

B.Sc. AGRICULTURE (4-YEARS) COURSE CONTENTS

SEMESTER WISE DETAILED LAYOUT OF COURSES

Semester-I						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Elementary Statistics	1+1	35	15	25	75
2	Agriculture Meteorology	1+1	35	15	25	75
3	Computer Application	1+1	35	15	25	75
4	Str. & Spoken English	1+1	35	15	25	75
5	Elementary Agriculture/Elementary Biology/ Elementary Mathematics (Only one depending on subjects in 10+2 standard)	2+1	35	15	25	75
6	Principles of Agronomy	2+1	35	15	25	75
7	Rural Sociology & Educational Psychology	2+1	35	15	25	75
	Total	10+7=17	245	105	175	525

Semester-II						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Fundamentals of Soil Science	2+1	35	15	25	75
2	Fundamental of Horticulture	2+1	35	15	25	75
3	Elementary Plant Biochemistry	2+1	35	15	25	75
4	Weed Management	1+1	35	15	25	75
5	Element of Genetics	2+1	35	15	25	75
6	Introductory Entomology	2+1	35	15	25	75
7	Introductory Plant Pathology	2+1	35	15	25	75
8	Microbiology	1+1	35	15	25	75
	Total	14+8=22	280	120	200	600

Semester-III						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Vegetable Production	2+1	35	15	25	75
2	Irrigation water management	2+1	35	15	25	75
3	Principles of Plant Breeding & Breeding of Field Crops	3+1	35	15	25	75
4	Soil Fertility and Nutrient Management	2+1	35	15	25	75
5	Agri. Marketing and International Trade	2+1	35	15	25	75
6	Field Crops (Kharif)	2+1	35	15	25	75
7	Crop Disease and their Management	2+1	35	15	25	75
	Total	15+7=22	245	105	175	525

Semester-IV						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Economic Entomology	2+1	35	15	25	75
2	Introduction to Plant Biotechnology	1+1	35	15	25	75
3	Field Crop II (Rabi)	2+1	35	15	25	75
4	Agriculture Co-operation, Finance and Bust. Mgt.	2+1	35	15	25	75
5	Insect pest and their Management	2+1	35	15	25	75
6	Fruit and Plantation Crops	2+1	35	15	25	75
7	Livestock Production	2+1	35	15	25	75
8	Rain fed Agriculture	1+1	35	15	25	75
	Total	14+8=22	280	120	200	600

Semester-V						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Poultry Management	2+1	35	15	25	75
2	Mushroom Cultivation	1+1	35	15	25	75
3	Elementary Crop Physiology	2+1	35	15	25	75
4	Farm Machinery and Power	2+1	35	15	25	75
5	Farm Mgt. and Natural Resource Economics	2+1	35	15	25	75
6	Fundamental and Rural Development	2+1	35	15	25	75
7	Post Harvest Mgt. & Processing of Fruit and Vegetables	2+1	35	15	25	75
8	Practical Crops Production-I	0+2	0	0	75	75
	Total	13+9=22	245	105	250	600

Semester-VI						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	Farming System and Sustainable Agriculture	2+1	35	15	25	75
2	Conservation and Management of soil and Water Resources	2+1	35	15	25	75
3	Ornamental Horticulture	2+1	35	15	25	75
4	Environmental Science	2+1	35	15	25	75
5	Silviculture and Agro-forestry	2+1	35	15	25	75
6	Seed Production and Processing Technology	2+1	35	15	25	75
7	Practical Crops Production-II	0+2	0	0	75	75
	Total	12+8=20	210	90	225	525

Semester-VII						
S.No.	Course Title	Credit Hrs	Theory		Practical	Total
			Ex.	Int.		
1	General Economics	2+0	35	15	0	50
2	Breeding and Improvement of farm Animals	2+1	35	15	25	75
3	Principles of Animal Nutrition	2+1	35	15	25	75
4	Element of Food Technology	2+1	35	15	25	75
5	Human Food and Nutrition	2+1	35	15	25	75
6	Soil Taxonomy, Survey and Remote Sensing	2+1	35	15	25	75
7	Production Technology of Medical and Aromatic Plants	2+1	35	15	25	75
	Total	14+6=20	245	105	150	500

Semester-VIII						
S.No.	Rural Agriculture Work Experience	0+20	0	0	525	525
	Total	0+20	0	0	525	525

Semester-I

Paper I: Elementary Statistics

Introduction to statistics, arithmetic mean, median, mode and partition values, range, inter quartile range, quartile deviation, mean deviation, variances, standard deviation, coefficient of variation, moments, skewness, kurtosis and its measure; Definition of probability, Simple problems based on probability theory; Definition of correlation; Scatter diagram; Karl Pearson's coefficient of correlation; Linear regression equations; Introduction to test of significance, one sample and two sample test for mean.

Practical

Based on Graphical representation of data, measure of dispersion **raw** & central tendency, partition value, measures of dispersion & central moments, measure of skewness & kurtosis, correlation and regression analysis, application of one sample t-test and fisher's sample t-test.

Paper II Agriculture Meteorology

Earth atmosphere-its composition, extent and structure; Atmospheric weather variable; pressure, its variation with height; Daily and seasonal variation of wind speed and direction. Cyclones and anticyclones, air masses and fronts; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave and thermal radiation, albedo; atmospheric temperature inversion, daily and seasonal variation of temperature balance of earth; atmosphere humidity; concept of saturation, vapour process of condensation, formation of dew, fog, mist, frost, snow rain and hail; precipitation, cloud formation and movement. Agriculture and weather relation; Modification of crop microclimate, use of weather data for irrigation scheduling, pesticides sprays, fertilizer application; climatic normals for crop production.

Practical

Visit to agro-meteorological observatory and its site selection, installation and exposure of various instruments, weather data recording, measurement of total solar radiation, short wave and long wave radiation, albedo and sunshine duration maximum and minimum, air temperatures, soil temperature, dew point temperature, Determination of vapor pressure, relative humidity, atmospheric pressure, wind speed and evapo-transpiration. Processing, tabulation and presentation of weather data.

Paper III Computer Application

Introduction to personal computer, peripherals, operating system (DOS & Windows) and high-level language, Introduction with software packages (Lotus, FoxPro, Statistical, Packages) and its execution for the following application; solution of simultaneous equations, plotting of graph and diagram, Simple agricultural statistics computation, Database file; creation and query.

Practical

Demonstration of working of computer system, MS-DOS, MS windows commands and utilities, writing sample software for agricultural problems, basic programmes, practice for plotting graphs based on various agricultural data.

Paper IV Structural and Spoken English

Structural patterns of communicative grammar, modern usages; functional language, verb, adjective, adverb, preposition, conjunction; articles; word formation and vocabulary building-affixes, prefix, suffixes, synonyms, antonyms, substitutions and foreign words; prepositions; phrases & idioms; gerunds; participles; infinitives; time and tense; modal verbs, conditional

parifies; synthesis; transformation controlled writing; paragraph writing; study of modern technical prose; listening and reading skills; comprehension; phonetic and scientific system of spoken English and speech mechanism; symbol and sound; stress and intonations.

Practicals

Speech mechanism speech event, production of speech organs; phonetic sound symbols-pure vowels; diphthongs; consonants(voiceless/voiced, accented/unaccented, aspirated/ un aspirate); stress and intonation word accent (syllable, consonant clusters), stress shift, compound word, word accent in Indian English Vs R sonant clusters; stress shift, compound word; word accent in English VS RP; rules for accentual patterns; accent in connected speech rhythm; weak forms; intonations-falling tone; rising falling tone; listening comprehension; skill sear training.

Paper V. (Any one unit of the following is to be opted by the student depending on subjects in intermediate level.)

Unit I. Elementary Agriculture

Indian Agriculture-scope and resources; crop plants-their significance as source of food, feed, fuel and raw material for various industries; crop seasons and classification of crop according to season. Cultivation of important crops in the state such as wheat, rice, cotton. Sorghum, maize, groundnut, rape seed & mustard, chickpea, pigeonpea, tobacco, berseem, potato and sugarcane. General acquaintance with horticultural crops such as cabbage, apple, mango, litchi, citrus, guava.

Soil-their formation, classification, physical and chemical properties; manures and fertilizers-essential plant nutrients, uptake of N,P, & K by important crops, methods of manure & fertilizer application, composition of bulky organic manures, concentrated organic manures, green manures and various types of inorganic fertilizer.

Introductory economics-Factor of production, exchange, different types of markets; pricing, bank and credits, law of diminishing returns, place of agriculture in five year plans. Statistics relating to agricultural production.

Study of main breeds of animals such as cows, buffaloes, goats, sheep and poultry. Elementary physiology and anatomy of cow and buffaloes. Characteristics of milch cattle. Care of animal, poultry management, principles of nutrition and common medicines.

Types of iron and steel used in agricultural implements; different water lifting devices, tillage, different methods of ploughing. Power transmission through belts, pullies, gears, chaff, cutter, cane crusher. Necessity for drainage, damage to soil due to excess moisture, land development, prevention and formation of acidic and alkalie soils. Irrigation and drainage-importance of water,

quality of irrigation water; sources methods and measurement of irrigation water, disadvantages of excessive soil moisture necessity and methods of drainage.

Practical

Identification of important crops, crop seeds, common fertilizers and agricultural chemicals, crops weeds, farm implements and acquaintance with irrigation resources and instruments. Acquaintance with vegetable and horticulture crops and their management, study of main cattle breeds and their management and also visit to livestock centers and laboratories. Practical knowledge of seed bed preparation and other recent agronomic practices of main crops, visit to agricultural museum and meteorology observatory estimation of yield and cultivation cost of main field and horticultural crops, study of different type of markets and banks including their visits.

Unit 2 Elementary Biology

Introduction to the living world, diversity of life, characteristics of life, system of classification, binomial nomenclature, main groups of animals from protozoa to mammals. Diversity of plants, classification, brief study of algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms, morphology of root, stem leaf, inflorescence, flower. Germination, systematics and ecology. Structure of cell, cell division, heredity and genetics, origin of life and evolution. Histology and physiology of rabbit.

Practical

Important characters of algae, fungi, bryophytes and gymnosperms. Morphology of flowering plants and their parts i.e. root, stem and leaf of both dicots and monocots. Families- cruciferae, leguminosceae, Compositeae and Gramineae. Field trip. Study of specimens and slides from protozoa to mammals. Cell division and tissues. Histology and skeletal system of rabbit.

Unit 3 Elementary Mathematics

Co-ordinates; Distance between two points, coordinates of a point division of straight line joining two points, area of triangle and quadrilateral, equations of straight line, change of axes, circle, parabola and ellipse. Simple problems based on them.

Functions: Limit continuity, differentiation, equations of tangent and normal, maxima and minima, Methods of integration including integration by parts. Define integral, application of definite integrals in finding areas under curves.

Determination: Matrices, matrix addition and matrix multiplication, trans–pose of matrix, solution of liner equation using crammers rule.

Paper VI Principles of Agronomy

Agronomy as a science and its scope, plant growth and development, environmental effects on crop growth, ideal plant type, tillage seed quality, sowing, crop density and spatial arrangement, crop nutrition, organic manures and fertilizers, irrigation and drainage, weed management, distribution of crops, cropping system, selection of crops and varieties for multiple cropping, crop yield contributing character; Organic farming concept, practices and scope in India; Crop production in dry lands, salt affected, acidic, flood affected, waterlogged and eroded areas.

Practical

Sowing techniques of different crops, effect of seeding depth on germination and seedling vigor, weeds and weed control experiments, top dressing of nitrogen, layouts, design and statistical techniques used in field experimentation, yield contributing characters and yield estimation, germination and viability test, forge crops and important experiments at LRC, numerical exercises on requirement of fertilizer, plant population and herbicides, tillage implements, morphological description of major crops, irrigation water measurement by Parshall flume and calculation of time required to irrigate unit area, preparation techniques of charts and diagram and preparation of cropping scheme for a given farm.

Paper VII. Rural Sociology and Education Psychology

Concept, method, tools, characteristics of rural society and people; rural-social continuum and difference, rural social stratification: status, roles, class, castes etc.

Panchayati Raj and Block Development Organization as rural people's participative agencies for planned development.

Specific program for rural area upliftment/ employment: JRY, IAT, EAS, MWS, IRDP, GKY, DWCRA, TRYSEM, DPAP, NSAP, Land reforms, etc. Council for Advanced of peoples action and rural Technology (CAPART), National Fund for Rural Development (NFRD), NGOs/Voluntary Sector.

Conceptual clarification on educational psychology, Psychology of individual difference- MA & IQ; the gifted, Slow Learner and socially disadvantaged child, hygiene and adjustment, guidance and counseling.

Practical

Socio economic survey and study about its tools, study about rural social institutions, Visit to Panchayati Raj institutions (any one tier of Panchayati Raj system), and measurement of IQ.

Semester II

Paper I. Fundamentals of Soil Science

Soil as a natural body and medium for plant growth; soil component and soil plant relationship; soil forming rocks and minerals; weathering and process of soil formation; physical properties of soils- texture, structure, density and porosity, soil colour consistence and plasticity, soil reaction pH and its measurement, soil acidity and alkalinity, buffering, effect of pH on nutrient availability, soil colloids-inorganic and organic; silicate clays: constitution and properties; humic substances nature and properties; ion exchange, cation exchange capacity, base saturation; soil organic matter: composition, properties and influence on soil properties, transformation of organic and inorganic wastes in soil- Urban and Industrial wastes. Soil water retention, dynamics and availability; soil air composition and dynamic; source, amount and flow of heat in soils; soil temperature and plant growth; soil survey and classification, soil of India; soil pollution behavior of pesticides and inorganic contaminants, prevention and mitigation of soil pollution.

Practical

Use of soil sampling tools, collection, preservation and storage of soil sample. Study of soil forming rocks, mineral density and porosity. Study of soil texture by feel method. Study of soil structure, colour and soil map. Capillary rise phenomenon of water in soil column and water movement in soil. Soil reaction measurement by indicators and glass electrode pH meter. Determination of electrical charges on soil colloids and its nutrient retention capacity. Estimation of organic matter content and buffering capacity of soil. Microscopic examination of soil microbes.

Paper II. Fundamentals of Horticulture

Horticulture: Definition and its branches; importance and scope; horticultural and botanical classification; climate, soil and distribution of fruit crops; propagation and nursery raising; principles of orchard establishment and management; flower bud differentiation and propagation; causes of unfruitfulness; pollinizers and pollinators; environmental and soil factors affecting vegetable production, kitchen gardening; types of gardens and their parts; care and maintenance of ornamental plants; lawn making; knowledge of landscaping of rural and urban areas; exposure to important medicinal & aromatic plants, spices and condiments, use of plant bio-regulator in Horticulture, post Harvest Technology- Principles and Practices.

Practical

Identification of garden tools and horticulture crops. Preparation of seed bed/nursery bed for fruit, crops. Practice in asexual methods of propagation-cutting, layering, budding & grafting, layout and planting of orchard plants, training and pruning of fruit trees, transplanting and care of vegetable seedling, making of herbaceous and shrubby borders and potting mixture; potting and repotting.

Paper III. Elementary Plant Biochemistry

Recapitulation of basic chemistry and biology, water, pH and buffer; cellular constituents: Structure and function –amino acids and protein, carbohydrates, lipids and biomembranes and nucleic acids; Enzymes- function, properties and mechanism, metabolism of cellular constituents: Central Metabolic Pathways: Derivative path ways- glycolysis, hexose mono phosphate pathways, degradation of starch, sucrose, other sugars, fatty acids and acylglycerols, proteins and amino acids; Biosynthetic path ways, photosynthesis, formation of sucrose and starch, Krebs's cycle and electron transport chain; Nitrogen and sulphur cycles; Nitrogen fixation, assimilation of ammonia; synthesis of DNA, RNA and proteins; Secondary metabolites- structure, function and metabolism.

Practical

Preparation of standard, buffer and colloidal solution; determination of pH; qualitative tests on carbohydrates, lipids, amino acids and proteins; quantitative estimation of reducing sugars, amino acids and protein and cholesterol; acid and enzymatic hydrolysis of starch and

identification of products by paper chromatography; enzymatic hydrolysis of starch and identification of products by paper chromatography of lipids; assay of dehydrogenase and demonstration of differential centrifugation, gel electrophoresis, ion exchange chromatography and gel filtration.

Paper IV. Weed Management

Introduction: definition, costs to society from weeds, classification of weed, Ecology of weeds: Reproduction (Seed production, seed dissemination, seed germination, vegetative reproduction), geographical distribution, factor influencing weed distribution, weed succession on uncultivated sites, competition between crops and weeds. Concepts of prevention, eradication and control of weeds. Weed control methods: Physical, cultural, biological, chemical and integrated weed management, Introduction to herbicides: basic concepts, polar vs. Non-polar, Esters, Salts, acids etc, Surfactant chemistry. Factors affecting foliage active herbicides: reaching the target plants, spray retention, absorption into leaf, translocation, and factors influencing soil applied herbicides: microbiological effect, soil absorption, photo-decomposition and volatilization, spray of herbicides.

Practicals

Study of common Indian weeds and their characteristics, mode of propagation, occurrence and importance, techniques of weed collection and preservation, herbicide classification and identification, spray equipment and their calibration, herbicide doses calculations, effect of herbicides growth and development of crops and weeds. Tours and visits to weed affected field & areas.

Paper V. Elements of Genetics

History : pre-mendelian and post-mendelian concepts of heredity, mendelian principles of heredity, probability and chi-square, Cell and animal cell, chromosome structure. Cell division mitosis, meiosis, variation in chromosomes polytene chromosome, Lampbrush chromosomes. Dominance relationship, gene interaction.

Multiple alleles, pleiotropism and pseudoalleles. Sex determination, sex linkage, sex limited and sex influenced traits. Linkage, crossing over mechanism, chromosomes mapping, structural change in chromosomes: Deletion and Duplication, Translocation and inversion, "Numerical change in chromosomes, chemical basis of heredity" Gene concept, mode of replication of genetic material, transcript and translation genetic material. Gene regulation and operon concept. Mutation- chemical and physical mutagens, mode of action of mutagens. Extra nuclear inheritance. Polygene and quantitative inheritance. Introduction to plant tissue culture.

Practicals

Simple and compound microscope, cell culture, monohybrid and dihybrid cross, epistatic interactions. Practice of mitotic and meiotic cell division over two point test cross linkage analysis, three point test cross linkage analysis, sex linked inheritance, pedigree analysis, DNA and RNA structure. Structural change in Chromosomes and numerical change in chromosomes.

Paper VI. Introduction Entomology

Introduction and scope of Entomology, brief history of entomology in India, Insects as Arthropods and its relationship with phylum Annelida and other classes of Arthropoda, origin of insects, major points related to dominance of insects in Animal Kingdom. External morphology and anatomy of grasshopper; body segmentation, integument, thorax and abdomen, antennae, legs and wings and their modifications, generalized mouth parts and their modification, Alimentary, Circulatory, Excretory, Respiratory, Reproductive and nervous system, major sensory organs like simple and compound eyes, chemoreceptors, endocrine glands; basic embryology and post embryonic development basic groups of present day insects with special emphasis to order and families of agricultural importance like Orthoptera: Tettigonidae, Gryllidae, Gryllotalpidae, Acrididae; Dictyoptera: Mantidae, Blattidae; Isoptera: Hemiptera, Coreidae, Cimicidae, Cicadellidae, Delphacidae, Lophophidae, Aleurodidae, Aphididae, Coccidae; Thysanoptera Coleoptera. Carabidae, Meloidae, Coccinellidae, Bruchidae, Chrysomelidae, Curculionidae, Cerambycidae; Diptera: Culicidae, Cecidomyiidae, Agromyzidae, Muscidae; Lepidoptera: Pieridae, Papilionidae, Hesperidae, Sphingidae, Noctuidae, Arctidae, Pyralidae, Saturniidae, Bombycidae; Hymenoptera. Tenthredinidae, Braconidae, Chalcididae, Trichogrammatidae.

Practical

Collection, Killing, Pinning and mounting of insects, study of different classes of phylum Arthropoda, external morphology of grasshopper, typical mouth parts and their modifications of antennae, legs, wings and parts and their coupling apparatus, structure of alimentary canal and nervous system, tracheal, reproductive and other system in insects, post embryonic development in insects and basics of insects classification. Basic groups of present day insects with special reference to orders and families of agricultural

Paper VII. Introduction Plant Pathology

Importance of plant disease, scope and objectives of plant pathology. Concept of plant diseases inanimate cause and plant virus. Classification of plant disease. Definition and terms, parasites, pathogens, biotrophs and hemibiotrophs, necrotrophs, pathogenicity, pathogenesis, virulence, infection, primary infection, inoculum, invasion and colonisation, inoculum potential, symptoms, incubation period, disease cycle, disease syndrome, single cycle disease, multiple

cycle disease, alternate host, collateral host, predisposition, physiologic race, biotype, symbiosis, mutualism, antagonism. History of plant pathology with special reference to Indian work. Pathogenesis & parasitism, Koch's postulate. Effect of pathogenesis on the plants, morphological changes, physiological changes. Development of epidemics. Principles and methods of plant disease management. Basic concepts; avoidance, eradication, protection, disease resistance and therapy.

General morphology, characteristics of fungi and somatic structure, reproduction of various structure. Basic and different methods of classification of fungi, taxonomy and nomenclature. Study of selected genera. Plasmodiophora, spongospora (Myxomycota), Synchronium, Physeoderma, pythium, phytophthora, albugo, sclerophthora, peronospora (Mastigomycotina); Taphrina, Erysiphe, claviceps, Sclerotinia (Ascomycotina), Puccinia, Melampsora, Uromyces, Ustilago, Tilletia, Neovossia, Sphacelotheca, Tolyposporium (Basidiomycotina), Colletotrichum, Alternaria, Cercospora, Fusarium, Helmenthosporium, Pyricularia, sclerotium, Rhizoctonia, Phyllosticta, Phoma (Deutromycotina). General morphological and cultural characters of procaryotes (Bacteria, basic methods of classification, taxonomy and nomenclature. Nutrition and effects of physiochemical factors on growth. Reproduction and life cycle. Genetics and variability, importance and general characters of mycoplasma, spiroplasma & Fastidious bacteria, reproduction, nomenclature and classification. Physical architecture and chemical composition of virus & virioids. Nomenclature and criteria of identification, multiplication, transmission and infective nature. General morphological characters, life cycle, reproduction of nematodes behaviour in soil and nematodes as vectors for other plant pathogens. Classification and general identifying characters of phanerogamic plant parasites, reproduction and life cycle.

Practical

Acquaintance with various laboratory equipments and microscopy. General study of different structures of representative fungal genera, straining and identification of plant pathogenic bacteria, diagrammatic representation, identification and transmission of plant viruses. Extraction and identification of plant parasitic nematodes, study of phanerogamic plant parasites. Preparation of media, isolation and Koch's postulates and use of chemicals and plant disease control.

Semester III

Paper I. Vegetable Production

Importance of vegetable in human nutrition and national economy, factors affecting vegetable productivity viz. light, temperature, moisture, oxygen, CO_2 minerals, nutrients, Soil reaction, disease and insect; types of vegetable farming; types of classification of vegetable viz. botanical, seasonal, classification based on cold hardiness, parts used, duration of crop; weed management, use of bio regulators, seed production, harvesting and marketing.

Cultivation practices viz. time of sowing, nursery management, transplanting, sowing/ planting distance, recommended cultivars, seed rate, manure and fertilizers does, harvesting, storage, physiological disorders, diseases and insects pests and their control measure of various vegetable crops namely potato, tomato, onion, garlic, okra, sweet corn peas, beans, cucurbitaceous croup-pumpkin, bottle gourd, sponge gourd, ridge gourd, pointed gourd, bitter gourd, cucumbers etc.

Practical

Identification of vegetable crops seed, study of morphological characters; practice of nursery raising. Transplanting of seedlings and direct seed sowing in the field; fertilizer application by different methods; raising of vegetable seed crops, seed extraction; harvesting and preparation for market; economics of vegetable production.

Paper II. Irrigation water management

Water resources of India, sources of irrigation water demand, supply and resources development of irrigation, soil moisture and its characteristics , soil water potential, retention and movement of soil water , water intake and infiltration. Moisture sensitive stage, water availability and nutrient up take.

Scheduling of irrigation based on soil moisture status, physiological stage of crop and meteorological parameters, irrigation under limited water supply conditions. Methods of irrigation; surface irrigation, flooding, furrow, border and basin irrigation. Sub-irrigation; drip and sprinkler irrigations.

Water stress and plant growth, effect of water stress on physio-morphological characteristics and productivity of plant, deficit irrigation and strategy for optimizing yield. Water quality standards and its suitability for irrigation, water use efficiency, agronomic techniques to boost water use efficiency, factors affecting water use-efficiency. Irrigation management in soil with low intake rate, saline and alkali soil, soil with shallow ground water table and in poorly drained soil.

Water requirement of crops, factor affecting the water requirement of crops method of determining water requirement, effective rainfall, evapo transpiration and potential evapo transpiration and consumptive use irrigation requirement of major crops.

Practical

Soil moisture measuring instruments, measurement of soil and plant water status with the help of different instruments. Measurement of irrigation water and efficiency of different methods. Use of meteorology data in scheduling irrigation, scheduling of irrigation on the basis of ET demand of crops, measurement of ground water, irrigation water quality determination, exercise on field capacity, PWP, Bulk density, consumptive use, irrigation water requirement, irrigation plan for a farm and fertilizer application with pressurize irrigation system.

Paper III. Principal of Plant Breeding & Breeding Field Crops

Historical development of plant breeding, plant breeding concept nature and role of plant breeding, major achievements and future prospects, genetics in relation to plant breeding, modes of reproduction, self incompatibility and sterility. Plant breeding materials, domestication, centers of origin, center of diversity, acclimatization and genetic variation and heritability.

Breeding methods in self pollinated crops: introduction, selection- pure-line theory, multilane varieties, hybridization techniques and handling of segregation population, Hardy-Weinberg law, methods of breeding crops pollinated crops, system of mating, heterosis and inbreeding depression, development of inbred lines and hybrids and synthetic varieties, breeding methods in asexually propagation crops, clonal selection and hybridization, polyploidy in relation to plant breeding, mutation breeding-methods, uses, nature of gene mutation, mutagenic agents, induced mutation in plant breeding, breeding for important biotic and abiotic stresses, and use of biotechnology in plant breeding, procedure for release of new varieties.

Crop systematic, species relationship, floral biology and inheritance of economically important character, breeding objectives- development of varieties with desired yield, adaptability, stability, disease and pest resistance and quality (Physical, chemical, nutritional and marketing); important varieties along with parentage and characteristics, future thrust area in varietal improvement in crops like wheat, rice maize, soybean, field pea, urd bean and rapeseed- mustard, sunflower, groundnut, sorghum, sugarcane, potato, cotton and tobacco.

Practical

Germ plasm of various crops. Floral structure and biology of self –pollinated and cross-pollinated crops. Self incompatibility, emasculation and hybridization techniques in self pollinated crops. Study of variation in segregation population for qualitative and quantitative in self pollinated crops. Study mean, range, variances, standard deviation and genetic advance; heterosis and inbreeding depression. Prediction of performance of double cross hybrids. Comparative study of selection method in self-pollinated crops. Induction of polyploidy through colchicines and other methods. Induction of mutation through chemical mutagens eg. EMS etc.

Germ plasm, breeding trials in field and features of the varieties of the region of crops viz. wheat, barley, pea maize, sugarcane, rapeseed, mustard, sunflower, oat, potato, urd bean and cotton.

Paper IV. Soil fertilizer and Nutrient Management

History of plant nutrition and soil fertilizer and productivity, problems of fertility in India; plant growth and development, factor affecting plant growth; essential plant nutrients, their role and deficiency and toxicity symptoms; ion exchange phenomena in soil and its role in plant nutrient availability; movements of nutrients from soil to plant roots, their uptake and translocation.

Chemistry of soil nitrogen- Nitrogen cycle, mineralization and immobilization, properties and use of inorganic and organic nitrogenous fertilizer in crop production; chemistry of phosphorus in soil, phosphate fixation and availability; chemistry of potassium in soil, potash fixation and availability; properties fixation and use of phosphorus and potassium fertilizers, chemistry of calcium, magnesium and their sources and usage; soil fertilizer evaluation and fertilizer

recommendations; bio fertilizer; integrated nutrient management; methods and time of application of fertilizers, efficient use of fertilizers.

Practical

Estimation of total and different inorganic forms of nitrogen in soil. Determination of available nitrogen, phosphorus, potassium sulphate and micronutrients in soil. Estimation of cation exchange capacity and exchange bases in soil. Interpretation of soil test data/report.

Determination of moisture. Total N, water soluble P and soluble K in fertilizers. Rapid plant tissue tests and use of soil water plant test kit. Field trip for studying visual symptoms of nutritional disorders in plants.

Paper V. Agriculture Marketing & International Trade

Concept of marketing human needs and marketing, the marketing mix, the marketing strategy, product planning, promotion. Physical distribution and pricing; marketing at different levels of development, function of prices and role of price in economic development; marketing planning and organization; elements of marketing mix concept of marketing segment, market segmentation, basis of market segmentation, Type of markets, classification of consumer behavior, consumers of farm products factors affecting demand and consumption of farm products; supply of farm products; product decision and strategies, product life cycle and new product development, characteristic of farm firm, farm products and farm production, spatial and temporal distribution of farm products, supply, marketed and marketable surplus, factors affecting supply marketed surplus and marketable surplus of farm products; women's role in agriculture produce marketing; pricing and promotion strategies market structure, determination of price under alternate market structures price movement overtime, seasonal cyclical and trend, marketing communication, advertising, publicity, personnel selling and sales promotion; marketing function, exchange function's buying and selling physical function storage, transportation and processing; facilitating function – packaging, branding, financing, market information, grading etc. Management of marketing functions, marketing channel's stages of marketing, selection and management of marketing channels for farm products; meaning and components of marketing cost, price spread and market margins, marketing efficiency, concept and measurements of marketing efficiency; Role of government in Agriculture marketing, public sector institution- CACP, FCL, CWE, DMI, Fair price shops, EXIM Banks etc.

The concept and importance of inter-regional and international trade; emerging scenario of international trade in Agriculture commodities; basic theories of international trade; concept of terms of trade and BOP, implications of new GATT agreement (WTO).

Practical

Plotting and study of demand and supply curves and calculation of their elasticity. Relationship between market arrivals and prices of some selected agricultural commodities and their temporal behavior. Acquaintance with pricing methods. Visit to local agricultural markets and cooperative marketing societies to study their organization, functioning and performance. Collection of data from the agriculture markets for some selected commodities to study the marketing margins and costs. Class discussion on marketing practical and problems related to major produce cereals, pulses, oilseeds, livestock and livestock products. Application of comparative cost advantage principles in international trade.

Paper VI. Field Crops I (kharif)

Origin, geographic distribution, economic importance, soil and climate requirement, varieties, cultural practices yield of kharif crops. Cereals-rice, maize, sorghum, pearl millet and finger millet; pulses-Pigeonpea, mungbean and urdbean; oilseeds-groundnut sesame and soybean crops-cotton, jute and sunhemp; and farage crops sorghum, maize, cowpea, cluster bean and napier.

Practical

Rice nursery preparation and their transplanting. Sowing of soybean, pigeon pea, mung bean, maize, ground nut and cotton. Effect of seed on germination and seedling vigor of soybean/groundnut. Effect of sowing depth on germination of soybean. Identification of seeds in rice, maize and soybean fields and study of weed control experiments in these crops. Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum millets. Study of yield contributing characters, yield calculation, harvesting and yield estimation of above crops. Study of crop varieties and important agronomic experiment. Study of forage experiments.

Paper VII. Crop Disease and their management

Wheat disease-rusts, loose smut, kernel bunt, powdery mildew, *Alternaria* blight, khaira and tungro; maize disease- stalk rots, downy mildews, leaf spots and helminthosporium leaf spots; sorgam disease-smuts. Grain mold, anthracnose and strigaa; bajra disease-downy mildews and ergot; Sugarcane disease-red rot, smut wilt; groundnut disease- Sclerotinia stem rot, and *Alternaria* blight; white rust, downy mildew, Sclerotinia rot, and bacterial rot Soybean disease-*Rhizoctonia* blight, pot blight, seed rot, bacterial pustule, seeding blight and mosaic; pigeon pea diseases- phytophthora blight, wilt and sterility mosaic; gram disease- wilt, grey mould and ascochyta blight; lentil disease- rust and wilt; cotton disease anthracnose, vascular wilt, and black gram; tobacco diseases- damping off, early and late blight scurf, common scab, bacterial wilt and virus diseases; Tamato diseases- damping off, late and early blight, wilts root knot and virus diseases; Brinjal diseases- *Phomopsis* blight, fruit rot, Sclerotinia rot bacterial wilt and rot knot, chilies diseases- anthracnose and virus diseases, vegetable crucifer diseases- damping off, Downey mildew, and black rot; vegetable cucurbit diseases- downy mildew, powdery mildew, fusarium wilt and mosaic, Pea diseases; powdery and rust, Bean disease- anthracnose, blights, and virus diseases; scab, collar rot powdery mildew, fire blight, stem black and brown, pink

diseases, Papaya diseases- stem and foot rot, leaf curl, and mosaic, citrus- canker, anthracnose, citrus decline and virus diseases; Peach and pear diseases- leaf curl, brown rot, and guava- wilt, anthracnose and stem canker.

Practical

Color preservation of disease plant materials and dry preservation concept and method, study of the three wheat rust (black rust, brown rust and yellow rust), specimens of plants with references to symptomatology and casual fungi; Study of the loose smut and kernel bunt diseases of wheat- comparative differences between casual fungi and symptoms, study of bacterial blight of rice with references to symptomatology and casual bacterium- microscope studies. Differential staining and identification of plant pathogenic bacteria. Study of sorghum smuts, ergot of bajra and downey mildew of bajara symptomatology and morphological characteristics of the casual fungi, study of red rot of sugarcane and cercospora leaf spots of groundnut- symptomatology and characteristics of the casual fungi. Histopathological studies of *Albugo candida* causing white rust of mustard. Mung bean yellow mosaic-symptoms and transmission through white fly vector, *Bemisia tabaci*. Histopathological studies of wilts (*Fusarium oxysporum*) of chickpea and cotton. Study of the late blight and early blight and mosaic diseases of potato and isolation and microscope study of root knot nematode, *Meloidogyne incognita*. Study of mango malformation and powdery mildew of mango, etiology and historical and study of citrus canker, apple scab and guava application of fungicides; sprayers and dusters and disease measurement concerning prevalence, incidence and severity etc.

Semester IV

Paper I. Economic Entomology

How insects become pest, economic importance of insects, classification of pests, principles and methods of pest control, viz, physical mechanical, cultural, legal, genetic & chemical. Biological principles and methods of insecticidal applications, Apiculture, Sericulture and lac cultivation with special reference to equipment used insects and diseases, production and marketing.

Practical

Insecticide formulation, application, equipment, their handling and maintenance. Identification of commonly available natural enemies, honey bee, and lac insects species and their rearing visit to institutes to bee keeping, sericulture and lac insects.

Paper II. Introduction to Plant Biotechnology

Introduction: History of plant tissue culture and biotechnology, scope and importance of agricultural biotechnology, Gene technology and Tissue and cell culture: Media, various modes of culture and their application. Organ culture cell suspension culture, Callus culture, Micro propagation methods: Organogenesis and embryogenesis, their signification, Anther culture; haploid production, diploidization and their signification, Protoplasts isolation, fusion, somatic hybridization and hybrids, Somaclonal variation and its use in crop improvement, Germ plasm storage and cryopreservation, Secondary metabolite production, Introduction to genetic engineering, Gene technology. Gene transfer methods; Physical Chemical and Agro bacterium dependent methods, Generation of transgenic plants and their identification, Molecular markers, RFLP, RAPD, simple sequence repeats etc, Role of biotechnology in crop improvement.

Practical

Plant tissue culture laboratory working procedure, Preparation of nutrient culture medium. Study of different micro propagation approaches viz, meristem shoot tip culture, auxiliary bud etc. Organogenesis in tissue culture and other approaches.

Paper III. Field Crops II (Rabi)

Origin and geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of rabi crops; cereals wheat, barley and triticale; pulses-chickpea, lentil, peas, French bean; Oil seed; rapeseed and mustard, sunflower and linseed; sugar crops; sugarcane and sugar beet, Regional medicinal and aromatic crops such as mentha, lemon grass, citronella, palma rose, Isabgol and posts, potato and tobacco, Forage crops; berseem, Lucerne and Oat.

Practical

Sowing of wheat, sugarcane and sunflower. Top dressing of nitrogen in wheat and study of fertilizer experiments on wheat and mustard. Identification of weeds in wheat and grain legumes, application of weedicides and study of weed control experiments. Morphological characteristics of wheat, sugarcane, chickpea and mustard. Yield contributing characters of wheat. Yield and quality analysis of sugarcane. Crop distribution in the state and the region, Important agronomic experiments of rabi crops and visit to research stations related to rabi crops.

Paper IV. Agricultural Cooperation, Finance and Business Management

Cooperation-Meaning, Signification under Indian agriculture conditions, objectives principles of cooperatives. Agricultural cooperation in India credit marketing, consumer and multi-purpose cooperative, farming co-operatives, processing cooperatives, cooperative warehousing, role of ICA,NCU,NCDC,NAFED etc. Women co-operatives.

Meaning, scope and signification of agriculture finance. Credit needs of Indian agriculture, economic principle in capital acquisition and use decisions, preparation and analysis of financial statements- balance sheet and income statement. Cost of credit. Access for women to agricultural credit facilities. Agricultural credit market- institutional and non institutional sources of credit cooperatives credit system, commercial banks and regional rural banks, NABARD and AFC, problems and issues in institutional agricultural credit system. Business management environment of agriculture business, tasks of a professional manager, management system and processes, types of management decisions, decision making techniques and processes, organizational culture and management ethics.

Practical

Acquaintance with balance sheet and profit & loss accounts. Estimation of credit requirement of farm, appraisal of the loan, interest and performance of cooperative, commercial banks and RRBs, analysis of the relevant publish data. Class seminars and discussion on selected topics. Visit of commercial bank, cooperative bank, agricultural cooperative societies and agri- business units in order to impart firsthand knowledge of their management and working.

Paper V. Insect pests and their Management

Nature and extent of damage, life cycle seasonal history, host range, distribution and management of the major insect pests attacking field crops; Cereals, pulses, oilseeds, fiber, sugar crops, Horticultural crops, Brinjal, okra, potato, tomato, cole crops, leguminous vegetable, cucurbits, chilies, sweet potato, leafy vegetables, onion and garlic, colocasia, yam, fruit crops (tropical/sub tropical); jack fruit, papaya, coconut and date palm, mango, citrus, litchi, banana, guava, peach, pear, plum, apricot, chestnut, almond, plantation and garden crops: narcotics, spices and condiments. Stored grain and household pests; Locust and other major poly phagous insects, Rodents and mites of agriculture importance.

Practical

Nature of damage, life cycle and seasonal cycle and seasonal cycle of insect pests attacking field, vegetable and crops including stored grains: rodents and mites, their nature of damage, life cycle and management. Visit to cold storage research and Training institute and Horticultural research station.

Paper VI. Fruit and Plantation crops

Importance and scope of fruit and plantation crop industries in India. Cultivation practices of important fruit and plantation crops with reference to their origin, soil and climatic requirement; botany, important cultivars, plant propagation practices, resource and planting .Care and management in respect of irrigation, nutrient deficiencies of fruit plant and their collection, inter cropping, major cultivation problem and their control measures, harvesting, yield, storage and

marketing; application of plant bio regulators; post-harvest and technology of plantation crops. Management of major insect pests and disease, principles and methods of evaluation of fruit tree, project formulation and evaluation, commercial orchard.

Practical

Introduction of fruit plants-vernacular and botanical names, families, distinguishing vegetables, fruit characters, lifting and packing of fruit plants from nursery operation-lifting and shifting plants, weeding and hoeing; orchard layout and planting; plant propagation; methods sexual and asexual; seed treatment, seed sowing and germination, planting; cuttings and preparation of stool beds, study of bud intake and success in manuring operation in the orchards, training and pruning of fruit plants, use of plant bio-regulators in fruit set, fruit drop, fruit growth and fruit ripening, harvesting, handling, sorting, grading, packing and storage. Visit to temperate fruit research station/tea nursery and garden.

Paper VII. Livestock Production

Place of livestock in the national economy, efficient livestock development programme of government of India, importance of exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting livestock fertility, reproduction behavior like oestrus, parturition, farrowing etc. Milk secretion, milking of animal and factors affecting milk yield and meat production. Feeding and management of calves, growing of heifers and milch animal and other classes and types of animal. Housing principles, space requirement for different species of livestock. Disease control and measures of measure livestock diseases, sanitation and care. Breeding feeding and production records.

Practical

Identification, handling and restraining of animal, judging and culling, feeding and ration formulation, visit to livestock farms, economics of livestock production.

Paper VIII. Rain fed Agriculture

History of rain fed agriculture, magnitude of its problem and delineating criteria for rain fed and dry lands, soil climatic condition prevalent in rain fed area. Water stress in relation to crop productivity, concept of crop productivity and plant type for rain fed farming areas and crop improvement for efficient water use, drought resistance in crop plants. Efficient utilization of water through soil and crop management practices; reducing water losses through mulching and use of anti-transpirants, their kinds, mode of action and effect on crop yield. Increasing water storage by reducing run off and increasing infiltration through mechanical and cultural measures, water harvesting techniques, watershed management. Efficient management of rain fed crops: land preparation, seeding and crop density, selection of efficient crops and their varieties,

alternate cropping and land use strategies, soil fertility management and fertilizer use techniques, weed control and inter culture operation, mid season correction for mitigating the aberrant weather, agro techniques for hilly tracts.

Practical

Climatic conditions prevalent at the various dry land research centers of the country and delineating criteria for rain fed and dry lands; Pattern of rainfall in different dry land tracts of the country; onset and withdrawal of the monsoon, amount, intensity and distribution, and studies of the effective cropping season; critical analysis of rainfall and estimation of moisture index, probable seeding time possible drought period, crops and cropping systems for dry lands; practical utilities of mulches, their mode of application and effect on soil and crop growth; seedling emergence survival and initial growth of crops at different moisture regimes.

Seed soaking, seed treatment with chemicals and depth of seeding under moisture stress on emergence and seedling vigor, methods of fertilizer application in dry land areas; Effect of plant density, thinning, leaf removal under moisture stress condition on crop growth. Study of the salient features of a model water shed; methods of measurement and determination of run off; alternate land use strategies: Agro forestry, grass-legume forage and alley cropping system; visit to dry land research station and operational research projects to expose students to the latest agro techniques, and watershed management practices.

Semester –V

Paper I. Poultry Management

Characteristics of important breed of poultry, their methods of rearing, breeding, feeding and management. Incubation, hatching and brooding, vaccination and prevention of diseases. Preservation and marketing of eggs, its economics and keeping quality. Broiler production and rearing, hatchery management.

Practical

Visit to poultry farm, economics of poultry management, identification of important poultry breeds.

Paper II. Mushroom Cultivation

First record of cultivation edible fungi, definition of mushrooms, present scenario of mushroom cultivation, uses; nutritional and medicinal values of mushrooms, general morphological features and important characters for identification of different edible mushrooms and biological backgrounds for mushroom breeding. Definition of spawn and their type, methods of spawn production raising cultures, preparation of spawn media/master culture/ commercial grade spawn characteristics of good spawn, storage of spawn. Cultivation of *Agricus* species: Compost and its formulations, preparation of compost using short and long methods of composting, turning schedules, compost micro flora and different temperatures zones. Spawning and methods of spawning. Preparation of casing mixture and its sterilization, identification, isolation and management of different disease, pests and competitions/moulds. Methods of harvesting mushrooms, after care of harvested fruit bodies, after care of beds and crop room on termination of crop. Cultivation of *Pleurotus*, *Volvareilla*, *Lentinus* and *Auricularia* spp: Types of substrate, substrate preparation and its sterilization; spawn and methods of spawning, spawn run and cropping, harvesting and packing, processing of mushrooms: Different methods-canning, dehydration, freeze dry and bringing etc.

Practical

Preparation of spawn, preparation of casing material, identification of various type of edible mushroom. Post harvest handling of various kinds of mushroom such as caning, dehydration, drying etc.

Paper III. Elementary Crop Physiology

An introduction to plant physiology, plant cell-an introduction, laws of thermodynamics, diffusion and osmosis, the concept of water potential, cell water relations, absorption of water, transpiration, stomatal physiology, ascent of sap, ion uptake and metabolic utilization of mineral ions, deficiencies of mineral ions in plants, photosynthesis, respiration, fat metabolism, physiology of growth and development, growth regulators, physiological parameter influencing the productivity of major cereal, pulse and oilseed crops.

Practical

Cell structure, process of diffusion osmosis and plasmolysis, structure and distribution of stomata in monocot and dicot leaves, process of transpiration with the help of cobalt chloride paper and other methods, demonstration of the measurement of photosynthetic rates by infra red gas analyzer, factor affecting the process of photosynthesis, separation of photosynthetic pigments by paper chromatography, process of root pressure by exudation method and manometer, detection of certain essential micro and macro-mineral elements in crop plants, process of aerobic respiration in germinated seed and alcoholic fermentation, tropism and movement.

Paper IV. Farm Machinery and Power

Sources of farm power including non-conventional sources, farm mechanization, tillage, primary and secondary tillage equipment, specialized tillage tools, seeding and fertilizer machinery, specialized sowing and planting machine, inter culture equipment, plant protection equipment, harvesting and threshing, chaff cutter. Estimation of operating cost of farm equipments. Basic engine types, parts of I.C. engine, working of different engine systems, types of tractors, working of different tractor systems.

Practical

Study and identification of a country plough, mould board plough, disc plough and different types of harrows, study of seed-cum-fertilizer drill and its calibration. Study of sugarcane and potato planter, identification of different plant protection equipments, study of tractor drawn reaper and different type of threshers. Identification of different types of engines and their parts. Acquaintance of different system and controls. Tractor and practice in tractor driving. Practice in tractor driving.

Paper V. Farm Management and Natural Resources Economics

Meaning, concept, objectives, nature and scope of farm management. Meaning and definition of farm, structure and characteristics of farm business. Different types of farm and factors determining types and size of farm.

Basic principles of farm management-factor-factor and product-product relationships, law of equi-marginal return and law of comparative advantage. Meaning and concept of cost, types of cost and their importance in farm management decision making.

Concepts of farm returns. Farm business analysis and various measures of efficiency. Importance of farm business records and accounts, inventory, balance sheet, Profit and loss account of farm. Status of farm inputs-land, labour and capital. Farm planning and budgeting, meaning and importance of farm plan and farm budgets, partial and complete budgeting, formulation of farm plan and budget. Concept, subject matter and importance of natural resource economics. Classification of natural resources and basic term; ecosystem, biomass, biosphere reserves, rate of use, environment, pollution etc. and concept of natural resource economics-ecology. Natural resource management and conservation, issues in natural resource problems. Time element in decision making and B/b analysis. The basic theory of natural resource economics- efficiency in private market economy, externalities in natural resource use and alternative solution thereof.

Important issues in economics and management of land, water and forest resources and the environment. Natural resources administration and policy formulation.

Practical

Preparation of farm layout including determination of cost of fencing, application of different farm management principles concerning resources allocation, determination of most profitable level of input use, least cost combination of inputs, optimum enterprises combination through empirical data and computation. Application of cost principles in the estimation of cost of crop and livestock enterprises and preparation of farm plan the area. Collection and analysis of relevant data on various natural resources in the country and review & discussion of case studies. Methodology of economic analysis of project in the context of natural resource projects.

Paper VI. Fundamentals of Extension Education and Rural Development

Meaning, concept and process of extension education. Objective, principles and philosophy of extension. History of extension work in India. Education -formal and non-formal. Components of behavior-knowledge, attitude, skill and motivation. Principles and steps in teaching-learning process, learning situation. Implication of teaching.

Concept, need and steps in programme planning. Principle of programme planning, Programme planning process. Panchayati Raj Institution, organization and its role in programme planning. Extension evaluation -its meaning, principles, steps, techniques and criteria. Critical analysis various extension programme.

Meaning and importance of rural leadership, types, selection and qualities, training of leadership.

Meaning of administration, public administration and extension administration. Coordination and team work, Organization, POSDCORB, Organization and management of NES and recognized extension system. Rural development programme: an over view of CD programs before 1952, agricultural/ rural development programme- IAAP, CADP, HYVP, SFDA, hill area development programme, integrated tribal development project, integrated dryland farming project, integrated child development scheme, IRDP, TRYSEM, JRY, DWCRA, Mahila uthan yojana, Sunishchit rojgar yojana. Role of voluntary organizations in rural development, women in agriculture and rural development.

Practicals

Visit and study of Panchayati Raj Institution; block/ extension training centre, Study about extension teaching aids and methods. Preparation extension teaching aids like folder, pamphlets, poster etc. Acquaintance with university extension system and study of rural development programs in villages, evaluation of extension programme,

Paper VII Post Harvest Management & Processing of Fruit and Vegetables

Importance of PHM for fruit and vegetable. Total production, consumption pattern and post harvest losses in fruit and vegetables. Maturity and ripening process, biochemical changes after

harvesting, quality management for fresh marketing and processing. Storage of fruit and vegetables-ambient, low temperature and controlled atmosphere storage system. Packaging of fresh and processed products. Transportation system, mode of marketing, sorting, grading and handling. Pre treatment of fresh produce for marketing and processing. General principles and methods of preservation of jam, marmalade, tomato products-pickles and chutney, drying fruit and vegetables, fruit beverages-juices, squashes, nectars, cordials, by products of fruit and vegetable processing industries such as vinegar, cider. Canned fruit and vegetable products, frozen fruit and vegetables, government policies-regulation and specifications for fresh and processed products. Export promotion agencies and their role in export of fresh and processed products.

Practical

Determination of respiration rate and detection of post harvest disorders/ disease. Marketing losses in fresh produce. Calculation of refrigeration load for processing/ storage. Effect of packaging material/ transport system on their quality. Preparation of jam, jellies, chutneys/ sauces, ketchup and pickles. Canning, dehydration and freezing on fruit and vegetables. Chemical analysis of fresh and processed products and visit to mandi, export terminals and processing industries.

Paper VIII. Practical Crops Production-I

Complete practical acquaintance relating to scientific production technique of major field crops of the season including sowing weeding, hoeing, fertilizer and manure application, harvesting etc.

Semester VI

Paper I. Farming System and Sustainable Agriculture

Definition and concepts of farming system. Historical developments in farming system. Farming systems in India based on cultivation system viz. shifting, regulated, semi-permanent and permanent cultivation on rain fed and irrigation lands with perennial crops; grazing systems, enterprise mix, graphical distribution, general characteristics including relevant case studies, weakness as well as development path of each system. Concepts, importance, need and indicators of sustainability. Ecological basis of sustainability/ resource management. A profile of Indian agriculture in terms of availability of natural resources and their carrying capacity, demographic compulsions, increasing fuel and fodder needs, problems of soil health, land

degradation and conservation of natural resources including soil and water as part of sustainable resource management. Maintenance of the production base in irrigation agriculture. Modernization of agriculture and its relation with sustainability, natural resource centered versus commodity led production system, low versus excessive external input agriculture (LEIA v/s HELA), necessity and limits of using external inputs in LEIA with particular references to artificial fertilizers, pesticides, improved seeds, irrigation and mechanization and their implication on sustainability. Basic ecological principles of low external input sustainable agriculture (LEISA), securing favorable soil condition for solar radiation, water and air, exploiting complementary, synergies and combining genetic resources, exploiting animal –plant and animal-animal interaction, mixing crop, mixing livestock and integrating crops and livestock including aquaculture, exploiting indigenous plants and animal. Some promising LEISA techniques and practices – improved manure handling, composting, green manuring and bio-fertilizers, crop residue management and strategic use of mineral fertilizers. Mulching, wind breaks, water harvesting, tied ridging, strip cropping, preamble contour line barriers and water ponds.

Practical

Inter cropping, trap and decoy crops, constructed traps, repellents, biological control and strategic used of pesticides in crop and natural medicines in animal health care. Bio –intensive gardening, control farming, integrated crop livestock-fish farming, integrated forage production and farmer-centered techniques and practices there of Evaluation of constraint and optimization of farming systems.

Paper II. Conservation and Management of Soil and Water Resources

Soil resources of India; distribution of waste land problem soils; water resources of India and their utilization in crop production; soil tilth management and relationship with tillage; tilth requirement of different crops; soil impedance layers and their improvement; management of soil water energy state of water in soil and availability to plants; management of soil moisture under different climates; water harvesting techniques, effect of water quality on soil and plants; soil aeration problems and management ; soil thermal regimes in relation to crop and their optimization.

Recycling of agricultural and industrial organic wastes; wastelands and their management; reclamation and management of acidic, saline and sodic soils; soil erosion; extent, type and effects; soil conservation techniques, watershed mgt; application of remote sensing for assessment of soil and water resources.

Practical

Evaluation of irrigation water quality indices such as pH, ES RSC and SAR. Tensiometer and their use. Measurement of water holding and field capacities of soil. Preparation of saturation paste and saturation extracts of salt affected soils. Determination of pH, EC, Ca, Mg and Na in saturation extracts. Measurement of infiltration rate of soil, Determination of CaCO₃ equivalent of liming material. Estimation of lime requirement of acid soil and Gypsum requirement of sodic soils. Measurement of ODR and ER of soil. Estimation of water stable aggregate in soil and field trip to study the problems and management of soil and water resources.

Paper III. Ornamental Horticulture

Importance of ornamental gardening in human life, theory and practice of lands and formal garden for various places, identification, use of ornamental plants for the beautification of private and public places, styles of garden; formal and informal etc., land scape and town planning, ornamental plants for rural and urban areas, indoor gardening, pot culture; bonsai, hanging baskets etc. principles and practices involved in growing ornamental annual and perennial plants, planning, planning and layout of various parts of garden, herbaceous and shrubbery borders, lilly pots, rock gardens etc. Cultivation of important ornamental plants, rose, gladiolus, chrysanthemum, tuberose, orchids, anthurium, gerbera, dahlia, fern, palms, cycades, cacti etc. Post harvest technology, project formulation and evaluation.

Practical

Identification of ornamental plants, preparation, planting and care of lawn seed bed preparation and sowing, potting and repotting of ornamental plants, training and pruning of ornamental plants, cultural practices in important ornamental plants, bonsai culture, planning and layout of gardens, project formulation, use of flowers for different purpose, care and maintenance of green house/ poly house panes and arranging flower show, visit to nurseries and florist centers.

Paper IV. Environment Science

UNIT:-I(BASICS OF ENVIRONMENTAL SCIENCES)

Introduction to Environmental Sciences:

- Definition, scope and importance (the multidisciplinary nature of environmental sciences)
- Need for public awareness on Environment, Role of individual in Environmental protection

Natural resources (Renewable and Non-renewable Resources):

- Natural resource conservation: concepts
- Freshwater resources: use and over-exploitation of surface and groundwater, conflicts over water, hydroelectric projects, problems, traditional methods of harvesting of freshwater resources.
- Mineral resources: use and exploitation, environmental effects of extracting mineral resources, lime stone quarrying in Uttaranchal.
- Food resources: World food problems, changes caused by agriculture and overgrazing, effect of modern agriculture, fertilizer operated problem, water logging, salinity.
- Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources.
- Land resources: Land as a resources, land degradation, landslides, soil erosion and desertification.

Ecosystems:

- Concepts, structure, and components of an ecosystem.
- Abiotic and biotic variables.
- Ecosystem function, trophic levels, energy flow, food chain, food web, Ecosystem, homeostasis.
- Examples of ecosystems(aquatic: pond, lake, river)
- Terrestrial ecosystem: Forest, mountain
- Ecological succession.

Biodiversity and its conservation:

- Introduction: - Definition, genetic, species and ecosystem diversity.
- Bio- geographical classification of India
- Values of biodiversity: 5 Es (Esthetic, Economic, Environmental, Ethical, Emotional).
- Biodiversity at global, national and local levels.
- India as a mega-diversity nation, hot spots of biodiversity.
- Himalayan wildlife: Habitat loss poaching of wildlife, man-wildlife conflicts, and conservation.
- Threatened categories as per IUCN.
- Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-II (APPLIED ENVIRONMENTAL SCIENCES)

Environmental Pollution:

- Definition, causes, effects, and control measures of Air pollution.
- Water pollution and thermal pollution.
- Marine pollution.

- Noise and radioactive pollution.
- Solid waste and their management (municipal, industrial (hazardous and non-hazardous)), problems of solid waste Management (ISWM).
- Environmental hazardous in Himalayas (Floods, river, blockades, cloud burst, landslide, earthquakes)

Environmental problems and Environmental Protection:

- Anthropogenic and natural environmental ethics: issues and possible solutions.
- Climate change, global warming: cause, effects and mitigation (national and international efforts)
- Ozone layer depletion: causes, effects and mitigation. (national and international)
- Environmental Protection Act 1986.
- Air (Prevention and Control of pollution) Act, Water (Prevention and control of Pollution) Act.
- Wildlife Protection Act 1972
- Forest Conservation Act 1980
- The Biological Diversity Act 2002
- Issues involved in enforcement of environmental legislation, public awareness, Article 48A and 51 A
- Automobile Emission standards (Eco/Bharat), Eco-mark.

Human Population and the Environment:

- Population growth, variation among nations, population explosion family welfare programme.
- Environmental and human health.
- Role of Information Technology in environment and health.

Sustainable Development:

- Definition, concepts and currencies.
- Sustainable development of agro-ecosystem (organic farming)
- Sericulture, floriculture, bee keeping.
- Sustainable development of hydro energy in Uttarakhand.
- Traditional Ecological knowledge. (TEK)

Field Work/ Practical

- Documentation of natural resources of local area (river, forest, lake, pond, mountain, grassland)

- Visit to local polluted sites-urban/rural/industrial/agricultural
- Study of common plants, birds and mammals
- Study of simple ecosystem (pond, river, lake, hill slopes, etc.)
- Visit to sanctuaries, national parks and biosphere reserves.

Paper V. Silviculture and Agro-forestry

Introduction to basic terms, concepts and scope, national and global need, growth and development of trees and forest stands growth and development stages and growth measurements, factors affecting tree and stand growth, plant succession kinds and causes, natural and artificial regeneration establishment and care of tree nurseries tending operation cleaning, weeding, thinning, pruning, and other cultural operation classification, regeneration and crop characteristics of major Silviculture systems, basic concept of rotation, sustainable yield management and multiple use, establishment of forest stands/crops and agro-forestry selection and management of tree and crop species i.e. planting density, geometry and Silviculture, comparison among various land uses mixed farming, multiple cropping and agro-forestry, Interactions between components of agro-forests for various resources and productivity. Problems, choice and management of agro-forestry systems in various agro-climatic zones.

Practical

Identification and judging of tree species for their agro-forestry potentials, growth and development stages of forest trees and shrubs, qualification of growth (tree height, diameter, volume and increment) in trees, forest types natural regeneration, seed collection, storage and testing, planning forest nurseries site preparation and planting, computation of biological rotation in tree crop and tree crop interaction studies in agro-forestry.

Paper VI. Seed Production and Processing Technology

Seed, its importance in green revolution difference between grain and seed, concept of seed quality, steps involved in seed production. Seed technology, its objectives and its role in increasing agriculture production. Seed industry in India. Development of seed programs, general principles of seed production. Seed replacement rate, multiplication rate, Breeder's foundation and certified seed, maintenance of genetic purity, Nucleus and breeders seed production of newly released and established varieties of self pollinated crops, viz; Rice, Wheat Soybean/chickpea, Pigeon pea, Rapeseed and mustard etc. Maintenance of nucleus and breeder's seed in cross of establish varieties, foundation and certified seed production of maize in breeds, single and double cross hybrids. Hybrid seed production of sunflower, Sorghum, pearl

millet and Rice using male sterility systems. Latest released hybrids of Maize, Sorghum, Bajra and Rice their characteristics feature, seed production of Wheat, Rice, Oats, Soybean, Gram, Urd, Moong, Sunflower, Pigeon pea etc. Seed certification, its concepts, role and goals, seed certification agencies, certified and truthfully labeled seeds Seed processing, storage and marketing, minimum seed certification standards for self and cross-pollinated crops. Field and seed inspection objectives, general principle and methods, Seed sampling and seed testing for analytical purity, varietal identification through electrophoreses, Grow out test for cultivar purity, seed legislation and seed law enforcement including IPR, PBR in India, Recent developments in seed industry, Genetic ascent of varietal determination.

Practical

Seed production in major crops viz, Rice, Wheat, Soybean, Pulses, Oil, Seeds, Maize, Sunflower, Sorghum, Bajra and Forage crops, Seed testing approaches and techniques in cereals, pulses, oilseeds and other crops.

Paper VII. Practical crops Production-II

Complete practical acquaintance relating to scientific production techniques of major field of the season crop(s) including sowing weeding, hoeing, fertilizer and manure application, harvesting etc.

Semester VII

Paper I: General Economics

Nature, scope and subject matter of economics, approaches to economic analysis and nature of economic theory, basic terms and concepts; law of demand, determinants of demand, price, cross pricing and income elasticity of demand and their application; law of diminishing marginal utility and principle of equi-marginal utility, consumer's equilibrium and derivation of demand

curve, factors of production and input-output relationships, law of variable proportions and laws of scale, cost concepts, law of supply, determinants of supply, elasticity of supply, firm's equilibrium and market equilibrium in short run and long run, features of perfectly competitive market, price determination under perfect competition, basic features of monopoly, duopoly, oligopoly, and monopolistic competition meaning of distribution, factor market and pricing of factors of production.

Importance of national income, concepts of national income, approaches of measuring nation income, difficulties and limitations of nation income accounting, importance of population studies, determinants of population, theories of population, barter system of exchange and its problems, classification of money and concepts of money supply, quantity theory of money, Inflation & deflation. Role of bank money in modern economy, types of banks and their function, credit creation by commercial banks, functions of central bank and instruments of credit control, current changes in banking, concept of economy and economic system, basic feature of capitalistic, socialist and mixed economic systems, elements of economic planning, international trade, its need and importance, theories of absolute and comparative advantage, exchange rate, TOT, BOP, devaluation of currency, recent developments in world trade.

Special characteristics of agriculture and its role in economic development. Agricultural planning and development in the country. Role of women in Indian Agriculture.

Paper II: Breeding and Improvement of Farm Animals

Reproductive systems of farm animals. Qualitative and quantitative inheritance and effect of environment on them. Various qualitative and quantitative traits of livestock. Gene frequency and forces affecting them. Random mating and Hardy -Weinberg's law, variation, its measures, genetic, phenotypic and environmental variances. Heritability and repeatability, its measurement and uses. Selection its genetic effect, selection for dominant and recessive gene and quantitative traits, selection differential, response to selection, generation interval and annual rate of gain. Genetic correlation and correlated response. Basis of selection, individual, family, progeny, pedigree and combined selection. Methods of selection for one or more traits- random, independent culling level and selection index. Inbreeding- its consequences, inbred lines, line breeding, inbreeding coefficient and relationship coefficient, out breeding- various types of out crossing and cross-breeding, species hybridization and development of new breeds.

Practical:

Computation of mean, variance, standard deviation, correlation and regression coefficients, inbreeding coefficients and relationship coefficient in economic traits of livestock, estimation of gene frequency, repeatability and heritability in animal population.

Paper III: Principals of Animal Nutrition

Introduction to expanding field of nutrition, chemical composition of animal and its food, digestive system and processes of farm animals. Digestion, absorption and metabolism of carbohydrates, lipids and proteins in protein content in various classes of feeds. Concept of essential amino acids for non-ruminants and protein quality of feeds. The absorption and metabolism of essential minerals and vitamins, symptoms of their deficiencies, minerals and vitamin content of various classes of feeds. The nutritive evaluation of feeds for energy and protein, digestibility of feeds and partition of feed energy within animal, systems of expressing energy values of feeds, nutrient requirements of farm animals for maintenance, growth, reproduction and lactation. Substances for stimulating growth.

Practical

Study of plant cell, forages and fodders, cereals, cereal offal and oil cakes, animal, avain and marine offal, mineral and vitamin supplements and other feed additives. Least cost ration formulation, proximate analysis of feed samples for moisture, crude protein, crude fat, crude fiber, ash, acid insoluble ash and nitrogen free extractive. Formulation of ration for cattle, buffaloes, sheep, goat, swine and poultry.

Paper IV: Elements of Food Technology

Scope and importance of food technology in Indian economy, Handling, transportation and storage of food grains, fresh milk, meat, fish and eggs; physical, chemical and nutritional characteristics of food grains, fresh meat fish, milk and eggs; role of milling and size reduction in food processing. Use of low temperatures in processing and storage of food grains, fresh milk, meat, fish and eggs; drying and dehydration of food grains and concentration and evaporation of milk; food fermentations and their application in food processing. Role of food additives in the processing of food grains, milk, meat, fish, eggs and their products; food irradiation and its application in extending shelf life of food grains, meat, fish, eggs and their products; food packaging and its function; by-products utilization and disposal of food industry wastes; quality control, total quality assurance(TQA) and various systems of TQA.

Practical

Milling of wheat and rice and testing quality of milled products, baking of bread, biscuits and cakes; physical and chemical properties of milk, separation of cream and ghee making, preparation of chhena, paneer, khoa, ice cream and cottage4 cheese. Slaughtering of poultry and pickling of culled meat. Preparation of meat kabab and patties. Evaluation and preservation of fresh eggs. Visit to food industries.

Paper V : Human Food and Nutrition

Trends in food production and consumption in India. Role of agricultural scientists and food technologist in meeting national nutritional requirements.

Definition of human nutrition, nutrient, nutritional care, health, Nutritional status and good nutrition. Food and its functions and functional classification. Calorific value of food and its measurement. Digestion and absorption of various nutrients present in food. Energy and nutrients needs of human body. Recommended dietary allowances for various age groups and classes of individuals. Common nutritional problems in India and their causes. Specific Nutritional deficiencies and disorders including protein calorie malnutrition, nutritional anaemias, vitamin deficiencies, obesity, atherosclerosis. Clinical symptoms and diagnoses of deficiency disorder. Important food groups and their role in the management of deficiency disorder and disease. Food habitat and their effect on regional balance. Balances diet and its formulation.

Food borne infection and food hygiene. Effect of processing on the nutritional value of foods. Applied nutritional programme in country, nutritional policies of foods fortification, enrichment and restoration, supplementary feeding programmes for vulnerable groups. State national and international agencies dealing with nutritional programmes.

Practical

Determination of proximate composition, pH, acidity, minerals and vitamins (B¹, B², B⁶, and C) in foods. Detection of adulteration in various foods. Determination of calorific value of foods and formulation of balanced diets. Microbiological analysis of foods (SPC, coliform, and yeast and mould count). Signs of malnutrition in animals. Diagnosis of nutritional deficiency disorders in human being.

Paper VI: Soil Taxonomy, Soil Survey and Remote-Sensing

Types of soil survey, morphological, physical and chemical properties used in distinguishing and classifying soils. Principles of soil taxonomy, classification system. Soil of India and classification. Advantages of taxonomic classification of soils.

Remote sensing-introduction, definition, concept, principles, importance, scope, types, merits and demerits and its application in agriculture and soil classification.

Practical

Field visit and practice of judging soil texture by feel method; examination of soil profile. Study of base maps for soil survey, village or cadastral maps, topographic maps, aerial photographs and use of stereoscope, satellite imagery. Examination of soil properties of some important soil of India. Aerial photographs, adjustment of stereoscope. Area estimation of eroded land from F.C.C (False colour composite). Visit of Remote Sensing application centre/soil survey organization.

Paper VII: Production Technology of Medicinal and Aromatic Plants

Importance and scope of medicinal and aromatic plants, geographical distribution of species, botanical description, management of nurseries, climate and relation to medicinal and aromatic plants, improved varieties, soil and land preparation, intercultural practices, irrigation and insect-pest management, post harvest techniques, harvesting, processing, storage and herbage/constituent yield. The following medicinal and aromatic plants shall be covered.

Medicinal Plants: Sarpagandha, poppy, sadabahar, digitalis, dioscorea, solanum, brahmi, isabgol, senna, aloe, neem cinchona and lpecac.

Aromatic Plants: Essential oils: Mints-menthol mint, pepper mint, Spearmint, bergamot mint; Aromatic grasses-lemon grass, palmarosa, citronella, vetiver, ocimum, geranium, pahauli. Dill (sowa), cinnamon, pine eucalyptus, sandalwood, liquorice.

Flower perfume: Lavender, rose, rosemerry, jasmine

Practical

Identification and preparation of herbarium techniques of sowing planting study of morphological and chemical characteristics yield techniques for quality analysis and visit to related research institutions drug farms and pharmaceutical industries involved in the cultivation and processing of medicinal and aromatic plants.

Semester-VIII

Rural Agriculture Work Experience

Each student will have a choice to opt any four components given below. He /She will submit his/her work in form of a report and present the result in the semester. The work will be evaluated internally in which seminar will be of 50% marks of the total.

- 1- Agro-based industries seed processing plants and industries, fruit preservation industries, food processing industries etc.

- 2- Plant clinics
- 3- NGO
- 4- Socio economic studies
- 5- Apiculture
- 6- Sericulture
- 7- Mushroom Cultivation
- 8- Attachment with agriculture Departments
- 9- Attachment with Agriculture research institute/organizations/agencies.