nog.Visit of food industries.

14. NHTAD-121 Fundamentals of Clothing Construction 3(1+2)

Theory: Terminology related to clothing construction Sewing tools and equipments required for measuring, drafting, cutting and stitching Selection and preparation of fabric for garment construction Layout of paper pattern, marking, cutting and stay stitching Unit construction method Importance and function of clothes Socio- economic and psychological factors affecting clothing choices Consumer behaviour and motivation Clothing requirements of different age groups: infant, toddler, pre-schooler, school age children, teenager, adolescent, adult and senior citizen Application of elements and principles of art in apparel designing

Practical: Demonstration on: Sewing equipments and tools, sewing machine and its care. Preparation of samples: Hand stitches; basting, slip-stitching, hemming, smocking, over casting, attaching 548 549 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee fastener and button holing, mending and patching Machine stitches; seam and seam finishes, pleats, gathers and tucks, stay stitch, under stitching, placket opening Demonstration on taking body measurements Preparation of fabric for cutting, and layout of paper pattern on different fabrics patterns including plain, print, lines, plaid and check. Drafting, cutting and stitching of different garments: i. Baby frock ii. Panty iii. Bloomer iv. Blouse

15. NFRM-121 System Dynamics and Management of Resources 2(1+1)

Theory: Systems approach to management. Motivating factors of management- valueas, goals and standards, origin, classification and role , Resources – definition, types , guidelines for use of resources and factors affecting, management of household resources and situation, Management process- planning - importance, types, characteristics and techniques, organizing; controllingdefinition, phases and factors, evaluating- definition and types of evaluating. Time - tools of time management, and process of time management. Decision making process - types, steps in decision making and factors affecting decion making. Money - management process, types and sources of income, steps in making budget, controlling budget and evaluation of budget.

Practicals

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Identification of individual and family values, identification of immediate, short term and long term goals of individual and family. Standards for individual and family goals. Decision making by individuals and families. Applying decision making process, group work presentation on types of decision and decision making process. Listing out human and non – human resources, listing community resources. Application of management process to organize an event – planning, organization, evaluation. Management of personal time record for a week. Presentation of personal time record.

16. NCOMP-121 Agricultural Informatics 3(1+2)

Theory: Introduction to computers, anatomy of computers, memory concepts, units of memory, operating system, definition and types. Application 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 health and nutrition. Internet and World Wide Web (WWW)- Concepts, components and creation of web, HTML, XML coding.

Practical

Study of computer components, accessories, practice of important DOS commands. Introduction of different operating systems such as windows, Unix, Linux, creating files and folders, file management. Use of MS-WORD and MS Powerpoint for creating, editing and presenting a scientific document, handling of tabular data, animation, video tools, art tool, graphics, template and designs. 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. Introduction to World Wide Web (WWW) and its components, creation of scientific website, presentation and management of health information through web. Use of smart phones and other devices for health warning signs and dietary management. Hands on practice on preparation of decision support system.

17. NHECM-211 Project Management 3(1+2)

Theory: Project management: Overview. Project - meaning, concept, types, elements of management. Project proposal- concept, designing, project initiation, resource allocation framework. Market and demand analysis. Environmental appraisal of projects, Environmental impact analysis, Technical analysis, Financial analysis. Budgeting Terminology of networks. Project management techniques.

Practical

Collection and screening of case studies on project management and report writing, Visit to project - Technology generation project. Visit to Project - Transfer of Technology (ToT). Visit to Project- Women entrepreneurship. Visit to state level and international level funding agencies. Visit to International funded projects. Visit to women and child development project. Visit to agriculture development project, Visit to rural development projects. Designing, planning and preparation of a mini project proposal. Working on

DEAN
College of Community Science
G.B.P.U.A.&T. Pantnagar
Almora (U.K.)

project management techniques: PERT. Working on project management : CPM. Working on project management techniques: WBS. Report writing

18. NTSD-211 Techniques of Fabric Construction 3(1+2)

Theory: History of weaving and looms Woven fabrics; simple woven structures and compound woven structures and characteristics of woven fabric Classification of looms on basis of mechanics, means of running loom, structure and means of weft insertion Parts of loom and loom accessories and their function Mechanism of weaving: primary, secondary and tertiary motions Basic weaves: Plain, twill and satin and their variations Complex weaves: extra yarn fabrics, pile fabrics, leno, damask and jacquard Knitting: Terminology and principle of knitting Knitting machine: Parts and their function and types of knitting machine Knitting stitches:plain, rib and purl and types of knit fabrics Macrame and crochet: Tools and materials. Manufacturing process of felt, properties and end uses

Practical

Observation of fabric structures under magnifying glass Graphical representation of woven design Handloom and its parts Weaving calculations and yarn preparation for plain weave Setting of loom and weaving of plain weave fabric Knitting machine and its parts Sample preparation of different fabric constructions hand knitting; plain, rib, purl knots of macramé stitches of crochet manual felting Suggested Reading.

19. NFPHFN-211 Community Nutrition and Education 3 (2+1)

Theory :Malnutrition- Definition and causes, PEM, Marasmus, Kwasiorkor, vicious cycle of malnutrition. Assessment of nutritional status. Clinical signs and symptoms, nutritional anthropometry, biochemical tests, biophysical tests, diet survey methods. Major nutritional problems prevalent in India and the state of Protein energy malnutrition, anaemia, vitamin A deficiency, iodine deficiency disorders, obesity, hypertension, atherosclerosis, diabetes mellitus. National programmes and role of national and international agencies. In improving nutritional status of the community. Integrated Child Development Service (ICDS), supplementary Nutrition Program (SNP), Applied Nutrition Program (ANP), Mid Day Meal Program (MDMP), Vitamin A Prophylaxis Program, Anaemia Prophylaxis Programme. Food and Agricultural Organization (FAO), World Health Organization (WHO), United Nations Children's Fund (UNICEF), UNDP, CARE and other Voluntary and Government Agencies. Nutrition education- Objectives and methods, principles.

Practical :Assessment of nutritional status of an individual/community using anthropometry and dietary survey. A) Preparation of schedule B) Survey work C) Analysis of data D) Writing of report. Visit to local health centre to identify clinical signs and symptoms of nutritional problems. Identification of adulterants in common foods. Visit to an ICDS Block. Development of audio visual aids- radio script; popular article; chart/posters leaflets etc. Planning, implementation and evaluation of nutrition education for a target group.

20. NFRM- 211 Financial Management and Consumer Education 2(2+0)

DEAN
College of Co...
A.N.G.R.A.U.

Theory: Concepts, importance, objectives and major aspects of family finance. Income concepts: productive income, hidden income, money income, real income, psychic income. Family – as income producing and utilizing unit, factors affecting in the use of family income. Analyzing income: income profile, methods of handling income, account keeping. Family budget: steps of budget making, factors influence on budget making, advantages of budget making, Engel's law of consumption, standard of living. Credit- needs types, use and source, planning for financial security of families, credit institution. Savings and investment- types of savings / investment, Saving institution and its importance, criteria for judging family investments. Taxation- objectives, characteristics and classification. Consumer – definition and role, concept of consumer and consumer economics. Market and merchandising – types of market, definition and importance of merchandising. Consumer problems in rural and urban areas: unfair trade practices, adulteration, faulty weights and measures. Consumer rights and responsibilities. Consumerism and consumer protection- history of consumer movement in the developed and developing countries, growth of consumerism, consumer protection Act and Govt. legislation and order, NGO's for consumer protection and welfare. Standard and standardization and legislative measures for regulating quality. Sources of consumer information – advertisements, labels, packaging etc. Consumer and environment.

21. NHDFS-211 Marriage and Family Dynamics 3 (2+1)

Theory : Marriage- Definition, goals/functions, types/forms of marriage in India, rituals and ceremonies of marriage in different religions of India readiness for marriage– Definition, importance, areas of readiness for marriage. Identifying characteristics of readiness for marriage Mate selectionmeaning, mode/methods of mate selection. Field of mate selection. Theories of mate selection. Ways of mate selection in tribal India. Factors responsible for wrong mate selection. Guidelines for mate selection, engagement and its importance. Marital roles and behaviours- Definition and importance of marital roles, marriage as status and role transition, determinants of marital role behaviour, concept related to gender roles, changing gender roles, factors responsible for change in gender roles, role conflict marital adjustment- definition, Areas of marital adjustment, factors influencing marital adjustment, types of marital relations and adjustments, marital adjustment over the family life cycle, obstacles in marital adjustment, Improving marital adjustment, marital adjustment techniques, general techniques of resolving differences, marital success, criteria of marital success marital dissolution: definition, types (Voluntary and Involuntary), factors responsible for an increase in the rate of legal marital dissolution, factors responsible for refraining from divorce after marriage failure, social process of marital failure and divorce, separation distress and factors affecting it, no-fault divorce, consequences of divorce, children's response to divorce, children as weapon against divorce, adjustment to divorce family. Definition, functions, forms/types of family. Family structure and relationships in India- Pattern of changes in family structure and relationships in India, familial (education and employment of women) and Extra Familial Factors (technology, peer group, society) responsible for the changes and consequences of these changes on the family life and society. Family life cycle- Definition, importance of studying family life cycle, developemntal tasks, stages of family life cycle, developmental tasks of stages of family life cycle, typical and alternative forms of families- Charactetristes of Single parent families, female headed families, childless families, adoptive families, dual earner families, reasons behind alternative form of family and its merits and demerits, alternatives to marriagesinglehood, heterosexual cohabitation/

DEAN
College of Community S...
A.N.D.U.A.T. Kum...
Ayodhya (U.P.)

consensual union, homesxual union, reasons behind it and its merits and demerits family stress – Definition, types/ categories of stressors, variables affecting family's response to stress, Hill ABCX Model/ theory of family stress, causes of family stress, effects/ impact of family stress, manifestations/ recognising symptoms of family stress, stress coping strategies, correlates of family stress. Family crises- Definition, when does stress becomes a crisis, hill's ABCX. Theory of family crisis, conditions for crisis, what happens in a crisis? Stages of a crisis, characteristics of crisis events, effects of crises, factors which affect meeting the crises, adjustment to crises, general things to do in times of crises. Laws and acts regarding marriage, adoption, divorce and inheritance in India. Counselling (premarital, marital and family)- objectives, importance, areas of counselling, types, process and effects.

Practicals

Study on motives of marriage, selection of partner; visit to marriage bureau and family counselling center. Comparative study on nuclear and joint families, atypical families and alternative forms of families. Marital roles and adjustments, family crisis and coping; Roles across family life cycle.

22. NHSTAT-211 Elementary Statistics 3(2+1)

Theory: Introduction to statistics; definitions, functions, uses and limitations Classification and tabulation of data; qualitative and quantitative classification, discrete and continuous variables, frequency tables, grouped and ungrouped data. Diagrammatic representation of data; One, Two and Three dimensional diagrams with applications. Graphical representation of data; Histogram, frequency polygon, frequency curve, ogives. Measures of central tendency; Introduction to basic concepts of logarithms, AM, GM, HM, median, mode with merits, demerits and uses, relationship between AM, GM and HM, quartile deviation, mean deviation from AM, median and mode, variance, standard deviation, coefficient of variation. Measures of dispersion; range coefficients, inter quartile range, quartile deviation, coefficient of quartile deviation, mean deviation from AM, median and mode, variance, standard deviation, coefficient variation. Moments; Raw moments, Central moments for grouped and ungrouped data, relationship between raw moments and central moments. Measures of skewness and kurtosis; definitions of symmetrical distribution, skewness and kurtosis, relationship between mean, median and mode and between quartiles for symmetrical and skewed distributions. Probability theory; introduction to simple problems of permutations and combinations, definition of random experiment sample space, events, mutually exclusive and equally likely events. Definition of probability, simple problems based on probability, addition and multiplication theorem of probability, conditional events and independent events, Correlation and linear regression analysis; definition of correlation its types, scatter diagrams, Karl Pearson's formula of correlation coefficients, properties of correlation coefficient, definition of regression, regression equations of Y on X and of X on Y, relationship between correlation coefficient and regression coefficients. Problems based on correlation and regression. Tests of significance; basic definitions, hypothesis, null and alternative hypothesis, tests statistic, testing of hypothesis, one sample t-test and two sample fisher's t-test. Chi-square test of goodness of fit and Chi-square test of independence of attributes. Discrete and continuous probability distributions; definition of random variable, discrete and continuous random variables probability distribution of random variable, concepts of discrete and continuous probability distribution, basic concept of binomial theorem, binomial

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

distribution, Poisson distribution, normal distribution and applications. Analysis of variance; definition of analysis of variance, assignable and nonassignable factors, analysis of one way classified data. Introduction to sampling methods; definition of population, random sample, sampling versus complete enumeration, use of random number table for selecting a simple random sample, simple random sampling with and without replacements.

Practicals: Graphical representation of data Diagrammatic representation of data Measures of central tendency (Ungrouped data) with calculation of quartiles, deciles and percentiles Measures of central tendency (Grouped data) with calculation of quartiles, deciles and percentiles Measures of dispersion (Ungrouped data) Measures of dispersion (Grouped data) Moments, measures of skewness and kurtosis (Ungrouped data) Moments, measures of skewness and kurtosis (Grouped data) Correlation and 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 Analysis of variance one way classification Selection of random sample using simple random sampling.

23. NHMICRO-211 Fundamentals of Food Microbiology 3(2+1)

Theory : Major groups of microorganisms associated with food Sources of microbial contamination in food factors effecting growth and survival of m.o. in foods Physical methods to control microorganisms. Chemical methods to control microorganisms Food Fermentations Traditional fermented foods of India and other Asian countries Probiotics, prebiotics and synbiotics Fermented foods based on milk Fermented foods based on meat Fermented foods based on grains Fermented foods based on fruits and vegetables Fermented beverages Role of microorganisms and food spoilage Spoilage organisms of milk Spoilage organisms of meat Spoilage organisms of grains Spoilage organisms of fruits and vegetables Principles of food preservation. Food poisoning and food borne infections Microbial toxins Indicator organisms Rapid methods for detection of microorganisms. Practical Microscopic examination of bacteria, and yeast and molds Preparation of media Methods of sterilization Isolation of microorganisms. Purification of microorganisms Maintenance of microorganisms Detection of faecal coliform, MPN of coli forms Microbiological examination of milk Microbiological examination of grains Microbiological examination of fruit and vegetables.

24. Food and Nutrition Policy and Agriculture 2(2+0) Theory Food situation in India and in the world, food production and consumption trends, food balance sheets. Role of nutrition in agricultural planning and national development. Linkages between agricultural practices, Food production, food distribution and nutritional status. Food crop failure and malnutrition, poverty and vicious cycle of low food production. Agricultural development and its effect on food availability. Effect of food production and economic policies on food availability. impact of physical resources, farming systems, cropping system, inputs and manipulation, agricultural marketing system, post harvest processing of foods on food and nutrition situation. Food distribution systems. Food security. Concepts and definitions agriculture and food security, nutrition and health urbanisation and food security, food systems and food security, macroeconomic policies Employment and cash income, markets and food prices. Effect of urban agriculture on the nutritional status of vulnerable groups Innovative approaches to enhance local food production and improve food distribution

Dean
College of Co... S...
A.N.D.U.A.T., Kumarganj
Ayodhya (U.P.)

systems. Innovative and effective approaches to manage health risks of urban agriculture. Implications for urban policies and programmes. Food and nutrition security at national and household level; nutrition policy implementation; nutritional impact of agricultural programmes, food price control and consumer subsidy; contribution of national and international organization for agricultural development.

25. NFRMCS-221 Housing and Space Management 3(2+1)

Theory: Housing and its importance, characteristics and effect of insufficient housing. Factors to be considered in selection of family housing, selection of site, housing needs at different stages of family life cycle. Housing problems – rural and urban housing problems in India. Housing legislation and regulation - Building Act 1984, Defective Premises Act 1972, Disability Discrimination Act 1995, Environment Protection Act etc. Housing policies - government and non-government housing policies and housing schemes. Housing standards – sanitary facility, food preparation and refuse disposal, space and security, thermal environment, illumination and electricity, structure and material, interior air quality, water supply, lead based paints, access, site and neighbourhood, sanitary condition and smoke detectors. Types of house planning – floor plan, site plan, cross sectional plan, perspective plan, elevation plan and landscape plan. Housing finance - governmentand non- government finance institutes. Advantages and disadvantages of renting and owning a house. Technology in housing – advance technology in housing construction, low cost building technology, low cost building materials. Economy in housing construction – principles of house planning (orientation, privacy, grouping, roominess, sanitation, ventilation, flexibility, circulation, economy, furniture requirement). Ergonomics and housing - space management and Interior types based on functional needs – interior for youth, elderly and other special needs, functional design of areas in interior .

Practical: Learning architectural symbols. Drawing of house plans for different income levels and activity groups. House plan for renovation according to needs of residents. Designing of kitchen, bathroom etc. for special needs. Market survey to study the available building materials in the local market.

26. NTSD-221 Textile Finishes 2(1+1)

Theory: Textile finishing: Definition and its importance Classification of textile finishes: Chemical, mechanical, temporary, permanent, durable, renewable, semi permanent, reactive and additive finishes Processes of removing impurities from fabrics: Scouring, desizing, degumming, carbonizing, souring Basic finishes that alter hand or texture: Fulling/milling, felting, singeing, stiffening, decatizing Surface finishes: Bleaching, delustering, calendering, beetling, napping, flocking, burnt out design, acid design, plisse design, tentering, shearing and brushing Functional finishes: Water proof and water repellent finish, shrinkage control, wrinkle resistance, antistatic finish, anti-microbial finish, durable press and flame retardant finish Dyes and pigments, classification of dyes Application of dyes: direct, acid, basic, vat, azoic, mordant, sulphur, reactive and disperse dyes Dyeing techniques and equipment: Solution dyeing, fibre dyeing; tow and stock dyeing, yarn dyeing; skein and package dyeing and piece dyeing Styles of printing: Direct, discharge and resist printing Printing methods and equipment: Block, screen, stencil, roller, heat transfer printing, tie and dye and batik Practical Finishing of cotton fabric Scouring Bleaching Mercerization Tying

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

nd dyeing of cotton fabric with direct dye Fabric designing by batik technique with napthol dye Printing of cotton fabric using different methods Block Stencil Screen Heat transfer.

27. NFSN-221 Normal and Therapeutic Nutrition 3(2+1)

Theory: Determination of nutritional requirements: recommended dietary allowance, calorie consumption unit, food exchange list method. Maternal nutrition. Physiological changes and nutritional requirements during pregnancy and lactation. Infancy. Growth, development and nutritional requirement, importance of breast feeding, weaning and supplementary foods. Preschool children. Growth and development, food habits and nutritional requirements. School age child and adolescents. Growth and development, food habits and nutritional requirements. Geriatric nutrition. Physiological and psychological changes during old age, nutritional requirements and consideration for diet planning. Importance and modification of normal diet to therapeutic diets. Methods of feeding. Normal and artificial. Aetiology, symptoms and dietary management in acute and chronic fevers. Typhoid, influenza, tuberculosis. Aetiology, symptoms and dietary management in gastrointestinal disorders. Diarrhoea, constipation, peptic ulcer. Aetiology, symptoms and dietary management in liver diseases. Hepatitis, jaundice, cirrhosis of liver. Aetiology, symptoms and dietary management in cardiovascular disease. Atherosclerosis and hypertension. Aetiology, symptoms and dietary management in diabetes mellitus Problems of weight control. Overweight and obesity, dietetic management and prevention.

Practical :Standardization of serving size portions. Planning and preparation of diets for different age groups-Infancy, preschool age, school age, adolescent, adult, old age. Planning and preparation of diets for pregnant and lactating women. Planning and preparation of diets for special occasion. Birthdays, festivals, packed lunches. Planning and preparation of diets for following diseased condition- diarrhea, constipation, hepatitis, hypertension, diabetes, mellitus, overweight/ obesity.

28. CC-221 Communication Skills and Personality Development 3(2+1)

Theory: Communication skills- Process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Role of ICT in communication. Recent advances in communication- Print and electronic, internet, e-mail, fax, mobile, interactive video and teleconferencing, computer, e-governance. Meaning and definition of personality; Theoretical perspectives on personality- Behavioural trait and humanistic personality pattern; moulding the personality patterns. Personality development- Self perception, self concept, self esteem and gender stereotyping, persistence and changes in personality determinants (physical, intellectual, emotional, social, educational and family). Aspirations, achievements and fulfillment. Dressing for formal and informal occasions. Practical Listening and note taking, writing skills, oral presentation skills;

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations. Developing questionnaire to study impact of physique, educational institutions, aspirations on personality; developing questionnaire to study social prescriptions, gender and family on personality, aspirations and achievements. Collecting data through the questionnaires on small samples. Report writing and presentation. Case study of an individual suffering with personality disorders.

29. NIHDFS-221 Developmental Challenges in Children 3(2+1)

Theory: Special needs and special education: Definition of special needs children and special education, terminologies for children with special needs, history of special education, current trends and issues in special education, legislation and litigations of special education labellingdefinition and its effects. Mainstreaming- definition, models of mainstreaming, problems in implementing mainstreaming, effect of mainstreaming on children with special needs mental retardation-definition, classification, prevalence, causes and measurement of mental ritardafoon, their psychological and behavioral characteristics and educational considerations for MR children, managing child in school learning disabilities- definition, prevalence, causes and measurement of LD, psychological and behavioural characteristics of LD children, educational considerations for LD children, managing child in school emotional disorders- definition, classification, prevalence, causes and identification of ED, psychological and behavioural characteristics of ED children, educational considerations for ED children, managing child in school communication disorders- definition, speech production, speech disorders, language disorders, multiple disorders (disorders associated with cerebral palsy, hearing impairment, cleft palate or cleft lip, MR, ED and LD), prevalence, Causes of CD, identification, psychological and behavioural characteristics of CD children, educational considerations for CD children, managing child in school hearing impairment- definition, anatomy and physiology of ear, classification, prevalence causes, measurement of HI children, psychological and behavioural characteristics of HI children, educational considerations for HI children, managing child in school visual impairment-definition, classification, prevalence, anatomy and physiology of eye, causesand measurement of VI children, psychological and behavioural characteristics of VI children, educational considerations for VI children, managing child in school physical impairment- definition, classification, prevalence, neurological impairments, musculoskeletal conditions, congenital malformations, accidents, 574 575 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee diseases and other conditions, psychological and behavioural characteristics of PI children, educational considerations for PI children, managing child in school giftedness- definition, prevalence, Origins of giftedness, Screening and identification of giftedness, Psychological and behavioural characteristics of gifted children, attitudes towards gifted children, educational considerations for gifted children, managing child in school. Rights and provisions for children with special needs in India. Intervention- concept, methods, steps and process, intervention strategies for children with special needs, role of professionals, need and importance of family centered intervention.

Practicals :Observational visits to institutes for children with special needs. Identification of children with special needs in the local community. Developing educational material on identification of children with

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

special needs, organising education programmes for families of children with special needs, planning recreational and vocational activities for children with special needs; Presentation of case study reports.

30. NFPNH-221 Food Standards and Quality Control 3(2+1)

Theory: Importance of quality control and assurance. Food laws and regulations. Prevention of Food Adulteration Act, Fruit Product Order, Agmark, Essential Commodity Act, Consumer Protection Act, Bureau of Indian Standards, Codex Standards. Specifications and application of food standards for raw materials and food products Food additives. Preservatives, coloring agents, antioxidants, emulsifying agents, leavening agents and stabilizing agents Various methods for the assessment of quality of different foods Selection of sensory panel and sensory evaluation of food products. Food safety, risks and hazards Assessment and prevention of food adulteration. Food packaging and packaging material. Practical Sensory and nutritional evaluation of some finished products. Detection of adulterants and preservatives in products.

31. NHECM-221 Extension Training Management 3(1+2)

Theory : Training: Concept, need, definition, importance. Identification of training need. Types of Training. training process, different phases of training and its management. Qualities of a good trainer-communications skills, training skills, motivational skills and handling difficult situations. Adult learning, characteristics of adult learner. Facilitation skills in training, problem and prospects of training. Designing training module: Basic guidelines, steps in module designing. Training methods. Training evaluation: Objectives, principle, steps and indicators of training evaluation. Important training institutions in India Practical Visit to state level training institutes, report writing and presentation. Visit to vocational training institutes, report writing and presentation. Hands-on-experience with training need analysis. Writing training objectives. Hands-on-experience on training methods, with monitoring and evaluation tools of training. Familiarization with offline and online training module. Preparation of training module, Designing, conducting and evaluation of training pogramme, Analysis of HRD programmes of academic and corporate institutions. Interaction with HRD professionals. Presentation of reports.

32. NFRMCS-222 Ergonomics and Appropriate Technologies 2(1+1)

Theory: Work-worker and workplace relationship, work simplification techniques, principles of ergonomics, Household drudgery- definition, Drudgery reduction. Household equipmentintroduction, definition, classification and base materials used in construction. Impact of household equipments on work, worker and environment, equipment design and its effect on body posture. Energy – definition, classification and sources, causes of energy crisis and solutions, status of energy crises in India and abroad. Renewable and non renewable energy saving technologies, ways and methods in the reduction of energy consumption in household, farm and community.

Practical: Use and care of common household appliances- refrigerator, washing machine, vacuum cleaner, oven etc. Demonstration of solar household technologies, biogas, zero energy cool chamber etc. Motion Studies – process chart, operational chart etc.

33. CC-311 Economics and Marketing 3(2+1)

Theory :Terms and definitions in Economics; Consumption, demand and supply. Factors affecting production. Gross Domestic Product (GDP) – Role of poultry sector in National GDP. MarketingDefinition, marketing process, need for marketing, role of marketing, marketing functions, classification of markets, marketing of various channels, price spread, marketing efficiency, integration, constraints in marketing of agricultural produce, market intelligence, bank norms, insurance, SWOT analysis, crisis management. Techno-economic parameters for preparation of projects and basic guidelines for preparation of project report.

Practical :Techno-economic parameters for preparation of project. Preparation of bankable projects for various agricultural products and its value added products. Identification of marketing channel, calculation of price spread, identification of market structure and visit to different markets.

34. NTAD-311 Garment and Accessory Designing 3(0+3) Practical :

Selection of figure template for men, women and children Designing of garments for women using different construction features: collar, sleeve, neckline men using different construction features: shoulder yoke, collar, sleeve, cuff children using different construction features: Yoke, gather, pleats, tucks, shirring, smocking, trimmings Drafting and construction of following garments for women, men and children fancy frock salwar/ pyjama/pyjami kurta (gents)/kameez (ladies) night dress/ gown Accessories: introduction and classification; footwear, hand bags, belt, jewelery, gloves, hats, scarves and umbrella Designing of accessories for women, men and children Selection of designs for construction of accessories Construction of one accessory each for women, men and children.

35. NFPNH-311 Food Hygiene and Sanitation 4(2+2)

Theory :Concept and significance of hygiene and sanitation in relation to food industry. Food storage general guidelines and storage of specific foods principles of hygiene and sanitation- sanitary procedures while preparation, cooking, and holding food, serving and displaying food, specific food operations. Sources of food contamination Sanitation of physical plant (premises) and sanitation of equipment- cleaning procedures. Personal hygiene and food handling habits of personnel. Water supply sources, impurities of water. Water purification methods. Domestic and Industrial. Food and water borne infections. Prevention and control. Regulatory lawsEnvironmental pollution- Sanitary regulations and standards.

Practical: Identification of micro organisms, preparation of slides, preparation of media. Collection of water samples. Testing of water for: (i) Physical quality (ii) Bacteriological quality. Survey of hygienic and sanitary condition in food shops/food vendors. Visit to food industries. Report writing.

36. NHSOC-311 Introduction to Rural Sociology 2(2+0)

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Theory: Rural sociology- Meaning, scope and significance. Structural differentiation in terms of difference and characteristics of rural and urban societies. Planned social change - Approaches to rural planning, improvement and transformation and their shortcomings. Indian rural development programs (IRDPs). Indian rural social stratification: Castes- Basic notions, changes and its role in economy and policy, difference between caste and class, backward classes and implementations of constitutional provisions. Indian rural institutions: Social- Family and marriage (Nature, forms and changes). Economic-political: Land relations and changes; rural poverty: its manifestations and causes. Socio-religious: Functional significance of beliefs, traditions and customs. Rural social changes - Processes and factors of transformation. Status of women in rural India and their role in rural and agricultural development

37. NHDFS-311 Family Counseling and Child Welfare 3(2+1)

Theory: Concept, nature, scope, principles and need of family counselling, trust areas in family counselling- educational, vocational, social, personal, premarital and marital, problems in family counselling, methods of handling problems, approaches to evaluate family counselling, counselor's self-awareness and growth. Situation analysis of child, women, youth, elderly, disabled and reserved category in India and in the world- Census, Issues and challenged, determining factors for the present status, impact of present status on the family and society at large. Child welfare- definition, need, constitutional, provisions for children, legislations pertaining to children, schemes/projects and policies for children, other activities of child welfare, women welfare- definition, need, constitutional, provisions for women, legislations pertaining to women, schemes/projects and policies for women youth welfare- definition, need, constitutional provisions for youth, legislations pertaining to youth, schemes/projects and policies for youth elderly welfare- definition, need, constitutional, provisions for elderly, legislations pertaining to elderly, schemes/projects and policies for elderly disabled/ exceptional pupil welfare- definition, need, constitutional, provisions for disabled, legislations pertaining to disabled, schemes/projects and policies for disabled reserved category welfare- definition, need, constitutional provisions for reserved category, legislations pertaining to reserved category, schemes/projects and policies for reserved category national and international organizations and agencies working for child, women, youth, elderly and disabled welfare: UNICEF, WHO, CARE, DWACRA, NIPCCD, CIF etc.

Practicals Visits to organisations offering counseling to families, studying the areas of family counseling, identifying the families which are in need of counseling, conducting counseling sessions to families, presentation of reports. Visits to various government and non government organisations working for the welfare of the children, Presentation of reports

38. NHPHYL-311 Elementary Human Physiology 3(2+1)

Theory: Physiological process, structural and functional basis of human body, skeletal system, joints and muscular system Functions of brain and spinal cord, nerve impulse reflex action and sense organs Composition and functions of blood and lymph, heart and course of blood circulation, blood pressure, pulse and heart sounds. Respiratory apparatus, mechanism of respiration, respiratory rates, volume and transport of gases Physiology of kidney and skin Physiology of digestion, digestive enzymes and their functions,

functions of liver, absorption from the intestine. The location, secretions and function of various endocrine glands Male reproductive organs and their functions Female reproductive organs and their functions Pregnancy, persecution and milk secretion Pre-Final Examinations .

Practicals: Skeletal system of mammal (rabbit) Hematology- R.B.C., W.B.C., T.L.C., D.L.C. and estimation of hemoglobin in mammalian blood Heart beat and heart sound, blood pressure measurement Respiratory quaotient, inspiration, expiration and measurement of O2 and CO2 at various partial pressure in lungs. Reproductive cycle-menstruation and estrous cycles, mating behavior and fertility test

39. NFRMCS-311 Residential and Commercial Space Design 3(2+1)

Theory: Design and space organization analysis of independent house of different income groups. Design and space organization analysis of apartments and flats. Understanding on building bye laws, regulations and specifications essential for building, and service management. Selecting materials and finishing scheme for interiors. Estimation of cost of fittings, fixtures, furniture, lighting and materials for interior finishing. Estimation of cost of fittings, fixtures, furniture, lighting and materials for commercial buildings. Appraisal on space needs in commercial buildings. Study of commercial interiors for business establishments, hotels/restaurants, hospitals, educational buildings, public service buildings Specifications writing-writing detailed clause by clause specification for materials pre and post execution, tests, mode of measurements, manufacturers details and specifications etc. Practical Develop conceptual drawings and floor plans for various income groups. Develop layouts of furniture, lighting, electrical and plumbing for various income groups.

Practical :Applications of design and space organization of apartments and flats and analysis. Cost estimation for designing interiors of various income groups. Planning of ergonomic work layout for a small project (1000 sq.ft.). Planning of ergonomic work layout for hills areas and commercial areas. Evolving interior decoration details with material sample for the small project. Evolving interior decoration details with material sample for hills areas. Evolving interior decoration details with material sample for the a large commercial area. Presentation of the detailed work done for small projects. Presentation of the detailed work done for hill areas. Presentation of the detailed work done for large commercial projects

40. NTSD-311 Retailing and Merchandising –Textiles and Apparel 2(2+0)

Theory: Retailing and merchandizing- Terminology, concept and principles Factors affecting merchandizing Role and responsibilities of merchandiser Merchandizing for buying house, departmental stores and export houses. Evolution of retail and retail formats marketing research: Meaning, scope and classification, steps in marketing research Role of marketing research in product planning Sale promotion and promotion mix: advertizing, sale promotion technique, personal selling and publicity Pricing methods and pricing of textile Export and Import: Channels of distribution, starting of export and import business and its procedure Organizations involved in export promotion in India WTO and its impact on retailing and merchandizing in textile and apparel industry

DEAN
Dept of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

41. AD-321 (N) Traditional Textiles and Costumes of India 3(2+1)

Theory :Traditional woven textiles of Indi History of woven textiles: Dacca muslin, Brocades, Calico Printing Traditional sareesof India Jamdani, Baluchari, Pochampalli, Patola and Ikat, Kanjivaram, Chanderi, Maheshwari, Bomkai, Sambhalpuri, Vichitrapuri, Paithani, Kota Doria, Gadwal, Irkal, Venkatagiri, Narayanpet, Kasavu, Tanchoi and Brocade Sarees. Traditional woven and embroidered shawls of India: Shawls of Kashmir, Himachal Pradesh, Gujarat, North Eastern States and other states. Printed and painted textiles Printed textiles Block printed textiles: Dabuprinting, Bagruprinting, Sanganeriprinting, Bagh printing Tie and dyed textiles of Rajasthan and Gujarat. Painted textiles: Kalamkari, Madhubani, Warli, Patchitra, Phad and Pichhavai. Embroideries of different states of India: Kashida of Kashmir, Chamba Rumal, Chikankari and Zari work of Uttar Pradesh, Phulkari and Bagh of Punjab, Embroideries of Gujarat, Kantha of Bengal, Manipuri Embroidery, Kasuti of Karnataka, Embroidery and Rabari work of Bihar, Pipli work of Orissa Importance of traditional textiles in textile and apparel industry Importance and market scenario of traditional Indian textiles and their impact on modern textiles industry. Geographical Indications obtained for traditional Indian textiles.

Practical :Documentation of motifs of traditional Indian embroideries. Sample preparation of traditional Indian embroideries Documentation of woven textiles of India. Creative projects in the adaptation of traditional motifs and designs in contemporary textiles through collection of samples, sketches and development of scrap book Visit to museum and art galleries.

42. CCHECM-321(N) Information and Communication Technology 3(1+2)

Theory: IT and its importance, IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; word and character representation; features of machine language, assembly language, high-level language and their advantages and disadvantages; principles of programming- algorithms and flowcharts; Operating systems (OS) - definition, basic concepts, introduction to WINDOWS and LINUX Operating Systems; Local area network (LAN), Wide area network(WAN), Internet and World Wide Web, HTML and IP; Introduction to MS Office - Word, Excel, Power Point. Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing. Communication process, Berlo' s model, feedback and barriers to communication.

Practical: Planning, preparation, presentation of posters, charts, overhead transparencies and slides. Handling of audio-visual equipments. Organization of an audio-visual programme. Exercises on 542 543 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee MS Word; MS Excel; MS Power Point; Internet applications- Web browsing, creation and operation of email account; analysis of data using MS Excel. Introduction to World Wide Web (WWW) and its components, creation of scientific website, presentation and management agricultural information through web. Introduction of

College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

various programming languages such as Visual Basic, Java, Fortran, C, C++, and their components. Hands on practice on writing small programmes.

43. HECM-322 (N) Diffusion and adoption of Homestead Technologies 3(2+1) Theory: Concept and elements of diffusion process. Innovation–decision process, types of innovation– decision, consequences of innovations. adoption: meaning, definition, adoption process, factor affecting adoption and innovation – decision process and constraints. Different terms used in diffusion of innovation and adoption process: Rate of adoption, overadoption, innovativeness, dissonance, rejection, discontinuance. Adopter categories: concept and types. Homestead technology: concept and its relevance to innovation – decision process different channels of communication and their characteristics. Social change: concept, theories, dimensions and factors. Change agents and opinion leader; change proneness – acceptance and resistance to social change. Different homestead technologies with special reference to Home Science.

Practical : Collection of homestead technologies. Adoption in localities- Observation, visit to different entrepreneurs with adopted home stead technologies for business enterprise. Visit to different successful SHGs, Categories of adopters among SHG members. Analysis and presentation of report. Identification of change agents in a locality, Presentation of report

44. FSN-321(N) Clinical Nutrition and Dieteties 3(2+1)

Theory: Clinical Nutrition- Introduction, nutritional status and disease, common deficiency diseases, pathogenesis of nutritional deficiency diseases - macronutrient and Micronutrient, protein calorie malnutrition, vitamin A deficiency, anemia, iodine deficiency disorders, gastro intestinal tract diseases- Introduction, different organs and diseases, diagnostic procedure, diseases of mouth and oesophagus, diseases of stomach and duodenum, diseases of small and large intestine, diverticulitis, malabsorptive syndrome and tropical sprue Diarrhoea- Symptoms of diarrhea pathogenesis and diagnosis of constipation, diseases of liver, pancreatitis, chronic obstructive pulmonary disease, diabetes mellitus cardio vascular disease: risk factors, lipo and apo proteins, role of nutrients in preventing atherosclerosis, major enzymes used for diagnosis, congestive heart failure, hypertension, renal disease. Functions of the kidney, nephritis, urinary calculi, types of renal failure, dialysis. Cancer. Causes of cancer cell development, impact of tumor on host metabolism, systematic effects of cancer. Burns. Physical destruction of skin, metabolic aberrations, alteration in nutritional requirement, interaction between nutrients, infection and drugs.

Practical : Estimation of albumin, glucose, ketone bodies, creatinine and creatine in urin.e Determination of bile pigments in urine Analysis of bile salts in urine Analysis of blood glucose level. Estimation of total protein, albumin, haemoglobin. Estimation of blood urea. Estimation of total cholesterol, HDL, LDL, TG in blood. Assignment and presentation

45. FSN-322(N) Food Analysis 3(1+2)

Theory : Sampling and sampling techniques. Proximate analysis- Moisture, ash, crude fat, crude fibre, crude protein and carbohydrates by difference. Principles and methods of food analysis. Basic principles: Refractometry, polarimetry, densitometry, HPLC, GLC, spectrophotometry electrophoresis, automatic

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

amino acid analyzer. Determination of starch. Test for unsaturation of fats, rancidity of fats. Quantitative analysis of protein by Biuret method, Ninhydrin method, Lowry's method and Dye-binding methodBioassays for protein quality of grainsChemical, microbiological, flurometric and colorimetric methods of analysis of fat soluble and water soluble vitaminsPrinciples and methods for estimation of minerals: Atomic absorption spectroscopy, colorimetric, titrimetric and gravimetric methodsMethods for determining physical and rheological properties of food.

Practical : Proximate analysis: Moisture, ash, crude fat, crude fibre, crude protein and carbohydrate by difference. Demonstration of kjelplus, fibreplus, sox-plus. Estimation of sugar content of fruit and reducing and non-reducing sugars in cereals. Estimation of starch content of cerealsDetermination of iodine value and saponification number of fatsEstimation of minerals, iron, calcium and phosphorus Estimation of vitamins. Ascorbic acid, thiamine, beta-carotene. Protein quality analysis, in-vitro method Physical test for grain quality and rheological properties of foods

46. CCFRMCS-321(N) Entrepreneurship Development and Business Management 3(2+1)

Theory: Development of entrepreneurship, motivational factors, social factors, environmental factors, characteristics of entrepreneurs, entrepreneurial attributes / competencies. Concept, need and importance of entrepreneurial development. Evolution of entrepreneurship, objectives of entrepreneurial activities, types of entrepreneurs, functions of entrepreneurs, importance of entrepreneurial development, and process of entrepreneurship development. Environment scanning and opportunity identification need for scanning – spotting of opportunity-scanning of environment – identification of product / service – starting a project; factors influencing sensing the opportunities. Infrastructure and support systems- Good policies, schemes for entrepreneurship development; role of financial institutions, and other agencies in entrepreneurship development. Steps involved in functioning of an enterprise. Selection of the product / services, selection of form of ownership; registration, selection of site, capital sources, acquisition of manufacturing know how, packaging and distribution. Planning of an enterprise, project identification, selection and formulation of project; project report preparation. Enterprise Management. Production management – product, levels of products, product mix, quality control, cost of production, production controls, Material management. Production management – raw material costing, inventory control. Personal management – manpower planning, labour turn over, wages / salaries. Financial management / accounting – funds, fixed capital and working capital, costing and pricing, long term planning and short term planning, book keeping, journal, ledger, subsidiary books, annual financial statement, taxation. Marketing management- market, types, marketing assistance, market strategies. Crisis management- raw material, production, leadership, market, finance, natural etc.

Practical : Visit to small scale industries. Interaction with successful entrepreneurs. Visit to financial institutions and support agencies. Preparation of project proposal for funding by different agencies

47. HDFS-321(N) Educational Psychology and Early Childhood Education 3(2+1)

Theory: Educational psychology- Meaning, nature, scope and importance of educational psychology, history of its evolution, abroad and in India, recent trends and challenges in educational psychology concept

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

of learning- definition, essential features, types of learning, laws of learning, principles of learning learning traits- sensation, perception, imagination, attention and memory, remembering and forgetting, intelligence- reasoning and thinking, temperament, problem solving, information processing learning environment- reinforcement- definition, types of reinforcements, schedules of reinforcement, importance of reinforcement in learning, punishment- meaning, functions, types, essentials of good punishment, effect of punishment on learning, motivation- definition, types, modes of motivation (contingency contract, token economy) relationship of motivation with learning and performance discipline- meaning, social attitudes towards it, need for discipline, wholesome and unwholesome functions of it, essentials in discipline, techniques of discipline, factors influencing choice of disciplinary techniques, evaluation of disciplinary techniques, theories for classroom teaching and its applicability – learning theories of jerome bruner, robert gagne, jean piaget, erik erikson, lev vygotsky, lawrence kohlberg performance evaluation – meaning of evaluation/ testing, ways of evaluation of student's performance. Types of tests used in classroom evaluation. Advantages and abuses of testing and tests. Meaning, characteristics and significance of early childhood years. Programme planning in ECE- Steps and types of programme planning, activities to promote all round development of preschool children- cognitive, language, socio-emotional and motor development, role, qualities and responsibilities of an early childhood personnel.

Practicals: Analysing effect of reinforcement, motivation, discipline on learning. Application of theories of classroom teaching. Application of different methods of evaluating performance and interpretation. Observation and recording of activities in ECE center. Developing and conducting activities to promote all round development- Gross and fine motor skills, cognitive skills, language skills, creativity and socio emotional skills. Preparation of suitable teaching learning material used for preschool children.

48. HECM-411 Print and Electronic Journalism 3(0+3)

Practical : Visit to print and electronic stations for familiarization with equipments, Interaction with personnel of print and electronic media. Report writing on observations and presentation. Planning a press note/ press release for print media, Screening of radio news programmes. Screening of TV news programmes. Exercises on writing different types of reports for radio. Exercises on writing different types of reports - television formats, Hands-on experience with editing. Planning a press note/ press release for electronic media, Writing and presentation of radio and television news, Orientation to photography and photographic equipment. Hands on training with different types of professional cameras, Writing captions for photographs. Writing and editing photo features for selected photographs and presentation. Familiarization with different online articles. Content creation for online journal. Creating a blog.

49. National Service Scheme 2(0+2)

Practical : The course aims at evoking social consciousness among students through various activities viz. working together, constructive and creative social work, increasing knowledge about self and community, contribution in solving social problems, to be skillful in executing democratic leadership, developing skill in programme development, to be able for self employment, reduce

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

50. HECM-412 Instructional Video Production 3(0+3)

Practical: Familiarization with instructional video, Writing instructions for instructional video. Familiarization with script. Hands-on-experience with script writing. Familiarization with video and audio formats. Preparation of amateur instructional video. Familiarization with video camera and operation. Hands-on-training with video camera. Production of video – pre-production, production and post production. Projection and evaluation.

50. HECM-413 Web designing and Multimedia production 4(0+4)

Practical: Familiarization with different types of websites Hands-on-experience with Adobe photoshop for designing of website. Hands-on-experience with HTML 4.01 writing for construction of website. Hands-on-experience with Dreamweaver for construction of website. Hands-on-experience with flash for animations of website. Familiarization with easeading sheet styles. Familiarization with web analytics. Practical orientation to Multimedia application. Exposure to multimedia hardware and maintenance-parts and connection, peripheral. Handling multimedia-parts, connections and peripheral. Scanning, retrieval, capturing and navigating skills. Planning and Production of multimedia package. Multimedia authoring tools - CD and DVD writing techniques. Presentation of the prepared Multimedia kit by using LCD Projector.

51. HECM-415 Seminar 1(1+0)

Theory: A power point presentation on any topic chosen from the subjects studied from vocational package to be prepared and delivered to the group of staff and students of department. 544 545 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee Organization of topic. Presentation of data. Oral presentation. Delivery, language, explanation of figures. Ability to grasp and understand the subject, Depth of understanding the topic

52. FSN-411 Diet and Nutrition Counseling 3(0+3)

Practical :Planning and preparation of diets using exchange lists. Processes and technique of counseling Diet planning in fever and infection Diet planning in GI disorders Diarrhea, constipation, gastritis, ulcerative colitis Diet planning in liver disease. Diet formulation in diabetes millitus. Diet planning in heart diseases. Diet planning in kidney diseases Diet planning in food allergies and gout Diet modification for prevention and treatment of cancer Diet in trauma and burns. Diet in obesity and underweight. Diet for old age people. Setting up a unit for nutrition counseling. Role play exercises for counseling. Supervised counseling of patients/clients. Visit to hospitals with therapeutic kitchen setup.

53. FSN-412 Food Preservation and Storage 3(0+3)

Practical: Market survey of raw and preserved foods. Preparation of preserved products. Squash, cordial, crush, jams, jellies, marmalade, candy, preserves, murabbas, pickles with and without oil, chutneys, ketchup, sauces, candies, toffees, cheese and syrup. Shelf life and sensory evaluation of developed products

Demonstration on canning and bottling of fruits and vegetables. Demonstration on storage of food grains. Visits to food processing and preservation units, canning and bottling units, grain storage institute dairy plant and FCI godown

54. FPHN-413 Food Service and Hospitality Management 3(0+3)

Practical :Contribution of food service institutions in meeting socioeconomic and dietary needs. Menu planning for industrial canteen, hospital canteen, cafeteria, snack bar, residential hostel. Standardization of recipes suitable for fast food outlet, industrial canteen, hospitals, college hostel. Multiplication of standard recipes for quantity food production, quantity food management, portioning and fixing of cost. Visit to canteen attached to hospital and dietary department cafeteria, 3 star hotel/restaurant, 5 star hotel / restaurant, industrial canteen. Presentation of report on hospital canteen, cafeteria, 3 star hotel / restaurant, 5 star hotel / restaurant in terms of organizational set up, production, preparation and service. Practical exercise on planning, preparation and service in a cafeteria, snack, bar fast food outlet. Management of cafeteria – preparation, costing and fixing of price for meal items. Evaluation of management process and report presentation.

55. FPHN-414 Nutraceuticals and Health Foods 3(0+3)

Practical ;Market survey for dietetic foods. Planning, preparation, nutrient calculation and acceptability of dietetic foods with preference to locally available food stuff. High/low energy, high/low protein high/low fibre low sodiumlow cholesterollow dycemic index low fluid, high fibre and low fat.RUTF (Ready to use therapeutic foods) for under nutrition in preschool and school age children. Food for sports person in intensive activities and endurance activities. celiac disease, Food for lactose intolerance Food for senior citizens (with dental problem, with flatulence, digestive disorders, physical and nervous diseases

56. HDFS-411 Methods and Materials for Teaching Young Children 4(0+4)

Practicals: Orientation on different methods and materials used for teaching young children. Survey of available different kinds of literature appropriate for infancy through early childhood. Visit to Organization and Children's libraries for development of literature, Reporting on different kinds of literature appropriate for infants and preschool children. Developing stories appropriate for infancy through early childhood- A Folk tale, A Fairy tales, A Personal story etc., Carry out discussions on developed stories, Collection and Observation of different techniques of story telling. Identifying and analyzing the different techniques of story telling. Practicing techniques of effective story telling. Identifying methods of development of creativity -Analyzing situations/ conditions that foster creativity-Preparation of art file with different forms of paintings and printing appropriate for infancy through early childhood- Preparation of collage, murals and models appropriate for infancy through early childhood -Art activities (Painting and graphics, Tearing, cutting, pasting and collage, murals, modeling, printing, blocks, sand and mud, water)- preparation of each medium of art activity for young child's development, types/variations in art activities, identification of different types of creative expressions in young children- creatingsongs with music and rhythm movements appropriate for infancy through early childhood- making simple musical instruments with indigenous material- preparation of different types of puppets -practicing musical activities- learning basic manipulation

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

skills: use of music, voice modulation and sound effects. Making sets and backgrounds- Identifying different types of creative dramasScripting for short puppet show and creative dramas, planning and implementing activities to promote creative expressions among young children through a variety of media i.e. painting, printing, modelling, cutting, pasting, blocks, puppetry, music movement, drama and language, Developing resource file, Organising an Exhibition and evaluation of materials developed.

57. HDFS-412 Education and Counseling of Parents and Community 2(0+2)

Practicals: Orientation on need and importance of parent and community education. Understanding recent issues and challenges. Parent-Child Relationships and its impact on children. Studying various methods of parent and community education. Visit of local community to identify parents 576 577 Report of the ICAR Fifth Deans' Committee Report of the ICAR Fifth Deans' Committee of normal and exceptional children, rapport building, identifying families with problems and conducting case studies, acquiring familiarization with the tests and techniques used for the assessment of troubled families, identification of areas and issues for parent education, developing parent education programmes, Planning, conducting and evaluating parenting education programmes, wisconsin model of community education, study on communication barriersdifferences between men and women, conducting sessions in the community on communication skills and effective human communication, studying on various approaches and techniques of counselling, organising counseling sessions for individuals,couples, parents and families of normal and exceptional children by using appropriate therapies – cognitive behavioural therapy (CBT), rational emotive behavioural therapy (REBT), client centered and existential therapies etc, establishing and managing the resource centre for parents and local community, implementing and evaluating the programmmes developed.

58. HDFS-413 Early Childhood Care, Education and Management 4(0+4)

Practicals : Visits to nursery schools/ ECCE centers for observation of material, space, personnel, finance, documentation, orientation on areas of development during early childhood period- – planning and implementing activities for physical and motor development, language development, cognitive development, socio-emotional development and creativity , planning theme based developmentally appropriate programmes for crèche, Nursery, LKG and UKG children, preparing yearly and weekly plans for pre-primary education programmes, implementation of prepared plans, visit to different types of ECE centers - based on funds and resources and philosophy and function styles, observation of records and reports maintained in ECE center, organizing parent teacher conferences/ meetings, planning parental participation in ECE programme, celebration of annual day of ECCD center, orientation on management of ECCE programmes - planning, organizing, staffing, leading, monitoring and controlling for quality, designing the activity corners in ECE center- arranging and equipping the classroom – block center, language and art center, creative art and construction center, science and collection center, math and manipulative material center, pretend and play center, sand and water center, outdoor nature center, preparing ECCE project proposal, budget preparation for ECE center, preparation of brochures, leaflets, communication documents for parents and public, evaluation of daily, weekly and monthly schedule of activities prepared, reporting on monitoring and evaluation of classroom arrangements, cleanliness, record keeping etc, planning and organizing field trips, identification of preprimary children with mild behavioural problems – planning and

DEAN
College of Community Science
A.N.D.U.A.T., Kumarganj
Ayodhya (U.P.)

execution of strategies of children with mild behavioural problems, evaluation of strategies planned for children with mild behavioural problems. Presentation of reports.

59. HDFS-414 Developmental Assessment of Young Children 3(0+3)

Practicals: Orientation on Screening and developmental assessment of young children for various developments through different tools and techniques. Exploring existing areas, approaches and tools in developmental screening; Orientation on formal and informal measures in assessment, special considerations and ethical issues in assessing various areas of developments of Toddlers, Infants, Preschoolers and Pre-Primary school children. Conducting tests for Neonatal assessment – APGAR and Gestational age, Neonatal Behavioural Assessment Scale (BNBAS), Conducting tests for Infant and Toodler hood assessment - Anthropometry, Developmental Screening Test, Bayley's Scale of Infant Development (BSID), Vineland social Maturity scale etc. Screening and assessment of preschool and Preprimary school children- Stanford Binet Inteiligence Scale, Weschler Scale of Intelligence for Preschool and Primary School Children, Vineland Social Maturity Scale, Adaptive Behaviour Scale; DAS II; Thematic Apperception Test (TAT), Children's Apperception Test (CAT), Raven's Coloured Progressive Matrices (RCPM); Pea body Picture Vocabulary test, PramilaPathak's Mental and Motor Growth of Indian babies; Ecological assessment of Preschool and Preprimary school children- HOME Inventory; Informal measures like Time sampling, event sampling, sociogram, Anectodtal records, Case studies etc; Assessment of readiness skills of pre-primary school children- Auditory perception, Visual perception skills, Writing skills, reading skills, arithematic skills, discriminatory skills, tests for preschool children; Presentation of reports; Conducting education programmes for parents on the developmental status of their children. Identifying the intervention needs of developmentally delayed child; Planning and implementation of intervention programmes and preparation of material; Evaluation of effectiveness of intervention program planned for developmentally delayed child. Presentation of reports.

60. AD-411 Apparel Designing Techniques- Flat Pattern and Draping 3(0+3) Practical :Designing and styling using flat pattern technique Moving, dividing and combining darts: Pivot and slash method Converting darts into seam lines Adding fullness by gathers, pleats and tuck Construction of different types of yokes collars: full roll collar, convertible collar, sailor collar, chines collar, polo collar sleeves: set-in sleeve and its variations, raglan sleeve, kimono sleeve skirts: 'A' line, pleated and gathered Preparation of basic block using draping techniques Construction of formal dress for teenager using draping technique Development of commercial pattern for a prepared dress: pattern envelope, patterns and instructions for use. Visit to fashion institute.

61. TSD-412 Principles of Textiles Designing 3(0+3)

Practical :Motif and its geometry Motif as basic unit of design: selection of components of motif, motif development, symmetrical and asymmetrical motifs and their arrangements Patter arrangement with motif in

Ayodhya (U.P.)

different repeats Geometry involved in basic textile designing- translation, rotation, reflection and glide reflection Geometrical motifs Developing geometrical motifs Use of monochromatic, analogous and complementary colour scheme in developed motif Arrangement of patterns with developed geometrical motifs Abstract motifs Developing abstract motifs Use of monochromatic, analogous and complementary colour scheme in developed motif Arrangement of patterns with developed abstract motifs Stylized motifs Developing stylized motifs Use of monochromatic, analogous and complementary colour scheme in developed motif Arrangement of patterns with developed stylized motif Natural motifs Developing natural motifs Use of monochromatic, analogous and complementary colour scheme in developed moti Arrangement of patterns with developed natural motifs Ethnic and Traditional motifs Using ethnic and traditional motifs for creating designs Application of suitable colour schemes in the developed designs Sketching and rendering of different types of border patterns Sketching and rendering of patterns for apparels Sketching and rendering of patterns for home textiles Preparation of swatch book of fabric samples of different types of structural and decorative designs Field visit to printing and textile design centre.

62. AD-413 Fashion Illustrations 3(0+3)

Practical : Drawing eight head figure using geometric body shape Proportion: proportion of body parts, proportion of head, face and feet according different age group, sketching figures of different age group based on head theory Facial expression in illustration-eyes, nose and lips Basics of drawing legs, hands and arms of children, men and women's hand Front, ¾ and profile faces of adult and child (Male and Female) Adult and child (Male and Female)figures in different poses Sketching of garment features: collars, neckline, fasteners, sleeves, pockets, cuffs and hemline Sketching of added fullness: frills, flounce, gathers, pleats Sketching of accessories: hats, shoes, boots, belts and purses Designing of garments for adult and child - Male and Female Illustration of fabric design and texture using different media -water colour, peneil colour, collage, poster colour and crayon colour.

63. AD-414 Computer Aided Designing- Pattern Designing 2(0+2)

Practical: Introduction to pattern making software Basics of pattern making tools Standard tool bar Piece tool bar Seam tool bar Edit tool bar Tool kit Rotate tool bar Internals Segment tool bar Grading tool bar Darts/Pleats Fabric and Stripes Basics of pattern making menus File menu Edit menu Piece menu Grading menu Point menu Segment menu Dart menu Pleat men Seam menu Walk menu Tool menu Help menu Creating and grading basic patterns Bodice front and back Sleeve Skirt front and back.

64.Retailing and Merchandising –Textiles and Apparel 2(2+0)

Theory Retailing and merchandizing- Terminology, concept and principles Factors affecting merchandizing Role and responsibilities of merchandiser Merchandizing for buying house, departmental stores and export houses. Evolution of retail and retail formats marketing research: Meaning, scope and classification, steps in marketing research Role of marketing research in product planning Sale promotion and promotion mix: advertizing, sale promotion technique, personal selling and publicity Pricing methods and pricing of textile Export and Import: Channels of distribution, starting of export and import business and its procedure

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

Organizations involved in export promotion in India WTO and its impact on retailing and merchandizing in textile and apparel industry

65. HECM-414 Public Relation and Social Marketing 3(0+3)

Practical :Visit to Institution under government sector for analyzing the public relations institution. Oientation to different models of PR. Designing PR models. Analysis of the situation to find out the social problems in a community,. Assessment and analysis of the problems. Preparation of report on collected information. Planning for social marketing strategy based on the identified problems. Execution of social marketing programme, Planning for publicity campaign, Execution of publicity campaign. Evaluation of programme and reporting.

66. FRMCS-411 Event Management 3(0+3)

Practical :Identifying practical situations for event management, conceptualizing goal and objectives,Overall show management. Exhibit sales and promotion. Attendance promotion. Contract negotiations. Festivals (diwali, religious ceremonies). Social gathering. Conference/ workshop/seminar/congress programming. SWOT analysis of event. Portfolio preparation; presentation and projection for work. Project report on visit to different types of organizational settings like hotel, guest house, hostel, small offices, clubs, fast food centres for management and organization of events. Project planning. Programme planning and execution. Project development. Event accountancy. Event communication and sponsorship. Event marketing and advertising. Live event management. Visit to different organizations/hotels etc. Project preparation and report presentation.

67. FRMCS-412 Interior Design and Decoration 3(0+3)

Practical: Application of elements and principles of interior design and Decoration Preparation of utility and decoration articles by using various painting/printing techniques Calligraphy Use of floor decoration in interiors Flower arrangement and decoration for different areas and occasions Stationery designs; cover designs for books, magazines, illustrations, lettering construction etc. Accessories; various types, materials and techniques; pottery, collage, handicrafts, utility articles, paper mache items, paper sculpture, poster making, greeting cards, fabric painting, glass painting, gift wrapping etc.

68. FRMCS-413 Computer Aided Interior Designing 4(0+4)

Practical :Use of computer in daily sphere and interior decoration. Basic knowledge to start: Installation Explore Auto CAD window. Concepts of Auto CAD window. Opening auto cad through keyboard, mouse and getting acquainted with main screen, tool bars, dialog box, cancel command, handling files. Drafting settings and setting preferences. Co-ordinate system and input methods, concept of isometrics .Function and toggle keys, command prompt. Draw commands – lines, multiline and pool lines. Draw commands – arc, circle and ellipse. Edit commands – trim, extend, stretch. Edit commands – rotate, mirror, break, offset. Edit commands – object properties, colour. Edit commands polyline filleting, chamfering. Layers – new, name,

DEAN
College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

line weight, line type and style, changing properties. Text style and editing. Dimensioning style and editing. Hatching concept, inquiry tools, introduction to dimension style. Creation of 2d floor plan line, offset, trim, erase. Add on to the floor plan – stretch, extend, mirror, copy, move, rectangle, circle, arc, fillet, chamfer. Get organized with layers – creation of new layers, layer names, colours to layers, line types, weight, freeze. Introduction to 3d modelling – co-ordinate systems, primitive solids objects – slice, revolve, rotate, aligning, filleting, chamfering, perspective view editing. Rendering – material, light effects, backgrounds, fog, landscapes, image creation. Render the images and save them with different image files in BMP, TGA and JPEG. Camera animation of walk through, seeing the preview files and then converting the same to a movie file as AVI, editing movies files and uniting to single file.

69. IP-HFRM/SD-421 Internship/Industrial attachment/RAWE 20(0+20)

Hands On Experience With Field Work Through Work Simplification , Time Mangement,Energy Mangement, Ergonomic Evaluation

70. IP-FSN-421 Internship/Industrial attachment/RAWE 20(0+20)

Hands On Experience With Field Workat Hospitals, Bakery And Confectionary

71. IP-HECM-421Internship/Industrial attachment/RAWE 20(0+20)
Hands On Experience With Field Work Through Multimedia Tools Handling And Production

72. IP-HDFS-421Internship/Industrial attachment/RAWE 20(0+20)
Hands On Experience With Field Work By Managing Preschoolers, Nurseries

73. IP-TSD-421 Internship/Industrial attachment/RAWE20(0+20)

Hands On Experience With Field Work By Imparting Tie Dye Practices , Printing , Embroidery To Villegers.

College of Community Science
A.N.D.U.A.T. Kumarganj
Ayodhya (U.P.)

SYLLABI FOR UNDER GRADUATE DEGREE PROGRAMME

COLLEGE OF AGRICULTURE

ACHARYA NARENDRA DEVA UNIVERSITY OF AGRICULTURE & TECHNOLOGY

KUMARGANJ, AYODHYA - 224 229, UTTAR PRADESH

Dean, College of Agriculture
A. N. D. Univ. of Agric. & Tech.
Kumarganj - Ayodhya

HORT-111 Fundamentals of Horticulture 2(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; Seed dormancy, Seed germination, principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy; medicinal and aromatic plants; importance of plant bio-regulators in horticulture. Irrigation – methods, Fertilizer application in horticultural crops.

Practical

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

BIOCHEM-111 Fundamentals of Plant Bio-chemistry and Biotechnology 3(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 Poly saccharides. 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. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids.

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; 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

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, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. 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 on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

SS-111 Fundamentals of Soil Science 2(1+1)

Theory

Composition of earth's crust, soil as a natural body – major components. Eluviations and alleviations formation of various soils. Physical parameters; texture – definition, methods of textural analysis, stock's law, assumption, limitations, textural classes, use of textural triangle; absolute specific gravity/particle density, definition, apparent specific gravity/bulk density – factors influencing, field bulk density. Relation between BD (bulk density), AD – practical problems. Pore space – definition, factors affecting capillary and non-capillary porosity, soil colour – definition, its significance, colour variable, value hue and chroma. Munsellcolour chart, factors influencing, parent material, soil moisture, organic matter, soil structure, definition, classification, clay prism like structure, factors influencing genesis of soil structure, soil consistency, plasticity, Atterberg's constants. Soil air, air capacity, composition, factors influencing, amount of air space, soil air renewal, soil temperature, sources and distribution of heat, factors influencing, measurement, chemical properties, soil colloids, organic, humus, inorganic, secondary silicate, clay, hydrous oxides. Ion exchange, cation-anion importance, soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants, hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, energy

concepts, PF scale, measurement, gravimetric – electric and tensiometer methods – pressure plate and pressure membrane apparatus – Neutron probe – soil water movement – classification – aerial photography – satellite of soil features – their interpretation; soil orders; land capability classification; soil of different eco-systems and their properties, Rock & Minerals classification, Pedogenic process. Objectives of soil science research institute in India (NBSS&LUP, ISSS, LTFE & NSSTL). Management of Soil Crusting, Soil Compaction and Soil Compression. Soil Biology benefits and harmful effects. Methods and objective of soil survey, Remote sensing application in soil and plant Studies, Soildegradation.

Practical

Collection and preparation of soil samples, estimation of moisture, EC, pH and bulk density. Textural analysis of soil by Robinson's pipette method. Description of soil profile in the field. Quantification of minerals and their abundance. Determination of Soil colour using Munsell Chart. Estimation of water holding capacity and hydraulic conductivity of soils. Estimation of Infiltration rate using double ring infiltrometer method. Estimation of soil moisture using gypsum block and neutron probe method. Soil compaction measurement with Pentrometer. Determination of pore space of soil. Determination of filed capacity and permanent wilting point of soil. Determination of soil water potential characteristic curves by tensiometer and pressure plate apparatus. Aggregate size distribution analysis of soil. Air capacity of soil by field method.

FOREST-111 Introduction to Forestry 2(1+1)

Theory

Definition of Forest and Forestry, importance, History, Forestry Education and Research in India, various branches in forestry. National Forest Policy of 1894, 1952, 1988: Indian Forest Act-1927: Karnataka Tree Preservation Act: Forest Conservation Act-1980: The Environment (Protection) Act-1986: Indian Wildlife Preservation Act-1972: Amendments to Environment (Protection) Act-1999. Forest wealth in India: Forest productivity. Deforestation: Various causes and implications, desertification, afforestation, reforestation. Indian wildlife and management. National parks and sanctuaries, endangered species; Forest ecosystem, natural forests and their formation, succession and zonation, limiting factors: climax vegetation, types of natural forests and their distribution. Food chain, natural forests, V/s man-made forest. Social forestry and its branches: Extension forestry, urban forestry, recreation forestry. Farm-forestry: Agro-forestry methods, woodlot system etc., and their management, windbreaks and shelterbelts: different types of waste lands and their reclamation through afforestation and joint forest management.

Practical

Identification of important trees, seeds and seedlings: Study of nursery techniques- Trench and mound plantation, pit plantation: Study of different types of plantations: Visit to agro-forestry and farm forestry plots: Measurement of volume of standing trees: Study of wood formation: study of wood specimens and non-timber forest products. Visit to a nearby National Park and forest.

ENG-111 Comprehension and Communication Skills in English 2(1+1)

Theory

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

Practical

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

AGRON-111 Fundamentals of Agronomy 4(3+1)

Theory

Agronomy and its scope, seeds and sowing, tillage and tilth, crop density and geometry, Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, soil-plant-water relationship, crop water requirement, water use efficiency, irrigation- scheduling criteria and methods, quality of irrigation water, logging.

Weeds- importance, classification, crop weed competition, concepts of weed management- principles and methods, herbicides- classification,

selectivity and resistance, allelopathy. Growthand development of crops, factors affecting growth and development, plant ideotypes, crop rotation and its principles, adaptation and distribution of crops, crop management technologies in problematic areas, harvesting and threshing of crops.

Practical

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

BIOL-111 Introductory Biology (New) 2(1+1)

Theory

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

Practical

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

GPB-121 Fundamentals of Genetics 3(2+1)

Theory

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity. Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example.

Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group

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

Practical

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

MICROB-121 Agricultural Microbiology 2(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 asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

Practical

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

from soil. Isolation of *Azospirillum* from roots. Isolation of BGA. Staining and microscopic examination of microbes.

AENG-121 Soil and Water Conservation Engineering 3(2+1)

Theory

Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development. Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE>25 and EI30 methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures– Bunds and terraces. Bunds - contour and graded bunds - design and surplussing arrangements. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching. Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks.

Practical

Study of different types and forms of water erosion. Exercises on computation of rainfall erosivity index. Computation of soil erodibility index in soil loss estimation. Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE. Exercises on soil loss estimation/measuring techniques. Study of rainfall simulator for erosion assessment. Estimation of sediment rate using Coshocton wheel sampler and multi- slot devisor. Determination of sediment concentration through oven dry method. Design and layout of contour bunds. Design and layout of graded bunds. Design and layout of broad base terraces. Design and layout of bench terraces. Design of vegetative waterways. Exercises on rate of sedimentation and storage loss in tanks. Computation of soil loss by wind erosion. Design of shelterbelts and wind breaks for wind erosion control. Visit to soil erosion sites and watershed project areas for studying erosion control and water

conservation measures.

CP-121 Fundamentals of Crop Physiology 2(1+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; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity.

Practical

Study of plant cells, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO_2 assimilation by Infra Red Gas Analyser (IRGA).

PP-121 Fundamentals of Plant Pathology 4(3+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. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups**:** fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

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

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

Viruses: nature, structure, replication and transmission. Study of phanerogamic plantparasites.

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

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

Practical

Acquaintance withvarious laboratory equipmentsandmicroscopy. Collectionandpreservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites.

Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting.

Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations**.**

ENT-121 Fundamentals of Entomology 4(3+1)

Part – I

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

reproductive system, in insects. Types of reproduction in insects. Major sensory organs like simple and compound eyes, chemoreceptor.

Part-II

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.

Part III

Categories of pests. Concept of IPM, Practices, scope and limitations of IPM. Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control- importance, hazards and limitations. Recent methods of pest control, repellents, anti feed ants, hormones, attractants, gamma radiation. Insecticides Act 1968- Important provisions.

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 upto Orders, basic groups of present day insects with special emphasis to orders and families of Agricultural importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae; Dictyoptera: Mantidae, phididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae; Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloinidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae; Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae; Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, lchneumonidae, 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; Types of insect antennae, mouthparts and legs; Wing venation, types of wings and wing coupling apparatus. Types of insect larvae and pupae; Dissection of digestive system in insects (Grasshopper); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance. Insecticides and their formulations. Pesticide appliances and their maintenance. Sampling techniques for estimation of insect population and damage.

EXT-121 Fundamentals of Agricultural Extension Education 3(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 Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

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

Practical

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

production; script writing, writing for print and electronic media, developing script for radio and television.

EXT-122 Communication Skills and Personality Development 2 (1+1)

Theory

Communication Skills: Structural and functional grammar; meaning and process of communication, verbal and nonverbal communication; listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences.

Practical

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

AGRON-211 Crop Production Technology-I (*Kharif* Crops) 2(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 and finger millet, pulses-pigeonpea, mungbean and urdbean; oilseeds- groundnut, and soybean; fibre crops- cotton & jute; forage crops-sorghum, cowpea, cluster bean and napier.

Practical

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

GPB-211 Fundamentals of Plant Breeding 3(2+1)

Theory

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

Practical

Plant Breeder's kit, Study of germ plasm of various crops. Study of floral structure of self-pollinated and cross pollinated crops. Emasculation and hybridization techniques in self & cross pollinated crops. Consequences of inbreeding on genetic structure of resulting populations. Study of male sterility system. Handling of segregationpopulations. Methods of calculating mean, range, variance, standard deviation, heritability. Designsused in plant breeding experiments, analysis of Randomized Block Design. To work out the mode of pollination in a given crop and extent of natural out-crossing. Prediction ofperformance of double cross hybrids.

AE-211 Agricultural Finance and Co-Operation 3(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 higherfinancing 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, NCDC, NAFED.

Practicals

Determination of most profitable level of capital use. 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.

STAT-212 Agri-Informatics 2(1+1)

Theory

Introduction to Computers, Operating Systems, definition and types, Applications of MS- Office for document creation & Editing, Data presentation, interpretation and graph creation, statistical analysis, mathematical expressions, Database, concepts and types, uses of DBMS in Agriculture, World Wide Web (WWW): Concepts and components. Introduction to computer programming languages, concepts and standard input/output operations.

e-Agriculture, concepts and applications, Use of ICT in Agriculture. Computer Models for understanding plant processes. IT application for computation of water and nutrient requirement of crops, Computer-

controlled devices (automated systems) for Agri-input management, Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri-information. Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc for supporting Farm decisions. Preparation of contingent crop-planningusing 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. MS-ACCESS: Creating Database, preparing queries and reports, demonstration of Agri-information system. Introduction to World Wide Web (WWW). Introduction of programming languages. Hands on Crop Simulation Models (CSM) such as DSSAT/Crop-Info/CropSyst/ Wofost; Computation of water and nutrient requirements of crop using CSM and IT tools. Introduction of Geospatial Technology for generating valuable information for Agriculture. Hands on Decision Support System. Preparation of contingent crop planning.

AENG-211 Farm Machinery and Power 2(1+1)

Theory

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

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.

HORT-211 Production Technology for Vegetable and Spices 2 (1+1)

Theory

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

Practical

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

AGM-211 Environmental Studies and Disaster Management 3 (2+1)Theory

Multidisciplinary nature of environmental studies Definition, scope and importance.

Natural Resources: Renewable and non-renewable resources, Natural resources and associatedproblems.

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)

Social Issues and the Environment: From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Environmental ethics: Issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. dies. 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.

STAT-211 Statistical Methods 2(1+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. Binomial & Poisson Distributions, 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, Chi-Square Test of Independence of Attributes in 2 ×2 Contingency Table. Introduction to Analysis of Variance, Analysis of One Way Classification. Introduction to Sampling Methods, Sampling versus Complete Enumeration, Simple Random Sampling with and without replacement, Use of Random Number Tables for selection of Simple Random Sample.

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. Analysis of Variance Two Way Classification. Selection of random sample using Simple Random Sampling.

AHS-211 Livestock & Poultry Management 4 (3+1)

Theory

Role of livestock in the national economy. Reproduction in farm animals and poultry. Housing principles, space requirements for different species of livestock and poultry. Management of calves, growing heifers and milch animals. Management of sheep, goat and swine. Incubation, hatching and brooding. Management of growers and layers. Important Indian and exotic breeds of cattle, buffalo, sheep, goat, swine and

poultry.Improvement of farm animals and poultry. Digestion in livestock and poultry. Classification of feedstuffs. Proximate principles of feed. Nutrients and their functions. Feed ingredients for ration for livestock and poultry. Feed supplements and feed additives. Feeding of livestock and poultry.

Introduction of livestock and poultry diseases. Prevention (including vaccination schedule) and control of important diseases of livestock and poultry.

Practical

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

AGRON-221 Crop Production Technology-II (*Rabi* crops) 2(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, lentil, peas, oilseeds-rapeseed, mustard and sunflower; sugar crops-sugarcane; medicinal and aromatic crops-mentha, lemon grass and citronella, Forage crops-berseem, lucerne and oat.

Practical

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

HORT-221 Production Technology for Ornamental Crops, MAPs and Landscaping 2 (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 cut flowers like rose, gerbera, carnation, lilium and orchids under protected conditions and gladiolus, tuberose, chrysanthemum under open conditions. Package of practices for loose flowers like marigold and jasmine under open conditions. Production technology of important medicinal plants like ashwagandha, asparagus, aloe, costus, Cinnamomum, periwinkle, isabgol and aromatic plants like mint, lemongrass, citronella, palmarosa, ocimum, rose, geranium, vetiver. Processing and value addition in ornamental crops and MAPs produce.

Practical

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

AENG-221 Renewable Energy and Green Technology 2(1+1)

Theory

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

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.

HORT-222 Production Technology for Fruit and Plantation Crops 2(1+1)

Theory

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

Practical

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

GBP-221 Principles of Seed Technology 3(1+2)

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, different classes of seed. Foundation and certified seed production of important **cereals, pulses, oilseeds, fodder and vegetables**. Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983, Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production.

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

Practical

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

AE-221 Agricultural Marketing, Trade and Prices 3(2+1)

Theory

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

administered prices; need for agricultural price policy; Trade: Concept of International Trade and its need, theories of absolute and comparative advantage. Present status and prospects of international trade in agri-commodities; GATT and WTO; Agreement on Agriculture (AoA) and its implications on Indian agriculture; IPR.

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.

AGM-221 Introductory Agro-meteorology & Climate Change 2(1+1)

Theory

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

Practical

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

AE-222 Agri-business Management 3 (2+1)

Theory

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

Practical

Study of agri-input markets: Seed, fertilizers, pesticides. Study of output markets: grains, fruits, vegetables, flowers. Study of product markets, retails trade commodity trading, and value added products. Study of financing institutions- Cooperative, Commercial banks, RRBs, Agribusiness Finance Limited, NABARD. Preparations of projects and Feasibility reports for agribusiness entrepreneur. Appraisal/evaluation techniques of identifying viable project- Non-discounting techniques. Case study of agro-based industries. Trend and growth rate of prices of agricultural commodities. Net present worth technique for selection of viable project. Internal rate of return

GPB-222 Commercial Plant Breeding 3(1+2)

Theory

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

Practical

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

grading and packaging. Visit to public private seed production and processing plants.

AGRON-321 Agro-chemicals 3 (2+1)

Theory

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

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

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

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

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

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

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

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

Practical

Sampling of fertilizers and pesticides. Pesticides application

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

HORT-223 Landscaping 3(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.

PP-311 Principles of Integrated Pest and Disease Management 3(2+1)

Theory

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

Practical

Methods of diagnosis and detection of various insect pests, and plant diseases, Methods of insect pests and plant disease measurement, Assessment of crop yield losses, calculations based on economics of IPM, Identification of bio control agents, different predators and natural enemies. Mass multiplication of *Trichoderma*, *Pseudomonas*, *Trichogramma*, NPV etc. Identification and nature of damage of important insect pests and diseases and their management. Crop (agro-ecosystem) dynamics of a selected insect pest and diseases. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases . Awareness campaign at farmers fields.

SS-311 Manures, Fertilizers and Soil Fertility Management 3(2+1)

Theory

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

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

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

Practical

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

ENT-311 Pests of Crops and Stored Grains and their Management 3(2+1)

Theory

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

Practical

Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: (a) Field Crops; (b) Vegetable Crops; (c) Fruit Crops; (d) Plantation, gardens, Narcotics, spices & condiments. Identification of insect pests and Mites associated with stored grain. Determination of insect infestation by different methods. Assessment of losses due to

insects. Calculations on the doses of insecticides application technique. Fumigation of grain store/ godown. Identification of rodents and rodent control operations in godowns. Identification of birds and bird control operations in godowns. Determination of moisture content of grain. Methods of grain sampling under storage condition. Visit to Indian Storage Management and Research Institute, Hapur and Quality Laboratory, Department of Food., Delhi. Visit to nearest FCI godowns.

AE-121 Fundamentals of Agricultural Economics 2(2+0)

Theory Economics: Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare. Agricultural economics: meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country. Demand: meaning, law of demand, schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship. Laws of returns: Law of variable proportions and law of returns to scale. Cost: concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, schedule, supply curve, determinants of supply, elasticity of supply. Market structure: meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points. Distribution theory: meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit. National income: Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Population: Importance, Malthusian and Optimum population theories, natural and socioeconomic determinants, current policies and programmes on population control. Money: Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, supply, general price index, inflation and deflation. Banking: Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance, public revenue and public expenditure. Tax: meaning, direct and

indirect taxes, agricultural taxation, VAT. Economic systems: Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

SS-221 Problematic Soils and their Management 2(2+0)

Theory

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

AGRON-222 Farming System and Sustainable Agriculture 1(1+0)

Theory

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

PP 312 Diseases of Field & Horticultural Crops & their Management-I 3(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 and

ergot; Groundnut: early and late leaf spots, wilt

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

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.

GPB-311 Crop Improvement – I (*Kharif*) 2(1+1)

Theory

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

Practical

Floral biology, emasculation and hybridization techniques in different crop species; viz., Rice, Jute, Maize, Sorghum, Pearl millet, Ragi, Pigeonpea, Urdbean, Mungbean, Soybean, Groundnut, Seasame, Caster, Cotton, Cowpea, Tobacco, Brinjal, Okra and Cucurbitaceous crops.

Maintenance breeding of different *kharif* crops. Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Kharif* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

EXT-311 Entrepreneurship Development and Business Communication 2 (1+1)

Theory

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

Practical

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

AFRON-311 Geo-informatics, Nano-technology and Precision Farming 2(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; Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

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

AGRON-312 Practical Crop Production-I *(Kharif Crops)* 2(0+2)

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.

BIOCHEM-311 Food Safety and Standards 3(2+1)

Theory

Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards. Management of hazards - Need. Control of parameters. Temperature control. Food storage. Product design. Hygiene and Sanitation in Food Service Establishments- Introduction. Sources of contamination and their control. Waste Disposal. Pest and Rodent Control. Personnel Hygiene. Food Safety Measures. Food Safety

Management Tools- Basic concepts. PRPs, GHPs, GMPs, SSOPs etc. HACCP. ISO series. TQM
- concept and need for quality, components of TQM, Kaizen. Risk Analysis. Accreditation and Auditing, Water Analysis, Surface Sanitation and Personal Hygiene. Food laws and Standards-Indian Food Regulatory Regime, FSSA. Global Scenario CAC. Other laws and standards related to food. Recent concerns- New and Emerging Pathogens. Packaging, Product labeling and Nutritional labeling. Genetically modified foods\ transgenics. Organic foods. Newer approaches to food safety. Recent Outbreaks. Indian and International Standards for food products.

Practical

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

ENT-SS 312 Bio-pesticides & Bio-fertilizers 3(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. Botanicals and their uses. Mass production technology of bio-pesticides. Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes. Methods of application of biopesticides. Methods of quality control and Techniques of biopesticides. Impediments and limitation in production and use of biopesticide.

Biofertilizers - Introduction, status and scope. Structure and characteristic features of bacterial biofertilizers- *Azospirillum, Azotobacter, Bacillus, Pseudomonas, Rhizobium* and *Frankia*; Cynobacterial biofertilizers- *Anabaena*, *Nostoc*, Hapalosiphon and fungal biofertilizers- AM mycorrhiza and ectomycorhiza. 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 biofertiizers. 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, Metarhyzium* 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.

BIOCHEM-321 Principles of Food Science and Nutrition 2(2+0)

Theory

Concepts of Food Science (definitions, measurements, density, phase change, pH, osmosis, surface tension, colloidal systems etc.); Food composition and chemistry (water, carbohydrates, proteins, fats, vitamins, minerals, flavours, colours, miscellaneous bioactives, important reactions); Food microbiology (bacteria, yeast, moulds, spoilage of fresh & processed foods, Production of fermented foods); Principles and methods of food processing and preservation (use of heat, low temperature, chemicals, radiation, drying etc.); Food and nutrition, Malnutrition (over and under nutrition), nutritional disorders; Energy metabolism (carbohydrate, fat, proteins); Balanced/ modified diets, Menu planning, New trends in food science and nutrition.

MATH-111 Elementary Mathematics 2(2+0)

Theory

Straight lines : Distance formula, section formula (internal and external division), Change of axes (only origin changed), Equation of co-ordinate axes, Equation of lines parallel to axes, Slope-intercept form of equation of line, Slope-point form of equation of line, Two point form of equation of line, Intercept form of equation of line, Normal form of equation of line, General form of equation of line, Point of intersection of two st. lines, Angles between two st. lines, Parallel lines, Perpendicular lines, Angle of bisectors between two lines, Area of triangle and quadrilateral. Circle: Equation of circle whose centre and radius is known, General equation of a circle, Equation of circle passing through three given points, Equation of circle whose diameters is line joining two points (x1 , y1) & (x2 ,y2), Tangent and Normal to a given circle at given point (Simple problems), Condition of tangency of a line y = mx + c to the given circle x2 + y2 = a2 . Differential Calculus : Definition of function, limit and continuity, Simple problems on limit, Simple problems on continuity, Differentiation of xn , ex , 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), Differentiation by substitution method and simple problems based on it, Differentiation of Inverse Trigonometric functions. 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, Integration by substitution method, 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.

AGRON-112 Agricultural Heritage 1(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.

EXT-112 Fundamentals of Rural Sociology, Educational Psychology and Constitution of India 2(0+2)

Practical

Sociology and Rural Sociology: Meaning, Definition, Scope, Importance of Rural Sociology in Agricultural Extension: Indian Rural Society: Important characteristics, Differences between Rural and Urban communities; Social Groups: Meaning, Definition, Classification, Factors considered in formation of groups; Social Stratification- Meaning, Definition, Bases for stratification, Forms of Social stratification-Characteristics and Differences between Class and Caste Systems; Cultural concepts: Culture, Customs, Folkways, Mores, Taboos and Rituals: Meaning and Definition; Social Values: Meaning, Definition and Types; Social Institutions: Meaning, Definition, Major institutions-Family, Village Panchayat and Co-operatives- their Functions and Role in Agricultural Extension; Social Organizations- Meaning, Definition and their types; social control- Meaning, Definition, Need of social control and means of social control; social change-meaning, definition, Nature of Social change, Dimensions of social change and factors of social change; Leadership-Meaning, Definition, Classification and Role of leaders in Agricultural Extension. Psychology and Educational Psychology: Meaning, Definition, Scope and Importance of Educational Psychology in Agricultural Extension. Experiment: Introduction to experimental psychology. Intelligence: Meaning, Definition, Types, Factors affecting intelligence and Importance of intelligence in Agricultural Extension. Experiment: 1 Non-verbal test (RPM). 2. Verbal test (GMAT). Personality: Meaning, Definition, Types, Factors influencing Personality and its Role in Agricultural Extension. Experiment:1.Eysenk personality inventory; 2.Edward's personality inventory. Teaching- Learning process: Meaning and Definition of Teaching, Learning, Learning experience and Learning situation, Elements of learning situation and its characteristics; Principles of learning and their implication for Teaching. Experiment: 1. Associative learning; 2. Trial and error learning. Attitudes: Meaning, Definition, Factors influencing and their Role in Agricultural Extension; Experiment: Attitude measurement. Meaning, Preamble and Characteristics of Constitution of India; Fundamental Rights and Duties; Directive Principles of State Policy; Constitutional provisions for welfare of SCs and STs, Minorities, Women and Children; Union Executive: President, Vice-President, Prime Minister, Council of MinistersPowers and Functions; Parliament and Supreme Court of India-Powers and Functions; State Executive: Governor, Chief Minister, Council of Ministers; Legislature and Judiciary: Powers and Functions; Electoral Process; Human Rights Commission-Structure, Powers and Functions.

EXT-112 Human Values & Ethics 1(1+0)

Theory

UNIT I

Universal human aspirations: Happiness and prosperity; Human values and ethics: Concept, definition, significance and sources; Fundamental values: Right conduct, peace, truth, love and non-violence; Ethics: professional, environmental, ICT; Sensitization towards others particularly senior citizens, developmentally challenged and gender.

UNIT II

Spirituality, positive attitude and scientific temper; Team work and volunteering; Rights and responsibilities; Road safety; Human relations and family harmony; Modern challenges and value conflict: Sensitization against drug abuse and other social evils; Developing personal code of conduct (SWOT Analysis); Management of anger and stress.

PE-111 NSS/NCC/Physical Education & Yoga Practices 2 (0+2)

Theory

Course aims at evoking social consciousness among students through various activities viz., working together, constructive and creative social work, to be skilful 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 y 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 y
- Documentation and data reporting y 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.

AGRON-311 Geo-informatics, Nano-technology and Precision Farming 2(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; Nanotechnology, definition, concepts and techniques, brief introduction about nano scale effects, nano-particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in seed, water, fertilizer, plant protection for scaling-up farm productivity.

Practical

Introduction to GIS software, spatial data creation and editing. Introduction to image processing software. Visual and digital interpretation of remote sensing images. Generation of spectral profiles of different objects. Supervised and unsupervised classification and acreage

estimation. Multispectral remote sensing for soil mapping. Creation of thematic layers of soil fertility based on GIS. Creation of productivity and management zones. Fertilizers recommendations based of VRT and STCR techniques. Crop stress (biotic/abiotic) monitoring using geospatial technology. Use of GPS for agricultural survey. Formulation, characterization and applications of nanoparticles in agriculture. Projects formulation and execution related to precision farming.

AE-311 Intellectual Property Rights 1(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 breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge-meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing

HORT-311 Protected Cultivation 3(2+1)

Theory

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

plants. Off-season production of flowers and vegetables. Insect pest and disease management.

Practical

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

BT-311 Micro propagation Technologies 3(1+2)

Theory

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

Practical

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

AGRON-321 Rainfed Agriculture and Watershed Management 2(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 and demarcation of rainfed area on map of India. Interpretation of meteorological data and scheduling of supplemental irrigation on the basis of evapo-transpiration demand of crops. Critical analysis of rainfall and possible drought period in the country, effective rainfall and its calculation. Studies on cultural practices for mitigating moisture stress. Characterization and delineation of model watershed. Field demonstration on soil & moisture conservation measures. Field

demonstration on construction of water harvesting structures. Visit to rainfed research station/watershed.

AENG-321 Protected Cultivation and Secondary Agriculture 2(1+1)

Theory

Green house technology: Introduction, Types of Green Houses; Plant response to Green houseenvironment, 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 green house heating systems, green house drying. Cost estimation and economicanalysis.

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 green houses based on shape. Determine the rate of air exchange in an active summer winter cooling system. Determination of drying rate of agricultural products inside green house. Study of green house 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.

PP-321 Diseases of Field & Horticultural Crops & their Management-II 3(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, ratoon stunting and Pokkah Boeng;

Sunflower: Sclerotinia stem rot and Alternaria blight; Mustard: Alternaria blight, white rust, downy mildew and Sclerotinia stem rot; Gram: wilt, grey mould and Ascochyta blight; Lentil: rustand wilt; Cotton: anthracnose, vascular wilt, and black arm; Pea: downy mildew, powdery mildewand rust.

Horticultural Crops:

Mango: anthracnose, malformation, bacterial blight and powdery mildew; Citrus: canker and gummosis; Grape vine: downy mildew, Powdery mildew and anthracnose; Apple: scab, powdery mildew, fire blight and crown gall; Peach: leaf curl.

Strawberry: leaf spot Potato: early and late blight, black scurf, 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; Turmeric: leaf spot

Coriander: stem gall Marigold: Botrytis blight; Rose: dieback, powdery mildew and black leaf spot.

Practical

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

HORT-321 Post-harvest Management and Value Addition of Fruits and Vegetables 2(1+1)

Theory

Importance of post-harvest processing of fruits and vegetables, extent and possible causes of post harvest losses; Pre-harvest factors affecting postharvest quality, maturity, ripening and changes occurring during ripening; Respiration and factors affecting respiration rate; Harvesting and field handling; Storage (ZECC, cold storage, CA, MA, and hypobaric); Value addition concept; Principles and methods of preservation; 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 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 processingunit/ industry.

ENT-321 Management of Beneficial Insects 2(1+1)

Theory

Importance of beneficial Insects, Beekeeping and pollinators, bee biology, commercial methods of rearing, equipment used, seasonal management, bee enemies and disease. Bee pasturage, bee foraging and communication. Insect pests and diseases of honey bee. Role of pollinators in cross pollinated plants.

Types of silkworm, voltinism and biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Rearing, mounting and harvesting of cocoons. Pest and diseases of silkworm, management, rearing appliances of mulberry silkwormand methods of disinfection.

Species of lac insect, morphology, biology, host plant, lac production – seed lac, button lac, shellac, lac- products. 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. Types of silkworm, voltinismand biology of silkworm. Mulberry cultivation, mulberry varieties and methods of harvesting and preservation of leaves. Species of lac insect, host plant identification. Identification of otherimportant pollinators, weed killers and scavengers. Visit to research and training institutions devoted to beekeeping, sericulture, lac culture and natural enemies. Identification and techniques for mass multiplication of natural enemies.

GPB-321 Crop Improvement– II (*Rabi*) 2(1+1)

Theory

Centers of origin, distribution of species, wild relatives in different cereals; pulses; oilseeds; fodder crops and cash crops; vegetable and horticultural crops; Plant genetic resources, its utilization and conservation; study of genetics of qualitative and quantitative characters; Major breeding objectives and procedures including conventional and modern innovative approaches for development of hybrids and varieties for yield, adaptability, stability, abiotic and biotic stress tolerance and quality (physical, chemical, nutritional); Hybrid seed production technology of *rabi* crops. Ideotype concept and climate resilient crop varieties for future.

Practical

Floral biology, emasculation and hybridization techniques in different crop species namely Wheat, Oat, Barley, Chickpea, Lentil, Field pea, Rajma, Horse gram, Rapeseed Mustard, Sunflower, Safflower, Potato, Berseem. Sugarcane, Tomato, Chilli, Onion; Handling of germplasm and segregating populations by different methods like pedigree, bulk and single seed decent methods; Study of field techniques for seed production and hybrid seeds production in *Rabi* crops; Estimation of heterosis, inbreeding depression and heritability; Layout of field experiments; Study of quality characters, study of donor parents for different characters; Visit to seed production plots; Visit to AICRP plots of different field crops.

AGRON-322 Practical Crop Production-II *(Rabi Crops)* 2(0+2)

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-323 Principles of Organic Farming 2(1+1)

1. Theory

Organic farming, principles and its scope in India; Initiatives taken by Government (central/ state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions

to nutrient use in organic farming; Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products.

Practical

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

AE-321 Farm Management, Production and Resource Economics 2(1+1)

Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: 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 labour income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises. 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-linear programming, 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

Preparation of farm layout. Determination of cost of fencing of a farm. 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 farmproduction 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 andaccounts and profit & loss accounts. Collection and analysis of data on various resources in India.

HORT-322 Hi-tech. Horticulture 3(2+1)

Theory

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

Practical

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

AGRON-324 Weed Management 3(2+1)

Theory

Introduction to weeds, characteristics of weeds their harmful and beneficial effects on ecosystem. Classification, reproduction and dissemination of weeds. Herbicide classification, concept of adjuvant, surfactant, herbicide formulation and their use. Introduction to mode of action of herbicides and selectivity. Allelopathy and its application for weed management. Bio-herbicides and their application in agriculture.

Concept of herbicide mixture and utility in agriculture. Herbicide compatibility with agro-chemicals and their application. Integration of herbicides with non chemical methods of weed management. Herbicide Resistance and its management.

Practical

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

AGM-321 System Simulation and Agro-advisory 3(2+1)

Theory

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

Practical

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

EXT-321 Agricultural Journalism 3(2+1)

Theory

Agricultural Journalism: The nature and scope of agricultural journalism characteristics and training of the agricultural journalist, how

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

Practical

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

ELP - 422

Seed production & Technology: Protoplast isolation, Culture, Manipulation and Fusion; Products of somatic hybrids and cybrids, Applications in crop improvement. Genetic engineering; Restriction enzymes; Vectors for gene transfer – Gene cloning – Direct and indirect method of gene transfer – Transgenic plants and their applications. Blotting techniques – DNA finger printing – DNA based markers – RFLP, AFLP, RAPD, SSR and DNA Probes – Mapping QTL – Future prospects. MAS, and its application in crop.

ELP – 425

Commercial Bee keeping: Procurement and arrangement of bee keeping equipments. Location and collection of potent nectar yielding bee flora seeds from wild. Raising/ enriching the high nectar yielding bee flora in the campus. Location and hiving the **natural** bee colony from the wild. Establishing the apiary with suitable/favourable necessaries. Maintenance and multiplication of hived colonies. Management of natural enemies and

diseases of bees. Maintenance of bee colonies during dearth and honey flow seasons. Harvesting and Processing of honey and bee wax. Marketing and cost analysis.

ELP – 423

Mushroom cultivation: Construction cultivation room/structure and Disinfection. Compost preparation & pasteurization. Procurement of mother culture and spawn preparation. Procurement of casing soil and preparation for production. Mushroom seeding, Casing with soil and maintenance, Harvesting, processing, Grading, packing, marketing and Cost economics of mushroom culture.

Dean, College of Agriculture
A. N. D. Univ. of Agric. & Tech.
Kumarganj -Ayodhya

(i) **DEPARTMENT OF VETERINARY ANATOMY**

VETERINARY ANATOMY **Credit Hours: 4+3**

Dissection will be carried out on cadavers procured by way of donation of animals or animals obtained from post-mortem section and the donated animals should be either incurable or in terminal stages and prossected specimens should be used.

Within one year each college must setup a body donation programme or wild body programme.

Computer simulations software's, models, mannequins, plastinated specimens, preserved body organs, models should be used for better understanding of the subject.

THEORY

UNIT: 1

Introduction to anatomy and branches of anatomy and descriptive terms used in anatomy and study of anatomical planes.

General Osteology, Arthrology and Myology: Study of properties and structure of bone. Classification of skeletons, classification of bones with suitable examples and terms used in osteology Introduction to arthrology, classification of joints, different diarthrodial joints, structure of diarthrodial joints and movements permitted. Introduction to myology, classification of muscles, etymology of muscles. Description of tendon, ligaments, aponeurosis, synovial bursa and synovial sheath.

(Note: Detailed description of muscles of different regions of the body will be studied in the respective practical).

General Angiology, Neurology and Aesthesiology: Introduction to angiology. Structure of heart. General plan of systemic and pulmonary circulations, lymphatic and venous systems. Introduction to neurology and parts of central, peripheral and autonomic nervous system and sense organs. Formation of spinal nerve. Structure of meninges, brain, spinal cord.

Different surface regions, joint regions, Palpable Bony areas or prominences of the body of the animal. Palpable Lymph nodes and Arteries of the body and Surface veins for Venepuncture. Sites for collection of Bone marrow and Cerebrospinal fluid.

General Splanchnology: Introduction to splanchnology, boundaries of thoracic, abdominal and pelvic cavities, topography of different organs of digestive, respiratory, urinary, endocrine, male and female reproductive systems of domestic animals and fowl.

Principles and application of Radiography and Ultrasound for bones and soft tissues.

UNIT-2

Fore limb: Study of bones of fore limb of ox and differences in horse, dog, pig and fowl. Study of hoof of ox and horse. Study of joints, ligaments, stay apparatus, major blood vessels, nerves, veins and lymph nodes of fore limb. Sites for Radial, Median, Ulnar and Volar nerve blocks.

UNIT-3

Head and neck: Study of cranial and facial bones, cervical vertebrae of ox and differences in horse, dog, pig and fowl. Boundaries of the oral, orbital, nasal and cranial cavities. Study of paranasal sinuses in ox, horse, dog and pig. Study of articulations and special ligaments of the head and neck. Muscles of face, mastication, eye, ear, tongue, pharynx, soft

palate ,hyoid and larynx. Study of teeth, hard and soft palate, tongue, pharynx, larynx, thyroid, parathyroid and salivary glands and differences in horse, dog, pig and fowl. Study of cranial nerves, blood vessels and lymph nodes of head and neck regions. Study of boundaries of jugular furrow and structures of carotid sheath along with neck muscles. Study of sense organs, trachea and oesophagus. Age determination by Dentition. Sites for Tracheotomy, Esophagotomy, Ligation of Stensons duct and Mental, Mandibular, Maxillary , Cornual, Infraorabital , Supraorbital (frontal) , Orbital and Auriculopalpebral nerve blocks and surgical approach to guttural pouches in horse. Importance of Cornual nerve and superficial Temporal artery in Amputation of Horn in cattle.

UNIT-4

Thorax: Study of thoracic vertebrae, ribs and sternum of ox and differences in horse, dog, pig and fowl. Study of joints, special ligaments, blood vessels, nerves, lymph vessels and lymph nodes of thorax. Study of organs of thorax i.e. trachea, thymus, oesophagus, lungs and differences in horse, dog, pig and fowl. Study of pleura, its reflections and mediastinum. Areas of auscultation and percussion of heart and lungs and site for Paracentesis Thoracis.

UNIT-5

Abdomen: Study of bones of abdomen of ox and differences in horse, dog, pig and fowl. Study of joints, special ligaments blood vessels, nerves of abdomen region. Blood and nerve supply to abdominal viscera. Study of peritoneal reflections, organs of digestive, urinary, male and female reproductive systems present in abdomen and differences in horse, dog, pig and fowl. Study of mammary glands in cow and differences in mare, bitch and sow. Study of spleen of ox and differences in horse, dog, pig and fowl. Study of major veins, lymph vessels, lymph nodes and endocrine glands of abdomen. Boundaries and Clinical importance of the flank and Para Lumbar Fossa. Sites for Liver ,Gall Bladder and Caecal Biopsies, Laparotomy,Rumenocentesis ,Rumenotomy,abomasotomy, spleenectomy, Cystotomy , Caesarean Operation , enterotomy, and paravertebral block .

UNIT-6

Hind limb and pelvis: Study of bones of hind limb and pelvis of ox and differences in horse, dog, pig and fowl. Study of joints, ligaments, blood vessels, lymph nodes and nerves of hind limb, pelvis and tail region and pelvic viscera. Study of pelvic peritoneal reflections, organs of digestive, urinary, male and female reproductive systems present in pelvic cavity and differences in horse, dog, pig and fowl. Boundaries of the inguinal canal and structures of the spermatic cord, pre pubic tendon and its importance. Study of external genital organs. Sites for Tibial , Peroneal ,Plantar and Pudic nerve blocks, Patellar desmotomy, Urethrotomy, Castration , Vasectomy, cranial and caudal epidural anaesthesia.

UNIT-7

Cytology, cell junctions, study of basic tissues i.e epithelial, connective, muscular and nervous tissues, blood and bone marrow. Study of microscopic structures of digestive, circulatory, urinary, respiratory, nervous, lymphatic, endocrine, male and female genital systems and mammary glands of domestic animals. Study of microscopic structure of sense organs i.e. eye, ear and integument.

UNIT-8

Introduction to embryology, gametogenesis, fertilization, cleavage, types of eggs, morula, blastulation, gastrulation, types of implantation, twinning. Formation of foetal membranes in mammals and birds, Placenta and its classification. Different germ layers and their derivatives. Study of development of organs of digestive system including accessory structures i.e tongue, teeth, salivary glands, liver and pancreas. Study of development of organs of respiratory, urinary, circulatory, lymphatic, nervous, musculoskeletal, male and female reproductive systems. Development of endocrine glands, sense organs i.e eye and ear.

PRACTICAL

UNIT-1

Study of general terms used in anatomy, study of anatomical planes. Study of different parts of skeleton, different surface and joint regions. Study of boundaries of thoracic, abdominal and pelvic cavities. Demonstration of different types of joints, muscles tendons, ligaments, synovial bursa and synovial sheath. In situ demonstration of heart, meninges, brain and spinal cord. Boundaries of Thoracic, Abdominal and Pelvic Cavities and in situ demonstration of organs of digestive, respiratory, urinary, endocrine, male and female reproductive systems of domestic animals.

Demonstration of Different surface regions, joint regions and Palpable Bony areas or prominences of the body of the animal , Common sites of fractures, Palpable Lymph nodes and Arteries of the body (ventral coccygeal artery in ox, femoral artery in dog and cat , facial artery in horse) and Surface veins for Venepuncture(cephalic vein and recurrent tarsal vein in dog and cat , jugular vein in large animals.) and Sites for collection of Bone marrow and Cerebrospinal fluid. Visualization of Radiographs and ultrasound pictures of various organs and Fractures of various bones.

UNIT-2

Fore limb: Demonstration of different bones of fore limb of ox and comparison with horse, dog, pig and fowl. Dissection of the fore limb. Study of joints, ligaments, muscles, major blood vessels, lymph nodes and nerves of fore limb. Study of sites for different nerves blocksorneurectomies in fore-limb. Study of suprascapular nerve paralysis-shoulder sweeny, radial nerve paralysis-capped elbow. Structure of the equine hoof and comparison with ox. Demonstration of radiographs of normal bones of fore limb. Clinical importance of cephalic vein for intravenous injections in dog.

UNIT-3

Head and neck: Demonstration of cranial and facial bones, cervical vertebrae of ox and comparison with horse, dog and fowl. Dissection of muscles of face, mastication, tongue, pharynx, soft palate, hyoid, larynx, eye and ear. Dissection of superficial neck muscles. Dissection of brain and its parts. Dissectionordemonstration of tunics of eye. Study of teeth, tongue, pharynx, thyroid, parathyroid and salivary glands and differences in horse, dog, pig and fowl. Study of cranial nerves, and blood vessels of head and neck regions. Study of trachea and oesophagus. Study of nerve blocks of the head i.e cornual, auriculo-palpebral, Peterson's orbital nerve block, mandibulo-alveolar and mental nerve blocks. Importance of facial artery for recording pulse in horse. Surgical importance of Stenson's duct in domestic animals. Surgical approach to guttural pouches-Viborg's triangle. Clinical importance of jugular vein for intravenous injections in large animals. Demonstration of radiographs of normal bones of head and neck.

UNIT-4

Thorax: Demonstration of thoracic vertebrae, ribs and sternum of ox and comparison with horse, dog, pig and fowl. Dissection of muscles, blood vessels, nerves and lymph nodes of thorax. Demonstration of organs of thorax i.e. trachea, oesophagus, thymus, lungs and heart and differences in horse, dog, pig and fowl. Study of pleural reflections of thoracic cavity. Demonstration of sites for auscultation and percussion. Recurrent laryngeal nerve paralysis-roaring in horses. Choke or oesophageal obstruction. Demonstration of radiographs and videos of ultrasonography of organs of thorax.

UNIT-5

Abdomen: Demonstration of bones forming boundaries of abdomen of ox and comparison with horse, dog, pig and fowl. Dissection of muscles, blood vessels and nerves of abdomen. Demonstration of peritoneum, omentum, mesentry and organs of digestive, urinary, male and female reproductive systems present in abdomen and differences in horse, dog, pig and fowl. Demonstration of mammary glands of cow, mare, bitch and sow. Demonstration of major veins, lymph vessels and lymph nodes of abdomen. Topographic location of abdominal viscera of ox and comparison with horse, dog, pig and fowl. Demonstration of sites for laparotomy, caesarean section, ovario-hysterectomy, catheterization of urinary bladder and sites for paravertebral and epidural anaesthesia. Demonstration of Boundaries and Clinical importance of the flank and Para Lumbar Fossa,Sites for Liver ,Gall Bladder and Caecal Biopsies, Laparotomy,Rumenocentesis ,Rumenotomy,abomasotomy, spleenectomy Cystotomy , Caesarean Operation, catheterization of urinary bladder and enterotomy and paravertebral block . Demonstration of radiographs and videos of ultrasonography of organs of abdomen.

UNIT-6

Hind limb and pelvis: Demonstration of bones of hind limb of ox and comparison with horse, dog, pig and fowl. Demonstration of joints and ligaments of hind limb and pelvis. Dissection of muscles, blood vessels, lymph nodes and nerves of hind limb and pelvic cavity. Demonstration of peritoneal reflections of pelvic cavity and organs of digestive, urinary, male and female reproductive systems in pelvic cavity and differences in horse, dog, pig and fowl. Study of external genital organs. Clinical importance of femoral artery to record pulse in dog. Clinical importance of recurrent tarsal vein for intravenous injections in dog. Demonstration of radiographs of normal bones and videos of ultrasonography of organs of pelvis. Demonstration of Sites for Tibial ,Peroneal ,Plantar and Pudic nerve blocks, Patellar desmotomy, Urethrotomy, Castration , Vasectomy and cranial and caudal epidural anaesthesia.

UNIT-7

Microscopy and micrometry. Comparison of light and electron microscopy. Histological techniques, processing of tissues for paraffin sectioning and haematoxylin and eosin staining. Microscopic examination of epithelium, connective tissue, muscular tissue, nervous tissue and blood. Microscopic examination of organs of digestive, circulatory, urinary, respiratory, nervous, lymphatic, endocrine, male and female genital systems and sensory organs of domestic animals.

UNIT-8

Demonstration of Placenta, umbilical cord and foetal membranes of different domestic animals. Demonstration of congenital anomalies of domestic animals as per availability. Study of slides of developing organs of different systems as per the availability.

A embalmed cadaver of buffalo calf (procured through donated animals or cadevars obtained from post-mortem section) for every 24 students to be used for dissection purposes.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2, 3and 4	100	20
Paper-II	5,6,7 and 8	100	20
PRACTICAL			
Paper-I	1, 2, 3and 4	60	20
Paper-II	5,6,7 and 8	60	20

(ii) **DEPARTMENT OF VETERINARY PHYSIOLOGY AND BIOCHEMISTRY**

VETERINARY PHYSIOLOGY AND BIOCHEMISTRY **Credit Hours: 6+2**

VETERINARY PHYSIOLOGY Credit Hours: 4+1

VETERINARY BIOCHEMSITRY Credit Hours: 2+1

VETERINARY PHYSIOLOGY

THEORY

UNIT- 1 (BLOOD, CARDIOVASCULAR, NERVOUS AND MUSCULAR SYSTEMS)

Introduction to Blood; Properties of blood as a body fluid, metabolism and fate of R.B.C; Hemoglobin-chemical structure, synthesis, physiological functions, derivatives of hemoglobin;

Heart- morphological characteristic, systemic excitability conduction and transmission processes. Cardiac Cycle: Regulation of cardiac output; coronary circulation; properties of pulse; metabolism and energetic of working myocardial cell, extrinsic and intrinsic regulation; Electro Cardio Graph and its significance in Veterinary Sciences - Echocardiography. Haemorrhage haemostasis. Haemodynamics of circulation, circulatory mechanics, resistance to flow, vasoconstriction, nervous and circulating fluid volume controls of blood pressure, neurohormonal control of vascular smooth muscle. Circulatory controls- shock stresses, regional and fetal circulation. Capillary exchange, control of blood pressure. Adjustment of circulation during exercise.

Muscle Physiology-basic muscle unit characteristic-electrical phenomenon in muscle cell - muscle action potential, excitation and propagation of impulse characteristics- latent period refractive ness, threshold level-all and none characteristics - contractile mechanism - excitation - contraction coupling-neuro-muscular transmission, types of muscle contraction, phenomenon of fatigue, rigor mortis. Organization of nervous system- Mechanism of information processing, hierarchical control. Major function system- sensory, consciousness, emotion, motor and visceral control and basic functional unit - neuron structure, type- functional characteristics of sub-units of neuron. Membrane potential - ionic basis of resting membrane potential (RMP) nerve action potential, excitation and propagation of impulse characteristics- latent period- refractive-ness, threshold level-all and none characteristics. Degeneration and regeneration of nerve fibre. Synaptic and junctional transmission. Functions of nervous system-reflexes-control of posture and movements, autonomic nervous system and visceral control. Neurotransmitter wakefulness, sleep cycle. Higher function of neurons system - learning, memory, electroencephalography. Sense organs and receptors physiology of special senses - Eye: functional morphology, nourishment and protection neural pathway, receptors- optics, ocular muscles and movements, photochemistry, Vision defects Ear: Physiology of hearing and common hearing impairment. Vestibule apparatus. Physiology of olfaction and taste

UNIT-2 (DIGESTIVE AND RESPIRATORY SYSTEMS)

Morphological characteristic of mono gastric and poly gastric digestive system. Prehension, rumination; defecation; vomition; regulation of secretory function of saliva, stomach, intestine, pancreas; bile secretion; hunger, appetite control, developmental aspects of digestion; luminous, membranous and microbial digestion in rumen and intestine; permeability characteristics of intestine, forces governing absorption, control intestinal transport of electrolyte and water, enzymatic digestion in monogastric and fermentative digestion in rumen, modification of toxic substances in rumen. Digestion in birds.

Functional morphology of respiratory apparatus. Mechanics of breathing. Transport of blood gases, foetal and neonatal oxygen transport, dissociation curves, pressures, recoil tendency, elasticity, surfactants, pleural liquid, compliance, exchanges of gases in lungs and tissues, neural and chemical regulation of breathing, diffusion, perfusion, hypoxia. Frictional resistance to air flow, airways smooth muscle contraction, respiratory muscle work, panting, adaptation of respiration during muscle exercise, high altitude hypoxia, Non-respiratory lung functions. Respiration in birds.

UNIT-3 (EXCRETORY AND ENDOCRINE SYSTEMS)

Kidney- Functional morphology of nephrons, factors determining filtration pressure, determination of glomerular filtration rate (GFR) and renal plasma flow – Re-absorption mechanisms for glucose, protein, amino acids, electrolytes; ammonium mechanism, glomerulo-tubular balance, methods of studying renal functions; urine concentration; micturition, uremia. Fluid, water balance, fluid therapy, dehydration, water concentration mechanisms. Acid base balance and H+ regulation, correction and evolution of imbalances, total osmotic pressure. Formation and excretion of urine of Birds. Cerebrospinal fluid, synovial fluids - composition, formation and flow; Joints. Regulation of bone metabolism and homeostasis.

Hormone cell interaction, sub-cellular mechanisms-metabolism of hormones-methods of study of endocrine system; Receptors- mechanism of regulation; Chemistry of hypothalamo- hypophyseal hormones, target organ, pineal, thyroid, thymus, pancreas, adrenal, prostaglandins, hormones of calcium metabolism, disorders, rennin-angiotensin system, atrial natriuretic factors, erythropoietin, GI hormones, pheromones.

UNIT-4 (REPRODUCTION, LACTATION, GROWTH AND ENVIRONMENTAL PHYSIOLOGY)

Genetic and endocrine control of gonadal development, modification of gonadotrophin release, ovarian functions, follicular development, dynamics, endocrine and receptor profiles, sexual receptivity, ovarian cycle, post-partum ovarian activity, ovum transport, capacitation, fertilization, reproductive cycles in farm animals- hormones present in the biological fluids during pregnancy and their uses for the diagnosis of pregnancy- maternal foetal placental participation in pregnancy and parturition, immunology of gestation, preparturient endocrine status.

Spermatogenic cycle and wave- function of sertoli cell-leydig cell-semen - composition- evaluation; Testosterone - function and regulation - cryptorchidism. Puberty - photoperiod - uses of androgens, progestogens, estrogens.

Functional and metabolic organization of mammary glands - structure and development; effect of estrogens and progesterone; hormonal control of mammary growth; lactogenesis and galctogenesis; biosynthesis of milk constituents-secretion of milk, and metabolism, prolactin and lactation cycle.

Biochemical and genetic determinants of growth, regulation of growth, metabolic and hormone interactions, factors affecting efficiency of growth and production in ruminants and single stomach animals. Growth in meat producing animals and birds, growth curves. Recombinant gene transfer technologies for growth manipulation- advantages and limitations. Protein deposition in animals and poultry.

Heat balance, heat tolerance, hypothermia, hyperthermia, thermo-regulation in farm animals, role of skin, responses of animals to heat and cold, fever, body temperature and hibernation. Temperature regulation in birds.

Climatology- various parameters and their importance. Effect of different environmental variables like temperature, humidity, light, radiation, altitude on animal performance. Acclimation, acclimatization - general adaptive syndrome. Clinical aspects of endocrine - reproductive functions, circadian rhythm.

Neurophysiology of behaviours, types of behaviour, communication, Learning and memory behavioural plasticity.

PRACTICAL

UNIT- 1 (BLOOD, CARDIOVASCULAR, NERVOUS AND MUSCULAR SYSTEMS)

Collection of blood samples - Separation of serum and plasma - Preservation of de-fribrinated blood - enumeration of erythrocytes, leucocytes - differential leucocytic count - platelet count - estimation of hemoglobin - haematocrit - erythrocyte sedimentation rate - packed cell volume - coagulation time- bleeding time -Erythrocyte fragility and viscosity - blood grouping - recording of ECG - measurement of arterial blood pressure (Sphygmomanometry). Simulation experiments on Nerve- Muscle and heart physiology.

UNIT-2 (DIGESTIVE AND RESPIRATORY SYSTEMS)

Counting of rumen motility, estimation of volatile fatty acids and ammonia nitrogen in rumen liquor. Bacterial and protozoal count. *In-vitro* action of proteolytic enzymes- Amylase, pepsin and trypsin. Recording of respiration, spirometry. Recording of volume and capacities in different physiological states including determination of vital capacities.

UNIT-3 (EXCRETORY AND ENDOCRINE SYSTEMS)

Urine analysis-physiological constituents, pathological determinates, determination of Glomerular Filteration Rate. Titerable acidity, determination of inorganic phosphorus, urine ammonia nitrogen and creatinine in urine. Recording of rumenorintestinal movements (Demonstration) and Bio assay for tropic hormone. Demonstration of hormone estimation.

UNIT-4 (REPRODUCTION, LACTATION, GROWTH AND ENVIRONMENTAL PHYSIOLOGY)

Oestrus and phases of oestrous cycle in animals (vaginal mucus). Behavioural signs of oestrus. Sperm motility, sperm concentration -live and dead - abnormal sperm count. Measurement of growth in various species. Measuring surface area of animals. Health parameters of animals- body temperature, pulse, respiration and heart rate. Measurement of animal environmental conditions. Behaviour of animals- mating behavior, feeding behaviour (liveorvideo graphicorcomputer simulated demonstration).

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1and 2	100	20
Paper-II	3 and 4	100	20
PRACTICAL			
Paper-I	1and 2	60	20
Paper-II	3 and 4	60	20

VETERINARY BIOCHEMISTRY **Credit Hours: 2+1**

THEORY

UNIT-1 (GENERAL VETERINARY BIOCHEMISTRY)

Scope and Importance of Biochemistry. Structure of Biological Membranes and Transport across Membranes. Donnan Membrane Equilibrium. Dissociation of Acids, pH, Buffer Systems, Henderson-Hasselbalch Equation. Biochemistry of Carbohydrates: Biological Significance of Important Monosaccharides(Ribose, Glucose, Fructose, Galactose, Mannose and Amino Sugars), Disaccharides (Maltose, Isomaltose, Lactose, Sucrose and Cellobiose), Polysaccharides, (Starch, Dextrins, Dextrans, Glycogen, Cellulose, Inulin, Chitin), and Mucopolysaccharides Including Bacterial Cell Wall Polysaccharides. Biochemistry of lipids: Properties and biological significance of simple, compound and derived lipids and lipoproteins. Fat indices. Structure and functions of prostaglandins. Biochemistry of proteins: Classification, Structure, Properties - Biological significance of proteins. Amino acids: Structure and classification. Physical and chemical properties of amino acids - amphoteric nature, optical activity, and peptide bond formation. Biochemistry of nucleic acids: Chemistry of purines, pyrimidines, nucleosides and nucleotides. Biological significance of nucleosides and nucleotides. Structures and functions of deoxyribonucleic acid (DNA) and a typical ribonucleic acid (RNA).

UNIT-2 (INTERMEDIARY METABOLISM)

Enzymes: Definition and classification. Coenzymes, cofactors and iso-enzymes. Properties: Protein nature, enzyme-substrate complex formation, modern concept of the active center of enzyme. Specificity of enzyme action: Substrate specificity, group specificity, stereo or optical specificity. Factors influencing enzyme action: Effects of temperature, pH, concentration of substrate and enzyme. Enzyme units: International Units, katal, turnover number and specific activity. Enzyme inhibition: Competitive, non-competitive, uncompetitive inhibition and suicidal inhibition. Allosteric enzymes. Biological oxidation: Enzymes and coenzymes involved in oxidation and reduction. Respiratory chain or electron transport chain, oxidative phosphorylation, inhibitors, uncouplers and other factors influencing electron transport chain. Carbohydrate metabolism: Glycolysis, Kreb's cycle, HMP shunt, gluconeogenesis, Cori cycle, glycogenesis, glycogenolysis, Bioenergetics of carbohydrate metabolism. Lipid metabolism: Beta oxidation of fatty acids, ketone body formation, biosynthesis of fatty acids. Bioenergetics of lipid metabolism.

Protein metabolism: Biosynthesis and Degradation. Deamination, transamination and decarboxylation of amino acids. Ammonia transport and urea cycle. Nucleic acid metabolism: Metabolism of purines and pyrimidines. DNA and RNA biosynthesis and regulation. Regulation and Integration of metabolism.

UNIT- 3 (VETERINARY ANALYTICAL BIOCHEMISTRY)

Disorders of Carbohydrate Metabolism: Diabetes mellitus, Ketosis, Bovine Ketosis, Pregnancy toxemia, hypoglycaemia in baby pigs, hyperinsulinism in Dogs. Hormonal control of carbohydrate metabolism and regulation of blood sugar.

Biochemical tests for the detection of disturbance in carbohydrate metabolism. Plasma Proteins and clinical significance, Proteins and Dysproteinemias,. Acute Phase proteins. Lipid Profile in disease diagnosis. Clinical Enzymology - Diagnostic importance of non-functional plasma enzymes and Isoenzymes, Liver function tests - Classification - Biochemical tests for differential diagnosis. Biochemical tests of renal function - Urine analysis - Role of BUN, Uric acid and Creatinine in diagnosis. Disturbance in acid base balance and its diagnosis. Biochemistry of digestive disorders. Biochemistry of oxidative stress and shock. Biochemical basis of fluid therapy. Detoxification in the body: Metabolism of xenobiotics, General reactions for biotransformation of different groups of substances, Cytochrome p450 system of enzymes.

PRACTICAL

UNIT-1 (GENERAL VETERINARY BIOCHEMISTRY)

Concentration of solutions and system International (S.I.) Units; Preparationor standardization of acids and alkalies; Preparation of Buffers; Titration curve of acid versus base; Qualitative test for carbohydrates and identification of unknown carbohydrates; Determination of acid number of an oil; Color and precipitation reactions of proteins; Estimation of amino acids (Sorensen's Method).

UNIT-2 (INTERMEDIARY METABOLISM)

Effect of temperature and pH on enzyme activity; Estimation of blood or plasma Glucose, Protein, Inorganic phosphate, Calcium, Magnesium; Estimation of ascorbic acid by Dichlorophenolindophenol (DCPIP) method; Estimation of milk lactose by Benedicts quantative method; Estimation of sodium and potassium by flame photometer; Paper or thin later Chromatography of amino acids; Estimation of vitamin A by colorimetry.

UNIT-3 (VETERINARY ANALYTICAL BIOCHEMISTRY)

Detection of Pathological Constituents in Urine; Assays of ALT and AST in Serum; Acute phase proteins (AorG Ratio); Estimation of total serum cholesterol, Blood Urea Nitrogen, creatinine, serum billirubin (Direct, Indirect and Total).

Principles of various diagnostic tests, normal and abnormal values in different species, differential diagnosis, correlating with diseases and rationale of arriving at the conclusion need to be rediscussed in detail during Final Profesional in the course VETERINARY CLINICAL PRACTICES-II, Diagnostic Laboratory Section.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1 and 3	100	20
Paper-II	2	100	20
PRACTICAL			
Paper-I	1and 3	60	20
Paper - II	21	60	20

(iii) **DEPARTMENT OF LIVESTOCK PRODUCTION MANAGEMENT**

LIVESTOCK PRODUCTION MANAGEMENT **Credit Hours: 4+2**

THEORY

UNIT-1 (GENERAL LIVESTOCK MANAGEMENT)

Demographic distribution of livestock and role in Indian economy. Problems and prospects of livestock industry in India. Common animal husbandry terms. (glossary) Body conformation and identification. Transportation of livestock and wild or zoo animals. Common farm management practices including disinfection, isolation, quarantine and disposal of carcass. Introduction to methods of drug administration. Common vices of animals (Cattle, Buffalo, Sheep, Goat,), their prevention and care. Livestock production systems. Animal holding and land holding patterns in different agro-climatic zones. Organic livestock production. Judging and BCS for body parts of livestock. Preparation of animals for show. Culling of animals. Selection and purchase of livestock.

UNIT-2 (FODDER PRODUCTION AND CONSERVATION)

Importance of grasslands and fodder in livestock production. Agronomical Practices for fodder production. Important leguminous and non-leguminous fodders in different seasons. Soil and Water conservation and drainage of water for fodder production. Fodder production for small livestock units. Structures for storage of feeds and fodders. Scarcity fodders and preservation of green fodder. Recycling of animal washings and wastes in fodders production and use of recycle waste.

UNIT-3 (LIVESTOCK PRODUCTION MANAGEMENT-RUMINANTS)

Housing systems, layout and design of different buildings for animals. Selection of site. General principles affecting the design and construction of building for housing for various livestock species. Arrangements of the building with special reference to Indian conditions. Utilization of local materials. Building materials used for construction of wall, roof and floor of animal houses, their characteristics, merits and demerits. Breeds of cattle and buffalo and descriptions of important breeds. Economic traits of cattle and buffaloes. General management and feeding practices of calves, heifers, pregnant, lactating and dry animals, bulls and working animals. Draught ability of cattle and buffaloes. Raising of buffalo males for meat production. Routine animal farm operations and labour management. Animal farm accounts and records. Methods of milking and precautions. Factors affecting quality and quantity of milk production. Clean milk production. Breeds of sheep and goat and their descriptions. Important economic traits for meat, milk and fibre. General management and feeding practices during different stages of growth, development and production (milk, meat and wool). Breeding schedule and management of ram and buck. Weaning and fattening of lambs and kids.

UNIT-4 (ZOO ANIMALS PRODUCTION MANAGEMENT)

Taxonomy of important wild zoo animals. Status and conservation practices of wild life in India. Basic principles of habitat and housing of various classes of wild zoo animals. Size and space requirement (dimension) of cubicles, enclosures of important wild zoo animals. Management of livestock in fringe areas, in and surrounding the breeding areas. Feeding habits, feeds and feeding schedules of captive animals. Restraining, capture, handling, physical examination of captive animals. Classification of zoos, management of sanctuaries, national parks etc. Acts and Rules related to captive animals. National and international organization and institutions interlinked to captive animals role and functioning.

UNIT-5 (ANIMAL WELFARE)

Definition of animal welfare and ethics. Human and animal welfare in relation to ecosystem and environmental factors. Role of veterinarians in animal welfare. Animal welfare organizations, Animal Welfare Board of India - their role, functions and current status. Rules, regulations, laws on animal welfare. Prevention of Cruelty to Animals (PCA) Act, 1960 {59 of 1960). Role and function of Committee for the Purpose of Controlling and Supervising Experiments in Animals (CPCSEA). Protection of wild life in nature and captivity. Protection and welfare of performing animals. Welfare of animals during transportation. Animal welfare in commercial livestock farming practices. Protection and welfare of working animals. Pet and companion animal welfare. Animal welfare during natural calamities and disaster management. Legal duties of veterinarians, Common offences against animals and laws related to these offences. Provincial and Central Acts relating to animals. Laws relating to offences affecting Public Health. Livestock Importation Act Evidence, liability and insurance. Code of Conduct and Ethics for veterinarians - the Regulations made under the Act.

UNIT-6 (POULTRY PRODUCTION MANAGEMENT)

Indian poultry industry – Brief outline of the different segments – poultry statistics. Classification of poultry with respect to production characters, age and standards. Production characters of other avian species. Description of indigenous fowls and their value in rural farming. Specific strains developed for rural poultry production; their acceptability and importance in rural eco-system

Brooding management – Types of brooders – preparation of shed – Importance of environmental factors. Housing – Types of poultry houses – space requirements. Recent advances in housing systems and rearing systems. Scavenging system of management – Low input technology – Backyard and semi-intensive units; their management and economic achievements. Deep litter management – control of litter-borne diseases and recycling of litter. Cage management – Different types; Advantages and disadvantages. Management of growers and layers. Management of broilers and breeders. Stress management. Feeding management–Classification of nutrients – Nutrient requirements and feed formulations. Feeding systems–Feed restrictions – phase feeding – Additives and supplements. Water management. Breeding systems and methods of mating. Selection and culling. Breeding for specific characters and for hybrid chicken production. Poultry judging. Egg structure – Physical and chemical composition. Bio-security and principles of disease prevention management. Health care for common poultry diseases – vaccination. General principles of poultry medication.

UNIT-7 (DIVERSIFIED POULTRY PRODUCTION AND HATCHERY MANAGEMENT)

Principles of incubation and hatchery management practices. Factors affecting fertility and hatchability, selection and care of hatching eggs and hatchery hygiene. Candling, sexing, grading, packing and disposal of hatchery waste. Economics of hatchery business – Troubleshooting hatchery failures–Computer applications in hatchery management. Poultry waste management, pollution and environmental issues. Organic and hill farming. Mixed or integrated poultry farming

Vertical & horizontal integration in commercial poultry production – Contract farming. Exportorimport of poultry produce and marketing. Management of ducks, geese, turkeys, Japanese quails, guinea fowls etc.

UNIT-8 (LABORATORY OR RABBIT OR PET ANIMAL PRODUCTION MANAGEMENT)

Importance and selection of laboratory animal, care and housing standards of mice, rats, hamster and guinea pigs. General considerations on feeding and breeding of laboratory animals. Concept of production of specific pathogen free and germ free laboratory animals. Scope of rabbit farming in the country, breeds and their distributions in India. Limitation of rabbit animal production, Selection, care and management of breeding stock for commercial purpose. Identification, care and management of kindling animals. Care of new born, growing stock. Breeding and selection techniques for optimal production of rabbit. Feeds and feeding for rabbit production. Hygienic care and Housing for rabbit production. Disposal, utilization and recycling of waste etc. Preparing projects for micro (Backyard), mini and major rabbit farms. Important breeds of dogs, cats and pet birds. Feeding of dogs, cats and pet birds. Dog show: preparation for show, kennel clubs, important characteristics for judgment. Utility of dogs- guarding, defense, patrolling, riot control, scouting, espionage, mine detection, tracking, guiding, hunting, races, retrieving rescue and other uses.

UNIT-9 (SWINE OR EQUINE OR CAMEL, YAK AND MITHUN PRODUCTION MANAGEMENT)

Introduction and scope of swine farming in the country. Demography of swine population. Selection and breeding techniques in swine. Important breeds (exotic and indigenous) & their characteristics. Housing and feeding of swine. Management of different categories of swine for optimal production: breeding and pregnant sows; sows at farrowing and after farrowing: pig-lets, growing stock, lactating sows, feedlot stock. Equine population of India. Horses, donkeys and mules and their utility. Colors and markings. Identification of breeds of horses. Dentition and ageing of horses. Care and routine management of equines including grooming, saddling and exercise. Stable and its management. Vices of horses. Foot care and shoeing care. Feeding routine for horse, donkeys and mules. Care of stallion. Mating of horses, brood mare and its care. Foaling and care of newborn. Breeding mules. Care of race horses and preparing horses for show. Doping and its detection. Colic and its prevention. Common breeds of camel in India and their utility, peculiarities in camel. Feeding schedule of camel, rutting symptoms in camel, Vices of camel. Care of breeding in camel, pregnancy and parturition of camel. Population statistics and utility, peculiarities of yak. Feeding and breeding of MithunorYaks. Yak × cattle crossing, hybrids from Mithun or Yaks and their adaptation to high altitude, milk composition of Mithun or Yaks.

PRACTCAL

UNIT-1 (GENERAL LIVESTOCK MANAGEMENT)

General introduction of the Institute animal farm. Identification of common tools used on animal farm. Familiarization with body points of animals. Methods of identification (marking, tattooing, branding, tagging and electronic chip under pre emptive analgesia). Use of rope for knot and halter making. Dentition and ageing of animals. Preparation of animals for show and judging. Selection and culling of animals. Preparation of project proposal

UNIT-2 (FODDER PRODUCTION AND CONSERVATION)

Visit to the fodder farm. Familiarization with the various types of fodders in the state and India. Familiarization with various fertilizers and manures. Collection, preservation and storage of feed and fodder; Damagesorloss during transfer and storage; methods to prevent them. Cost of calculations of fodder production. Livestock waste utilization and recycling.

UNIT-3 (LIVESTOCK PRODUCTION MANAGEMENT-RUMINANTS)

Layout plans for different livestock houses. Visit to different animal farms and Identification of various breeds of cattle, buffalo, sheep and Goat. Humane handling and restraining of cattle, buffalo, sheep and Goat. Clipping, shearing, dipping, spraying and spotting sick animals. Determination of body weight using different measurements. Familiarization with routine cattle, buffalo, sheep and goat farm operations. Milking of dairy animals. Shearing of sheep. Training of breeding males. Detection of heat. Identification and care of pregnant animals, care of neonatal and young stock. Economics of dairy, sheeporgoat farm.

UNIT-4 (ZOO ANIMALS PRODUCTION MANAGEMENT)

Visit to nearby wildlife sanctuary, captive animals centres to study care and management of these animals. To study housing of captive animals. To study feeds and feeding schedule of captive animals. Hygienic preparation, preservation

and storage of feeds of captive animals. Familiarization about restraining, handling and physical examination of captive animals.

UNIT-5 (POULTRY PRODUCTION MANAGEMENT)

Common breeds of poultry, different classes, Indian chickens and other avian species breeds. Digestive and respiratory system of chicken. Male and female reproductive system–Quality changes in egg during storage. Economic traits of broilers. Economic traits of egg-type chicken and breeders. AI in poultry. Housing and design of a poultry farm. Poultry farm equipment and their classification. Brooding arrangement in broiler farms. Poultry feed ingredients and its quality assessment. Poultry feed preparations. Calculation of different economic indices of broiler farm. Calculation of economic indices of layer farm. Fundamentals in poultry Post-mortem examination for sample collection. Collection and dispatch of samples for PM examination. Management during Summer, Winter and Rainy season. Automization in poultry farms (EC house).

UNIT-6 (INCUBATION AND HATCHERY MANAGEMENT)

Hatchery layout and design. Project report for establishing a broiler farm. Project report for establishing a layer farm. Project report for establishing a breeder farm. Visit to commercial poultry farms or hatchery or feed mill. Visit to farms of other avian species.

UNIT-7 (LABORATORY OR RABBIT OR PET ANIMAL PRODUCTION MANAGEMENT)

Identification of body parts and handling, weighing, sexing and weaning of laboratory animals. Marking for identification of laboratory animals for purpose of their individual recording. Computation, feeding schedule of balanced diet for high breeding efficiency of laboratory animals. Maintenance of breeding records of laboratory animals. Prophylactic measures against common disease of laboratory animals. Hygienic care and control of parasites. Shearing of rabbit. Feeding and Housing requirement and equipments for rabbit. Projects report for establishing of rabbit farm. Handling and restraining of dog, cat and pet bird and equipments for pet animals and birds. Brushing or grooming and bathing of dogs and cats. Nail and tooth care, clipping of hairs for show purpose. Care of pups, kitten and weaning.

UNIT-8 (SWINE OR EQUINE OR CAMEL, YAK AND MITHUN PRODUCTION MANAGEMENT)

Handling, restraining of swine, equines, camel. Identification of pregnant animals, care during pregnancy, isolation and care of farrowing sows and piglets. Preparation of swine, equine for show and judging, Economics of pig. Routine inspection, tooth care and vaccination schedule. Horse riding: walking, trotting, cantering and galloping. Layout plans for sty, stables

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2, 3, 4 and 5	100	20
Paper-II	6,7,8 and 9	100	20
PRACTICAL			
Paper-I	1, 2, 3and 4	60	20
Paper - II	5,6,7 and 8	60	20

(iv) **DEPARTMENT OF VETERINARY MICROBIOLOGY**

VETERINARY MICROBIOLOGY **Credit Hours: 3+2**

THEORY

UNIT-1 (GENERAL & SYSTEMATIC VETERINARY BACTERIOLOGY)

Introduction and history of Microbiology; Classification and nomenclature of bacteria; Microscopy and Micrometry; Bacterial stains and techniques; Structure and morphology of bacteria; Growth and nutritional requirement of aerobic and anaerobic bacteria; Normal, opportunistic and saprophytic bacterial flora: Types and sources of infection, method of transmission of infection. Pathogenicity, virulence, determinants of virulence, Epizootic and enzootic diseases, bacteremia, septicaemia and toxaemia, endotoxins, exotoxins, antitoxins, toxoids; Bacterial genetics (Mutation, Transformation, Transduction and Conjugation), plasmids and antibiotic resistance.

Study of the following bacteria in relation to isolation, growth, cultural, morphological, biochemical and antigenic characteristics, epidemiology and pathogenesis, pathogenicity, diagnosis, prevention and control of bacterial diseases caused by following bacteria:

Staphylococcus; Streptococcus; *Corynebacterium, Trueperella,Rhodococcus; Listeria* and *Erysepelothrix; Bacillus; Mycobacterium; Clostridium, Actinomyces, Nocardia, Streptomyces* and *Dermatophilus;* Family *Enterobacteriaceae* (*E.coli, Klebsiella, Salmonella, Yersinia, Proteus*); *Pseudomonas* and *Burkholderia; Pasteurella, Mannheimia, Actinobacillus and Haemophilus, Brucella; Vibrio; Campylobacter; Bordetella and Moraxella; Gram negative anaerobes: Bacteriodes, Dichlobacteria and Fusobacterium; Leptospira and other Spirochaetes;Mycoplasma, Coxiella, Neorickettsia, Ehrlichia, Anaplasma, Rickettsia; Chlamydia and Chlamydophila*

Emerging, re-emerging and transboundry bacterial pathogens.

UNIT-2 (VETERINARY MYCOLOGY)

Introduction, classification, general properties of fungi; Growth and Reproduction of fungi; Study of following important pathogenic fungi in relation to their isolation, growth, morphological, cultural, biochemical and antigenic characteristics, epidemiology, pathogenesis, diagnosis and control of fungal diseases caused by following genera: *Candida* and *Cryptococcus; Aspergillus; Penicillium;* Dermatophytes and Malassezia; Dimorphic fungi, *Rhinosporidium* and *Sporotrichum;* Mycetoma and *Zygomycetes;* Mycotic mastitis and mycotic abortion; Mycotoxicoses

UNIT-3 (MICROBIAL BIOTECHNOLOGY)

Basic concepts and scope of Recombinant DNA technology; Gene cloning, Cloning vectors and expression vectors; Transformation and transfection; Southern, Northern and Western blotting; Bioinformatics, Gene banks; Application of molecular and biotechnological techniques: Polymerase chain reaction, Nucleic acid hybridization, DNA library, DNA sequencing and DNA fingerprinting; IPR. Ethics and regulatory issues in Animal Biotechnology.

UNIT-4 (VETERINARY IMMUNOLOGY AND SEROLOGY)

History of Immunology; Lymphoid organs, tissues and Cells: Types of Immunity; Antigens, hapten, epitope, Specificity, T dependent and T independent Antigens, heterophile Antigens, cross reacting Antigens, blood group Antigens, Mitogens and factors affecting immunogenicity; Adjuvants; Antibody: Structure, physiochemical properties and functions of various classes of immunoglobulins, Theories of antibody production; Hybridoma and monoclonal antibodies, Serological reactions. Major histocompatibility complex (MHC) structure, function and gene organization; Structure of BCR and TCR; Antigen processing and presentation; Complement system: activation pathways and biological consequences; Cytokines: general properties, major types and function; Hypersensitivity: classification and mechanism of induction; Autoimmunity; Immunotolerance; Concept of Immunity to Microbes, Vaccines and other biological.

UNIT-5 (GENERAL AND SYSTEMATIC VETERINARY VIROLOGY)

History of Virology; Introduction to viruses; Structure of Viruses; Classification of Viruses; Viral Replication; Genetic and Non-genetic viral interactions; Virus-Cell Interactions; Viral Pathogenesis, Oncogenesis, latency and immunopathology. Studies on General Properties, Antigens, Cultivation, Pathogenesis, Epidemiology, Clinical Signs, Diagnosis, Prevention and Control of following Viruses and Prions Causing Diseases in Livestock and Poultry: *Birnaviridae*: Infectious bursal disease virus; *Reoviridae:* Rotaviruses, Bluetongue virus, African horse sickness virus; *Paramyxoviridae*: Newcastle disease virus, Canine distemper virus, PPR virus; *Rhabdoviridae*: Rabies virus, Ephemeral fever virus, *Bornaviridae*: Borna virus. *Orthomyxoviridae*: Swine, Equine, Avian Influenza Viruses. *Coronaviridae*: Infectious Bronchitis virus, Transmissible gastroenteritis virus; *Arterivirdae:* Equine viral arteritis virus, *Picornaviridae*: FMD virus, Duck viral hepatitis virus; *Caliciviridae*: Feline calici Virus, *Togaviridae*: Equine encephalomyelitis viruses; *Flaviviridae*: Swine fever virus, BVD virus; *Retroviridae*: Visna or maedi virus, Equine infectious anemia virus, Lymphoid leucosis virus, Bovine leukemia virus. *Poxviridae*: Capripoxvirus, Avipoxvirus, Cowpoxvirus; *Asfarviridae*: African Swine Fever Virus; *Herpesviridae*: Bovine herpes viruses, Equine Herpes viruses, Infectious laryngotracheitis virus, Marek's disease virus, Pseudorabies virus, Malignant Catarrhal Fever virus; Duck Plague virus, *Adenoviridae*: Infectious Canine Hepatitis virus, Egg Drop Syndrome virus, Fowl adenovirus, *Papillomaviridae*: Papillomatosis, *Parvoviridae*: Canine parvoviruses, Feline panleucopenia virus; *Circoviridae*: Chicken Anemia Virus: Prions: Scrapie, Bovine Spongiform Encephalopathy; Emerging, re-emerging and transboundry viruses and Viral Infections.

PRACTICAL

UNIT-1 (GENERAL AND SYSTEMATIC VETERINARY BACTERIOLOGY)

Orientation to bacteriology laboratory; Methods of sterilization and disinfection; Preparation of culture media for cultivation of aerobic and anaerobic bacteria; Methods of inoculation, Cultivation of aerobic and anaerobic bacteria; Isolation of bacteria in pure culture; Simple staining, Negative staining, Differential staining procedures of bacteria: Gram's staining, Acid fast staining; Special staining procedures: Capsule and Spore staining; Bacterial motility; Culture sensitivity test; Outlines of collection, transportation and processing of samples for bacterial disease diagnosis.

Characterization of *Staphylococcus; Streptococcus; E. coli Salmonella; Klebsiella and Proteus; Pseudomonas; Pasteurella; Clostridium;* Isolation and identification of bacteria from clinical cases of Mastitis, Abortions, Enteric, Respiratory and Pyogenic infections.

UNIT-2 (VETERINARY MYCOLOGY)

Outline of collection, transportation and processing of samples for fungal disease diagnosis, Preparation of culture media, Cultivation and slide culture technique of fungi; Cultural characteristics of fungi; Lactophenol cotton blue staining to study morphology of fungi; Culture sensitivity test of fungi; Diagnosis of Aspergillosis and Candidiasis; Demonstration of other important yeast, moulds and Dermatophytes

UNIT-3 (MICROBIAL BIOTECHNOLOGY)

Extraction and quantitation of nucleic acid; Plasmid isolation and plasmid profiling; Agarose gel electrophoresis for studying or diagnosis of nucleic acid of microbes; SDS PAGE electrophoresis for studying or diagnosis of proteins of microbes; Use of Multimedia and audio-visual aids for molecular biology aspects.

UNIT-4 (VETERINARY IMMUNOLOGY AND SEROLOGY)

Inoculations of lab animals, preparation of antigen, Raising of antisera, separation and preservation of serum, Concentration of Immunoglobulins, Agglutination tests: Plate, Tube, Haemagglutination, Precipitation test: Agar gel precipitation Test, Single radial immunodiffusion test, Immunoelectrophoresis, Cell mediated immune response (DTH), Enzyme linked immunosorbent assay (ELISA), Visit and appraisal of Veterinary biological institute.

UNIT-5 (GENERAL AND SYSTEMATIC VETERINARY VIROLOGY)

Orientation to a virology laboratory; Collection, preservation, transport of samples and their processing in virology laboratory; Isolation of viruses in laboratory animals or poultry or embryonated chicken eggs; Preparation of media and reagents for cell culture; Subculture and maintenance of continuous cell lines; Quantitation of cells by viable cell counts in a haemocytometer; Cryopreservation and recovery of cell cultures; Preparation of Primary cell culture (chicken embryo fibroblast or Lamb kidney); Demonstration of cytopathic effect by viruses in cell culture (Important virus isolates available in the department); Demonstration of Titration of virus by $TCID_{50}$ and plaque assay in cell cultures*; Demonstration of neutralizing antibodies by serum neutralization test in cell cultures* ; Agar gel precipitation test for detection of virus infection*; Titration of Newcastle disease virus by haemagglutination test; Haemagglutination inhibition test for detection of antibodies to Newcastle disease virus; ELISA for detection of viral antigen and antibodies; Molecular techniques for viral disease diagnosis

*Important virus isolates available in the department.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1,2 and 3	100	20
Paper-II	4 and 5	100	20
PRACTICAL			
Paper-I	1, 2and 3	60	20
Paper - II	4 and 5	60	20

(v) **DEPARTMENT OF VETERINARY PATHOLOGY**

VETERINARY PATHOLOGY **Credit Hours: 4+2=6**

THEORY

UNIT-1 (GENERAL VETERINARY PATHOLOGY)

Introduction and scope of Veterinary Pathology. Major intrinsic and extrinsic causes of disease. Haemodynamic disorders (hyperaemia, congestion, haemorrhage, oedema, thrombosis, embolism and infarction). Glycogen overload, amyloidosis and fatty changes. Reversible and irreversible cell injury- degenerations, necrosis and its types, apoptosis, differences between post-mortem autolysis and necrosis, gangrene and its types. Major exogenous and endogenous pigments. Metastatic and dystrophic calcification. Photosensitization. Disturbances in growth (Aplasia, hypoplasia, atrophy, hypertrophy, hyperplasia, metaplasia and dysplasia). Inflammation: Definitions, classification, various cell types

and their functions, mediators, cardinal signs and systemic effects. Wound healing by primary and secondary intention including growth factors. Immunopathology in brief (immunodeficiency, hypersensitivity and autoimmunity).

UNIT-2 (SYSTEMIC VETERINARY PATHOLOGY)

Pathological changes affecting Digestive, Respiratory, Musculoskeletal, Cardiovascular, Haematopoietic, Lymphoid, Urinary, Reproductive, Nervous, Endocrine systems, Skin and Appendages, Ear and Eye.

UNIT-3 (ANIMAL ONCOLOGY, VETERINARY CLINICAL PATHOLOGY AND NECROPSY)

Animal Oncology: Definitions, general characteristics and classification of neoplasms. Differences between benign and malignant tumours, aetiology, carcinogenesis and spread of neoplasms, tumour immunity, effects and diagnosis of tumours, staging and grading of neoplasms. Pathology of various types of tumours in domestic animals (epithelial, connective tissue, hematopoietic tissue etc.)

Veterinary Clinical Pathology: Introduction, Haematology – Different anticoagulant used in haematology, interpretation of blood tests (haemoglobin, packed cell volume, total erythrocyte count, erythrocytic indices, erythrocytic sedimentation rate, total leukocyte count, absolute count of different leucocytes), blood smear examination and its interpretation.

Urinalysis- Interpretation of physical, chemical and microscopic examination of urine. Study of biopsy and cytology including exfoliative cytology as rapid diagnostic techniques.

Necropsy: Introduction, objectives, pre-necropsy guidelines, procedure for post mortem examination of various species of animals including wild animals, post mortem changes, collection, preservation and dispatch of specimens (morbid materials) for laboratory examination, writing of post mortem report, veterolegal necropsy , veterolegal wounds.

UNIT-4 (PATHOLOGY OF INFECTIOUS AND NON-INFECTIOUS DISEASES OF DOMESTIC ANIMALS)

Pathology of viral infections: Pathogenesis, gross and microscopic pathology of foot and mouth disease,Rinderpest, malignant catarrhal fever, blue tongue, infectious bovine rhinotracheitis, bovine viral diarrhoea, Peste des Petitis (PPR), equine infectious anaemia, equine influenza, equine viral arteritis, equine rhinopneumonitis, classical swine fever, swine influenza, rabies, canine distemper, infectious canine hepatitis, canine parvovirus infection, feline panleukopenia, maedi, jaagziekte, pox virus diseases in different animals. Vesicular stomatitis, vesicular exanthema, equine encephalomyelitis, diseases caused by rota and corona viruses.

Pathology of prion diseases (scrapie, bovine and feline spongiform encephalopathies).

Pathology of bacterial infections: Pathogenesis, gross and microscopic pathology of tuberculosis, Johne's disease, actinomycosis, actinobacillosis, anthrax, clostridial group of diseases (black quarter, black disease, enterotoxaemia, braxy, botulism tetanus), streptococosis including strangles in horses, staphylococosis, glanders, pasteurellosis, leptospirosis, listeriosis, swine erysipelas, brucellosis, corynebacterium infections (caseous lymphadenitis, pseudotuberculosis), campylobacteriosis, salmonellosis, and colibacillosis including oedema disease in pigs, and necrobacillosis).

Pathogenesis, gross and microscopic pathology of mycoplasma infection (contagious bovine pleuropneumonia, contagious caprine pleuropneumonia, porcine enzootic pneumonia), diseases of chlamydial group, Q-fever, anaplasmosis and ehrlichiosis.

Pathogenesis, gross and microscopic pathology of superficial and deep mycoses - ringworm (dermatophytosis), aspergillosis, zygomycosis, histoplasmosis, cryptococosis, rhinosporidiosis and candidiasis. Pathogenesis, gross and microscopic pathology of aflatoxicosis, ochratoxicosis, trichothecosis, Degnala disease and ergotoxicosis.

Pathogenesis, gross and microscopic pathology of fasciolosis, babesiosis, theileriosis and trypanosomosis. Pathological changes (in brief) of amphistomiasis, ascariasis, strongylosis, haemonchosis, spirocercosis, filariasis, hookworm, tapeworm infections, coccidiosis, toxoplasmosis, cryptosporidiosis,

Pathological changes of nutritional imbalances (in brief) due to carbohydrates, proteins, fats, minerals and vitamins and metabolic diseases (pregnancy toxaemia, post-parturient haemoglobinuria, hypomagnesemic tetany, azoturia, and sway backorenzootic ataxia, pica and Rheumatism like syndrome).

Gross and microscopic pathologyin (brief) of toxicities like arsenic, copper, lead, mercury, cadmium, strychnine, nitrateornitrite, hydrocyanic acid, fluoride, selenium and oxalates; insecticideorpesticide poisoning, plant poisoning (braken fern, gossypol, ratti and lantana)

UNIT-5 (AVIAN PATHOLOGY)

Avian Inflammation, Viral Diseases: Pathogenesis, gross and microscopic pathology of Ranikhet disease, infectious bursal disease, infectious bronchitis, infectious laryngotracheitis, fowl pox, avian influenza, Marek's disease,

leukosisorsarcoma group of diseases, reticuloendotheliosis, avian encephalomyelitis, inclusion body hepatitis, hydro-pericardium syndrome, chicken infectious anaemia, avian nephritis, egg drop syndrome, reovirus infections.

Bacterial Diseases: Pathogenesis, gross and microscopic pathology of colibacillosis, infectious coryza, clostridial diseases, salmonella infections, fowl cholera, tuberculosis and spirochaetosis. Pathogenesis, gross and microscopic pathology of *Mycoplasma* infections, chlamydiosis.

Pathogenesis, gross and microscopic pathology of aspergillosis, thrush, favus, aflatoxicosis, ochratoxicosis and trichothecosis.

Gross and microscopic pathology (in brief) of helminthic diseases (flukes, cestodes, nematodes), protozoal diseases (coccidiosis, histomoniasis), ectoparasites.

Gross and microscopic pathology of nutritional imbalances due to carbohydrates, proteins, minerals and vitamins. Miscellaneous diseases (Heat stroke, vent gleet, internal layer, false layer, pendulous crop, breast blister, ascites syndrome, fatty liver and kidney syndrome, fatty liver syndrome, cage layer fatigue, gout, hemorrhagic syndrome, round heart disease, impaction of oviduct, egg bound condition, bumble foot) and common vices.

UNIT-6 (PATHOLOGY OF DISEASES OF LABORATORY AND WILD ANIMALS)

Pathology of important diseases of rats, mice, and guinea pigs (Tyzzer's disease, Pseudotuberculosis, Salmonellosis, Infectious ectromelia, Infantile diarrhea, Murine hepatitis virus, Lymphocytic choriomeningitis); Pathology of important diseases of rabbits (Pasteurellosis, Blue breasts, Treponematosis, Enterotoxaemia, Rabbit pox , Infectious myxomatosis, Papillomatosis , Coccidiosis, Mite infestation). Gross and microscopic pathology of important diseases of wild animals (West Nile Fever, Rabies, FMD, Pox, Kyasanaur forest disease, Infectious hepatitis virus, Anthrax, Tuberculosis, Colibacillosis, Clostridial infections Trypanosomosis, Babesiosis, Theileriosis, Nutritional deficiency diseases)

PRACTICAL

UNIT-1 (GENERAL VETERINARY PATHOLOGY)

Study of gross pathological specimens and recognition of pathological lesions. Histopathological techniques– Processing of tissue for paraffin embedding technique, section cutting, staining and identification of microscopic lesions. Examination of histopathological slides showing general pathological alterations.

UNIT-2 (SYSTEMIC VETERINARY PATHOLOGY)

Study of gross specimens and histopathological slides pertaining to systemic pathology.

UNIT-3 (ANIMAL ONCOLOGY, VETERINARY CLINICAL PATHOLOGY AND NECROPSY

Macroscopic and microscopic examinations of various types of benign and malignant tumours. Examination of blood for routine haematological tests in domestic animals and poultry. Physical, chemical and microscopic examination of urine. Post mortem examination of different species of animals including wild and laboratory animals.

UNIT-4 (PATHOLOGY OF INFECTIOUS AND NON-INFECTIOUS DISEASES OF DOMESTIC ANIMALS)

Post mortem examination and its interpretations, Study of gross specimens and histopathological slides of various organs pertaining to infectious and non- infectious diseases of domestic animals. Demonstration of causative agents in tissue section by special staining methods and use of rapid diagnostic tests.

UNIT-5 (AVIAN PATHOLOGY)

Post mortem examination of poultry and writing of post mortem report. Collection, preservation and dispatch of morbid materials in poultry diseases. Study of gross specimens and histopathological slides of different diseases of poultry.

UNIT-6 (PATHOLOGY OF DISEASES OF LABORATORY AND WILD ANIMALS)

Post mortem examination of laboratory and wild animals. Study of gross specimen and histopathological slides of diseases affecting laboratory and wild animals.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2 and 3	100	20
Paper-II	4, 5 and 6	100	20

PRACTICAL			
Paper-I	1, 2 and 3	60	20
Paper - II	4, 5 and 6	60	20

(vi) **DEPARTMENT OF ANIMAL GENETICS AND BREEDING**

ANIMAL GENETICS AND BREEDING **Credit Hours: 3+1**

THEORY

UNIT-1 (BIOSTATISTICS AND COMPUTER APPLICATION)

Biostatistics: Introduction and importance of statistics and biostatistics, Classification and tabulation of data. Parameter, Statistic and Observation. Graphical and diagrammatic representation of data. Measures of Central tendency (simple and grouped data). Measures of Dispersion (simple and grouped data). Probability and probability distributions: Binomial, Poisson and Normal. Moments, Skewness and Kurtosis. Correlation and Regression. Introduction of sampling methods. Tests of hypothesis- t and Z- tests. Chi-square test. Design of experiment- Completely randomized design (CRD). Randomized block design (RBD). Analysis of variance and F-test of significance. Introduction to Non-parametric tests.

Computer Application: Introduction to computer languages. Data Base Management. Review of MS-Office and its components (MS-Word, Excel, Power Point and Access). Analysis of data using MS-Excel. Concepts of computer networks, internet & e-mail.

UNIT-2 (PRINCIPLES OF ANIMAL AND POPULATION GENETICS)

Animal Genetics: History of Genetics. Mitosis vors Meiosis. Chromosome numbers and types in livestock and poultry. Overview of Mendelian principles. Modified Mendelian inheritance. Pleiotropy, Penetrance and expressivity. Multiple alleles; lethals; sex-linked, sex limited and sex influenced inheritance. Sex determination. Linkage, crossing over and construction of linkage map. Mutation, Chromosomal aberrations. Cytogenetics, Extra-chromosomal inheritance. Molecular genetics, nucleic acids-structure and function. Gene concept, DNA and its replication. Introduction to molecular techniques.

Population Genetics: Introduction to population genetics; individual vors population. Genetic structure of population: Gene and genotypic frequency. Hardy - Weinberg law and its application. Forces changing gene and genotypic frequencies (eg Mutation, migration, selection and drift). Quantitative vors qualitative genetics; concept of average effect and breeding value. Components of Variance. Concept of correlation and interaction between Genotype and Environment. Heritability and Repeatability. Genetic and Phenotypic Correlations.

UNIT-3 (PRINCIPLES OF ANIMAL BREEDING)

Livestock and Poultry Breeding: History of Animal Breeding. Classification of breeds. Economic characters of livestock and poultry and their importance. Selection, types of selection, response to selection and factors affecting it. Bases of selection: individual, pedigree, family, sib, progeny and combined, indirect selection. Method of selection, Single and Multi trait. Classification of mating systems. Inbreeding coefficient and coefficient of relationship. Genetic and phenotypic consequences of inbreeding, inbreeding depression, application of inbreeding. Out breeding and its different forms. Genetic and phenotypic consequences of outbreeding, application of outbreeding, heterosis. Systems of utilization of heterosis; Selection for combining ability (RS and RRS). Breeding strategies for the improvement of dairy cattle and buffalo. Breeding strategies for the improvement of sheep, goat, swine and poultry. Sire evaluation. Open nucleus breeding system (ONBS). Development of new breeds or strains. Current livestock and poultry breeding policies and programmes in the state and country. Methods of conservation- livestock and poultry conservation programmes in the state and country. Application of reproductive and biotechnological tools for genetic improvement of livestock and poultry. Breeding for disease resistance.

Breeding of pet, zoo and wild animals: Classification of dog and cat breeds. Pedigree sheet, selection of breeds and major breed traits. Breeding management of dogs and cats. Common pet birds seen in India and their breeding management.

Population dynamics and effective population size of wild animals in captivityorzooornatural habitats. Planned breeding of wild animals. Controlled breeding and assisted reproduction. Breeding for conservation of wild animals.

PRACTICAL

UNIT-1 (BIOSTATISTICS AND COMPUTER APPLICATION)

Collection, compilation and tabulation of data. Estimation of measures of central tendency (mean, median, mode) for simple and grouped data. Estimation of measures of dispersion (Range, standard deviation, standard error, variance, and coefficient of variation) for simple and grouped data. Graphical and diagrammatic representation of data. Estimation of correlation and regression. Simple probability problems, Normal distribution. Tests of significance: t-test, Z – test, Chi-

square, F- tests. Completely randomized design (CRD). Randomized block design (RBD). Computer basics and components of computer. Simple operations: internet and e-mail, Entering and saving biological data through MS-Office (MS-Excel)

UNIT-2 (PRINCIPLES OF ANIMAL AND POPULATION GENETICS)

Monohybrid, Dihybrid cross and Multiple alleles. Modified Mendelian inheritance and sex linked inheritance. Linkage and crossing over. Demonstration of Karyotyping in farm animals. Calculation of gene and genotypic frequencies, Testing a population for Hardy-Weinberg equilibrium. Calculation of effects of various forces that change gene frequencies. Computation of population mean, average effect of gene and gene substitution and breeding value. Estimation of repeatability, heritability, genetic and phenotypic correlations.

UNIT-3: (PRINCIPLES OF ANIMAL BREEDING)

Computation of selection differential and intensity of selection, Generation interval, expected genetic gain, correlated response, EPA and Most probable producing ability (MPPA). Estimation of inbreeding and relationship coefficient. Estimation of heterosis. Computation of sire indices. Computation of selection index.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1 and 2	100	20
Paper-II	3	100	20
PRACTICAL			
Paper-I	1 and 2	60	20
Paper - II	3	60	20

(vii) **DEPARTMENT OF ANIMAL NUTRITION**

ANIMAL NUTRITION **Credit Hours: 3+1**

THEORY

UNIT-1 (PRINCIPLES OF ANIMAL NUTRITION AND FEED TECHNOLOGY)

History of animal nutrition. Importance of nutrients in animal production and health. Composition of animal body and plants. Nutritional terms and their definitions. Nutritional aspect of carbohydrates, protein and fats. Role and requirement of water, metabolic water. Importance of minerals (major and trace elements) and vitamins in health and production, their requirements and supplementation in feed. Common feeds and fodders, their classification, availability and importance for livestock and poultry production. Measures of food energy and their applications - gross energy, digestible energy, metabolizable energy, net energy, total digestible nutrients, starch equivalent, food units, physiological fuel value. Direct and indirect calorimetry, carbon and nitrogen balance studies. Protein evaluation of feeds - Measures of protein quality in ruminants and non-ruminants, biological value of protein, protein efficiency ratio, protein equivalent, digestible crude protein. Calorie protein ratio. Nutritive ratio. Introduction to feed technology- Feed industry; Processing of concentrates and roughages. Various physical, chemical and biological methods for improving the nutritive value of inferior quality roughages. Preparation, storage and conservation of livestock feed through silage and hay and their uses in livestock feeding. Harmful natural constituents and common adulterants of feeds and fodders. Feed additives in the rations of livestock and poultry and their uses.

UNIT-2 (APPLIED RUMINANT NUTRITION-I)

Importance of scientific feeding. Feeding experiments. Digestion and metabolism trial. Norms adopted in conducting digestion trial. Measurement of digestibility. Factors affecting digestibility of a feed. Feeding standards, their uses and significance, merit and demerits of various feeding standards with reference to ruminants. Balanced ration and its characteristics.

UNIT-3 (APPLIED RUMINANT NUTRITION-II)

Nutrient requirements and methods for assessing the energy and protein requirements for maintenance and production in terms of growth, reproduction, milk, meat, wool and draft purpose. General principles of computation of rations.

Formulation of rations and feeding of dairy cattle and buffaloes during different phases of growth and production (neonate, young, adult, pregnant, lactating and dry animals; breeding bull) and working animals. Formulation of ration and feeding of sheep and goat during different phases of growth and production (milk, meat and wool). Feeding of high yielding animals and role of bypass nutrients. Metabolic disorders and nutritional interventions. Use of NPN compound for ruminants.

UNIT-4 (APPLIED NON-RUMINANT NUTRITION)

Nutrient requirements in poultry, swine and equine - Energy and protein requirement for maintenance and production. Methods adopted for arriving at energy and protein requirements for maintenance and production in terms of growth, reproduction and production (egg, meat and work). Feeding standards for non-ruminants and poultry Formulation of rations as per Bureau of Indian Standards and Indian Council of Agricultural Research specifications. Feeding of swine (Piglets, Growers, Lactating and pregnant sows, Breeding boar, Fattening animals), equine (foal, yearling, broodmare, stallion and race horses) and poultry (Starter, Growers, Broilers, Layers) with conventional and unconventional feed ingredients. Feeding of ducks, quails, turkeys and laboratory animals. Nutrient requirements of mice, rat, rabbit and guinea pig. Diet formulation, preparation and feeding of rabbits and laboratory animals. Nutrient requirement and feeding of different categories of dogs and cats; peculiarities of feeding cats. Feeding of wild animals and birds in captivity. Metabolic disorders and nutritional intervention.

PRACTICAL

UNIT-1 (PRINCIPLES OF ANIMAL NUTRITION AND FEED TECHNOLOGY)

General precautions while working in nutrition laboratory. Familiarisation of various feeds and fodders. Preparation and processing of samples for chemical analysis - herbage, faeces, urine and silages. Preparation of solutions. Weende System of analysis - Estimation of dry matter, total ash, acid insoluble ash, crude protein, ether extract, crude fibre, nitrogen free extract in feed samples. Estimation of calcium and phosphorus. Demonstration of detergent methods of forage analysis. Qualitative detection of undesirable constituents and common adulterants of feed.

UNIT-2 (APPLIED RUMINANT NUTRITION-I)

Calculation of nutritive value of different feed stuffs in terms of digestible crude protein (DCP), total digestible nutrient (TDN), Nutritive ratio (NR) and balance of nutrients.

UNIT-3 (APPLIED RUMINANT NUTRITION-II)

Calculation of requirements of nutrients in terms of DCP, TDN and metabolisable energy (ME) for maintenance, growth, and other types of production like meat, milk, wool, reproduction and draft purpose. Formulation of rations for different categories of livestock under different conditions. Formulation of rations for feeding of livestock during scarcity periods. Visit to Animal Farm and Feed Mill.

UNIT-4 (APPLIED NON-RUMINANT NUTRITION)

Calculation of requirements of nutrients for growth, reproduction and other types of production like egg and meat. Formulation of rations for poultry and swine with conventional and unconventional feed ingredients. Principles of compounding and mixing of feeds. Visit to farms. Formulation of balance diets for horses, dogs and cats. Feeds and feeding schedule of zoo animals and birds-diet charts.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1 and 2	100	20
Paper-II	3 and 4	100	20
PRACTICAL			
Paper-I	1and 2	60	20
Paper - II	3 and 4	60	20

(viii) **DEPARTMENT OF VETERINARY PHARMACOLOGY AND TOXICOLOGY**

VETERINARY PHARMACOLOGY **Credit Hours: 4+1**

THEORY

UNIT-1 (GENERAL PHARMACOLOGY)

Introduction, historical development, branches and scope of Pharmacology. Sources and nature of drugs. Pharmacological terms and definitions, nomenclature of drugs. Principles of drug activity: Pharmacokinetics - Routes of drug administration, absorption, distribution, biotransformation and excretion of drugs. Pharmacodynamics - Concept of drug and receptor, dose-response relationship, terms related to drug activity and factors modifying the drug effect and dosage. Adverse drug reactions, drug interactions.

UNIT-2 (DRUGS ACTING ON AUTONOMIC NERVOUS SYSTEM)

Neurohumoral transmission, Pharmacology of neurotransmitters. Adrenoceptors agonists and antagonists, adrenergic neuron blockers, cholinoceptor agonists and antagonists.

Autacoids: Histamine, histamine analogues and antihistaminic agents, 5-Hydroxytryptamine and its agonists and antagonists, eicosanoids, platelet activating factors, angiotensin, bradykinin and kallidin.

UNIT-3 (DRUGS ACTING ON CENTRAL NERVOUS SYSTEM)

Classification of drugs acting on CNS. History, mechanism and stages of general anaesthesia.

Inhalant, intravenous and dissociative anaesthetics. Hypnotics and sedatives; psychotropic drugs, anticonvulsants, opioid analgesics, non-steroidal anti-inflammatory drugs, analeptics and other CNS stimulants. Drugs acting on somatic nervous system: Local anaesthetics, muscle relaxants. Euthanizing agents.

UNIT-4 (DRUGS ACTING ON DIFFERENT BODY SYSTEMS)

Drugs acting on digestive system: Stomachics, antacids and antiulcers, prokinetics, carminatives, antizymotics, emetics, antiemetics, purgatives, antidiarrhoeals, choleretics and cholagogues. Rumen pharmacology.

Drugs acting on cardiovascular system: Cardiotonics and cardiac stimulants, antiarrhythmic drugs, vasodilators and antihypertensive agents, haematopoietic drugs, coagulants and anticoagulants.

Drugs acting on respiratory system: Expectorants and antitussives, respiratory stimulants, bronchodilators and mucolytics.

Drugs acting on urogenital system: Diuretics, drugs affecting urinary pH and tubular transport of drugs, ecbolics and tocolytics.

Pharmacological basis of fluid therapy. Pharmacotherapeutics of hormones. Drugs acting on skin and mucous membranes: Emollients, demulcents and counter irritants.

UNIT-5 (VETERINARY CHEMOTHERAPY)

Introduction and historical developments of chemotherapy. Antimicrobial agents: Classification, general principles in antimicrobial chemotherapy, antimicrobial resistance, combined antimicrobial therapy. Sulphonamides and their combination with diaminopyrimidines. Penicillins, cephalopsorins, cephamycins and other beta lactams, beta lactamase inhibitors. Aminoglycosides and aminocyclitols, tetracyclines, amphenicols (chloramphenicol, thiamphenicol, florfenicol), macrolides, quinolones and fluoroquinolones, polypeptides (polymixins, bacitracin) and glycopeptide antibiotics, Miscellaneous agents: Lincosamides, novobiocin, virginiamycin, tiamulin, nitrofurans and methenamine, Antitubercular drugs. Antifungal agents: Topical and systemic agents including anti-fungal antibiotics. Antiviral and anticancer agents. Anthelmintics: Drugs used against nematodes, cestodes, trematodes. Antiprotozoal agents: Drugs used in trypanosomosis, theileriosis, babesiosis, coccidiosis, amoebiosis, giardiosis and trichomoniasis. Ectoparasiticides. Antiseptics and disinfectants. Pharmacology of drugs of abuse in animals.

Pharmacology of indigenous medicinal plants: Scientific name, common name, active principles, pharmacological actions and therapeutic uses of Ginger, ocimum, neem, piper longum, withania, leptadenia, tinospora, embilica, eucalyptus, glycerrhiza, trichospermum, curcuma, adhantoda, butea, aloes, sena, rheubarb, catechu etc.

UNIT-6 (VETERINARY TOXICOLOGY)

General Toxicology: Definitions, history of toxicology, fundamentals and scope of toxicology. Sources and classification of toxicants, factors modifying toxicity, general approaches to diagnosis and treatment of poisoning.

Toxicity caused by metals and non-metals: Arsenic, lead, mercury, copper, molybdenum, selenium, phosphorus, fluoride, nitratesor nitrites, chlorate, common salt and urea.

Poisonous plants: Cyanogenetic plants, abrus, ipomoea, datura, nux vomica, castor, oxalate producing plants, plants causing thiamine deficiency, plants causing photosensitization and lathyrism, oleander, and cotton.

Toxicity caused by Agrochemicals: Insecticides - Chlorinated hydrocarbons, organophosphates, carbamates, pyrethroids, newer insecticides. Herbicides, fungicides and rodenticides.

Fungal and bacterial toxins: Aflatoxins, rubratoxin, ochratoxin, sporidesmin, citrinin, F-2 toxin, trichothecenes, ergot, fescue, botulinum toxin and tetanus toxin.

Venomous bites and stings: Snake, scorpion, spider, bees and wasp, toad and fishes (puffer fish, shellfish). Toxicity caused by food additives and preservatives. Drug and pesticide residue toxicology. Environmental pollutants: Air and water pollutants. Concept of radiation hazards.

PRACTICAL

UNIT-1 (GENERAL PHARMACOLOGY)

Handling and washing of laboratory wares. Handling and operation of commonly used laboratory instruments. Concept of good laboratory practices (GLP). Pharmacy appliances. Principles of compounding and dispensing. Metrology, systems of weights and measures, pharmacy calculations. Pharmaceutical processes. Pharmaceutical dosage forms. Prescription writing, incompatibilities. Drug standards and regulations, custody of poisons. Compounding and dispensing of powders, ointments, mixtures, liniments, lotions, liquors, tinctures, emulsions, and electuaries.

UNIT-2 (ANS PHARMACOLOGY)

Demonstration of the action of autonomic agonists and antagonists on intact or isolated preparations of the laboratory animals. Simulated animal experiments should be preferred over use of live animals. The lab for simulated experiments should be established within a span of one year.

UNIT-3 (CNS PHARMACOLOGY)

Handling of lab animals. Regulatory guidelines for use of lab animals. Demonstration of the effect of CNS active drugs and local anaesthetics in laboratory animals. The lab for simulated experiments should be established within a span of one year.

UNIT-4 (VETERINARY CHEMOTHERAPY)

Demonstration of various chemotherapeutic agents and their dosage forms. Demonstration of antibiotic sensitivity test and its interpretation.

UNIT-5 (VETERINARY TOXICOLOGY)

Collection, preservation and dispatch of material for toxicological analysis. General principles for toxicological analysis. Detection of heavy metalsor non-metalsor plant poisons. Demonstration of agrochemical toxicity and its antidotal therapy via simulation methods. Demonstration of toxic weeds and plants of local area. Methods of calculation of median lethal dose (LD_{50})or maximum tolerated dose (MTD).

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2, 3 and 4	100	20
Paper-II	5 and 6	100	20
PRACTICAL			
Paper-I	1 and 2	60	20
Paper - II	3, 4 and 5	60	20

(ix) **DEPARTMENT OF VETERINARY PUBLIC HEALTH AND EPIDEMIOLOGY**

DEPARTMENT OF VETERINARY PUBLIC HEALTH AND EPIDEMIOLOGY

Credit Hours: 3+1=4

THEORY

UNIT-1 (VETERINARY PUBLIC HEALTH AND FOOD SAFETY)

Aims and scope of Veterinary Public Health. Role of veterinarians in public health. One Health concept and initiatives. Veterinary Public Health administration. Sources of contamination. Principles and concepts of food hygiene and safety. Milk hygiene in relation to public health. Hygienic and safe milk production practices including steps for prevention and control of milk contamination, adulterants, antimicrobial residues, agrochemicals, subclinical mastitisorudder infections

etc.. Microbial flora of milk and milk products. Milk plant and dairy equipment hygiene. Quality control of milk and milk products. Milk hygiene practices in India and other countries.

Elements of meat inspection and meat hygiene practices. Pathological conditions associated with the transport of food animals. Hygiene in abattoirs and meat plants. Detection of conditionsor diseases and judgements during ante mortem and post mortem inspection. Examination of lymph nodes. Meat as a source of disease transmission. Sources of contamination of meat and methods of carcass decontamination. Speciation of meat. Animal welfare and public health issues. Classification of low risk and high risk material generated in an abattoir and its hygienic disposal. Inspection of poultry for human consumption. Occupational health hazards in abattoir and meat plants.

Foodborne infections and intoxications associated with foods of animal origin. Toxic residues (pesticides, antibiotics, metals and hormones) in foods and associated health hazards. Types of biohazards. Hazard analysis and critical control points (HACCP) system. Importance of ISO 9000 and 14000 series in meat industry. Risk analysis, assessment and management. International food safety standards: World Organisation for Animal Health (OIE), World Trade Organization (WTO) agreements and Codex Alimentarius Commission. Sanitary and phytosanitary measures in relation to foods of animal origin. Food Safety and Standards Act and Regulations. Role of Food Safety and Standards Authority of India (FSSAI), Bureau of Indian Standards (BIS) and other national agencies.

UNIT-2 (VETERINARY EPIDEMIOLOGY)

Definitions, components and aims of epidemiology. Factors influencing occurrence of livestock diseases and animal production. Determinants of disease. Transmission and maintenance of infections. Ecology of disease. Measures and patterns of disease occurrence. Survey and surveillance of animal diseases and related parameters. Epidemiological methods- Descriptive, analytical, experimental, theoretical, serological and molecular. Animal disease forecasting. Strategies of disease management: prevention, control and biosecurity. Economics of animal diseases. National and international regulations on livestock diseases. Role of OIE and laws on international trade of animals and animal products.

UNIT-3 (ZOONOTIC DISEASES)

Definition, history and socio-economic impact of zoonotic diseases. Classification of zoonoses and approaches to their management. Multisectoral approach for zoonoses prevention and control. Emerging, re-emerging and occupational zoonoses. Role of domestic, wild, pet and laboratory animals and birds in transmission of zoonoses. Zoonotic pathogens as agents of bioterrorism. Epidemiology, clinical manifestations and management of the following zoonoses: Rabies, Japanese encephalitis, influenza, Kyasanur forest disease, Crimean Congo haemorrhagic fever, Nipah encephalitis, Ebola virus infection, anthrax, brucellosis, tuberculosis, leptospirosis, listeriosis, plague, glanders, Q fever, rickettsiosis, chlamydiosis, taeniasis, cysticercosis, hydatidosis, larva migrans, diphyllobothriasis, trichinellosis, toxoplasmosis, fasciolosis, paragonimiasis, sarcocystosis, cryptosporidiosis, amoebiasis, giardiasis, leishmaniasis, superficial and systemic mycosis and prion diseases. Foodborne bacterial zoonoses: salmonellosis, *E. coli* infection, staphylococcal gastroenteritis, clostridial food poisoning, campylobacteriosis etc.

UNIT-4 (ENVIRONMENTAL HYGIENE)

Scope and importance. Ecosystem: Components structure and functions. Biodiversity: uses, threats and conservation. Natural resources: types, uses and abuses. Environmental contaminants in food chain-bioaccumulation, biomagnification and persistent organic pollutants. Environmental pollution: Sources, nature of pollutants, effects on animal and human health. Rural and urban pollution. Air pollution, sources and hazard. Air pollution in animal houses, effect on health and productivity. Airborne diseases – Classification, health hazard, prevention and control. Water-Sources, contamination & their prevention. Water qualities- Physical, chemical, bacteriological and radiological. Water purification methods for community water supplies. Waterborne diseases – Classification, health hazard, prevention and control. Soil, marine and thermal pollution- Classification, sources, hazard, prevention and control. Noise pollution – Sources, hazards, prevention and control. Nuclear hazardsor radiological hazard-Types, hazards and radiation protection. National rules and legislations related to environmental pollution and role of pollution control board in India. Biosafety: Importance, classification and biosafety measures for prevention of risk hazards. Disaster management and mitigation. Solid and liquid waste management at farms and biomedical waste management. Sanitation and disinfection of farm and hospital environment in veterinary public practice for infection control. Global warming and greenhouse effect- Definition, greenhouse gases, impact of climate change and international treatiesorprotocols. Management of waste from animal industries. Stray and fallen animal management and carcass disposal. Vector and reservoir control.

PRACTICAL

UNIT-1 (VETERINARY PUBLIC HEALTH AND FOOD SAFETY)

Collection of samples for chemical and bacteriological examination. Grading of milk by dye reduction test, direct microscopic examination and standard plate count. Quality assurance tests for processed milk and milk products. Tests for plant sanitation-Air, water and equipment. Microbiological examination of raw milk, pasteurized milk, milk products, meat, meat products and eggs-standard plate count, coliform count, enterococcal count, psychrophilic and psychrotophic

organisms, thermophilic bacteria and yeast and mold count. Detection of organisms of public health significance from food products by techniques. Tests for detection of mastitic milk. Ante-mortem and post-mortem inspection of food animals. Demonstrationordetection of toxic chemicals and contaminants of public significance from milk and meat. Detection of antimicrobial residues in milk and meat by microbiological and analytical techniques. Demonstration of speciation of meat.

UNIT-2 (VETERINARY EPIDEMIOLOGY)

Sampling methods for epidemiological studies. Measurement of disease frequencies. Sources, storage, retrieval and representation of disease informationordata. Demonstration of selected software programmesor models. Evaluation of sensitivity and specificity of diagnostic tests by epidemiological methods. Determination of associations of disease and hypothesized causal factors. Survey of an animal disease on a farm. Epidemiological investigation of disease outbreaks.

UNIT-3 (ZOONOTIC DISEASES)

Detection, isolation and identification of important pathogens of zoonotic importance from animal, human and environmental sources including foods of animal origin. Detection of zoonotic diseases by serological, molecular and hypersensitivity tests. Study of probable association of human diasease conditions with animal diseases present in an area. Study of rural environment and health status of rural community.

UNIT-4 (ENVIRONMENTAL HYGIENE)

Sampling methods for testing quality of air, water, soil and other environmental sources. Physical, chemical and microbiological examination of water. Estimation of residual chlorine and chlorine demand. Isolation & identification of pathogens from air, water and other environmental sources. Disinfection of animal houses. Determination of efficacy of disinfectants – Phenol coefficient, MIC and MBC. Demonstrationorvisit to water purification system. Demonstration of various ventilation systems in animal houses and specialized laboratories. Demonstration of toxic residues in water and other environmental sources. Visit to local polluted site and documentation of local environmental problems – like dumping grounds, local slum areas, crowded localities etc.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1 and 2	100	20
Paper-II	3 and 4	100	20
PRACTICAL			
Paper-I	1 and 2	60	20
Paper - II	3 and 4	60	20

(x) **DEPARTMENT OF VETERINARY PARASITOLOGY**

VETERINARY PARASITOLOGY **Credit Hours: 3+2**

THEORY

UNIT- 1 (GENERAL VETERINARY PARASITOLOGY)

Parasitology: Introduction, Important historical landmarks, importance of parasitology in veterinary curriculum. Types of parasites (ecto, endo, hyper, obligatory, facultative, stenoxenous, euryxenous, monoxenous, heteroxenous, histozoic, coelozoic, temporary, permanent, pseudo, aberrant, incidental, opportunistic, zoonotic, protelean etc.). Types of hosts (definitive, intermediate, reservoir, paratenic, natural, unnatural, etc.) and vectors. Types of animal associations (symbiosis, phoresy, commensalism, parasitism, mutualism and predatorism). Modes of transmission of parasites and methods of dissemination of the infective stages of the parasites. International Code of Zoological Nomenclature: Rules and regulations, Standard Nomenclature of Animal Parasitic Diseases (SNOAPAD). Immunity against parasitic infectionsorinfestations, natural and acquired immunity, premunity, sterile immunity, autoimmunity, passive immunity, concomitant immunity and immune evasion by parasites. General harmful effects of parasites including various tissue reactions caused by parasites. General control measures against parasites. Characters of various phyla of parasites.

UNIT-2 (TREMATODES AND CESTODES OF VETERINARY IMPORTANCE)

Trematodes: Introduction, general account and classification, general life cycle of trematodes with morphological features of their developmental stages. Important morphological features, life cycles, modes of transmission,

pathogenesis, epidemiology, diagnosis and general control measures (including chemo- and immuno-prophylaxis) of the following trematode parasites: Liver flukes (*Fasciola, Dicrocoelium* and *Opisthorchis*), intestinal flukes (*Fasciolopsis*). Blood flukes causing nasal schistosomosis (*Schistosoma nasalis*), visceral schistosomosis (*S. spindale, S. indicum, S. incognitum*) and cercarial dermatitis. Paramphistomes (*Paramphistomum, Cotylophoron, Calicophoron, Gigantocotyle, Gastrothylax, Fischoederius,Carmyerius, Gastrodiscus, Gastrodiscoides* and *Pseudodiscus*). *Paragonimus, Prosthogonimus* and Echinostomes.

Cestodes: Introduction, general account and classification, general life cycle of cestodes with morphological features of their developmental stages (Metacestodes). Important morphological features, life cycles, modes of transmission, pathogenesis, epidemiology, diagnosis and management of the following cestode parasites: Equine tape worms (*Anoplocephala, Paranoplocephala*) and ruminant tape worms (*Moniezia, Avitellina, Stile*sia,*Thysaniezia*). Dog tape worms (*Dipylidium, Taenia, Echinococcus*). Poultry tape worms (*Davainea, Cotugnia, Raillietina, Amoebotaenia, Choanotaenia* and *Hymenolepis.* Broad fish tapeworm (*Diphyllobothrium)* and *Spirometra.*

UNIT-3 (NEMATODES OF VETERINARY IMPORTANCE)

Nematodes: Introduction, general account and classification, general life cycle of nematodes with morphological features of their developmental stages. Important morphological features, life cycles, modes of transmission, pathogenesis, epidemiology, diagnosis and management of the following nematode parasites: *Ascaris, Parascaris, Toxocara, Toxascaris, Ascaridia, Heterakis* and *Oxyuris. Strongyloides, Strongylus, Chabertia, Syngamus* and *Oesophagostomum*. Kidney worms (*Stephanurus* and *Dioctophyma*), hook worms (*Ancylostoma* and *Bunostomum*). *Trichostrongylus, Ostertagia, Cooperia, Nematodirus, Haemonchus* and *Mecistocirrus*. *Habronema, Draschia, Thelazia, Spirocerca, Gongylonema, Physaloptera* and *Gnathostoma*. *Dirofilaria, Parafilaria, Onchocerca, Setaria* and *Stephanofilaria*. Lung worms (*Dictyocaulus, Muellerius, Protostrongylus* and *Metastrongylus*). Guinea worm (*Dracunculus*), *Trichinella, Trichuris, Capillaria.* Acanthocephala (*Macracanthorhynchus*). Study of anthelmintic resistance and its types.

UNIT-4 (ARTHROPODS OF VETERINARY IMPORTANCE)

Arthropods: Introduction, general account and classification, general life cycle of arthropods with morphological features of their developmental stages. Important morphological features, general bionomics, life cycle, vector potentiality, pathogenesis and control of following arthropods affecting animals and birds: Bugs (*Cimex).* Biting midges (*Culicoides*), black flies (*Simulium*), sandflies (*Phlebotomus*), mosquitoes (*Culex, Anopheles* and *Aedes*). Horse flies (*Tabanus*), *Haematopota* and *Chrysops*. *Musca, Stomoxy*s, *Haematobia* and *Sarcophaga*. Warbles (*Hypoderma*), stomach bots (*Gasterophilus,Cobboldia*), nasal bots (*Oestrus ovis,Cephalopina*), Bottle flies (*Calliphora, Lucilia, Chrysomya*), myiasis. *Hippobosca, Melophagus, Pseudolynchia.* Lice (*Haematopinus, Linognathus, Trichodectes, Damalinia, Menopon, Lipeurus, Menacanthus* and *Heterodoxus*). Fleas (*Ctenocephalides, Echidnophaga, Xenopsylla, Pulex*). Arachnids : General account, soft ticks (*Argas, Ornithodoros* and *Otobius*). Hard ticks (*Hyalomma, Haemaphysalis, Rhipicephalus (Boophilus), Dermacentor, Ixodes* and *Amblyomma*). Mites (*Dermanyssus, Ornithonyssus, Demodex, Notoedres, Sarcoptes, Psoroptes, Chorioptes, Cnemidocoptes* and *Otodectes*). Pentasomida (*Linguatula*). Study of insecticideoracaricide resistance.

UNIT-5 (PROTOZOA OF VETERINARY IMPORTANCE)

Introduction, general account and classification, general life cycle of protozoa with morphological features of their developmental stages. Differentiation from bacteria and rickettsia. Important morphological features, life cycles, modes of transmission, pathogenesis, epidemiology, diagnosis and general control measures (including chemo- and immuno-prophylaxis) of the following protozoan parasites of veterinary and zoonotic importance : *Leishmania* (Visceral and cutaneous leishmanosis), *Trypanosoma* (*T. evansi, T. theileri, T. equiperdum*). *Trichomonas* (Bovine and avian trichomonosis). *Histomonas* (Black head in turkeys). *Entamoeba, Giardia* and *Balantidium* spp, Coccidia and coccidiosis of poultry and domestic animals. Cyst forming coccidia (*Toxoplasma, Sarcocystis* and *Neospora caninum*) and *Cryptosporidium.* Malarial parasites of animals and poultry (*Plasmodium, Haemoproteus* and *Leucocytozoon*). Piroplasms (*Babesia, Theileria)* and *Hepatozoon*. *Anaplasma* and *Ehrlichia* Resistance to antiprotozoals.

PRACTICAL

UNIT- 1 (GENERAL VETERINARY PARASITOLOGY)

Demonstration of the types of final and intermediate hosts. Demonstration of different organsortissues of the hosts affected with endo-and ectoparasites. Visit to Post Mortem Hall to acquaint with different organs of animals affected with parasites. Demonstration of specific parasitic lesions caused by endo- and ectoparasites. Faecal examination techniques, egg counts, examination of faecal samples for the trematode, cestode, nematode eggs and protozoan cystsoroocystsortrophozoites. Demonstration of faecal culturing techniques. Methods of collection, fixation, preservation, staining and mounting of various types of parasites. Blood smear preparation: Wet, thin and thick smears. Staining of blood smears for demonstration of microfilariae and haemoprotozoan parasites. Collection and examination of skin scrapings for mites. Examination of urine samples and nasal washings for parasitic findings.

UNIT-2 (TREMATODES AND CESTODES OF VETERINARY IMPORTANCE)

Study of morphological characters of adults and developmental stages of the following trematodes and cestodes: *Fasciola, Fasciolopsis, Dicrocoelium, Opisthorchis, Schistosoma, Paragonimus, Prosthogonimus,* Echinostomes, Paramphistomes (*Paramphistomum, Cotylophoron, Gigantocotyle, Gastrothylax, Fischoederius, Gastrodiscus, Gastrodiscoides* and *Pseudodiscus*). *Anoplocephala, Paranoplocephala, Moniezia, Avitellina, Stilesia, Davainea, Cotugnia, Raillietina, Amoebotaenia, Choanotaenia, Hymenolepis, Dipylidium, Taenia, Echinococcus, Diphyllobothrium* and *Spirometra.* Demonstration of gross and microscopic lesions of parasites.

UNIT-3 (NEMATODES OF VETERINARY IMPORTANCE)

Study of morphological characters of adults and developmental stages of the following nematodes : *Ascaris, Parascaris, Toxocara, Toxascaris, Ascaridia, Heterakis, Oxyuris, Strongyloides, Strongylus, Chabertia, Syngamus* and *Oesophagostomum. Stephanurus, Dioctophyma, Ancylostoma, Bunostomum, Ostertagia, Trichostrongylus, Cooperia, Nematodirus, Haemonchus* and *Mecistocirrus. Habronema, Draschia, Thelazia, Spirocerca, Gongylonema, Physaloptera, Gnathostoma, Dirofilaria, Parafilaria, Onchocerca, Setaria, Stephanofilaria, Dictyocaulus, Muellerius, Protostrongylus, Metastrongylus, Dracunculus, Trichinella, Trichuris, Capillaria* and *Macracanthorhynchus.* Demonstration of gross and microscopic lesions of parasites.

UNIT-4 (ARTHROPODS OF VETERINARY IMPORTANCE)

Study of morphological characters of adults and life cycle stages of the following arthropods : *Culicoides, Simulium, Phlebotomus, Cimex, Culex, Anopheles, Aedes, Tabanus, Haematopota* and *Chrysops Musca, Stomoxys, Haematobia, Gasterophilus, Hypoderma, Oestrus ovis,* bottle flies, *Sarchophaga, Hippobosca, Melophagus* and *Pseudolynchia. Trichodectes, Menopon, Menacanthus, Lipeurus, Haematopinus, Linognathus* and *Damalinia Xenopsylla, Ctenocephalides* and *Echidnophaga.Argas, Ornithodoros, Otobius, Ixodes* , *Hyalomma, Rhipicephalus (Boophilus*), *Haemaphysalis, Dermacentor* and *Amblyomma. Dermanyssus, Ornithonyssus, Demodex, Notoedres, Sarcoptes, Psoroptes, Chorioptes, Cnemidocoptes, Otodectes* and *Pentastomida.* Demonstration of gross and microscopic lesions of parasites.

UNIT-5 (PROTOZOA OF VETERINARY IMPORTANCE)

Study of morphological characters of different stages of following protozoan parasites: *Leishmania, Trypanosoma, Trichomonas, Histomonas, Entamoeba, Balantidium, Giardia, Eimeria, Isospora, Sarcocystis* , *Toxoplasma* and *Cryptosporidium. Plasmodium, Haemoproteus* and *Leucocytozoon. Babesia, Theileria* and *Hepatozoon,* Rickettsial organism *Anaplasma* and *Ehrlichia*. Demonstration of formol ether and Ziehl-Neelson's staining techniques and other faecal examination techniques. Diagnosis of intestinal protozoan infections by iodine and eosin stain methods. Demonstration of gross and microscopic lesions due to protozoan parasites. Demonstration of *Haemoproteus columbae* in the blood. Demonstration of sporulation for diagnosis of coccidian parasites.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2 and 3	100	20
Paper-II	4 and 5	100	20
PRACTICAL			
Paper-I	1, 2 and 3	60	20
Paper - II	4 and 5	60	20

(xi) **DEPARTMENT OF LIVESTOCK PRODUCTS TECHNOLOGY**

LIVESTOCK PRODUCTS TECHNOLOGY **Credit Hours: 2+1=3**

THEORY

UNIT-1 (MILK AND MILK PRODUCTS TECHNOLOGY)

Retrospect and prospects of milk industry in India. Layout of milk processing plant and its management. Composition and nutritive value of milk and factors affecting composition of milk. Physico-chemical properties of milk. Microbiological deterioration of milk and milk products. Collection, chilling, standardization, pasteurization, UHT treatment, homogenization, bactofugation. Dried, dehydrated and fermented milk. Introduction to functional milk

products. Preparation of cream, butter, paneer or channa, ghee, khoa, lassi, dahi, ice-cream, mozzarella cheese and dairy byproducts. Common defects of milk products and their remedial measures. Packaging, transportation, storage and distribution of milk and milk products. Good manufacturing practices and implementation of HACCP in milk plant. Organic milk products. Food safety standards for milk and milk products. Cleaning and sanitation in milk plant. Dairy effluent management

UNIT-2 (WOOL SCIENCE)

Introduction to wool, fur, pelt and specialty fibers with respect to processing industry. Glossary of terms of wool processing. Basic structure and development of wool follicle. Post shearing operations of wool, classification and grading of wool, physical and chemical properties of wool. Impurity of wool, factors influencing the quality of wool. Brief outline of processing of wool.

UNIT-3 (ABATTOIR PRACTICES AND ANIMAL BYPRODUCTS TECHNOLOGY)

Layout and management of rural, urban and modern abattoirs. HACCP concepts in abattoir management. FSSA standards on organization and layout of abattoirs. Animal welfare and pre-slaughter care, handling and transport of meat animals including poultry. Procedures of Ante-mortem and post mortem examination of meat animals. Slaughtering and dressing of meat animals and birds. Emergency and casualty slaughter. Evaluation, grading and fabrication of dressed carcasses including poultry. Abattoir byproducts; rendering, meat, bone, glue, gelatin, fat and byproducts of pharmaceutical value. Skin and hides; methods of flaying, defects, preservation and tanning. Treatment of condemned meat and carcasses. Management of effluent emanating from abattoir.

UNIT-4 (MEAT SCIENCE)

Prospect of meat industry in India. Structure and composition of muscle (including poultry muscle). Conversion of muscle to meat. Nutritive value of meat. Fraudulent substitution of meat. Preservation of meat and poultry; drying, salting, curing, smoking, chilling, freezing, canning, irradiation and chemicals. Ageing of meat. Modern processing technologies of meat and meat products. Packaging of meat and meat products. Formulation and development of meat; kabab, sausages, meat balls or patties, tandoori chicken, soup, pickles. Fermentation of meat products. Physico-chemical and microbiological quality of meat and their products. Basics of sensory evaluation of meat products. Nutritive value, preservation, packaging of egg and egg products. Laws governing nationalorinternational trade in meat and meat products. Organic and genetically modified meat and poultry products.

PRACTICAL

UNIT-1 (MILK AND MILK PRODUCTS TECHNOLOGY)

Sampling of milk. Eestimation of fat, solid not fat (SNF) and total solids. Platform tests. Cream separation. Detection of adulteration of milk. Determination of efficiency of pasteurization. Preparation of milk products like ghee, paneer or channa, khoa, ice-cream or kulfi, milk beverages. Visit to modern milk processing and milk products manufacturing plants.

UNIT-2 (WOOL SCIENCE)

Wool sampling techniques. Tests for identification of wool; determination of fleece density, fiber diameter, staple length, crimp and medulation percentage. Scouringorclean fleece yield.

UNIT-3 (ABATTOIR PRACTICES AND ANIMAL BYPRODUCTS TECHNOLOGY)

Methods of ritual and humane slaughter, flaying and dressing of food animals including poultry. Carcass evaluation. Determination of meat yield, dressing percentage, meat bone ratio and cut up parts. Preparation of different abattoir byproducts. Visit to slaughterhousesor meat plants.

UNIT-4 (MEAT SCIENCE)

Packaging of meat, poultry and shell eggs and their products. Estimation of deteriorative changes in meat and meat products. Preparation of comminuted and non comminuted meat and poultry products. Evaluation of external and internal egg quality and preservation technique of eggs

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1 and 2	100	20
Paper-II	3 and 4	100	20

PRACTICAL			
Paper-I	1and 2	60	20
Paper - II	3 and 4	60	20

(xii) **DEPARTMENT OF VETERINARY AND ANIMAL HUSBANDRY EXTENSION EDUCATION**

VETERINARY AND ANIMAL HUSBANDRY EXTENSION EDUCATION Credit Hours: 3+1

THEORY

UNIT-1 (LIVESTOCK BASED LIVELIHOODS AND THEIR EVOLUTION)

History of domestication and their social dimensions. Evolution and relationship between agriculture and animal husbandry. Farming and characteristics of farming in India. Classification of farming, types and systems. Peasant farming, cooperative farming, collective farming, contract farming, estate farming, organic farming, capitalistic farming, small-scale farming, large-scale farming, intensive, extensive farming, specialized, diversified, mixed, integrated and dry land farming. Role of animals in the contemporary society.

UNIT-2 (EXTENSION EDUCATION AND DEVELOPMENT)

Early extension efforts in India. Types of education: Formal, non-formal and informal education. Extension education: Concept, levels, objectives and dimensions. Principles, philosophy and functions of extension education. Teaching-learning process and steps in extension teaching. Concept of need and its types. Rural development - Concept, significance and importance of rural development programmes for poverty alleviation. Problems and Issues in development. Panchayati Raj System.

UNIT-3 (RURAL SOCIOLOGY IN VETERINARY EXTENSION)

Concept of sociology and rural sociology in animal husbandry extension. Culture: definition, elements, change, impact on production systems. Basic sociological concepts - society, community and association. Rural society: characteristics and differences among society, community and culture. Characteristics and differences among tribal, rural and urban communities. Social control: concept and means of social control (techniques, folkways, taboos, mores and laws). Social stratification: definition, forms and characteristics (caste system and class system). Social institutions in rural society: Social, economic, political, religious and educational (definition, composition and function). Social change: concept, importance and factors. Social groups: different groups, classification of social groups and their characteristics. Leadership: definition, functions of leader, types of rural leaders, Key communicators and their role in the animal husbandry extension.

UNIT-4 (TRANSFER OF TECHNOLOGY FOR LIVESTOCK DEVELOPMENT)

Technology- Concept, generation process, application, merits and de-merits. Adoption and diffusion of innovations, stages of adoption, adopter categories, innovation decision process, attributes of innovations, diffusion process, factors affecting adoption and diffusion processes. Programme planning- principles, objectives and steps. Evaluation of extension programme, constraints in the adoption of scientific animal husbandry practices. Role of extension agents in diffusion of livestock innovations. Cattle and buffalo improvement programmes: Key Village Scheme, Intensive Cattle Development Project, Gosadan and Gaushala. Dairy development programmes: concept of cooperation, Rochdale principles of cooperation, objectives of cooperative, Amul pattern of dairy cooperative system and Operation Flood. Transfer of technology projects of Indian Council of Agricultural Research (ICAR): Krishi Vigyan Kendra (KVK), Agricultural Technology Information Centre (ATIC), Agricultural Technology Management Agency (ATMA), National Agricultural Innovation Project (NAIP), Rashtriya Krishi Vikas Yojana (RKVY) etc. Different ongoing central and state government animal husbandry development programmes being run related to sheep, goat, poultry, piggery, fodder production etc.

UNIT-5 (COMMUNICATION AND EXTENSION TEACHING METHODS)

Communication and its functions. Basic concepts: communication fidelity, communication gap, time lag in communication, empathy, homophily and heterophily, propaganda, publicity, persuasion and development communication. Types of communication: Intrapersonal, interpersonal, verbal, non- verbal, vertical, horizontal, organizational communication etc. Elements of communication: Communicator, message, channel, treatment of message, audience, and audience response (feedback). Barriers of communication. Individual contact methods: Farm and home visit, farmer's call, personal letter, adaptive or minikit trial, farm clinic etc. Group contact methods: Result demonstration, method demonstration, group meeting, training, field day or farmers' day, study tour etc. Mass contact methods: Farm publications (leaflet, folder, pamphlet, booklet, bulletin, farm magazine, newsletter etc.), mass meeting, campaign, exhibition, newspaper, radio, television, mobile short message service. Selection and use of extension teaching methods.

UNIT-6 (LIVESTOCK ECONOMICS AND MARKETING)

Introduction to Economics and Livestock Economics: definition and scope (production, consumption, exchange and distribution). Basic concepts- wants, goods, wealth, utility, price, value, assets, capital, money, income etc. Important features of land, labour, capital and organization. Theories of demand, supply and cost. Theories of production (law of diminishing return, increasing return, constant return and return to scale). Concept of market: market, market structure and classification of markets. Market price and normal price, price determination under perfect competition in short and long run. Marketing functions: meaning and their classification (packaging, transportation, grading, standardization, storage and warehousing, processing and value addition, buying and selling, market information, financing, risk bearing, minimization of risks (speculation and hedging). Marketing agencies, institutions and channels for livestock and livestock products. Government interventions and role in marketing of livestock and livestock products. External trade in livestock products, recent policies on trade and international trade agreements and their implications in livestock sector.

UNIT-7 (LIVESTOCK ENTREPRENEURSHIP)

Definition of entrepreneur, entrepreneurship, enterprise and manager. Difference between entrepreneur and entrepreneurship, entrepreneur and enterprise, entrepreneur and manager. Theories of entrepreneurship: Sociological theory, economic theory, cultural theory, psychological theory. Types, characteristics and functions of an entrepreneur. Forms of entrepreneurship: (Sole proprietorship, partnership, corporation, cooperative, joint stock company, Private and Public Limited Company). Introduction to financial management: concept, function, analysis of financial statement, sources of capital (banks, venture capitals, etc.). Project appraisal- Introduction, importance, techno-economic feasibility, criteria of project evaluation (discounted and non-discounted), capital budgeting, etc. Business plan for enterprise. Institutions promoting entrepreneurship in India. Entrepreneurship development programmes. Accounting: objectives, common terms. Personnel management-identification of work, job analysis, division of labour etc. Resource management- organization aspect of livestock farms, resources and procurement of inputs and financial resources, break-even- analysis etc.

UNIT-8 (INFORMATION AND COMMUNICATION TECHNOLOGY)

Strengths and limitations of ICTs application in livestock sector and farmers capacity building. Information kiosk, E-learning, CAD, virtual class room, virtual reality, multi-media etc. Cyber extension- problems and prospects in livestock extension. Computer networking: (LAN, MAN, WAN, Internet, tele-conferencing, tele-text, radio-text, video-text, interactive cable distribution system, satellite communication, internet, www, etc.).

UNIT-9 (CONTEMPORARY ISSUES IN LIVESTOCK ENTERPRISES)

Gender and animal husbandry- definition, difference between gender and sex, role of women in animal husbandry, gender sensitization, importance of gender sensitization in animal husbandry, need for gender analysis, gender budgeting and mainstreaming. Salient features of recent livestock census, livestock insurance scheme, national livestock mission. Sustainability- concept of sustainability of livestock production system (social, environmental and economic challenges faced). Introduction to environmental consequences of livestock rearing. Animal welfare: Introduction to animal welfare, ethics and rights. Importance of animal welfare in the contemporary society. Expectations from veterinary professionals.

PRACTICAL

UNIT-1 Tools of data collection: Preparation of instrument for conducting social survey; Visit to nearby village: Conducting social survey for assessment of farming system and constraints; Data analysis and reporting; Organizing demonstration for farmers; identification of key communicators by Socio-metric method; Familiarization with audio-visual aids; Principle and use of projectors; Preparation of Radio Script Preparation of Television script; Preparation and use of poster; Preparation and use of chart; Preparation and use of flash cards; Preparation and use of farm publications for extension work; Planning and organizing an awareness campaign (Health and Production); Planning and organization of animal health camps; Exercise on rapid rural appraisal (RRA).; Exercise on participatory rural appraisal (PRA) technique; Planning and organization of group discussion.

UNIT-2 Rules of debit and credit in livestock business transactions. Journal Entry and Ledger Posting. Writing of Cash Book. Balancing and preparation of final accounts. Exercise on calculation of depreciation. Visit to commercial enterprises of livestock production. Preparation of dairy entrepreneurial project report. Preparation of sheep and goat entrepreneurial project report. Preparation of poultry entrepreneurial project report. Preparation of piggery or rabbit entrepreneurial project report. Techno-economic feasibility report. Exercise on Break-even analysis. Exercise on BCR, IRR and NPW. Case study of successful entrepreneurial project. Visit to livestock market. Visit to livestock fair. Exercise on economics of diseases

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	**1, 2, 3, 4 and 5**	**100**	**20**
Paper-II	**6, 7, 8,and 9**	**100**	**20**
PRACTICAL			
Paper-I	**1**	**60**	**20**
Paper - II	**2**	**60**	**20**

(xiii) **VETERINARY CLINICAL COMPLEX (VCC)**

VETERINARY CLINICAL PRACTICES-I (Third year) Credit Hours: 0+1

Orientation and understanding the working of Veterinary Clinics including hospital set up, administration and work force management. Doctor client interaction, Orientation to local language or dialector local terminology of the diseases. Registration, filling up registration cards, history taking, handling and restraining of animals. Preliminary clinical examination such as recording of temperature, respiration, pulse, motility of digestive sustem etc. Familiarization and practice of first aid procedures. Practice of collection, labeling, packaging and storage of laboratory samples. Preparation and sterilization of surgical packs, instruments, drapes and operation theaters. Familiarisation with antiseptic dressing techniques and bandaging.

VETERINARY CLINICAL PRACTICES-II (Fourth year) Credit Hours: 0+6

The students shall be Imparted the trainings on rotation basis in the following sections of Veterinary Clinical Complex (VCC):

Ambulatory Section:

Each Veterinary college should adopt five villages where in the health, production and treatment part should be taken care of in a holistic manner.

Handling, examination, diagnosis and treatment of sick animals in the field conditions under the supervision of faculty. Ambulatory Clinics shall be operated by small groups of students and faculty of clinical departments through an equipped ambulatory mobile unit.

Diagnostic Laboratory Section:

Veterinary Clinical Diagnostic Laboratory will be an important component of Teaching Veterinary Clinical Complex that will impart training to students for laboratory evaluation and interpretation of clinical samples leading to definitive diagnosis of diseases. This activity will improve competence of students in examining clinical samples (biochemical, toxicological, pathological, parasitological and bacteriological) at the clinical complex, analyzing and correlating with clinical findings and interpreting the results. Collection labeling, transportation, and preservation of body fluid samples, writing results and report. Interpretation of data in relation to specific diseases. Clinical significance and interpretation of serum glucose, lipids, proteins, blood urea nitrogen, creatinine, uric acid, ketone bodies, bilirubin and electrolytes from samples. Clinical significance and interpretation of examination of urine samples. Clinical evaluation of blood (Haemoglobin, packed cell volume, total erythrocytic count, erythrocytic sedimentation rate, total leukocytic count and differential leukocytic count) from clinical samples. Evaluation of acid-base balance and interpretation. Biochemical aspects of digestive disorders, endocrine functions. Liver, kidney and pancreatic function tests. Role of enzymes for detection of tissue or organ affection. Preparation of microscopic slides from tissue collected for diagnosis and its histopathological interpretation. Examination of biopsy and morbid material for laboratory diagnosis. Laboratory evaluation and diagnosis of samples for parasitic diseases (routine faecal examinations- direct smear method, simple sedimentation and floatation methods, quantitative faecal examination, pastural larval counts). Examination of skin scrapings, examination of blood. Orientation to a clinical Microbiology laboratory, collection, transport and processing of specimens from clinical cases for diagnosis of important bacterial, fungal and viral diseases. Isolation of bacteria from clinical samples, identification of bacteria by Grams staining and culturalor biochemical characteristics. Drug sensitivity and rationale for therapy. Diagnosis of diseases by employing tests like Agar Gel precipitation Test, ELISA etc.

Note: The Laboratory shall run in collaboration with the Department of Pathology and Physiology and Biochemistry. Biochemist appointed in this section will be involved in teaching of students regarding principles of

various diagnostic tests, normal and abnormal values in different species, differential diagnosis, correlating with diseases and rationale of arriving at the conclusion.

Medicine Section:

Orientation and understanding the working of Veterinary Clinics including hospital set up, administration and work force management. Understanding the different methods of record keeping, retrieval, processing, analysis and interpretation of data. Involvement in outpatient department (OPD), Indoor patient, Critical care or intensive care unit, sanitation, practice management etc. Doctor client interaction: Orientation to local language or dialect or local terminology of the diseases.

Registration, filling up registration cards, clinical practice comprising of clinical examination of the patient, with emphasis on history taking, examination techniques- palpation, percussion and auscultation. Familiarization and practice of first aid procedures and emergency medicine. Practice of collection, labeling, packaging and evaluation of laboratory samples. Relating generic and trade names of drugs along with their doses, indications and contraindications to prescribed treatment regimens.

Systematic examination of various systems, recording of clinical observations viz. temperature, respiration, pulse, cardiac sounds, cardiac function, pulmonary function, functional motility of digestive system, routes and techniques of administration of medicaments. Tentative and confirmatory diagnosis and treatment of common clinical cases like pharyngitis, laryngitis, stomatitis, indigestion, gastritis, ruminal impaction, tympany, enteritis, traumatic reticulo-peritonitis, traumatic pericarditis, pneumonia, haemoglobinurea, haematuria. milk fever, ketosis, rickets, osteomalacia, common poisoning, and others clinical cases as reported in the section.

Collection of materials like urine, faeces, skin scraping, blood, milk and other body fluids for laboratory tests. Preparation of case records; follow-up records etc. Readiness to treat and handle causalities and other emergencies in the clinics. Learning and practicing passing of stomach and naso-gastric tube. Screening of livestock or poulty through tests, mass diagnostic campaigns. Vaccination and other disease prevention and control programmes in the field.

Learning the use of various advance non invasive diagnostic aids like Ultrasonography, Opthalmoscope etc.

Practice of feeding of sick animals. Acts and regulations pertaining to generation and disposal of biomedical wastes in veterinary institutions. Biomedical waste generation, handling, storage, sorting, coding, transportation and disposal. Hazards of biomedical waste, and impact of biomedical waste on the environment.

Gynecology and Obstetrics Section

Practice of artificial insemination, pregnancy diagnosis, clinical examination and management of cases of anoestrus, silent oestrus, infertility and conception failure. Treatment of cases of metritis, cervicitis , vaginits etc. Handling and management of cases of retention of placentaorfetal membranes, ante and post partum prolapse of vagina. Examination and handling of cases of dystocia, fetotomy, caesarian etc. Castration of male calves, breeding soundness, evaluation of bulls, ovariohysterectomy and collection of cervical and vaginal mucus for cytology. Rectal examination and vaginal examination of genitalia. Familiarization with common drugs and hormones used in reproductive disorders including infertility, epidural and local anaesthesia for gynaecological cases. Filling of clinical case records and their maintenance.

Surgery and Radiology Section

Familiarization and understanding the use of equipments used in surgical sections of the VCC. Restraining and positioning of different species of animals for examinations, diagnosis and surgical treatment. Prescription of common drugs, their doses and uses in clinical surgical practice. Filling of clinical case records and their maintenance. Preparation and sterilization of surgical packs, instruments, drapes and operation theaters. Passing of stomach tube and gastric tube. Catheterization and urine collection.

Techniques of examination of neuromuscular and skeletal functions, Familiarisation with antiseptic dressing techniques, bandaging, abdomino-centesis, thoracocentesis. Topography anatomy of animals. Radiographic positioning, terminology and interpretation.

Treatment and Management of various surgical conditions including inflammation, wounds, abscess, cysts, tumors, hernia, haematoma, hemorrhage, sinus, fistula, necrosis, gangrene, bum, sprain, tendinits etc. Management and treatment of fractures, dislocations and other affections of joints, facial paralysis, Eye worm and other affections of Eye. Irregular teeth and their rasping, tail amputation, knuckling, upward fixation of patella (medical patellar desmotomy) etc.

Familiarisation with the landmarks for the approach to various visceral organs, thoraco-centesis, abdominocentesis. Rumenotomy, laparotomy, palpation and visualisation of viscera, urethrotomy, castration, vasectomy, caudectomy, thoracotomy, cystotomy, cystorraphy and spleenectomy. Examination of horse for soundness, lameness and preparation of certificate for soundness. Tenotomies, suturing of tendon, shortening of tendon.

Pet Animal Section

Registration, filling up registration cards, history taking. Relating generic and trade names of drugs alongwith their doses, indications and contraindications to prescribed treatment regimens. Familiarization and practice of first aid procedures and emergency medicine. Practice of collection, labeling, packaging and evaluation of laboratory samples. Clinical examination techniques- palpation, percussion and auscultation, systematic examination of various systems, recording of clinical observations viz. temperature, respiration, pulse, cardiac sounds, cardiac function, pulmonary function, functional motility of digestive systems. Routes and techniques of administration of medicaments. Diagnosis and treatment of diseases. Collection of materials like urine, faeces, skin scraping, blood, milk and other body fluids for laboratory tests. Preparation of case records; follow-up records etc. Vaccination and other disease prevention and control programmes. Practice of pregnancy diagnosis, examination of cases of anoestrus, silent oestrus and conception failure. Rectal examination of genitalia, vaginal examination. Epidural and local anaesthesia for gynaecological cases. Resteraining and positioning techniques for examination, diagnosis and surgical treatment. Preparation of surgical packs, sterilization procedures for surgical instruments. Passing of stomach tube and gastric tube. Catheterization and urine collection. Familiarization with antiseptic dressing techniques. Topography anatomy of pet animals. Radiographic positioning and terminology.

The practical component will be dealt with internally. The examination for VCP shall be conducted twice a year i.e. first practical exam after completion of 50% syllabus and the second one, when the course is completed but the second exam shall comprise of entire syllabus. Annual professional examination shall be held after the completion of 100% course content in each subject.

The examination should comprise of following components:

(i) Submission of 10 complete cases each of Surgery, Medicine, Gynaecology

(ii) Case presentation

(iii) Review of treatment of 5 cases

(iv) Written Objective Questions (Surgery, Medicine, Gynaecology

(v) and Lab diognosis)

(vi) Viva

(xiv) **LIVESTOCK FARM COMPLEX**

LIVESTOCK FARM PRACTICES (Third year) Cr. Hr. 0+2

Aim of Livestock farm practices is actual involvement of students in all aspects of animal rearing so that they can rear animals on their own. Hands on training of the students on the overall farm practices of livestock management including cleaning, feeding, watering, grooming, milking, routine health care, record keeping, sanitation, housing, fodder production, preparation of mineral mixture, cost economic of fodder production. Care of pregnant animals, management of parturition, care of neonatal and young stock. Management of broiler, layer farm and hatchery.

One full day per week comprising of six contact hours will be kept entirely for LFP where the students should be divided into small batches on rotational basis wherein they should be actually involved in different activities such as milking, feeding etc.

The practical component will be dealt with internally. The examination for LFC shall be conducted twice a year i.e. first practical exam after completion of 50% syllabus and the second one, when the course is completed but the second exam shall comprise of entire syllabus. Annual professional examination shall be held after the completion of 100% course content in each subject.

The examination should comprise of following components:

(i) Day to day activities

(ii) Record Book

(iii) Written Objective Questions

(iv) Viva Any other suitable component as per conditions

(xv) **DEPARTMENT OF VETERINARY SURGERY AND RADIOLOGY**

VETERINARY SURGERY AND RADIOLOGY Credit Hours:2+1

THEORY

UNIT-1(VETERINARY GENERAL SURGERY)

Introduction: Historical perspective, Definitions, classification of surgery, tenets of Halsted. Pre-operative, intra-operative and post-operative considerations: History taking, physical examination, clinico-pathological testing, intra-operative and postoperative care.

Sterilization and disinfection: Definitions, surgical sterilization, various methods of sterilization (Heat, chemical and radiations etc.), disinfections.

Sutures: Definitions, suturing, factors influencing suturing, characteristics of an ideal suture material, types of suture material-absorbable and non-absorbable, surgical knots, various suture patterns-apposition, eversion, inversion and special.

Treatment of acute and chronic inflammation: Use of anti-inflammatory drugs and proteolytic enzymes. Haemostasis (physical and chemical methods, systemic haemostats, surgical diathermy)

Basic surgical affections: Definitions, classification, diagnosis and treatment of abscess, tumour, cyst, hernia, haematoma, necrosis, gangrene, burn and scald, frost bite and surgical affections of muscles, artery and vein, sinus and fistula.

Wounds: Definition, classification, examination and diagnosis, general principles for treatment of aseptic, contaminated and septic wounds, healing and factors affecting wound healing, complications of wounds and their remedies. Surgical infection; their prevention and management: Classification of infection, Introduction to biomaterials and stem cell therapy in wound management

Management of surgical shock. Principles of fluid therapy in surgical patients.

UNIT-2 (VETERINARY ANAESTHESIOLOGY)

Introduction: Development of anaesthesiology, Terminology, classification and indications. General considerations of anaesthesia: Factors affecting anaesthesia and selection of anaesthetic technique, factors modifying uptake, distribution and elimination, patient evaluation, categories of patients according to physical status, selection of anaesthetic agent and patient preparation. Pain and its management in animals Local and regional anaesthesia: Definitions, local anaesthetics, mechanism of action Premedication, properties and use of different preanaesthetics: Uses of premedication, ,

Anticholinergic, sedatives and tranquilizers (Phenothiazine derivatives, Benzodiazepines, Butyrophenones, Narcotic analgesics, Alpha-2 agonists, dosage chart of all the drugs.

General anaesthesia: Definitions, methods of induction of anaesthesia, Intravenous anaesthetics (Total intravenous anaesthesia), monitoring of anaesthesia.

Inhalation anaesthesia: Advantages of inhalant anaesthetics, types of inhalant anaesthetics their properties and effect on various systems, methods of administration of inhalant anaesthesia.

Dissociative anaesthesia: Definition, drugs, clinical application, properties and effect on various body systems.

Avian, wild, zoo, exotics and lab animal anaesthesia and capture myopathy

Anaesthetic emergencies and management, Toxicity, antidote and reversal agents.

UNIT-3 (VETERINARY DIAGNOSTIC IMAGING TECHNIQUES)

Introduction to Radiology-General terminology of radiology, Physical properties of X-Rays, Scope and uses of Radiology, Directional terms for veterinary radiology. Production of X-rays and factors influencing production of X-rays. Radiation hazards and safety measures- Scattered radiation, Biological effects of radiation, Direct and indirect effects, Early and late effects, Radiation sensitivity of different body cells, Radiation protection, General principles of radiation safety, Radiation monitoring devices, Requirement of an ideal radiographic section. The statutory requirements of radiology set-up as per Atomic Energy Regulatory Board of India (AERB). Production of quality diagnostic radiograph. Recording of image- Manual and digital processing of X-ray films, storage and retrieval system. Radiographic Quality and faults- Radiographic detail, density and contrast and factors affecting them, Radiographic faults, their possible causes and prevention. Contrast radiography- Definition, indications, contraindications and types of contrast radiography, Different contrast materials and their use, Techniques of some selected contrast radiography in animals(Barium swallow, Retrograde urography etc) Diagnostic ultrasonography- Principles, indications, techniques and artifacts of ultrasonography. Advanced diagnostic imaging tools- The brief introduction to the use and limits of some advanced imaging techniques, Interventional radiology - CAT scanning, MRI, etc

UNIT-4: (REGIONAL SURGERY-I)

Head and Neck: Affections of lips, cleft palate, tongue, cheek, and their treatment: General anatomical considerations, avulsion of lip, cleft lip ranula, neoplasm and traumatic injuries. Affections of teeth and jaws and their treatment: General anatomical considerations, Developmental abnormalities, dental tartar, periodontal disease, overgrown molars, fractures and luxations of jaw. Affections of nose, face, ear, head and horn and their treatment: General anatomical considerations.

Brachycephalic syndrome, Stenotic nostrils, nasal polyps, empyema of sinuses, fracture and avulsion of horn, horn cancer, aural haematoma, otitis. Affections of eye and their treatment: General anatomical considerations and examination of eye. Affections of eyelids and nictitating membrane and their treatment: entropion, ectropion, chalazion, sty, Cherry eye and traumatic injuries. Affections of lachrymal apparatus, eyeball and orbit and their treatment: occlusion of nasolacrimal duct, traumatic proptosis, panophthalmia, orbital neoplasms, glaucoma, eye worms. Affections of cornea, iris and lens and their treatment: corneal ulcers, corneal opacity, Kerato Conjunctivitis Sicca (KCS), prolapse of iris, corneal dermoid, corneal lacerations and perforations, cataract. Affections of guttural pouch, oesophagus and their treatment: General anatomical considerations. Empyema, tympanitis and Mycosis of guttural pouch, oesophageal diverticulum, megaoesophagus, achalasia and choke. Affections of glands of head and neck and their treatment: General anatomical considerations. Salivary mucocele, sialoliths, salivary fistula Affections of neck and their treatment: General anatomical considerations. Yoke gall, yoke abscess, fistulous withers, poll evil, torticollis. Affections of larynx and Trachea: Tracheal collapse, stenosis, roaring in horses, dorsal entrapment of soft palate in horses and camels, emergency tracheotomy. Management of ocular emergencies. Tracheotomy

UNIT-5: (REGIONAL SURGERY-II)

Thorax and Abdomen: Thoracic affections: Surgical approaches, perforated wounds, pyothorax, pneumothorax, pneumocele, Diaphragmatic hernia and traumatic pericarditis in cattle. Abdominal affections: Surgical approach to the abdomen in different animal species. Common surgical affections of the stomach in dogs and their management: dilation and torsion of stomach, gastric ulcerations, foreign bodies in the stomach, pyloric stenosis. etc Surgical affections of the stomach in large animal and their management: Ruminal impaction, traumatic reticulitis, omasal and abomasal impaction and abomasal displacement. Surgical affections of small intestines and their management: Intestinal obstruction, intussusception and strangulation (volvulus). Techniques of intestinal anastomosis. Surgical affections of large intestine and their management: Caecal dilatation and torsion, rectal prolapse, rectal and perineal tear, recto-vaginal fistula. Surgical affections of anus and perineal region and their management: Atresia-ani, anal stenosis, anal sac impaction. Other surgical affections of abdomen and their management: Perforating wounds and fistulae of abdomen, umbilical hernia, ventral abdominal hernia, inguinal and scrotal hernia, perineal hernia. Urinary system: Urolithiasis and its management. Urolithiasis in small and large animals. Patent urachus, ectopic ureter. Surgical management of equine colic. Genital system: Surgical affections of male genital system and their management, prostatic enlargementor hyperplasiaor neoplasm, Phimosis, paraphimosis, preputial prolapse, penile amputation. Castration, vasectomy, scrotal ablation in large and small animals. Surgical affections of female genital system and their management: Canine transmissible venereal tumour. Ovariohysterectomy and caesarean section. Applications of rigid and flexible endoscopes in the management of surgical disorders. Integumentary system: Surgical affections of udder, teat and canine mammary neoplasms. Surgical affections of tail and tail docking Wildorzoo animal surgery(only awareness)

UNIT-6 (ORTHOPEDICS AND LAMENESS)

Body conformation of the horse in relation to lameness (trunk, fore limb and hind limb).

Lameness: Its definition classification and diagnosis. General methods of therapy for lameness. Body and limb conformation in relation to lameness in equine.

Equine lameness: Shoulder slip (sweeny), bicipital bursitis, omarthritis, capped elbow, radial paralysis, carpitis. bent knee, and knock- knee. Hygroma of knee, open knee, blemished knee. Fracture of carpal bone, fracture of accessory carpal, contraction of digital flexors. Splints, sore shin, wind puffs, sesamoid iris Osstots, ringbone, quittor, side bone, Navicular disease, pyramidal disease. Laminitis, sand crack, seedy toe, fractures of third phalanx, pedal osteitis, and sole penetration. Canker, thrush and corn, Monday morning disease, cording up, myositis of psoas, Mac thrombosis, Crural paralysis, subluxation of sacroiliac joint rupture of round ligament trochantric bursitis. Upward fixation of patella, stringhalt, gonitis, chondromalacia of patella, rupture of tendoachilles, rupture of peroneus tertius, fibrotic myopathy and ossifying myopathy. Thoroughpin, bog spavin, spavin, curb, capped hock.

Canine lameness: Intervertebral disc diseases, elbow and hip dysplasia, rupture of cruciate ligament, elbow hygroma etc.; their management, Onychectomy.

Bovine lameness: Contusion of sole, ulceration of sole, septic laminitis, avulsion of hoof and subluxation of patella, interdigital fibroma, cyst, sand crack, and hoof deformities.

Fracture: Definitions, classification, fracture healing and complications.

Fracture: The preliminary assessment and management of fractures. Techniques of external immobilization of fractures.

Techniques of internal immobilization of fractures. Management of fracture complications

Luxations: Definition, signs, diagnosis. Management of common joint luxations in animals.

Spinal trauma, diagnosis and its management

Rehabilitation and physiotherapy of orthopaedic patients

PRACTICAL

UNIT-1(VETERINARY GENERAL SURGERY)

Introduction to layout of operation theatre and surgical unit. Introduction of common surgical equipment and instruments. Suture materials, surgical knots and suture patterns. General examination of surgical patients. Preparation of surgical patients. Other operation theatre routines like sterilization, preparation of theatre, Surgeon and surgical pack. Bandaging and basic wound management Demonstration (or Audio visual aids) of surgery, control of haemorrhage and suturing

UNIT-2 (VETERINARY ANAESTHESIOLOGY)

Familiarization with anaesthetic apparatus, monitoring equipment and accessories. Methods of local infiltration analgesia (Linear ring block, inverted L block etc.) Regional nerve block demonstration and practice (Auriculopalpebral block, Peterson block or 4 point retrobulbar nerve block, Paravertebral, epidural etc.) Intravenous regional anaesthesia in cattle. Administration of general anaesthesia in small and large animals. (Demonstration and practice). Administration of inhalant anaesthesia (Demonstration). Monitoring of general anaesthesia. Management of anaesthetic emergencies, use of artificial respirator and analeptics. Visit to a wild animal facility or audio-visual aids or both.

UNIT-3 (VETERINARY DIAGNOSTIC IMAGING TECHNIQUES)

Familiarization with the operation of the x-ray unit. Formulation of X-ray exposure technique charts, Adoption of safety measures and film processing. Positioning and radiography of different parts of the body in small and large animals Handling, viewing and interpretation of radiograph. Familiarization with the film contrast, density and details, common radiographic artifacts. Radiographic pathology of the head, neck and thorax of large and small animals. Radiographic pathology of abdomen of large and small animals. Radiographic pathology of the bones and joints of large and small animals. Demonstration of contrast radiographic techniques in animals. Demonstration of ultrasonography in animals. Fluoroscopy or Image intensifier (familiarization).

UNIT-4: (REGIONAL SURGERY-I)

Demonstration or Audio visual aids: Amputation of horn and disbudding. Tooth rasping, dental scaling. Examination of ear (otoscopy). Examination of eye (General examination, Ophthalmoscopy, tonometry, fluorescein dye test, Scherimer tear test, test for blindness). Operation for aural haematoma. Protection and bandage of eyes, tarsorhhaphy, third eyelid flap, flushing of nasolacrimal duct

UNIT-5: (REGIONAL SURGERY-II)

Demonstration or Audio visual aids-Castration in different species in clinical cases and under animal birth control programme in canine. Ovariohysterectomy in dogs and cats. Rumenotomy, Gastrotomy in dogs, Urethrotomy and urethrostomy. Cystotomy and cystorrhaphy. Enterotomy or Enterectomy. Management of teat and udder affections. Amputation of tail in different animals in clinical cases. Circumcision operation for prepucial and rectalprolapse. Thoracocentesis and abdominocentesis.

UNIT-6 (ORTHOPEDICS AND LAMENESS)

Demonstration or Audio visual aids-Familiarization with various orthopaedic instruments and implants. Basic orthopaedic and neurological examination in small and large animals. Nerve blocks in equine. Application of basic physiotherapy techniques in animals. Basic limb stabilization techniques and splinting techniques. Application of cast in small and large animals. Internal fixation techniques in animals. Medial patellar desmotomy in bovines. Examination of animals for soundness and preparation of soundness certificate.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2, 3 and 4	100	20
Paper-II	5 and 6	100	20
PRACTICAL			
Paper-I	1, 2, 3 and 4	60	20
Paper - II	5 and 6	60	20

(xvi) **DEPARTMENT OF VETERINARY MEDICINE**

VETERINARY MEDICINE **Credit Hours: 4+1**

THEORY

UNIT-1 (GENERAL)

History and scope of Veterinary Medicine, concept of animal diseases. Concepts of diagnosis, differential diagnosis, treatment and prognosis. General systemic states, hyperthermia, hypothermia, fever, septicemia, toxemia, shock, allergy, anaphylaxis, oedema, coma, anaemia, common clinical poisonings and dehydration.

Estimates of diseases, patterns of disease, disease monitoring and surveillance, herd health and quarantine.

UNIT-2 (SYSTEMIC DISEASES)

Etiology, clinical manifestations, diagnosis, differential diagnosis, treatment, prevention and control of the following diseases of cattle, buffalo, sheep, goat, horse, pig, dog, cat and poultry: Diseases of digestive, respiratory, cardiovascular, urinary, nervous, musculoskeletal, haemopoietic, and lymphatic systems, skin, sense organs

including affections of peritoneum, liver and pancreas. Emergency medicine and critical care.

UNIT-3 (METABOLIC AND DEFICIENCY DISORDERS)

Diagnosis and management of diseases caused by deficiency of iron, copper, cobalt, zinc, manganese, selenium, calcium, phosphorus, magnesium, iodine, vitamin A, D, E, B complex, K and C. Diseases of neonates, Alternative or integrated or ethno veterinary medicine in animal disease management. Aetiology, clinical manifestations, diagnosis, differential diagnosis, treatment prevention and control of metabolic or production and endocrine diseases of cattle, buffalo, sheep, goat, horse, pig, dog, cat and poultry i.e. Milk fever, eclampsia, osteodystrophy fibrosa, lactation tetany, downer cow syndrome, ketosis, fat cow syndrome, hypomagnesaemia, Nutritional haemoglobinuria, azoturia, diabetes, hypothyroidism, Cushing syndrome, Addison's disease and Gout.

UNIT-4 (ZOO AND WILD ANIMAL MEDICINE)

Principles of zoo hygiene, public health problems arising from zoos. Prevention, control and treatment of infectious, parasitic, nutritional and metabolic diseases in zoo and wild animals including exotic birds. Acts and Rules related to Zoo and wild animals. National and international organizations and institutions interlinked to wild and zoo animals – role and functioning.

UNIT-5 (BACTERIAL, FUNGAL AND RICKETTSIAL DISEASES)

Aetiology, epidemiology, clinical manifestations, diagnosis, treatment, prevention and control of bacterial, fungal and rickettsial diseases of livestock: mastitis, hemorrhagic septicaemia, brucellosis, tuberculosis, Johne's disease, listeriosis, leptospirosis, campylobacteriosis, actinomycosis, actinobacillosis, bordetellosis, glanders, strangles, ulcerative lymphangitis, colibacillosis, fowl typhoid, pullorum disease, fowl cholera, avian mycoplasmosis, spirochaetosis, salmonellosis, swine erysipelas, contagious caprine pleuropneumonia, contagious bovine pleuropneumonia, anthrax, clostridial infections, ehrlichiosis, chlamydosis, Q fever, anaplasmosis, dermatophilosis, aspergillosis, candidiasis, histoplasmosis, sporotrichosis, coccidiodomycosis, mycotoxicosis and rhinosporidiosis.

UNIT-6 (VIRAL AND PARASITIC DISEASES)

Aetiology, epidemiology, clinical manifestations, diagnosis, treatment, prevention and control of viral and parasitic diseases of diseases of cattle, buffalo, sheep, goat, horse, pig, dog, cat and poultry: Foot and mouth disease, rinderpest, bovine viral diarrhoea, malignant catarrhal fever, infectious bovine rhinotracheitis, ephemeral fever, blue tongue, sheep pox, goat pox, PPR, classical swine fever, rabies, equine influenza, equine infectious anemia, equine rhinopneumonitis, canine distemper, infectious canine hepatitis, canine parvoviral disease, corona viral infection, adeno virus infection, feline rhinotracheitis, feline pan leucopenia, feline infectious peritonitis, avian influenza, New Castle disease, Marek's disease, avian leucosis, infectious bronchitis, infectious laryngotracheitis, avian encaphalomyelitis, chicken reo virus, fowl pox, infectious bursal disease, chicken infectious anemia, inclusion body hepatitis-hydropericardium syndrome, emerging and exotic viral diseases of global importance.

Parasitic diseases: Trematodes, cestodes, nematodes, protozoan infections and external parasites of clinical importance.

UNIT-7 (JURISPRUDENCE, ETHICS, AND ANIMAL WELFARE)

Legal duties of veterinarians, laws related to medicine, evidence, common offences against animals and laws related to these offences. Examination of living and dead animals in criminal cases. Cruelty to animals and bestiality. Legal aspects of: Examination of animals for soundness, examination of injuries and post-mortem examination. Causes of sudden death in animals. Collection and despatch of materials for chemical examination, detection of frauds-doping, alternation of description, bishoping etc. Cattle slaughter and evidence procedure in courts. Provincial and Central Acts relating to

animals. Glanders and Farcy Act 1899 (13 of 1899). Dourine Act 1910 (5 of 1910), Laws relating to offences affecting Public Health. Laws relating to poisons and adulteration of drugs. Livestock importation act, liability and insurance. Code of conduct and ethics for veterinarians - the regulations made under the Act.

Animal welfare organizations and its role in animal welfare, welfare assessment, behaviour and animal welfare, principles and philosophy of animal welfare, animal welfare ethics, improving animal welfare through legislation and incentives, assessment of physiological, behavioural, disease and production measures of animal welfare, assessing welfare in practice, environment enrichment, euthanasia, welfare of animals used in education and research and transportation, religion and animal welfare, human and animal welfare conflict, veterinary disaster management, human–animal interactions, economics and animal welfare and veterinarians as animal welfare educators

PRACTICAL

UNIT-1 (GENERAL)

Collection of history and general clinical examination. Collection, preservation, packing and dispatch of samples from clinical cases. Nasogastric and orogastric intubation in animals. Oxygen therapy in veterinary practice. Gastric and peritoneal lavage. Collection and examination of cerebrospinal fluid. Blood transfusion .

UNIT-2 (SYSTEMIC DISEASES)

Special examination of cardiovascular system. Examination of urinary system. Special examination of respiratory system. Special examination of gastrointestinal system. ECG, Echocardiography, Ultrasonography, Endoscopy. Special examination of sense organs. . Examination of eye and ear. Collection and examination of peritoneal fluid. Peritoneal dialysis. Neurological examination in animals. Lymph node biopsy and bone marrow aspirate. Methods of medication. Disease Estimation

UNIT-3 (ZOO AND WILD ANIMAL MEDICINE)

Management and restraint of zoo and exotic animals. Drug delivery in zoo and wild animals. Visit to Zooor Sanctuary. Examination of veterolegal cases.

UNIT-4 (BACTERIAL, FUNGAL AND RICKETTSIAL DISEASES)

PRACTICALS

TB, JD and Mallein testing in animal. Brucellosis testing in animals. Physical and chemical tests for detection of mastitis. Application of molecular and serology techniques on clinical samples for disease diagnosis. Pen-side diagnostic tests for infectious diseases. Practical approaches to disease outbreak investigation and its control.

UNIT-5 (VIRAL AND PARASITIC DISEASES)

Collection and examination of skin scrapings- Parasitic, fungal, bacterial. Examination of blood for parasites. Dark field microscopy. Application of Molecular and serological techniques or clinical samples for diagnosis of viral and parasitic diseases.

ANNUAL EXAMINATION

PAPERS	UNITS	MAXIMUM MARKS	WEIGHTAGE
THEORY			
Paper-I	1, 2, 3 and 4	100	20
Paper-II	5, 6 and 7	100	20
PRACTICAL			
Paper-I	1, 2 and 3	60	20
Paper - II	4 and 5	60	20

(xvii) **DEPARTMENT OF VETERINARY GYNAECOLOGY AND OBSTETRICS**

VETERINARY GYNAECOLOGY AND OBSTETRICS **Credit Hours 2+1**

THEORY

UNIT- 1 (VETERINARY GYNAECOLOGY)

Bovine : Applied clinical anatomy and embryology of female reproductive tract - Hereditary and congenital anomalies of female reproductive tract –Puberty and sexual maturity and their endocrine control- Delayed puberty- Its causes, clinical

approach, treatment and prevention of delayed puberty- Applied reproductive physiology and endocrinology of oestrous cycle- Oestrous cycle and factors affecting the length of the oestrous cycle-Aberrations of oestrus and their clinical management and problems in oestrus detection and oestrus detection aids –Transportation and survivability of gametes in female reproductive tract-Follicular Dynamics and its clinical impact on fertility improvement- ovulation and aberrations of ovulation-Incidence causes, diagnosis treatment and prevention of ovulatory failures- Fertilization and aberrations of fertilization- Fertilization failures - embryonic mortality-incidence, causes, diagnosis, treatment and prevention – Pathological affections of ovary, uterine tubes, uterus, cervix , vagina and external genitalia – Clinical management of specific and non-specific forms of infectious infertility- Role of nutrition, climate and stress on reproductive efficiency - Managemental causes of infertility- Anoestrus and repeat breeding syndrome - Diagnostic procedures in infertility investigation – Clinical uses of hormones and drugs in the management of infertility- Surgical procedures for correction of abnormalities of the female reproductive tract. Herd reproductive health management and fertility parameters in individual animals and in herds.

Assisted reproductive techniques: Synchronization of estrus and ovulation and its principle. methodology and implications- Multiple ovulation and Embryo transfer technology-In vitro fertilization.

Equines: oestrous cycle- Seasonality- breeding management- Aberrations of oestrous cycle and ovulations- Techniques of Pregnancy diagnosis- Clinical management of specific and non-specific forms of infectious infertility- Diagnostic procedures in infertility investigation

Ovines and caprines: oestrous cycle- Seasonality- Control of oestrous cycle and infertility

Swines : oestrous cycle- breeding management- Techniques of Pregnancy diagnosis and infertility

Canines and Felines : oestrous cycle- breeding management- Phantom pregnancy- Medical termination of pregnancy – Aberrations of oestrous cycle- Medical and surgical management of affections of ovary, uterine tubes, uterus, cervix, vagina and external genitalia – Methods of Population control by medical and surgical techniques. Comparative reproductive events in camel

Principle, procedure and application of ultrasonography in farm and pet animal reproduction

UNIT-2 (VETERINARY OBSTETRICS)

Farm and pet animals - Maternal recognition of pregnancy – Applied Endocrinology of pregnancy – Pregnancy diagnosis- Duration of pregnancy -Factors affecting gestation length- Care and management of pregnant animals- Implantation, Placentation- Classification, functions –Wandering of ovum- Telegony- Superfetation and Superfecundation – Clinical management of specific and non specific causes of abortion, extra uterine pregnancy, dropsy of fetal membranes and fetus, mummification, maceration, cervicovaginal prolapse, uterine torsion and hysterocele. Parturition- Signs of approaching parturition - Stages of parturition - Initiation and induction of parturition - lactational disorders - Puerparium and factors affecting puerparium - Postpartum care of the dam and neonate in different species of farm and pet animals - Dystocia – Classification - Clinical signs and diagnosis - Handling of Fetal and maternal dystocia – Obstetrical interventions - Mutation – Forced extraction – Fetotomy – Cesarean section in small and large animals – Maternal obstetrical paralysis - Retention of fetal membranes, Total uterine prolapse and common metabolic diseases of puerperal period – Post partum hemorrhage – Sub involution of placental sites - Injuries incidental to parturition - Post partum uterine infections – Post partum resumption of ovarian activity .

UNIT–3(VETERINARY ANDROLOGY AND A.I.)

Farm and pet animals - Comparative clinical reproductive anatomy and endocrinology of the male reproduction - Common congenital and genetic defects of the male reproductive tract – Puberty and sexual maturity and factors affecting them - Sexual behaviour and libido - Sperm transport, erection and ejaculation - Coital injuries and vices in male animals - Semen and ejaculate – Semen collection techniques- Structure of Spermatozoa - Semen evaluation - Semen extenders, dilution, preservation and post thaw evaluation - Artificial insemination techniques in farm and pet animals - Forms of male infertility - Impotentia coeundi and impotentia generandi – Affections of the scrotum, testis, accessory sex glands, penis and prepuce - Breeding soundness evaluation of bull – *In vitro* tests for evaluation of male fertility - Medical and surgical techniques for population control of the male reproduction – Surgical procedure on the male reproductive tract in farm and pet animals.

PRACTICAL

UNIT- 1 (VETERINARY GYNAECOLOGY)

Study of female genital organs using slaughter house specimens- Oestrus detection aids - Techniques of rectal palpation of female reproductive tract - Gynaecological equipment and instruments -Vaginal exfoliative cytology and vaginoscopy- Ultrasonography of female reproductive tract - Surgical procedures on the vulva, vagina and uterus-Study of pathological specimens of female genital tract- Demonstration and practice of ovario-hysterectomy and panhysterectomy- Diagnostic procedures in investigation of infertility in female animals

UNIT-2 (VETERINARY OBSTETRICS)

Study of pelvis and pelvimetry- Pregnancy diagnosis-Study of foetal membranes of domestic and pet animals -and identification of normal and abnormal foetal membranes-Approaching signs of parturition- Stages of parturition-Approach to an obstetrical case- Obstetrical anaesthesia - obstetrical instrument and equipment - Manipulation of foetal malpresentation in phantom boxes - Maternal causes of dystocia and its management-Fetotomy in cadavers, Demonstration of forceps delivery and Caesarean section in small and large animal clinical cases. Handling of prolapse of genitalia.

UNIT–3 (VETERINARY ANDROLOGY, AI AND ASSISTED REPRODUCTIVE TECHNIQUES)

Study of male genital organs using slaughter house specimens- Techniques of rectal palpation of the male reproductive tract- Andrological and AI equipment -Vasectomy and castration -Surgical procedures on penis, prepuce and scrotum-Planning and organization of AI centre-Preparation of teaser animals -Selection, care, training and maintenance of male animal used for breeding purpose-Techniques of semen collection-Semen evaluation techniques -Sterilization, storage of equipment used for semen collection and Artificial insemination-Preparation of extenders and extension of semen-Preservation of semen-Thawing of semen and technique of AI-Handling and maintenance of LN_2 containers. Diagnostic procedures in investigation of infertility in male animals-Breeding soundness evaluation of bulls- Oestrus synchronization procedures- Multiple Ovulation and Embryo Transfer- *In Vitro* Fertilization

महामाया कृषि अभियंत्रण एवं प्रौद्योगिकी महाविद्यालय, अंबेडकर नगर
(आचार्य नरेंद्र देव कृषि एवं प्रौद्योगिकी विश्वविद्यालय, कुमारगंज, अयोध्या)

बी0 टेक कृषि अभियंत्रण	**Principles of Agronomy(BEAS-212)** 3(2+1)
	Introduction and scope of agronomy. Classification of crops, Effect of different weather parameters on crop growth and development. Principles of tillage, tilth and its characteristics. Crop seasons. Methods, time and depth of sowing of major field crops. Methods and time of application of manures and fertilizers. Organic farming-Sustainable agriculture. Soil water plant relationship, crop coefficients, water requirement of crops and critical stages for irrigation, weeds and their control, crop rotation, cropping systems, Relay cropping and mixed cropping. **Practical** Identification of crops and their varieties, seeds, manures, fertilizers and weeds; Fertilizer application methods; Different weed control methods; Practice of ploughing, Practice of Puddling, Practice of sowing.
	Principles of Horticultural Crops and Plant Protection) 2(1+1) BEAS-211 **Theory** Scope of horticultural. Soil and climatic requirements for fruits, vegetables and floriculture crops, improved varieties, Criteria for site selection, layout and planting methods, nursery raising, commercial varieties/hybrids, sowing and planting times and methods, seed rate and seed treatment for vegetable crops; macro and micro propagation methods, plant growing structures, pruning and training, crop coefficients, water requirements and critical stages, fertilizer application, fertigation, irrigation methods, harvesting, grading and packaging, post harvest practices, Garden tools, management of orchard, Extraction and storage of vegetables seeds. Major pests and diseases and their management in horticulture crops. **Practical** Judging maturity time for harvesting of crop; Study of seed viability and germination test; Identification and description of important fruits, flowers and vegetable crops; Study of different garden tools; Preparation of nursery bed; Practices of pruning and training in some important fruit crops, visit to commercial greenhouse/ polyhouse; cultural operations for vegetable crops (sowing, fertilizer application, mulching, irrigation and weed control); seed extraction techniques; identification of important pests and diseases and their control.
	Principles of Soil Science 3(2+1) BEAS-114/ SS-111 **Theory** Nature and origin of soil; soil forming rocks and minerals, their classification and composition, soil forming processes, classification of soils – soil taxonomy orders; important soil physical properties; and their importance; soil particle distribution; soil inorganic colloids – theircomposition, properties and origin of

	charge; ion exchange in soil and nutrient availability; soil organic matter – its composition and decomposition, effect on soil fertility; soil reaction – acidic, saline and sodic soils; quality or irrigation water; essential plants nutrients – their functions and deficiency symptoms in plants; important inorganic fertilizers and their reactions in soils. Use of saline and sodic water for crop production, Gypsum requirement for reclamation of sodic soils and neutralising RSC; Liquid fertilisers and their solubility and compatibility. **Practical** Identification of rocks and minerals; Examination of soil profile in the field; Collection of Soil Sample;Determination of bulk density; particle density and porosity of soil; Determination of organic carbon of soil; Determination of Nitrogen, Determination of Phosphorus and Determination of Potassium; Identification of nutrient deficiency symptoms of crops in the field; Determination of gypsum requirement of sodic soils; Determination of water quality parameters.
	Engineering Chemistry 3(2+1) **Theory**
	Phase rule and its application to one and two component systems. Fuels: classification. calorific value. Colloids: classification. properties. Corrosion: causes. types and method of prevention. Water: temporary and permanent hardness. disadvantages of hard water, scale and sludge formation in boilers, boiler corrosion. Analytical methods like thermo-gravimetric. polarographic analysis. nuclear radiation. detectors and analytical applications of radioactive materials. Enzymes and their use in the manufacturing of ethanol and acetic acid by fermentation methods. Principles of food chemistry. Introduction to lipids, proteins, carbohydrates, vitamins, food preseltators, colouring and flavouring reagents of food. Lubricants: properties. mechanism. classification and tests. Polymers. types of polymerization. properties. uses and methods for the determination of molecular weight of polymers. Introduction to IR spectroscopy. **Practical** Determination of temporary and permanent hardness of water by EDTA method: Estimation of chloride in water: Estimation of dissolved oxygen in water: Determination of BOD in water sample: Determination of COD in water sample: Estimation of available chlorine in bleaching powder: Determination of viscosity of oil: Estimation of activity of water sample: Estimation of alkalinity of water sample: Determination of carbonate and non- carbonate hardness by soda reagent: Determination of coagulation of water and chloride ion content: Determination of specific rotation of an optically active compound: Determination of Xnax and verification of Beer Lambert Law: Determination of calorific value of fuel: Identification of functional groups (alcohol, aldelyde, ketones, carboxylic acid and amide) by IR: Chromatographic analysis: Determination of molar refraction of organic compounds.
	Workshop Technology 3(1+2) **Theory** Introduction to basic materials: Ferrous and non-ferrous materials and important engineering materials such as timber, abrasive materials, silica, ceramics, glasses,

	graphite, diamond, plastic polymers and composite materials, their properties and applications; Safety measures in workshop; Indian Factory Acts on safety; Measuring and Gauging: Basic measuring instruments and gauges; Heat treatment processes: Introduction to hardening, tempering, annealing, normalizing, etc.;Welding: Introduction, types of welding, types of electrodes, types of flames, types of weldingjoints, edge preparation, welding techniques and equipments; Gas welding and gas cutting, arc welding; Introduction to soldering and brazing and their uses; Estimation of welding and soldering cost; Smithying and forging: Introduction to different tools and their uses; Different forging operations, defects of forging; Brief ideas about power hacksaw, etc.; Carpentry: Introduction to various carpentry tools and materials; Type of woods and their characteristics, brief ideas about band saw, wooden lathe circular saw, wood planner, etc.; Machinery: Introduction to various workshop machines (1) Lathe, (2) Milling machine, (3) Shaper and planner, (4) Drilling and boring machine, (5) Grinder and (6) CNC machines; Length of cut, feed, depth of cut, RPM, cutting speed, time, time allowances; Estimation of machining time for different lathe operations; Estimation of machining time for casting, shaping, slotting and planning operations, work holding and tool holding devices; Sheet-metal: Introduction, different operations, sheet metal joints; Allowances for sheet metal, operations and joints, estimate of cost. **Practical** Identification of different materials of manufacture; Demonstration of different measuring instruments and measurement technique; Identification of various hand tools; Demonstration of various power tools and machine tools; Simple exercises in filing, fitting, chipping, hack sawing, chiseling, tapping, etc.; Introduction to welding machine, processes, tools, their use and precautions; Simple exercises on arc welding; Simple exercises in gas welding; Demonstration of various casting processes and equipments, tools and their use; Exercises on mould making using one piece pattern and two piece pattern; Demonstration of mould making using sweep pattern and match plate pattern; Simple exercises on turning: Step turning, taper turning, drilling and threading; Introduction to shaper and planner machine and preparations of various jobs on them; Introduction to drilling machines and preparation of a related jobs; Demonstration of other important operations and preparation of additional jobs.
	Surveying and Levelling 3(1+2) **Theory** Surveying: Introduction, classification and basic principles, Linear measurements. Chain surveying. Cross staff survey, Compass survey. Planimeter, Errors in measurements, their elimination and correction. Plane table surveying. Levelling, Leveling difficulties and error in leveling, Contouring, Computation of area and volume. Theodolite traversing. Introduction to setting of curves. Total station, Electronic Theodolite. Introduction to GPS survey **Practical** Chain survey of an area and preparation of map; Compass survey of an area and plotting of compass survey; Plane table surveying; Levelling. L section and X sections and its plotting; Contour survey of an area and preparation of contour

	map; Introduction of software in drawing contour; Theodolite surveying; Ranging by Theodolite, Height of object by using Theodolite; Setting out curves by Theodolite; Minor instruments. Use of total station.
	Engineering Drawing 2(0+2) BEAS-117/ME-111 **Practical** Introduction of drawing scales; First and third angle methods of projection. Principles of orthographic projections; References planes; Points and lines in space and traces of lines and planes; Auxiliary planes and true shapes of oblique plain surface; True length and inclination of lines; Projections of solids (Change of position method, alteration of ground lines); Section of solids and Interpenetration of solid surfaces; Development of surfaces of geometrical solids; Isometric projection of geometrical solids. Preparation of working drawing from models and isometric views. Drawing of missing views. Different methods of dimensioning. Concept of sectioning. Revolved and oblique sections. Sectional drawing of simple machine parts. Types of rivet heads and riveted joints. Processes for producing leak proof joints. Symbols for different types of welded joints. Nomenclature, thread profiles, multi start threads, left and right hand threads. Square headed and hexagonal nuts and bolts. Conventional representation of threads. Different types of lock nuts, studs, machine screws, cap screws and wood screws. Foundation bolts. Forms of screw threads, representation of threads, Bolts- headed centre, stud screws, set screws, butt, hexagonal and square; keys-types, taper, rank taper, hollow saddle etc.
	Environmental Science and Disaster Management 3(2+1)BEAS-122/ EVS-121 **Theory** Environmental Studies: 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
	Entrepreneurship Development and Business Management 3(2+1) BEAS-123/ BM-121 Entrepreneurship, management – Management functions – planning- Organizing -Directing – motivation – ordering – leading – supervision-Communication and control – Capital – Financial management – importance of financial statements – balance sheet – profit and loss statement, Analysis of financial statements –

	liquidity ratios – leverage ratios, Coverage ratios – turnover ratios – profitability ratios, Agro-based industries – Project – project cycle – Project appraisal and evaluation techniques – undiscounted measures – payback period – proceeds per rupee of outlay, Discounted measures – Net Present Value (NPV) – Benefit-Cost Ratio (BCR) – Internal Rate of Return (IRR) – Net benefit investment ratio (N / K ratio) – sensitivity analysis-Importance of agribusiness in Indian economy International trade-WTO agreements – Provisions related to agreements in agricultural and food commodities. Agreements on agriculture (AOA) – Domestic supply, market access, export subsidies agreements on sanitary and phyto-sanitary (SPS) measures, Trade related intellectual property rights (TRIPS). Development (ED): Concept of entrepreneur and entrepreneurship Assessing overall business environment in Indian economy– Entrepreneurial and managerial characteristics- Entrepreneurship development Programmes (EDP)-Generation incubation and commercialization of ideas andinnovations-Motivation and entrepreneurship development- Globalization and the emerging business entrepreneurial environment- Managing an enterprise: Importance of planning, budgeting, monitoring evaluation and follow-up managing competition. Role of ED in economic development of a country- Overview of Indian social, political systems and their implications for decision making by individual entrepreneurs- Economic **Practical** Preparation of business – Strengths Weaknesses Opportunities and Threats (SWOT) analysis, Analysis of financial statements (Balance Sheet, Profit loss statement). Compounding and discounting, Break-even analysis Visit to agro-based industries – I, Visit to agro-based industries II Study of Agro-industries Development Corporation , Ratio analysis – I, Ratio analysis – II,Application of project appraisal technique – I(Undiscounted measures), Application of project appraisal technique – II(Discounted Measures), Formulation of project feasibility reports – Farm Machinery Project proposals as entrepreneur – individual and group - Presentation of project proposals in the class.
	Engineering Mathematics-I 3 (2+1) **Theory** Matrices: Elementary transformations, rank of a matrix, reduction to normal form, Gauss- Jordon method to find inverse of a matrix, Eigen values and Eigen vectors, Cayley-Hamilton theorem, linear transformation, orthogonal transformations, diagonalisation of matrices, quadratic forms. PAQ form, Echelon form, Solution of linear equations, nature of rank, using Cayley-Hamilton theorem to find inverse of A. Differential calculus: Taylor's and Maclaurin's expansions; indeterminate form; curvature, function of two or more independent variables, partial differentiation, homogeneous functions and Euler's theorem, composite functions, total derivatives, maxima and minima. Integral calculus: volumes and surfaces of revolution of curves; double and triple integrals, change of order of integration, application of double and triple integrals to find area and volume. Vector calculus: Differentiation of vectors, scalar and vector point functions,

	vector differential operator Del, Gradient of a scalar point function, Divergence and Curl of a vector point function and their physical interpretations, identities involving Del, second order differential operator; line, surface and volume integrals, Stoke's, divergence and Green's theorems (without proofs). **Practical** Tutorials on rank of a matrix, reduction to normal form, consistency and solution of linear equations, eigen values and eigen vectors, Cayley-Hamilton theorem, diagonalization of matrices, quadratic forms; Taylor's and Maclaurin's expansion, indeterminate form, curvature, tracing of curves, partial differentiation, maxima and minima, volume and surface of revolution, multiple integrals, Beta and Gama functions, differentiation of vectors, gradient, divergence and curl of a vector point function, line, surface and volume integrals, Stoke's divergence and Green's Theorems.
	Computer programming & data structures 3(1+2) BEAS-321 **Theory** Introduction and historical background: Review of computer technology; Processor, memory, secondary storage, display devices and other peripheral devices; Basic computer organization, future trends; Brief review of present-day applications, programming; Introduction to systems software, applications software and programming language; Algorithms and flow-charts: Input-processing-output model of a computer program; Role of the compiler and the integrated development environment; Introduction to C: Structure of a C program, simple data types, declarations, operators and expressions; The assignment statement; Library functions; Control Structures: Conditional and iterative execution of statements; Importance of documentation;Nesting of control structures and the use of indentation to indicate nesting levels; Labels and the "go to" statement; Arrays; Single and multi-dimensional arrays: Character strings and string functions; Functions: Scope rules; Argument passing by reference and by value; Storage classes; Use of function prototypes; Structures, unions and user-defined types; Operations on files: Concept of standard input and output files; Formatting of data on input and output; Use of include files; Introduction to high level languages;Primary data types and user defined data types, variables, typecasting, operators, building and evaluating expressions, standard library functions, managing input and output, decision making, branching, looping, arrays, user defined functions, passing arguments and returning values, recursion, scope and visibility of a variable, string functions, structures and union, pointers, stacks, push/pop operations, queues, insertion and deletion operations, linked lists. **Practical** Familiarizing with Turbo C IDE; Building an executable version of C program; Debugging a C program; Developing and executing simple programs; Creating programs using decision making statements such as if, go to and switch; Developing program using loop statements while, do and for; Using nested control structures; Familiarizing with one and two dimensional arrays; Using string functions; Developing structures and union; Creating user defined

	functions; Using local, global and external variables; Using pointers; Implementing stacks; Implementing push/ pop functions; Creating queues; Developing linked lists in C language; Insertion/deletion in data structures.
	Engineering Physics 3 (2+1) BEAS-112/PHY-111 **Theory** Dia, Para and ferromagnetism-classification. Langevin theory of dia and paramagnetism. Adiabatic demagnetization. Weiss molecular field theory and ferromagnetism. Curie-Weiss law. Wave particle quality, de-Broglie concept, uncertainty principle. Wave function. Time dependent and time independent Schrodinger wave equation, Qualitative explanation of Zeeman effect, Stark effect and Paschan Back effect, Raman spectroscopy. Statement of Bloch's function. Bands iii solids, velocity of Bloch's electron and effective mass. Distinction between metals. insulators and semiconductors. Intrinsic and extrinsic semiconductors, law of mass action. Determination of energy gap in semiconductors. Donors and acceptor levels. Superconductivity, critical magnetic field. Meissner effect. Isotope effect. Type-I and II superconductors, Josephson's effect DC and AC, Squids. Introduction to high Tc superconductors. Spontaneous and stimulated emission, Einstein A and B coefficients. Population inversion, He-Ne and Ruby lasers. Ammonia and Rubymasers, Holography-Note. Optical fiber. Physical structure. basic theory. Mode type, input output characteristics of optical fiber and applications. Illumination: laws of illumination, luminous flux, luminous intensity, candle power, brightness. **Practical** To find the frequency of A.C. supply using an electrical vibrator; To find the low resistance using Carey Foster bridge without calibrating the bridge wire; To determine dielectric constant of material using De Sauty's bridge; To determine the value of specific charge (e/m) for electrons by helical method; To study the induced e.m.f. as a function of velocity of the magnet; To obtain hysteresis curve (B-H curve) on a C.R.O. and to determine related magnetic quantities; To study the variation of magnetic field with distance along the axis of a current carrying circular coil and to detuning the radius of the coil; To determine the energy band gap in a semiconductor using a p-n Junction diode; To determine the slit width from Fraunhofer diffraction pattern using laser beam; To find the numerical aperture of optical fiber: To set up the fiber optic analog and digital link; To study the phase relationships in L.R. circuit; To study LCR circuit; To study the variations of thermoemf of a copper-constantan thermo-couple with temperature; To find the wave length of light by prism.
	Thermodynamics, Refrigeration and Air Conditioning 3(2+1) BEAS-218 Theory Thermodynamics properties, closed and open system, flow and non-flow processes, gas laws, laws of thermodynamics, internal energy. Application of first law in heating and expansion of gases in non-flow processes. First law applied to steady flow processes. Carnot cycle, Carnot theorem. Entropy, physical concept of entropy, change of entropy of gases in

	thermodynamics process. Otto, diesel and dual cycles. Principles of refrigeration, - units, terminology, production of low temperatures, air refrigerators working on reverse Carnot cycle and Bell Coleman cycle. Vapour refrigeration-mechanism, P-V,P-S,P-H diagrams, vapor compression cycles, dry and wet compression, super cooling and sub cooling. Vapour absorption refrigeration system. Common refrigerants and their properties. Design calculations for refrigeration system. Cold storage plants. Thermodynamic properties of moist air, perfect gas relationship for approximate calculation, adiabatic saturation process, wet bulb temperature and its measurement, psychometric chart and its use, elementary psychometric process. Air conditioning – principles –Type and functions of air conditioning, physiological principles in air conditioning, air distribution and duct design methods, fundamentals of design of complete air conditioning systems – humidifiers and dehumidifiers – cooling load calculations, types of air conditioners – applications. **Practical** Tutorials on thermodynamic air cycles, Study and application of P V and T S chart in refrigeration, P H chart (or) Mollier diagram in refrigeration, Numerical on air refrigeration cycle systems, Numerical on vapour compression cycle refrigeration system, Study of domestic water cooler, Study of domestic household refrigerator, Study of absorption type solar refrigeration system, Study cold storage for fruit and vegetables, Freezing load and time calculations for food materials, Determination of refrigeration parametersusing refrigeration tutor – II, Numerical on design of air conditioning systems, Study of window air conditioner, Study on repair and maintenance of refrigeration and air-conditioning systems. Visit to chilling or ice making and cold storage plants.
	Tractor and Farm Machinery Operation and Maintenance 2 (0+2) FMPE-322 **Practical** Familiarization with different makes and models of agricultural tractors. Identification of functional systems including fuels system, cooling system, transmission system, steering and hydraulic systems. Study of maintenance points to be checked before starting a tractor. Familiarization with controls on a tractor. Safety rules and precautions to be observed while driving a tractor. Driving practice of tractor. Practice of operating a tillage tool (mould-board plough/ disc plough) and their adjustment in the field. Study of field patterns while operating a tillage implement. Hitching & De-hitching of mounted and trail type implement to the tractor. Driving practice with a trail type trolley – forward and in reverse direction. Introduction to tractormaintenance – precautionary and break-down maintenance. Tractor starting with low battery charge. Introduction to trouble shooting in tractors. Familiarization with tools for general and special maintenance. Introduction to scheduled maintenance after 10, 100, 300, 600, 900 and 1200 hours of operation. Safety hints. Top end overhauling. Fuel saving tips. Preparing the tractor for storage. Care and maintenance procedure of agricultural machinery during operation and off- season. Repair and maintenance of implements – adjustment of functional parameters in tillage implements. Replacement of broken components in tillage implements. Replacement of furrow

	openers and change of blades of rotavators. Maintenance of cutter bar in a reaper. Adjustments in a thresher for different crops. Replacement of V-belts on implements. Setting of agricultural machinery workshop.
	Engineering Mechanics3 (2+1) BEAS-116/CE-112 **Theory** Basic concepts of Engineering Mechanics. Force systems, Centroid, Moment of inertia, Free body diagram and equilibrium of forces. Frictional forces Analysis of simple framed structures using methods of joints, methods of sections and graphical method. Simple stresses. Shear force and bending moment diagrams. Stresses in beams. Torsion. Analysis of plane and complex stresses. **Practical** Problems on composition and resolution of forces, moments of a force, couples, transmission of a couple, resolution of a force into a force & a couple; Problems relating to resultant of; Co- planer force system, collinear force system, concurrent force system, co-planer concurrent force system, co-planer non-concurrent force system, Non-coplaner concurrent force system, Non-coplaner non-concurrent force system, system of couples in space; Problems relating to centroids of composite areas; Problems on moment of inertia, polar moment of inertia, radius of gyration, polar radius of gyration of composite areas; Equilibrium of concurrent – co-planer and non concurrent – co-planer force systems; Problems involving frictional forces; Analysis of simple trusses by method of joints and method of sections; Analysis of simple trusses by graphical method; Problems relating to simple stresses and strains; Problems on shear force and bending moment diagrams; Problems relating to stresses in beams; Problems on torsion of shafts; Analysis of plane and complex stresses.
	Design of Structures2(1+1) BEAS-216 **Theory** Loads and use of BIS Codes. Design of connections. Design of structural steel members in tension, compression and bending. Design of steel roof truss. Analysis and design of singly and doubly reinforced sections, Shear, Bond and Torsion. Design of Flanged Beams, Slabs, Columns, Foundations, Retaining walls and Silos. **Practical** Design and drawing of single reinforced beam, double reinforced beam, Design and drawing of steel roof truss; Design and drawing of one way, two way slabs, Design and drawing of RCC building; Design and drawing of Retaining wall. To measure workability of cement by slump test
	Engineering Properties of Agricultural Produce2(1+1)PFE-221 1. **Theory** Classification and importance of engineering properties of Agricultural Produce, shape, size, roundness, sphericity, volume, density, porosity, specific gravity, surface area of grains, fruits and vegetables, Thermal properties, Heat capacity, Specific heat, Thermal conductivity, Thermal diffusivity, Heat of respiration; Co-efficient of thermal expansion, Friction in agricultural materials; Static friction, Kinetic friction, rolling resistance, angle of internal friction, angle of repose, Flow

	of bulk granular materials, Aero dynamics of agricultural products, drag coefficients, terminal velocity. Rheological properties; force, deformation, stress, strain, elastic, plastic and viscous behaviour, Newtonian and Non-Newtonian liquid, Visco-elasticity, Newtonian and Non- Newtonian fluid, Pseudo-plastic, Dilatant, Thixotropic, Rheopectic and Bingham Plastic Foods,Flow curves. Electrical properties; dielectric loss factor, loss tangent, A.C. conductivity anddielectric constant, method of determination. Application of engineering properties in handling processing machines and storage structures **Practical** Determination of the shape and size of grains, fruits and vegetables, Determination of bulk density and angle of repose of grains, Determination of the particle density/true density and porosity of solid grains, Finding the co-efficient of external and internal friction of different crops, Finding out the terminal velocity of grain sample and study the separating behaviour in a vertical wind tunnel, Finding the thermal conductivity of different grains, Determination of specific heatof some food grains, Determination of hardness of food material and determination of viscosity of liquid foods.
	Soil Mechanics2(1+1)BEAS-215 **Theory** Introduction of soil mechanics, field of soil mechanics, phase diagram, physical and index properties of soil, classification of soils, effective and neutral stress, elementary concept of Boussinesq and Wester guards analysis, new mark influence chart. Seepage Analysis; Quick condition-two dimensional flow-Laplace equation, Velocity potential and stream function, Flow net construction. Shear strength, Mohr stress circle, theoretical relationship between principle stress circle, theoretical relationship between principal stress, Mohr coulomb failure theory, effective stress principle. Determination of shear parameters by direct shear test, triangle test & vane shear test. Numerical exercise based on various types of tests. Compaction, composition of soils standard and modified protector test, abbot compaction and Jodhpur mini compaction test field compaction method and control. Consolidation of soil: Consolidation of soils, one dimensional consolidation spring analogy, Terzaghi's theory, Laboratory consolidation test, calculation of void ratio and coefficient of volume change, Taylor's and Casagrande's method, determination of coefficient of consolidation. Earth pressure: plastic equilibrium in soils, active and passive states, Rankine's theory of earth pressure, active and passive earth pressure for cohesive soils, simple numerical exercises. Stability of slopes: introduction to stability analysis of infinite and finite slopes friction circle method, Taylor's stability number. **Practical** Determination of water content of soil; Determination of specific gravity of soil; Determination of field density of soil by core cutter method; Determination of field density by sand replacement method; Grain size analysis by sieving (Dry sieve analysis); Grain size analysis by hydrometer method; Determination of liquid limit by Casagrande's method; Determination of liquid limit by cone penetrometer and plastic limit; Determination of shrinkage limit; Determination

	of permeability by constant head method; Determination of permeability by variable head method; Determination of compaction properties by standard proctor test; Determination of shear parameters by Direct shear test; Determination of unconfined compressive strength of soil; Determination of shear parameters by Tri-axial test; Determination of consolidation properties of soils.
	Soil and water conservation engineering3(2+1)SWCE-311 **Theory** Soil erosion - Introduction, causes and types - geological and accelerated erosion, agents, factors affecting and effects of erosion. Water erosion - Mechanics and forms - splash, sheet, rill, gully, ravine and stream bank erosion. Gullies - Classification, stages of development. Soil loss estimation – Universal soil loss equation (USLE) and modified USLE. Rainfall erosivity - estimation by KE>25 and EI30 methods. Soil erodibility - topography, crop management and conservation practice factors. Measurement of soil erosion - Runoff plots, soil samplers. Water erosion control measures - agronomical measures - contour farming, strip cropping, conservation tillage and mulching. Engineering measures– Bunds and terraces. Bunds - contour and graded bunds - design and surplussing arrangements. Terraces - level and graded broad base terraces, bench terraces - planning, design and layout procedure, contour stonewall and trenching. Gully and ravine reclamation - principles of gully control - vegetative measures, temporary structures and diversion drains. Grassed waterways and design. Wind erosion- Factors affecting, mechanics, soil loss estimation and control measures - vegetative, mechanical measures, wind breaks and shelter belts and stabilization of sand dunes. Land capability classification. Rate of sedimentation, silt monitoring and storage loss in tanks. **Practical** Study of different types and forms of water erosion. Exercises on computation of rainfall erosivity index. Computation of soil erodibility index in soil loss estimation.Determination of length of slope (LS) and cropping practice (CP) factors for soil loss estimation by USLE and MUSLE. Exercises on soil loss estimation/measuring techniques. Study of rainfall simulator for erosion assessment. Estimation of sediment rate using Coshocton wheel sampler and multi- slot devisor. Determination of sediment concentration through oven dry method. Design and layout of contour bunds. Design and layout of graded bunds. Design and layout of broad base terraces. Design and layout of bench terraces. Design of vegetative waterways. Exercises on rate of sedimentation and storage loss in tanks. Computation of soil loss by wind erosion. Design of shelterbelts and wind breaks for wind erosion control. Visit to soil erosion sites and watershed project areas for studying erosion control and water conservation measures.
	Farm Machinery and equipment-I 3 (2+1) FMPE-312 Theory Introduction to farm mechanization. Classification of farm machines. Unit

	operations in crop production. Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery. Calculation of field capacities and field efficiency. Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification. Familiarization with land reclamation and earth moving equipment. Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage. Measurement of draft of tillage tools and calculations for power requirement for the tillage machines. Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, cultivators, Identification of major functional components. Attachments with tillage machinery. Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip- till drills. Introduction to planters, bed-planters and other planting equipment. Study of types of furrow openers and metering systems in drills and planters. Calibration of seed-drills/ planters. Adjustments during operation. Introduction to materials used in construction of farm machines. Heat treatment processes and their requirement in farm machines. Properties of materials used for critical and functional components of agricultural machines. Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components. **Practical** Familiarization with different farm implements and tools. Study of hitching systems, Problems on machinery management. Study of primary and secondary tillage machinery – construction, operation, adjustments and calculations of power and draft requirements. Study of sowing and planting equipment – construction, types, calculation for calibration and adjustments. Study of transplanters – paddy, vegetable, etc. Identification of materials of construction in agricultural machinery and study of material properties. Study of heat treatment processes subjected to critical components of agricultural machinery.
	Tractor and Automotive Engines3(2+1)FMPE-221 Theory Study of sources of farm power –conventional & non-conventional energy sources. Classification of tractors and IC engines. Review of thermodynamic principles of IC (CI & SI) engines and deviation from ideal cycle. General energy equation and heat balance sheet. Study of mechanical, thermal and volumetric efficiencies. Study of engine components their construction, operating principles and functions. Study of engine strokes and comparison of 2-stroke and 4-stroke engine cycles and CI and SI engines. Study of Engine Valve systems, valve mechanism, Valve timing diagram, and valve clearance adjustment Study of Cam profile, valve lift and valve opening area. Study of importance of air cleaning system. Study of types of air cleaners and performance characteristics of various air cleaners. Study of fuel supply system. Study of fuels, properties of fuels, calculation of air-fuel ratio. Study of tests on fuel for SI and CI engines. Study of detonation and knocking in IC engines. Study of carburetion system, carburetors

	and their main functional components. Study of fuel injection system – Injection pump, their types, working principles. Fuel injector nozzles – their types and working principle. Engine governing-need of governors, governor types and governor characteristics. Study of lubrication system – need, types, functional components. Study of lubricants – physical properties, additives and their application. Engine cooling system – need, cooling methods and main functional components. Study of need and type of thermostat valves. Additives in the coolant. Study of radiator efficiency. Study of ignition system of SI engines. Study of electrical system including battery, starting motor, battery charging, cut-out, etc. Comparison of dynamo and alternator. Familiarization with the basics of engine testing **Practical** Introduction to different systems of CI engines; Engine parts and functions, working principles etc. Valve system – study, construction and adjustments; Oil & Fuel – determination of physical properties; Air cleaning system; Fuel supply system of SI engine; Diesel injection system & timing; Cooling system, and fan performance, thermostat and radiator performance evaluation; Part load efficiencies & governing; Lubricating system & adjustments; Starting and electrical system; Ignition system; Tractor engine heat balance and engine performance curves; Visit to engine manufacturer/ assembler/ spare parts agency.
	Watershed Hydrology 2(1+1)SWCE-221 **1. Theory** Hydrologic cycle, precipitation and its forms, rainfall measurement and estimation of mean rainfall, frequency analysis of point rainfall. Mass curve, hyetograph, depth-area-duration curves and intensity-duration-frequency relationship. Hydrologic processes-Interception, infiltration -factors influencing, measurement and indices. Evaporation - Estimation andmeasurement. Runoff - Factors affecting, measurement, stage - discharge rating curve, estimation of peak runoff rate and volume, Rational method, Cook's method and SCS curve number method. Geomorphology of watersheds – Linear, aerial and relief aspects of watersheds- stream order, drainage density and stream frequency. Hydrograph - Components, base flow separation, unit hydrograph theory, S-curve, synthetic hydrograph, applications and limitations. Stream gauging - discharge rating curves, flood peak, design flood and computation of probable flood. Flood routing – channel and reservoir routing. Drought – classification, causes and impacts, drought management strategy. **Practical** Visit to meteorological observatory and study of different instruments. Design of rain gauge network. Exercise on intensity - frequency - duration curves. Exercise on depth - area - duration and double mass curves. Analysis of rainfall data and estimation of mean rainfall by different methods. Exercise on frequency analysis of hydrologic data and estimation of missing data, test for consistency of rainfall records. Exercise on computation of infiltration indices. Computation of peak runoff and runoff volume by Cook's method and rational formula. Computation

	of runoff volume by SCS curve number method. Study of stream gauging instruments - current meter and stage level recorder. Exercise on geomorphic parameters of watersheds. Exercise on runoff hydrograph. Exercise on unit hydrograph. Exercise on synthetic hydrograph. Exercise on flood routing.
	Engineering Mathematics-II 3(2+1) BEAS-121/MATH-121 **Theory** Matrices: Elementary transformations, rank of a matrix, reduction to normal form, Gauss- Jordon method to find inverse of a matrix, consistency and solution of linear equations, Eigen values and Eigen vectors, Cayley-Hamilton theorem, linear transformation, orthogonal transformations, diagonalisation of matrices, bilinear and quadratic forms; Functions of a complex variable: Limit, continuity and derivative of complex functions, analytic function, Cauchy-Reimann equations, conjugate functions, harmonic functions; Fourier series: Infinite series and its convergence, periodic functions, Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series, harmonic analysis; Partial differential equations: Formation of partial differential equations, Lagrange's linear equation, higher order linear partial differential equations with constant coefficients, solution of non-linear partial differential equations, Charpit's method, application of partial differential equations (one- dimensional wave and heat flow equations, two-dimensional steady state heat flow equation (Laplace equation).
	Electrical Machines and Power Utilization3(2+1)BEAS-219 **Theory** Electro motive force, reluctance, laws of magnetic circuits, determination of ampere-turns for series and parallel magnetic circuits, hysteresis and eddy current losses, Transformer: principle of working, construction of single phase transformer, EMF equation, phasor diagram on load, leakage reactance, voltage regulation, power and energy efficiency, open circuit and short circuit tests, principles, operation and performance of DC machine (generator and motor), EMF and torque equations, armature reaction, commutation, excitation of DC generator and their characteristics, DC motor characteristics, starting of shunt and series motor, starters, speed control methods-field and armature control, polyphase induction motor: construction, operation, phasor diagram, effect of rotor resistance, torque equation, starting and speed control methods, single phase inductionmotor:double field revolving theory, equivalent circuit, characteristics, phase split, shaded pole motors, various methods of three phase power measurement; power factor, reactive and apparent power, Concept and analysis of balanced poly-phase circuits; Series and parallel resonance. **Practical** To obtain load characteristics of d.c. shunt/series /compound generator; To study characteristics of DC shunt/ series motors; To study d.c. motor starters; To Perform load-test on 3 ph. induction motor & to plot torque V/S speed characteristics; To perform no-load & blocked –rotor tests on 3 ph. Induction motor to obtain equivalent ckt. parameters & to draw circle diagram; To study the

	speed control of 3 ph. induction motor by cascading of two induction motors, i.e. by feeding the slip power of one motor into the other motor; To study star- delta starters physically and (a) to draw electrical connection diagram (b) to start the 3 ph. induction motor using it. (c) to reverse the direction of 3 ph. I.M.; To start a 3-phase slip –ring induction motor by inserting different levels of resistance in the rotor ckt. and to plot torque –speed characteristics; To perform no load & blocked –rotor test on 1 ph. induction motor & to determine the parameters of equivalent ckt. drawn on the basis of double revolving field theory; To perform load –test on 1 ph. induction motor & plot torque –speed characteristics; To study power consumed in a three-phase circuit; Two lights in series controlled by one switch; Two lights in parallel controlled by one switch.
	Farm Machinery and Equipment-II3(2+1)FMPE-321 Theory Introduction to plant protection equipment – sprayers and dusters. Classification of sprayers and sprays. Types of nozzles. Calculations for calibration of sprayers and chemical application rates. Introduction to interculture equipment. Use of weeders – manual and powered. Study of functional requirements of weeders and main components. Familiarization of fertilizer application equipment. Study of harvesting operation – harvesting methods, harvesting terminology. Study of mowers – types, constructional details, working and adjustments. Study of shear type harvesting devices – cutter bar, inertial forces, counter balancing, terminology, cutting pattern. Study of reapers, binders and windrowers – principle of operation and constructional details. Importance of hay conditioning, methods of hay conditioning, and calculation of moisture content of hay. Introduction to threshing systems – manual and mechanical systems. Types of threshing drums and their applications. Types of threshers- tangential and axial, their constructional details and cleaning systems. Study of factors affecting thresher performance. Study of grain combines, combine terminology, classification of grain combines, study of material flow in combines. Computation of combine losses, study of combine troubles and troubleshooting. Study of chaff cutters and capacity calculations. Study of straw combines – working principle and constructional details. Study of root crop diggers – principle of operation, blade adjustment and approach angle, and calculation of material handled. Study of potato and groundnut diggers. Study of Cotton harvesting – Cotton harvesting mechanisms, study of cotton pickers and strippers, functional components. Study of maize harvesting combines. Introduction to vegetables and fruit harvesting equipment and tools. **Practical** Familiarization with plant protection and interculture equipment. Study of sprayers, types, functional components. Study of dusters, types and functional components. Calculations for chemical application rates. Study of nozzle types and spread pattern using patternator. Familiarization with manual and powered weeding equipment and identification of functional components. Study of fertilizer application equipment including manure spreaders and fertilizer broadcasters. Study of various types of mowers, reaper, reaper binder. Study of functional components of mowers and reapers. Familiarization with threshing

	systems, cleaning systems in threshers. Calculations of losses in threshers. Familiarization with functional units of Grain combines and their types. Calculations for grain losses in a combine. Study of root crop diggers and familiarization with the functional units and attachments. Familiarization with the working of cotton and maize harvesters. Familiarization with vegetable and fruit harvesters.
	Irrigation Engineering3(2+1)IDE-221 **Theory** Major and medium irrigation schemes of India, purpose of irrigation, environmental impact of irrigation projects, source of irrigation water, present status of development and utilization of different water resources of the country; measurement of irrigation water: weir, flumes and orifices and other methods; open channel water conveyance system : design and lining of irrigation field channels, on farm structures for water conveyance, control & distribution; underground pipe conveyance system: components and design; land grading: criteria for land levelling, land levelling design methods, estimation of earth work; soil water plant relationship: soil properties influencing irrigation management, soil water movement, infiltration, soil water potential, soil moisture characteristics, soil moisture constants, measurement of soil moisture, moisture stress and plant response; water requirement of crops: concept of evapotranspiration (ET), measurement and estimation of ET, water and irrigation requirement of crops, depth of irrigation, frequency of irrigation, irrigation efficiencies; surface methods of water application: border, check basin and furrow irrigation- adaptability, specification and design considerations. **Practical:** Measurement of soil moisture by different soil moisture measuring instruments; measurement of irrigation water; measurement of infiltration characteristics; determination of bulk density, field capacity and wilting point; estimation of evapotranspiration; land grading methods; design of underground pipeline system; estimation of irrigation efficiency; study of advance, recession and computation of infiltration opportunity time; infiltration by inflow-outflow method; evaluation of border irrigation method; evaluation of furrow irrigation method; evaluation of check basin irrigation method
	Post harvest Engineering of Cereals, Pulses and Oil Seeds 3(2+1) PFE-312 **Theory** Cleaning and grading, aspiration, scalping; size separators, screens, sieve analysis, capacity and effectiveness of screens. Various types of separators: specific gravity, magnetic, disc, spiral, pneumatic, inclined draper, velvet roll, colour sorters, cyclone, shape graders. Size reduction: principle, Bond's law, Kick's law, Rittinger's law, procedure (crushing, impact, cutting and shearing), Size reduction machinery: Jaw crusher, Hammer mill, Plate mill, Ball mill. Material handling equipment. Types of conveyors: Belt, roller, chain and screw. Elevators: bucket, Cranes & hoists. Trucks (refrigerated/ unrefrigerated), Pneumatic conveying. Drying: moisture content and water activity; Free, bound and equilibrium moisture content, isotherm, hysteresis effect, EMC

	determination, Psychrometric chart and its use in drying, Drying principles and theory, Thin layer and deep bed drying analysis, Falling rate and constant rate drying periods, maximum and decreasing drying rate period, drying equations, Mass and energy balance, Shedd's equation, Dryer performance, Different methods of drying, batch-continuous; mixing-non-mixing, Sun- mechanical, conduction, convection, radiation, superheated steam, tempering during drying, Different types of grain dryers: bin, flat bed, LSU, columnar, RPEC, fluidized, rotary and tray. Mixing: Theory of mixing of solids and pastes, Mixing index, types of mixers for solids, liquid foods and pastes. Milling of rice: Conditioning and parboiling, advantages and disadvantages, traditional methods, CFTRI and Jadavpurmethods, Pressure parboiling method, Types of rice mills, Modern rice milling, different unit operations and equipment. Milling of wheat, unit operations and equipment. Milling of pulses: traditional milling methods, commercial methods, pre-conditioning, dry milling and wet milling methods: CFTRI and Pantnagar methods. Pulse milling machines, Milling of corn and its products. Dry and wet milling. Milling of oilseeds: mechanical expression, screw press, hydraulic press, solvent extraction methods, preconditioning of oilseeds, refining of oil, stabilization of rice bran., Extrusion cooking: principle, factors affecting, single and twin screw extruders. By-products utilization. **Practical** Performance evaluation of different types of cleaners and separators, Determination of separation efficiency, Study of different size reduction machines and performance evaluation, Determination of fineness modulus and uniformity index, Study of different types of conveying and elevating equipments, Study of different types of mixers. Measurement of moisture content: dry basis and wet basis, Study on drying characteristics of grains and determination of drying constant, Determination of EMC (Static and dynamic method), Study of various types of dryers, Study of different equipments in rice mills and their performance evaluation, Study of different equipments in pulse mills and their performance evaluation, Study of different equipments in oil mills and their performance evaluation, Type of process flow charts with examples relating to processing of cereals pulses and oil seeds, Visit to grain processing industries.
	Post Harvest Engineering of Horticultural Crops 2 (1+1) PFE-321 **Theory** Importance of processing of fruits and vegetables, spices, condiments and flowers. Characteristics and properties of horticultural crops important for processing, Peeling: Different peeling methods and devices (manual peeling, mechanical peeling, chemical peeling, and thermal peeling), Slicing of horticultural crops: equipment for slicing, shredding, crushing, chopping, juice extraction, etc., Blanching: Importance and objectives; blanching methods, effects on food (nutrition, colour, pigment, texture), Chilling and freezing: Application of refrigeration in different perishable food products, Thermophilic, mesophilic & Psychrophilic micro-organisms, Chilling requirements of different fruits and vegetables, Freezing of food, freezing time calculations, slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic), Effect on food during chilling and freezing, Cold storage heat load calculations and cold storage

	design, refrigerated vehicle and cold chain system, Dryers for fruits and vegetables, Osmo-dehydration Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials commonly used for raw and processed fruits and vegetables products, bulk and retail packages and packaging machines, handling and transportation of fruits and vegetables, Pack house technology, Minimal processing, Common methods of storage, Low temperature storage, evaporative cooled storage, Controlled atmospheric storage, Modified atmospheric packaging, Preservation Technology, General methods of preservation of fruits and vegetables, Brief description and advantages and disadvantages of different physical/ chemical and other methods of preservation, Flowcharts for preparation of different finished products, Important parameters and equipment used for different unit operations, Post harvest management and equipment for spices and flowers, Quality control in fruit and vegetable processing industry. Food supply chain. **Practical** Performance evaluation of peeler and slicer, Performance evaluation of juicer and pulper, Performance evaluation of blanching equipment, Testing adequacy of blanching, Study of cold storage and its design, Study of CAP and MAP storage, Minimal processing of vegetables, Preparation of value added products, Visit to fruit and vegetable processing industry, Visit to spice processing plant.
	Fluid Mechanics and Open Channel Hydraulics 3(2+1) BEAS-124/ CE-121 **Theory** Properties of fluids: Ideal and real fluid. Pressure and its measurement, Pascal's law, pressure forces on plane and curved surfaces, centre of pressure, buoyancy, meta centre and meta centric height, condition of floatation and stability of submerged and floating bodies; Kinematics of fluid flow: Lagrangian and Eulerian description of fluid motion, continuity equation, path lines,streak lines and stream lines, stream function, velocity potential and flow net. Types of fluid flow, translation, rotation, circulation and vorticity, Vortex motion; Dynamics of fluid flow, Bernoulli's theorem, venturimeter, orifice meter and nozzle, siphon; Laminar flow: Stress strain relationships, flow between infinite parallel plates both plates fixed, one plate moving, discharge, average velocity; Laminar and turbulent flow in pipes, general equation for head loss Darcy, Equation, Moody's diagram, Minor and major hydraulic losses through pipes and fittings, flow through network of pipes, hydraulic gradient and energy gradient; Flow through orifices (Measurement of Discharge, Measurement of Time),Flow through Mouthpieces, Flow over Notches , Flow over weirs, Chezy's formula for loss of head in pipes, Flow through simple and compound pipes, Open channel design and hydraulics: Chezy's formula, Bazin's formula, Kutter's Manning's formula, Velocity and Pressure profiles in open channels, Hydraulic jump; Dimensional analysis and similitude: Rayleigh's method and Buckingham's `Pi' theorem, types of similarities, dimensional analysis, dimensionless numbers. Introduction to fluid machinery. **Practical** Study of manometers and pressure gauges; Verification of Bernoulli's theorem;

	Determination of coefficient of discharge of venturi-meter and orifice meter; Determination of coefficient of friction in pipeline; Determination of coefficient of discharge for rectangular and triangular notch; Determination of coefficient of discharge, coefficient of velocity and coefficient of contraction for flow through orifice; Determination of coefficient of discharge for mouth piece; Measurement of force exerted by water jets on flat and hemispherical vanes; Determination of meta-centric height;Determination of efficiency of hydraulic ram; Performance evaluation of Pelton and Francis turbine; Study of current meter; Velocity distribution in open channels and determination of Manning's coefficient of rugosity.
	Heat and Mass Transfer2 (2+0)BEAS-118/ ME-112 **Theory** Concept, modes of heat transfer, thermal conductivity of materials, measurement. General differential equation of conduction. One dimensional steady state conduction through plane and composite walls, tubes and spheres with and without heat generation. Electrical analogy. Insulation materials. Fins, Free and forced convection. Newton's law of cooling, heat transfer coefficient in convection. Dimensional analysis of free and forced convection. Useful non dimensional numbers. Equation of laminar boundary layer on flat plate and in a tube. Laminar forced convection on a flat plate and in a tube. Combined free and forced convection. Introduction. Absorptivity, reflectivity and transmissivity of radiation. Black body and monochromatic radiation, Planck's law, Stefan-Boltzman law, Kirchoff 's law, grey bodies and emissive power, solid angle, intensity of radiation. Radiation exchange between black surfaces, geometric configuration factor. Heat transfer analysis involving conduction, convection and radiation by networks. Types of heat exchangers, fouling factor, log mean temperature difference, heat exchanger performance, transfer units. Heat exchanger analysis restricted to parallel and counter flow heat exchangers. Steady state molecular diffusion in fluids at rest and in laminar flow, Flick's law, mass transfer coefficients. Reynold's analogy.
	Auto CAD Applications2(0+2)BEAS-222 **Practical** Application of computers for design. CAD- Overview of CAD window – Explanation of various options on drawing screen. Study of draw and dimension tool bar. Practice on draw and dimension tool bar. Study of OSNAP, line thickness and format tool bar. Practice on OSNAP, line thickness and format tool bar. Practice on mirror, offset and array commands. Practice on trim, extend, chamfer and fillet commands. Practice on copy, move, scale and rotate commands. Drawing of 2 D- drawing using draw tool bar. Practice on creating boundary, region, hatch and gradient commands. Practice on Editing polyline-PEDIT and Explode commands. Setting of view ports for sketched drawings. Printing of selected view ports in various paper sizes. 2D- drawing of machine parts with all dimensions and allowances- Foot step bearing and knuckle joint. Sectioning of foot step bearing and stuffing box. Drawing of hexagonal, nut and bolt and other machine parts. Practice on 3-D commands- Extrusion and loft. Practice on 3-D commands-on sweep and press pull. Practice on 3-D Commands-

	revolving and joining. Demonstration on CNC machine and simple problems.
	Machine Design2(2+0)BEAS-217 **Theory** Meaning of design, Phases of design, design considerations. Common engineering materials and their mechanical properties. Types of loads and stresses, theories of failure, factor of safety, selection of allowable stress. Stress concentration. Elementary fatigue and creep aspects. Cotter joints, knuckle joint and pinned joints, turnbuckle. Design of welded subjected to static loads. Design of threaded fasteners subjected to direct static loads, bolted joints loaded in shear and bolted joints subjected to eccentric loading. Design of shafts under torsion and combined bending and torsion. Design of keys. Design of muff, sleeve, and rigid flange couplings. Design of helical and leaf springs. Design of flat belt and V-belt drives and pulleys. Design of gears. Design of screw motion mechanisms like screw jack, lead screw, etc. Selection of anti-friction bearings.
	Tractor systems and control 3(2+1) FMPE-311 **Theory** Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems. Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive.Study of Brake system – types, principle of operation, construction, calculation for braking torque. Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC. Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study ofwheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids. Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes. **Practical** Introduction to transmission systems and components; Study of clutch functioning, parts and design problem on clutch system; Study of different types of gear box, calculation of speed ratios, design problems on gear box; Study on differential and final drive and planetary gears; Study of brake systems and some design problems; Steering geometry and adjustments; Study of hydraulic systems

	in a tractor, hydraulic trainer and some design problems; Appraisal of various controls in different makes tractors in relation to anthropometric measurements. Determination of location of CG of a tractor, Moment of Inertia of a tractor. Traction performance of a traction wheel.
	Web Designing and Internet Applications2(1+1)BEAS-128/ COMP-121 **Theory** Basic principles in developing a web designing, Planning process, Five Golden rules of web designing, Designing navigation bar, Page design, Home Page Layout, Design Concept. Basics in Web Design, Brief History of Internet, World Wide Web , creation of a web site, Web Standards, Audience requirement. Introduction to Java Script, variables & functions, Working with alert, confirm and prompt, Connectivity of Web pages with databases; Project. **Practical** FLASH: Animation concept FPS, Understanding animation for web, Flash interface, Working with tools, DREAM WEAVER :Exploring Dreamweaver Interface, Planning & Setting Web Site Structure, Working with panels, Understanding and switching views, Using property inspector, Formatting text, JAVA SCRIPT: Working with alert, confirm and prompt, Understanding loop, arrays, Creating rollover image, Working with operator, GIF ANIMATION: Learning to use FTPSetting FTP, Uploading of site, Using Control panel, FTP UPLOADING SITE: Understanding gif animation interface, Knowing GIf file format, Creating basic web banners, Creating web banners with effects, Creating animated web buttons.
	Strength of Materials2(1+1)BEAS-125/ ME-123 **Theory** Slope and deflection of beams using integration techniques, moment area theorems and conjugate beam method. Columns and Struts. Riveted and welded connections. Stability of masonry dams. Analysis of statically intermediate beams. Propped beams. Fixed and continuous beam analysis using superposition, three moment equation and moment distribution methods. **Practical** To perform the tension test on metal specimen (M.S., C.I.), to observe the behaviour of materials under load, to calculate the value of E, ultimate stress, permissible stress, percentage elongation etc. and to study its fracture; To perform the compression test on; Concrete cylinders &cubes, C.I., M.S. & Wood specimens and to determine various physical and mechanical properties; To perform the bending test on the specimens; M.S. Girder, Wooden beam, Plain concrete beams& R.C.C. beam, and to determine the various physical and mechanical properties; To determine Young's modulus of elasticity of beam with the help of deflection produced at centre due to loads placed at centre & quarter points; To study the behaviour of materials (G.I. pipes, M.S., C.I.) under torsion and to evaluate various elastic constants; To study load deflection and other physical properties of closely coiled helical spring in tension and compression; To perform the Rockwell, Vicker's and Brinell's Hardness tests on the given specimens; To perform the Drop Hammer Test, Izod Test and Charpay's impact tests on the given specimens; To determine compressive & tensile strength of

	cement after making cubes and briquettes; To measure workability of concrete (slump test, compaction factor test); To determine voids ratio & bulk density of cement, fine aggregates and coarse aggregates; To determine fatigue strength of a given specimen; To write detail report emphasizing engineering importance of performing tension, compression, bending,torsion, impact and hardness tests on the materials.
	Agricultural structures and environmental control 3(2+1) PFE-311 **Theory** Planning and layout of farmstead. Scope, importance and need for environmental control, physiological reaction of livestock environmental factors, environmental control systems and their design, control of temperature, humidity and other air constituents by ventilation and other methods, Livestock production facilities, BIS Standards for dairy, piggery, poultry and other farm structures. Design, construction and cost estimation of farm structures; animal shelters, compost pit, fodder silo, fencing and implement sheds, barn for cows, buffalo, poultry, etc. Storage of grains, Causes of spoilage, Water activity for low and high moisture food and its limits for storage, Moisture and temperature changes in grain bins; Traditional storage structures and their improvements, Improved storage structures (CAP, hermetic storage, Pusa bin, RCC ring bins), Design consideration for grain storage godowns, Bag storage structures, Shallow and Deep bin, Calculation of pressure in bins, Storage of seeds. Rural living and development, rural roads, their construction cost and repair and maintenance. Sources of water supply, norms of water supply for human being and animals, drinking water standards and water treatment suitable to rural community. Site and orientation of building in regard to sanitation, community sanitation system; sewage system and its design, cost and maintenance, design of septic tank for small family. Estimation of domestic power requirement, source of power supply and electrification of rural housing. **Practical** Measurements for environmental parameters and cooling load of a farm building, Design and layout of a dairy farm, Design and layout of a poultry house, Design and layout of a goat house/ sheep house, Design of a farm fencing system, Design of a feed/fodder storage structures,Design of grain storage structures, Design and layout of commercial bag and bulk storage facilities, Study and performance evaluation of different domestic storage structure, Estimation of a Farm building.
	Ground water, Wells and Pumps3 (2+1)IDE-311 **Theory** Occurrence and movement of ground water; aquifer and its types; classification of wells, fully penetrating tubewells and open wells, familiarization of various types of bore wells; design of open wells; groundwater exploration techniques; methods of drilling of wells: percussion, rotary, reverse rotary; design of tubewell and gravel pack, installation of well screen, completion and development of well; groundwater hydraulics-determination of aquifer parameters by different method such as Theis, Jacob and Chow's, Theis recovery method; well interference, multiple well systems, estimation of ground water potential, quality of ground

	water; artificial groundwater recharge techniques; pumping systems: water lifting devices; different types of pumps, classification of pumps, component parts of centrifugal pumps, priming, pump selection, installation and trouble shooting, performance curves, effect of speed on capacity, head and power, effect of change of impeller dimensions on performance characteristics; hydraulic ram, propeller pumps, mixed flow pumps and their performance characteristics; deep well turbine pump and submersible pump. **Practical** Verification of Darcy's Law; study of different drilling equipments; sieve analysis for gravel and well screens design; estimation of specific yield and specific retention; testing of well screen; estimation of aquifer parameters by Theis method, Coopers-Jacob method, Chow method; Theis Recovery method; well design under confined and unconfined conditions; well losses and well efficiency; estimating ground water balance; study of artificial ground water recharge structures; study of radial flow and mixed flow centrifugal pumps, multistage centrifugal pumps, turbine, propeller and other pumps; installation of centrifugal pump; testing of centrifugal pump and study of cavitations; study of hydraulic ram; study and testing of submersible pump.
	Applied Electronics and Instrumentation3(2+1) **Theory** Semiconductors. p—n junction. V—I characteristics of p—n junction. diode as a circuit element. rectifier. clipper. damper, voltage multiplier, capacitive filter. diode circuits for OR &AND (both positive and negative logic), bipolar junction transistor: operating point. classification (A.B & C) of amplifier. various biasing methods (fixed. self potential divider). h-parameter model of a transistor. analysis of small signal. CE amplifier. phase shift oscillator, analysis of differential amplifier using transistor. ideal OP-AMP characteristics. linear and non-linear applications of OP-AMP (adder. subtractor. integrator, active rectifier. comparator. differentiator. differential, instrumentation amplifier and oscillator). zener diode voltage regulator. transistor series regulator. current limiting. OP-AMP voltage regulators. Basic theorem of Boolean algebra. Combinational logic circuits(basic gates. SOP rule and Kmap). binary ladder D/A converter, successive approximation A/D converter, generalized instrumentation, measurement of displacement. temperature. velocity, force and pressure using potentiometer. Resistancethermometer. thermocouples. Bourclen tube. LVDT. strain gauge and tacho-generator. **Practical** To study V-I characteristics of p-n junction diode: To study half wave. full wave and bridge rectifier: To study transistor characteristics in CE configurations: To design and study fixed and self bias transistor: To design and study potential divider bias transistor: To study a diode as clipper and clamper: To study a OP-AMP IC 741 as inverting and non- inverting amplifier: To study a OP-AMP IC 741 as differentiator and integrator to study a differential amplifier using two transistor: To study a OP-AMP IC 741 as differential amplifier: To study a zener regulator circuit: To study a OP-AMP IC 741 as a active rectifier: To study a OP-AMP IC 741 as a comparator: To familiarize with various types of transducers.

	Drainage Engineering 2(1+1) IDE-311 **Theory** Water logging- causes and impacts; drainage, objectives of drainage, familiarization with the drainage problems of the state; surface drainage coefficient, types of surface drainage, design of surface drains; sub-surface drainage: purpose and benefits, investigations of design parameters- hydraulic conductivity, drainable porosity, water table; derivation of Hooghoudt's and Ernst's drain spacing equations; design of subsurface drainage system; drainage materials, drainage pipes, drain envelope; layout, construction and installation of drains; drainage structures; vertical drainage; bio-drainage; mole drains; salt balance, reclamation of saline and alkaline soils, leaching requirements, conjunctive use of fresh and saline water. **Practical** In-situ measurement of hydraulic conductivity by single auger hole and inverse auger hole method; Estimation of drainage coefficients; installation of piezometer and observation wells; preparation of iso-bath and isobar maps; determination of drainable porosity; design of surface drainage systems; design of gravel envelop; design of subsurface drainage systems; determination of chemical properties of soil and water; study of drainage tiles and pipes; installation of sub-surface drainage system; cost analysis of surface and sub-surface drainage system.
	Water Harvesting and Soil Conservation Structures 3 (2+1) SWCE-321 **Theory** Water harvesting-principles, importance and issues. Water harvesting techniques-classification based on source, storage and use. Runoff harvesting – short-term and long-term techniques. Short-term harvesting techniques - terracing and bunding, rock and ground catchments. Long- term harvesting techniques - purpose and design criteria. Structures - farm ponds - dug-out and embankment reservoir types, tanks and subsurface dykes. Farm pond - components, site selection, design criteria, capacity, embankment, mechanical and emergency spillways, cost estimation and construction. Percolation pond - site selection, design and construction details. Design considerations of nala bunds. Soil erosion control structures - introduction, classification and functional requirements. Permanent structures for soil conservation and gully control - check dams, drop, chute and drop inlet spillways - design requirements, planning for design, design procedures - hydrologic, hydraulic and structural design and stability analysis. Hydraulic jump and its application. Drop spillway - applicability, types - straight drop, box-type inlet spillways - description, functional use, advantages and disadvantages, straight apron and stilling basin outlet, structural components and functions. Loads on head wall, variables affecting equivalent fluid pressure, triangular load diagram for various flow conditions, creep line theory, uplift pressure estimation, safety against sliding, overturning, crushing and tension. Chute spillway - description, components, energy dissipaters, design criteria of Saint Antony Falls (SAF) stilling basin and its limitations. Drop inlet spillway - description, functional use and design criteria. **Practical** Study of different types of farm ponds. Computation of storage capacity of

	embankment type of farm ponds. Design of dugout farm ponds. Design of percolation pond and nala bunds. Runoff measurement using H-flume. Exercise on hydraulic jump. Exercise on energy dissipation in water flow. Hydrologic, hydraulic and structural design of drop spillway and stability analysis. Designof SAF stilling basins in chute spillway. Hydrologic, hydraulic and structural design of drop inlet spillway. Design of small earthen embankment structures. Practice on softwares for design of soil and water conservation structures. Field visit to watershed project areas treated with soil and water conservation measures / structures.
	Dairy and Food Engineering 3 (2+1)PFE-322 **Theory** Deterioration in food products and their controls, Physical, chemical and biological methods of food preservation. Nanotechnology: History, fundamental concepts, tools and techniques nanomaterials, applications in food packaging and products, implications, environmental impact of nanomaterials and their potential effects on global economics, regulation of nanotechnology. Dairy development in India, Engineering, thermal and chemical properties of milk and milk products, Process flow charts for product manufacture, Unit operation of various dairy and food processing systems. Principles and equipment related to receiving of milk, pasteurization, sterilization, homogenization, centrifugation and cream separation. Preparation methods and equipment for manufacture of cheese, paneer, butter and ice cream, Filling and packaging of milk and milk products; Dairy plant design and layout, Plant utilities; Principles of operation and equipment for thermal processing, Canning, Aseptic processing, Evaporation of food products: principle, types of evaporators, steam economy, multiple effect evaporation, vapour recompression, Drying of liquid and perishable foods: principles of drying, spray drying, drum drying, freezedrying, Filtration: principle, types of filters; Membrane separation, RO, Nano-filtration, Ultra filtration and Macro-filtration, equipment and applications, Non-thermal and other alternate thermal processing in Food processing. **Practical** Study of pasteurizers, Study of sterilizers, Study of homogenizers, Study of separators, Study of butter churns, Study of evaporators, Study of milk dryers, Study of freezers, Study of filtration, Design of food processing plants & preparation of layout, Visit to multi-product dairy plant, Estimation of steam requirements, Estimation of refrigeration requirements in dairy & food plant, Visit to Food industry.
	Communication Skills and Personality Development 2(1+1)BEAS-213 Theory UNIT I Communication skills: Structural and functional grammar; Meaning and process of communication; Verbal and nonverbal communication; Listening and note taking; Writing skills; Oral presentation skills; Field diary and lab record; Indexing, footnote and bibliographic procedures; Reading and comprehension of general and technical articles; Precise writing, summarizing, abstracting; Individual and group presentations; Impromptu presentation; Public speaking;

	Group discussion and interviews; Organizing seminars and conferences. UNIT II Voice modulation basics and their usage for meaningful impact on people; Attributes of an effective leader; Stress and conflict management; Time management: Personal organization, prioritizing and balancing; Cosmopolitan culture; Impact of non verbal communication; Science of body language; Role of team work. **Practical** Listening and note taking, writing skills, oral presentation skills; Field diary and lab record; Indexing, footnote and bibliographic procedures; Reading and comprehension of general and technical articles, precise writing, summarizing, abstracting; Individual and group presentations; Video recorded mock group discussions and interviews; Attitude management; Setting and achieving a short term goal; Creating a personal vision statement of life; Voice modulation; Practicing conscious body postures and movements; Rapport building; Video recorded practical to evaluate change in confidence level; Team work exercises; Time management.
	Fundamentals of Renewable Energy Sources 3(2+1)REE-221 Theory Concept and limitation of Renewable Energy Sources (RES), Criteria for assessing the potential of RES, Classification of RES, Solar, Wind, Geothermal, Biomass, Ocean energy sources, Comparison of renewable energy sources with non renewable sources. Solar Energy: Energy available from Sun, Solar radiation data, solar energy conversion into heat through, Flat plate and Concentrating collectors, different solar thermal devices, Principle of natural and forced convection drying system, Solar Photo voltaics: p-n junctions. Solar cells, PV systems, Stand alone, Grid connected solar power station, Calculation of energy through photovoltaic power generation and cost economics. Wind Energy: Energy available from wind, General formula, Lift and drag. Basis of Wind energyconversion, Effect of density, Frequency variances, Angle of attack, Wind speed, Types of Windmill rotors, Determination of torque coefficient, Induction type generators, Working principle of wind power plant. Bio-energy: Pyrolysis of Biomass to produce solid, liquid and gaseous fuels. Biomass gasification, Types of gasifier, various types of biomass cook stoves for rural energy needs. Biogas: types of biogas plants, biogas generation, factors affecting biogas generation and usages, design consideration, advantages and disadvantages of biogas spent slurry. **Practical** Study of different types of solar cookers, solar water heating system, natural convection solar dryer, forced convection solar dryer, solar desalination unit, solar greenhouse for agriculture production, biogas plants, biomass gasifiers, biomass improved cook-stoves, solar photovoltaic system.
	Bio Energy System, Design and Application 3 (2+1)REE-321 Theory Fermentation processes and its general requirements, An overview of aerobic and anaerobic fermentation processes and their industrial application. Heat transfer

	processes in anaerobic digestion systems, land fill gas technology and potential. Biomass Production: Wastelands, classification and their use through energy plantation, selection of species, methods of field preparation and transplanting. Harvesting of biomass and coppicing characteristics. Biomass preparation techniques for harnessing (size reduction, densification and drying). Thermo-chemical degradation. History of small gas producer engine system. Chemistry of gasification. Gas producer – type, operating principle. Gasifier fuels, properties, preparation, conditioning of producer gas. Application, shaft power generation, thermal application and economics. Trans- esterification for biodiesel production. A range of bio-hydrogen production routes. Environmental aspect of bio-energy, assessment of greenhouse gas mitigation potential. **Practical** Study of anaerobic fermentation system for industrial application, Study of gasification for industrial process heat, Study of biodiesel production unit, Study of biomass densification technique (briquetting, pelletization, and cubing), Integral bio energy system for industrial application, Study of bio energy efficiency in industry and commercial buildings, Study and demonstration of energy efficiency in building, Measuring efficiency of different insulation technique, Study of Brayton, Striling and Rankine cycles, Study of modern greenhouse technologies.
	Renewable Power Sources 3(2+1)REE-311 **Theory** Energy consumption pattern & energy resources in India. Renewable energy options, potential and utilization. Biogas technology and mechanisms, generation of power from biogas, Power generation from urban, municipal and industrial waste. Design & use of different commercial sized biogas plant. Solar thermal and photovoltaic Systems for power generation. Central receiver (Chimney) and distributed type solar power plant, OTEC, MHD, hydrogen and fuel cell technology. Wind farms. Aero-generators. Wind power generation system. Power generation from biomass (gasification &Dendro thermal), Mini and micro small hydel plants. Fuel cells and its associated parameters. **Practical** Performance evaluation of solar water heater; Performance evaluation of solar cooker; Characteristics of solar photovoltaic panel; evaluation of solar air heater/dryer; Performance evaluation of biomass gasifier engine system (throatless& downdraft), Performance evaluation of a fixed dome type biogas plant; Performance evaluation of floating drum type biogas plant; Estimation of calorific value of biogas & producer gas; Testing of diesel engine operation using dual fuel and gas alone.
	Project Planning and Report Writing (Student READY) 10(0+10) READY-421
	Sprinkler and Micro Irrigation Systems 2(1+1)IDE-222 Theory Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection,

	hydraulic design of lateral, sub- main and main pipe line, design steps; selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency;Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; Design of drip irrigation system: general considerations, wetting patters, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps; necessary steps for proper operation of a drip irrigation system; maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation. **Practical** Study of different components of sprinkler irrigation system; design and installation of sprinkler irrigation system; determination of precipitation pattern, discharge and uniformity coefficient; cost economics of sprinkler irrigation system; study of different components of drip irrigation; design and installation of drip irrigation system; determination of pressure discharge relationship and emission uniformity for given emitter; study of different types of filters and determination of filtration efficiency; determination of rate of injection and calibration for chemigation/fertigation; design of irrigation and fertigation schedule for crops; field visit to micro irrigation system and evaluation of drip system; cost economics of drip irrigation system.
	Watershed planning and Management 2(1+1)SWCE-312 Theory Watershed - introduction and characteristics. Watershed development - problems and prospects, investigation, topographical survey, soil characteristics, vegetative cover, present land use practices and socio-economic factors. Watershed management - concept, objectives, factors affecting, watershed planning based on land capability classes, hydrologic data for watershed planning, watershed codification, delineation and prioritization of watersheds – sediment yield index. Water budgeting in a watershed. Management measures - rainwater conservation technologies - in-situ and ex-situ storage, water harvesting and recycling. Dry farming techniques inter-terrace and inter-bund land management. Integrated watershed management - concept, components, arable lands - agriculture and horticulture, non-arable lands - forestry, fishery and animal husbandry. Effect of cropping systems, land management and cultural practices on watershed hydrology. Watershed programme - execution, follow-up practices, maintenance, monitoring and evaluation. Participatory watershed management - role of watershed associations, user groups and self-help groups. Planning and formulation of project proposal for watershed management programme including cost-benefit analysis. **Practical** Exercises on delineation of watersheds using toposheets. Surveying and preparation of watershed map. Quantitative analysis of watershed characteristics

	and parameters. Watershed investigations for planning and development. Analysis of hydrologic data for planning watershed management. Water budgeting of watersheds. Prioritization of watersheds based on sediment yield index. Study of functional requirement of watershed development structures. Study of watershed management technologies. Practice on softwares for analysis of hydrologic parameters of watershed. Study of role of various functionaries in watershed development programmes. Techno-economic viability analysis of watershed projects. Visit to watershed development project areas.
	Skill Development Training-I (Students READY)-Registration only 5(0+5)READY-311
	10 Weeks Industrial Attachment /Internship (Student-READY)10 (0+10)READY-411
	10 Weeks Experiential Learning on campus(Student-READY)10 (0+10)READY-412
	READY Skill Development training-II(RSDT-II)-Registration only 05(0+5) READY-413
	Educational Tour(Registration Only)*2 (0+2)ET-411
	Precision Farming Techniques for Protected cultivation 3(2+1)FMPE-421 Theory Protected cultivation: Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses /shed nets, Cladding materials, Plant environment interactions – principles of limiting factors, solar radiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbon dioxide enrichment, Design and construction of green houses – site selection, orientation, design, construction, design for ventilation requirement using exhaust fan system, selection of equipment, Greenhouse cooling system – necessity, methods – ventilation with roof and side ventilators, evaporative cooling, different shading material fogging, combined fogging and fan- pad cooling system, design of cooling system, maintenance of cooling and ventilation systems, pad care etc. Greenhouse heating – necessity, components, methods, design of heating system. Root media – types – soil and soil less media, composition, estimation, preparation and disinfection, bed preparation. Planting techniques in green house cultivation. Irrigation in greenhouse and net house – Water quality, types of irrigation system, components, design, installation and material requirement. Fogging system for greenhouses and net houses – introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems. Fertilization – nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application. Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse – irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economic analysis.

	Practical Estimation of material requirement for construction of greenhouse ; Determination of fertilization schedule and rate of application for various crops; Estimation of material requirement for preparation of root media; Root media preparation, bed preparation and disinfections; Study of different planting techniques ; Design and installation of irrigation system; Design and installation of fogging system ; Greenhouse heating; Study of different greenhouse environment control instruments; Study of operation maintenance and fault detection in irrigation system; Study of operation maintenance and fault detection in fogging system; Economic analysis of greenhouses and net houses; Visit to greenhouses.
	Floods and control Measures 3(2+1)SWCE-421 **Theory** Floods - causes of occurrence, flood classification - probable maximum flood, standard project flood, design flood, flood estimation - methods of estimation; estimation of flood peak rational method, empirical methods, unit hydrograph method. Statistics in hydrology, flood frequency methods - log normal, Gumbel's extreme value, log-Pearson type-III distribution; depth-area-duration analysis. Flood forecasting. Flood routing - channel routing, Muskingum method, reservoir routing, modified Pul's method. Flood control - history of flood control, structural and non-structural measures of flood control, storage and detention reservoirs, levees, channel improvement. Gully erosion and its control structures - design and implementation. Ravine control measures. River training works, planning of flood control projects and their economics. Earthen embankments - functions, classification - hydraulic fill and rolled fill dams - homogeneous, zoned and diaphragm type, foundation requirements, grouting, seepage through dams, flow net and its properties, seepage pressure, seepage line in composite earth embankments, drainage filters, piping and its causes. Design and construction of earthen dam, stability of earthen embankments against failure by tension, overturning, sliding etc., stability of slopes - analysis of failure by different methods. Subsurface dams - site selection and constructional features. Check dam - Small earthen embankments - types and design criteria. Subsurface dams - site selection and constructional features.
	Human Engineering and Safety 3(2+1)BEAS-221 **Theory** Human factors in system development – concept of systems; basic processes in system development, performance reliability, human performance. Information input process, visual displays, major types and use of displays, auditory and factual displays. Speech communications. Biomechanics of motion, types of movements, Range of movements, strength and endurance, speed and accuracy, human control of systems. Human motor activities, controls, tools and related devices. Anthropometry: arrangement and utilization of work space, atmospheric conditions, heat exchange process and performance, air pollution. Dangerous machine (Regulation) act, Rehabilitation and compensation to accident victims, Safety gadgets for spraying, threshing, Chaff cutting and tractor & trailer

	operation etc. **Practical** Calibration of the subject in the laboratory using bi-cycle ergo-meter. Study and calibration of the subject in the laboratory using mechanical treadmill; Use of respiration gas meter from human energy point of view. Use of Heart Rate Monitor. Study of general fatigue of the subject using Blink ratio method, Familiarization with electro-myograph equipment, anthropometric measurements of a selected subjects. Optimum work space layout and locations of controls for different tractors. Familiarization with the noise and vibration equipment. Familiarization with safety gadgets for various farm machines.
	Building Construction and Cost Estimation 2(2+0) BEAS-221 **Theory** Building Materials: Rocks, Stones, Bricks Properties and varieties of Tiles, Lime, Cement, Concrete, Sand. Glass, Rubber, Plastics, iron, Steel, Aluminium, Copper, Nickle. Timber. Building components: Lintels, Arches, stair cases, Different types of floors, Finishing: Damp Proofing and water proofing, Plastering, pointing, white washing and distempering – Painting, Building design, Design procedures, Technology, building construction, Types of agricultural buildings and related needs, application of design theory and practice to the conservation, sloped and flat roof buildings, construction economics: Preliminary estimates, Detailed Estimates of Buildings source of cost information, use of cost analyses for controlling design, Factors affecting building costs; cost evaluation of design and planning alternatives for building and estate development, Measurement and pricing, Economic methods for evaluating investments in buildings and building systems: cost-in-use, benefit-to-costs and savings-to-investment ratios, rate of return, net benefits, payback