

NIILM UNIVERSITY KAITHAL
SYLLABUS FOR UNDER GRADUATE PROGRAMME
BSc. AGRICULTURE DEGREE (4 YEARS)

FIRST YEAR: 1st SEMESTER

Sr.No	Course Code	Course Name	Credits		
			Total Credits	Theory	Practical
1		Introduction to Agriculture	1	1	0
2		Principles of agronomy	2	1	1
3		Agriculture Meteorology	2	1	1
4		Production Technology Of Flowers and Vegetables	3	2	1
5		Fundamental of soil science	3	2	1
6		Insect Morphology and systematic	3	2	1
7		Principles of Agriculture Economics	2	2	0
8		Fundamentals of rural sociology and Educational psychology	2	1	1
9		National service Scheme	1	0	1

SUBJECT: INTRODUCTION OF AGRICULTURE

Theory:

Art, Science and business of crop production, Basic elements of crop production; History of Agricultural development; Ancient Indian Agriculture in Civilization Era, Chronological Agricultural Technology development in India; Different agricultural related revolutions in India (green, yellow, blue, white, silver etc); Present and past basic statistical data of area, production, productivity, fertilizer consumption, livestock, irrigation in India and Haryana; Cropping system and soil groups formed in different parts of the country as defined by ICAR;

Innovation in agriculture: definition and concept; Hi-tech agriculture, precision farming, sustainable agriculture, contract farming, crop modeling, GIS and Remote sensing technology; Women in Agriculture: multifaceted roles and tasks, work stress factors, nutritional and rural life standards, role in house hold design making, drudgery reduction for farm women, women friendly agricultural technology, empowerment of women, group dynamics for farm women and rural women.

References:

1. Reddy, S.R. 1999. Principles of Agronomy. Kalyani Publication Ludhiana.
2. Randhawa, M.S. 1983, History of Agriculture in India, ICAR, New Delhi, Vol.: I, II & III.
3. Chandra, S. 1996. Women in Agriculture. ICAR, PAU, Ludhiana.
4. Jayanthi, C., Devasenapathy, P. and Vennila, C. 2008. Farming System: Principles & Practices. Satish Serial Publishing House.

SUBJECT: PRINCIPLES OF AGRONOMY

Theory:

Agronomy – Definition, scope and importance, its relationship with other sciences, historical sketch of agronomy; Agro-climatic zones of India and Haryana State; National and International Agricultural Research Organizations in India. Classification of Crops; Factors affecting crop production; Essential plant nutrients their role in crop growth; Manures and fertilizers- classification and nutrient content; Tillage- objectives, classification and function of tillage implements; Crop stand establishment-seed bed preparation and seeding methods; Planting geometry and its effect on growth and yield; Cropping system- different types of cropping system-intercropping, mixed cropping, intensive cropping, relay cropping, Alley cropping etc. definition and advantages with examples; Crop Rotation - objectives types and advantage. Harvesting and post harvest operation.

Practical: Principle of agronomy

1. Identification of Field Crops and preparation of crop herbarium,
2. Study of tillage implements and operations,
3. Practice of field preparation,
4. Study of seeding equipments,
5. Different methods of sowing,
6. Identification of manures, fertilizers and green manure crops,
7. Calculation of seed rate and fertilizers,
8. Study of inter-culture implements and practice,
9. Practice of methods of fertilizer application and
10. Participation in ongoing field operations.

References:

1. Hand book of Agriculture: ICAR.
2. Principles & Practices of Agronomy – S.S. Singh.
3. Introduction to Agronomy and Soil & Water management – V.G. Vaidya & H.R. Sahasrabudhe.
4. Nature and Properties of Soils – N.C. Brady.
5. Prarambhik Sasya Vigyan: Nandeha, K. L.

SUBJECT: AGRICULTURE METEOROLOGY

Theory:

Agricultural Meteorology- Definition, Scope and practical utility; Study of atmosphere, its composition and properties; Weather and climate, micro climate, weather elements and their impact on agriculture, earth's atmosphere, composition and structure, solar radiation, nature and properties, solar constant and energy balance, Atmospheric temperature, factors affecting horizontal and vertical distribution of temperature variations and global warming, Air pressure variations; Wind: factors affecting it , Cyclone and anti cyclones, general circulation, atmospheric humidity, vapor pressure and saturation vapor pressure; Process of condensation, formation of dew, fog, mist, snow, rain and hail; Formation and classification of clouds, Introduction to monsoon, Basics, types and importance of weather forecasting; Weather hazards; Agro-climatic classification and requirement of crops- Rice, Soybean, Maize, Sorghum, Sugarcane, Groundnut, Cotton, Wheat and Vegetables; Climatic water balance-Water balance equation its application in agriculture, Agro climatic indices-Aridity, humidity and moisture index and index of moisture adequacy.

PRACTICAL:

1. Site selection for Agro met observatory; Description, exposure, installation, operation and measurement from various meteorological equipments.
2. Measurement of temperature; rainfall; evaporation (atmospheric/soil); atmospheric pressure; sunshine duration and solar radiation; wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts.

Reference:

1. Environment & Plant ecology- J.B. Etherington
2. Plant & Environment – R.F. Deubenmire
3. Agriculture Meteorology- H.S. Mavi
4. Agriculture Meteorology- G.S.L.H.V. Prasad Rao
5. Agriculture Meteorology- S.R. Reddy and D.S. Reddy
6. Climatology- D.S.Lal

SUBJECT: PRODUCTION TECHNOLOGY OF FLOWERS AND VEGETABLES

Theory:

Importance of Olericulture, vegetable gardens, vegetable classification; Origin, area, production, varieties, package of practices for fruit vegetables, tomato, brinjal, chilies, and okra; Cucurbitaceous vegetables cucumber, ridge gourd, ash gourd, snake gourd, bottle gourd, bitter gourd and melons, Cole crops – cabbage, cauliflower and knol-khol; Bulb crops – onion and garlic; Beans and peas – French beans, cluster beans, dolichos beans, peas and cowpea; Tuber crops – potato, sweet potato, tapioca, colocasia, yams; Root crops – carrot, radish, turnip and beet root; Leafy vegetables - amaranthus, palak; Perennial vegetables- drumstick, coccinia and curry leaf; Importance of ornamental gardens; Planning of ornamental gardens; Types and styles of ornamental gardens; Use of trees, shrubs, climbers, palms, houseplants and seasonal flowers in the gardens; Package of practices for rose, jasmine, chrysanthemum, crossandra, marigold and tuberose.

Practical:

1. Planning and layout of kitchen garden;
2. Identification of important vegetable seeds and plants; Raising of vegetable nurseries;
3. Identification of ornamental plants (trees ,shrubs, climbers, house plants, palms etc.,) and development of garden features;
4. Transplanting of vegetable seedlings in main field;
5. Layout of lawns and maintenance;
6. Seed extraction in tomato and brinjal;
7. Depotting, repotting and maintenance of house plants;

8. Visit to commercial vegetable farms;
9. Training and pruning of rose(standards, hybrid „T“ roses scented roses) and chrysanthemum (pinching and disbudding);
10. Planning and layout of gardens and garden designs for public and private areas;
11. Intercultural operations in vegetable plots;
12. Seed production in vegetable crops;
13. Harvesting indices of different vegetable crops;
14. Grading and packing of vegetables;
15. Prolonging the shelf life of cut flowers.

Reference:

1. “Vegetable Crops” – Bose, T.K., M.G.Som and J.Kabir, Naya Prokash, Calcutta,
2. “Introductory Ornamental Horticulture” – Arora, J.S. 1998, *Kalyani Publishers, Ludhiana.*
3. “Commercial Flowers” – Bose, T.K. and L.P.Yadav (Eds) 1988. *Naya Prokash Calcutta.*
4. “Ornamental Horticulture” – Swarup, V. 1997. *Mac Millan, Indian Ltd. Delhi.*
5. “Progressive Floriculture” – Yadav, I.S. and M.L.Choudhary, 1997. *The House of Sarpan, Bangalore.*
6. “Udyan Vigyan” – Dr.Shyam Sundar Shrivastava, *Central Book House, Raipur. (in Hindi)*
7. “Floriculture in India” – G.S.Randhawa and A.Mukhopadhyam, *Allied Publishers Limited, New Delhi.*
8. “Vegetable Production in India” – Dr.V.S.Chauhan, *Ram Prasad and Sons, Agra.*
9. “Text Book of Vegetables, Tuber Crops and Spices” – S.Thamburaj, *N. Singh, ICAR, New Delhi.*
10. “Vegetable Production in India” – S.P.Singh, *Agrotech Publishing Academy, Udaipur.*
11. “Principles of Vegetable Production” – S.P.Singh, *Agrotech Publishing Academy Udaipur.*
12. “A Guide Book on Vegetable Science” – D.Sharma and N.Rai, *Researcho Publishing, New Delhi.*
13. “Seed production technology of vegetables” – Prabhakar Singh and B.S.Asati, *Daya Publishing House, New Delhi.*

SUBJECT: FUNDAMENTALS OF SOIL SCIENCE

Theory:

Soil:-Pedagogical and edaphological concepts, Origin of the earth, Earth's crust; Composition: Rocks and minerals Weathering, Soil formation factors and processes Components of soils; Soil profile, Soil physical properties, Soil texture, Particle size distribution system, Soil structure classification and its significance, Soil aggregates, Soil consistency and its types, Bulk density and particle density of soils & porosity, their significance in agriculture, Soil Color,– definition, its significance, value, hue and chroma, use of Munsell color chart; Elementary knowledge of soil classification soil orders and characteristics of soils of Haryana, land capability classification ; Soil water, forms, hygroscopic, capillary and gravitational, soil moisture constants- hygroscopic coefficient, wilting point, field capacity, moisture equivalent, maximum water holding capacity, PF scale, energy concepts, Soil moisture measurement methods, saturated and unsaturated water movement Elementary idea of Infiltration, percolation, permeability, Drainage, runoff and its role in crop production, Soil temperature, Soil air, and its role on plant growth; Soil colloids, Properties, nature, types and significance; Layer silicate clays, and sources of charges, Ion exchange, CEC & AEC Factors influencing ion exchange and its Significance; Soil organic matter, sources of soil organic matter, Decomposition of organic matter, formation of Humus, Fractionation of organic matter, Carbon cycle, C: N ratio. Soil biology, Biomass, Soil organisms and their beneficial and harmful roles.

Practical:

1. Collection and processing of soil for analysis
2. Study of a soil profile
3. Identification of rocks and minerals.
4. Determination of soil bulk density and particle density,
5. Soil Aggregate analysis by wet sieving method,
6. Determination of Soil strength by cone penetrometer
7. Determination of Soil moisture by Gravimetric & Volumetric method
8. Determination of Soil moisture constants – Field capacity, water holding capacity & wilting point
9. Determination of Infiltration rate by double ring in infiltrometer,
10. Determination of soil texture by International pipette method
11. Preparation of primary and secondary standard solutions.
12. Determination of soil Organic carbon,
13. Determination of soil pH, EC,
14. Determination of soil CEC, soluble cations and anions

Reference:

1. Nature and Properties of Soils by Brady
2. Mrida Vigyan ke Moolbhut Siddhant by Dr Vinay Singh Published by Bharati Bhandar Meerut.

3. Soil Physics by Ghildyal & Tripathi, Published by Wiley and Eastern LTD, New Delhi.
4. Mrida Vigyan By NL Sharma and TB Singh Rama Publishing House Badli, Meerut
5. Soil Physics by LD Baver et al, Published by Wiley and Eastern LTD, New Delhi.

SUBJECT: INSECT MORPHOLOGY AND SYSTEMATIC

Theory:

History of Entomology in India; Factors for insect abundance; Classification of phylum Arthropod up to classes; Relationship of class Insecta with other classes of Arthropoda; Morphology: Structure and functions of insect cuticle and moulting; Body segmentation- Structure of Head, thorax and abdomen; Structure and modifications of insect antennae, mouth parts and legs; Wing venation, modifications and wing coupling apparatus; Structure- male and female genitalia. Sensory organs; Metamorphosis and diapause in insects; Types of larvae and pupae; Structure and functions of digestive, circulatory, excretory, respiratory, nervous, secretory (Endocrine) and reproductive system in insect; Types of reproduction in insects; Systematic: Taxonomy- importance, history and development and binomial nomenclature; Definitions of Biotype, Sub-species, Species, Genus, Family and Order. Classification of class Insecta upto Orders. Orthoptera- Acrididae, Dictyoptera- Mantidae, Odonata, Isoptera- Termitidae, Thysanoptera- Thripidae, Hemiptera- Pentatomidae, Coreidae, Reduviidae, Pyrrhocoridae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Neuroptera- Chrysopidae Lepidoptera- Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera- Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera- Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera- Cecidomyiidae, Trypetidae, Tachinidae, Agromyzidae.

Practical:

1. Methods of collection and preservation of insects including immature stages;
2. External features of Grasshopper/Blister beetle;
3. Types of insect antennae, mouthparts and legs;
4. Wing venations, types of wings and wing coupling apparatus Types of insect larvae and pupae;
5. Dissection of digestive system in insects (Grasshopper);
6. Study of characters of Orders-Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importance.

Reference:

1. Krishi keet Shastra- J.P. Sharma.
2. Imm's General Text Book of Entomology by Richards, D.W. and

- Davis, E.C.
3. Agricultural Entomology for Indian Students by Khanna, S.S.
 4. Agricultural Entomology by Mathur and Upadhayay.
 5. General and Applied Entomology by B.V. David and T.N. Ananthkrishnan.
 6. Introduction to General and Applied Entomology By B.V. Awasthi.
 7. Principles of Insect Morphology by R. E. Snodgrass.
 8. Insect structure and Function by R.F. Chapman.
 9. Essentials of Agricultural Entomology by G.S. Dhariwal.
 10. Destructive and useful insects-their habit and control by C.L. Metcaff & W.P. Flint.
 11. A Text Book of Agricultural Entomology by H.S. Pruthi.

SUBJECT: PRINCIPLES OF AGRICULTURAL ECONOMICS

Theory:

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

References:

1. Dewett, K.K. 2007. Modern Economic Theory, B.Chand & Co., New Delhi.
2. Subba Reddy S., Raghu Ram P., Neelkanta Sastry, T.V., Bhavani Devi I. 2007
3. Agricultural Economics. Agricultural Economics, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
4. Randall, Allan. 1981. Resource Economics - An Economic Approach to Natural Resources and Environmental Policy, Grid Publishing, Inc. Columbus, Ohio.
5. Howe, Charles W. 1979. Natural Resource Economics- Issues, Analysis and Policy, John Wiley & Sons, New York.
6. John, M. Kerr, D.K. Marothia, K. Singh, C. Ramasamy and W.E. Bentley (editors) (1997). Natural Resource Economics: Theory and Application in India, Oxford & IBH, New Delhi.
7. Lipsey Richard G. 1963. A Introduction to Positive Economics, William Clowes Sons,

SUBJECT: FUNDAMENTALS OF RURAL SOCIOLOGY AND EDUCATIONAL PSYCHOLOGY

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

Reference :

1. Chitambar, J.B. “Introductory Rural Sociology”, Wiley Eastern Limited, 4835/24, Ansari Road, Dariyaganj, New Delhi-110002.
2. “Gramin Samaj Shastra” (Hindi) Dharmvir Mahajan and Kamlesh, Mahajan, Shiksha, Sahitva, Prakashan, 312/313, Chahshir, Meruth-2.
3. Educational Psychology, Mathur S.S., Vinod Pustak Madir, Agra.
4. “Exstension and Rural Welfare” Daham, O.P. and Bhatnagar Ram Prasad & sons, Agra.
5. “Indian Social System” Singh K. Prakashan Kendra, Railway Crossing, Sitapur Road, Lucknow 226620.

6. Rural Sociology and Psychology” Tyagi, B.D. Rama Publishing House, Badoth (Maroth).
7. Desai, A.R., “Rural Sociology in India” 5th edition, Popular Prakashan, 35-C, Pt. Madan Mohan Malviya Road, Tardeo, Bombay 400034.
8. Mathur, S.S., Educational Psychology, vinod Pustak Mandir, Agra.
9. Dahama, O.P., “Extension and Rural Welfare” Ram Prasad and Sons, Agra. Shanker Rao C.N., “Sociology”, S. Chand and Co. Ltd., Ram Nagar, New Delhi-110055.

SUBJECT: NATIONAL SERVICE SCHEME

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 programs, consumer awareness, highlights of consumer act. Environment enrichment and conservation, health, family welfare and nutrition. NCC: Introduction to NCC, defence services, system of NCC training, foot drill, sizing, forming up in three ranks, open and close order march, dressing, getting on parade, dismissing and falling out, saluting, marching, arms drill, shoulder arm, order arm, present arm, guard of honour, ceremonial drill, weapon training – rifle bayonet, light machine gun, sten machine carbine, introduction and characteristic stripping, assembling and cleaning, loading, unloading and firing. Field craft, visual training, targets, judging distance, fire discipline and fire control orders, battle craft, field signals, description of ground, section formation, section battle drill, scouts and patrols, ambush, field engineering, map reading, conventional signs, grid systems, use of service protractor, prismatic compass and its use, self defence, general principles, precautions and training, attacks and counter attacks, marching and searching, first aid, hygiene and sanitation, civil defence, leadership and NCC song. Physical Education: Introduction to physical education. Posture, exercise for good posture, physical fitness exercises for agility, strength, coordination, endurance and speed. Rules 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-to-day 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.

Note: Warming up and conditioning exercises are compulsory before the commencement of each class.

FIRST YEAR: 2ND SEMESTER

Sr.no	Course code	Course Name	Credits		
			TC	Theory	Prac.
1		Principles of Genetics	3	2	1
2		Field Crops – I	3	2	1
3		Plant Pathogens and Principles of Plant Pathology	3	2	1
4		Biochemistry	3	2	1
5		Fundamentals of soil and water conservation energy	3	2	1
6		Production technology of fruit crops	3	2	1
7		Dimensions of agriculture Extension	3	2	1
8		Comprehension and communications skills in English	2	1	1

SUBJECT: PRINCIPLES OF GENETICS

Theory:

Mendel's laws of inheritance and exceptions to the laws; Types of gene action, Multiple alleles, Pleiotropism, Penetrance and expressivity; Quantitative traits, Qualitative traits and differences between them; Multiple factor hypothesis; Cytoplasmic inheritance, its characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and its characteristic features; Methods of inducing mutations and C / B technique. Gene expression and differential gene activation; Lac operon and Fine structure of Gene; Ultra structure of cell and cell organelles and their functions; Study of chromosome structure, morphology, number and types, Karyotype and Idiogram; Mitosis and meiosis, their significance and differences between them; DNA and its structure, function, types, modes of replication and repair. RNA and its structure, function and types; Transcription, Translation, Genetic code and outline of protein synthesis; Crossing over and factors affecting it; Mechanism of crossing over and Cytological proof of crossing over; Linkage, Types of linkage and estimation of linkage; Numerical chromosomal aberrations (Polyploidy) and evolution of different crop species like Cotton, Wheat, Tobacco, Triticale and Brassicas; Structural chromosomal aberrations.

Practical:

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

References:

1. Genetics by P.K Gupta, Rastogi Publication Meerut.
2. Fundamentals of Genetics By B.D. Singh, Kalyani Publication Ludhiana.
3. Cytogenetics and Plant Breeding By Chandrasekharan, S.N. and Parthasarthy, P.Vadachary & Co. 8, Linghi Chatty street, Madras
4. Genetics by Stick Berger, H.W., McMillan Co. New York.

SUBJECT: FIELD CROP I

Theory:

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

Practical:

1. Seed bed preparation and sowing of *Rabi* crops
2. Effect of sowing depth on germination of different *Rabi* crops.
3. Identification of weeds in *Rabi* crops.
4. Calculation of fertilizer requirement and their application in *Rabi* crops.
5. Study of growth and yield contributing characters and yield estimation.
6. Study of crop varieties and important agronomic experiments.
7. Working out cost of cultivation of important *Rabi* crops.
8. *Rabi* crops distribution in the state and the region.
9. Important agronomic experiments of *rabi* crops and visit to research stations related to *rabi* crops and sugar mills.

References:

1. Hand Book of Agriculture: ICAR.
2. Scientific crop production: C. Thakur.
3. Field Crops: Y.M. Iyer.
4. Cereal Crops: W.H. Leonard and J.H. Martin

SUBJECT: PLANT PATHOGENS AND PRINCIPLES OF PLANT PATHOLOGY

Theory:

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, virioids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them; General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual); Nomenclature, Binomial system of nomenclature, rules of nomenclature; Classification of fungi and bacteria; Key to divisions and sub-divisions; Introduction: Definition and objectives of Plant Pathology; History of Plant Pathology; Terms and concepts in Plant Pathology; Survival and Dispersal of Plant Pathogens;

Phenomenon of infection – pre-penetration, penetration and post penetration; Pathogenesis; Defense mechanism in plants– Structural and Bio-chemical (pre and post-infection); Plant disease epidemiology; Plant Disease Forecasting - Remote sensing - General principles of plant diseases management –Importance, general Principles- Avoidance, exclusion, protection - Plant Quarantine and Inspection – Quarantine Rules and Regulations. Cultural methods – Rouging, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage; Role and mechanisms of biological control and PGPR. Physical Methods – Heat and Chemical methods – Methods of application of fungicides; Host plant resistance; Integrated plant disease management (IDM) – Concept, advantages and importance.

Practical:

1. Acquaintance to plant pathology laboratory and equipments
2. Preparation of culture media for *fungi* and *bacteria*
3. Isolation techniques, preservation of disease samples
4. Study of *Pythium*, *Phytophthora* and *Albugo*
5. Study of *Sclerospora*, *Peronosclerospora*, *Pseudoperonospora*, *Peronospora*, *Plasmopara* and *Bremia*;
6. Study of genera *Mucor* and *Rhizopus*.
7. Study of *Oidium*, , *Erysiphe*, *Phyllactinia*, *Uncinula* and *Podosphaera*;
8. Study of *Puccinia* (different stages), *Uromyces*,;
9. Study of *Sphacelotheca*, *Ustilago* and *Tolyposporium*;
10. Study of *Agaricus*, *Pleurotus* and *Ganoderma*;
11. Study of *Septoria*, *Colletotrichum*, *Pestalotiopsis* and *Pyricularia*;
12. Study of *Aspergillus*, *Penicillium*, *Trichoderma*, and *Fusarium*;
13. Study of *Helminthosporium*, *Drechslera*, *Alternaria*, *Stemphyllium*, *Cercospora*, , *Rhizoctonia* and *Sclerotium*;
14. Demonstration of Koch's postulates;
15. Study of different groups of fungicides and antibiotics;
16. Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Chestnut compound; Methods of application of fungicides – seed, soil and foliar;
17. Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique;
18. Bio-control of plant pathogens – dual culture technique, seed treatment.

References:

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| 1. Introduction to principles of Plant Pathology - | R.S. Singh. |
| 2. Plant Pathology | - G.N. Agrios |
| 3. Plant Pathology | - R.S. Mehrotra |
| 4. Plant Pathology | - P.D. Sharma |

SUBJECT : BIOCHEMISTRY

Theory:

Biochemistry –Introduction and importance ;Plant Cell: Structure, cell components and biochemical function ; Bio-molecules – introduction and applications: Amino acids, peptides and proteins –Plant proteins and their quality. Enzymes –Factors affecting the activity, classification, Immobilization and other industrial applications.;Lipids– Definition, classification, properties and their industrial application in soaps, detergents, paints, Varnishes, lubricants, adhesives, plastics, nylon, Bio- diesel, Biodegradable plastics etc. Carbohydrates; Definition, classification, properties. Nucleotides and Nucleic acids. Metabolic energy and its generation – Metabolism – Basic concepts, Glycolysis, Citric acid Cycle, Pentose phosphate pathway, oxidative phosphorylation, Fatty acid oxidation.General reactions of amino acid degradation. ; Biosynthesis – carbohydrates,lipids,proteins and nucleic acids; Introduction of Terpenoids, Alkaloids,Phenolics and their application in food and pharmaceutical industry

Practical:

1. Models of sugars, sucrose, starch and amino acid.
2. Qualitative determination of carbohydrates, protein, lipids, reducing and non-reducing sugars.
3. Paper electrophoresis for the separation of plant pigments;
4. Protein denaturation – heat, pH, precipitation of proteins with heavy metals,
5. Protein estimation by Kjeldahl method; enzyme immobilization;
6. Characterization of lipids by T.L.C.;
7. Extraction of oil from oil seeds;
8. Estimation of fatty acids by G.L.C.
9. Quantitative determination of sugars;
10. Paper chromatography for the separation of sugars;
11. Determination of phenols.

REFERENCE;

1. Outline of biochemistry: E.E.Conn and P.K. Stumpf.
2. Essentials of Biochemistry: M.C.Pant
3. Introduction to Biochemistry:Mertz.
4. Chemistry of natural products: Agarwal

SUBJECT: FUNDAMENTALS OF SOILS AND WATER CONSERVATION ENGINEERING

Theory:

Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields; Leveling- leveling equipment, terminology, methods of calculation of reduced levels, types of leveling, contouring. Irrigation, classification of projects, flow irrigation and lift irrigation; Water source, Water lifting devices – pumps (shallow and deep well), capacity, power calculations; Irrigation water measurement – weirs, flumes and orifices and methods of water measurement and instruments; Water conveyance systems, open channel and underground pipeline; Irrigation methods – drip and sprinkle irrigation systems. Soil and water conservation – soil erosion, types and engineering control measures.

Practical:

1. Acquaintance with chain survey equipment;
2. Ranging and measurement of offsets;
3. Chain triangulation;
4. Cross staff survey;
5. Plotting of chain triangulation;
6. Plotting of cross staff survey;
7. Levelling equipment – dumpy level, levelling staff, temporary adjustments and staff reading;
8. Differential leveling;
9. Profile leveling;
10. Contour survey – grid method;
11. Plotting of contours;
12. Study of centrifugal pumping system and irrigation water measuring devices;
13. Study of different components of sprinkler irrigation systems;
14. Study of different components of drip and sprinkle irrigation systems;
15. Uniformity of water application in drip and sprinkle systems;
16. Study of soil and water conservation measures.

Reference:

1. Agor, R. 1998. Surveying and leveling, Khanna Publishers, New Delhi.
2. Kanetkar, T.P. and Kulkarani, S.P. 1965. Surveying and leveling A.V. Griha Prakashan, Pune-4.
3. Kochher, C.L. 1986. A test book of surveying, Vol. I & II, Katson Publishing House, Ludhiana.
4. Michael, A.M. 1997. Irrigation Theory and Practice, Vikash Publisher, New Delhi.
5. Dhruvanarayan, V.V. 1993. Soil Conservation Research in India, Publication and Information Division, ICAR, New Delhi.
6. Israelson, O.W. and Hensen, V.E. 1962. Irrigation Principles & Practices, John Wiley and Sons, Inc., New York.
7. Tideman, E.M. 1999. Watershed Management: Guidelines for Indian Conditions, Omega

Scientific Publishers, New Delhi.

8. Michael, A.M. and Ojha, T.P. 2004. Principals of Agricultural Engineering, Vol. II, Jain Brothers, New Delhi.

SUBJECT: PRODUCTION TECHNOLOGY OF FOOD CROPS

Theory:

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

Practical:

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

Reference:

1. “Commercial Fruits” – Dr. S.P. Singh, Kalyani Publishers, Ludhiana
2. “Fruit Physiology and Production” – Amar Singh, Kalyani Publishers, Ludhiana.

3. "Hand Book of Horticulture" – Dr. K.L. Chadha, I.C.A.R., New Delhi.
4. "Fruit Culture in India" – Dr. Shyam Singh, Dr. S. Krishnamurthi and Dr. S. L. Katyaj, I.C.A.R., New Delhi.

SUBJECT: DIMENSIONS OF AGRICULTURE EXTENSIONS

Theory:

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

Practical:

1. Visits to a village and kisan mandal to study the ongoing development programmes
2. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (ZPP).
3. Visit and study the District Rural Development Agency (DRDA).
4. Participation in monthly workshops of Training and Visit (T & V) System.
5. Visit to Watershed Development Project area.
6. Visit to a village to study the Self Help Groups (SHGs) of DWCRA.
7. Visit to a voluntary organization to study the developmental activities.
8. Organizing PRA techniques in a village to identify the agricultural problems.

Reference :

1. Govt. of India: "Extension Education in Community Development" Directorate of Extension, Ministry of Food and Agri., Govt. of India New Delhi.
2. Supe S.V. "An Introduction to Extension Education," Oxford & IBH Publishing Company Pvt., Ltd., 66 Janpath, New Delhi 110001.
3. Dahama, O.P. & Bhatnagar "Extension and Communication for Development" Oxford & IBH Publishing Company, 66-Janpath, New Delhi 110001/ Dahama, O.P., Communication & Extension (Revised Edition) Ram Prasad & Sons, Agra.
4. Dahama, O.P. "Extension & Rural Welfare", Ram Prasad & Sons, Agra.

SUBJECT: COMPREHENSION AND COMMUNICATION SKILLS IN ENGLISH

Theory:

Reading comprehension- Scientific and general passages. Vocabulary Development; Prefix and Suffix, Synonyms and antonyms; words often confused; Homonyms and homophones; Letter writing - Mechanics of good letter, Effective Business correspondence, Personal correspondence; Report writing - Reports of events, meetings, experiments, business, etc. ; Paragraph writing. Preparation of Curriculum vitae and Job applications; Interviews, Types of interviews, purpose, different settings, as interviewer, interviewee, physical makeup and manners, appearance, poise, speech, self reliance, Evaluation process, review or feedback.

Practical

1. Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature)
2. listening to at least two tapes, recorded conversations aimed at testing the listening comprehension of students;
3. Communication: Spoken English, oral communication, importance stress and intonation.
4. Spoken English practice by using audiovisual aids, the essentials of good conversations, oral exercises in conversation practice
5. Oral Presentation of Reports: Seminars and conferences, features of oral presentation,

Reference :

1. 'Strengthen your Writing', By - V.R. Narayan Swami, Orient Longman Publication.
2. 'Business Communication and Report writing', By - G.S.R.K. Babu Rao, Himalaya Publishing House, Mumbai.
3. 'Write to Communicate', By - Geeta Nagraj, Foundation Books, New Delhi.
4. 'Improve your writing', By - V.N. Arora & Laxmi Chandra, Oxford University Press.
5. 'Creative English for Communication', By - N. Krishna Swami & N.T. Sriraman, MacMillan India Limited

SECOND YEAR: 3RD SEMESTER

Sr.no	Course code	Course Name	Credits		
			Total Credits	theory	practical
1		Principles of Plant breeding	3	2	1
2		Field Crops II	3	2	1
3		Agriculture finance and cooperation	2	1	1
4		Statistics method	3	2	1
5		Field crop diseases and management	3	2	1
6		Insect ecology, integrated pest management & beneficial insects	3	2	1
7		Crop physiology	3	2	1
8		Entrepreneurship Development and communication skills	2	1	1

SUBJECT: PRINCIPLES OF PLANT BREEDING

Theory:

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

Practical:

1. Botanical description and floral biology Rice and Sorghum; Maize and Wheat; Bajra and Ragi; Sugarcane and Coconut; Groundnut, Castor, Safflower and Sesamum; Redgram, Bengalgram and Greengram; Soybean and blackgram; Chillies, Brinjal and Tomato; Bhendi, Onion, Bottle-gourd and Ridge-gourd; Cotton and Mesta; Jute and Sunhemp
2. Study of megasporogenesis and microsporogenesis
3. Fertilization and life cycle of an angiospermic plant
4. Plant Breeder's kit; Hybridization techniques and precautions to be taken
5. Floral morphology, selfing, emasculation and crossing techniques
6. Study of male sterility and incompatibility in field plots;

References:

1. Essentials of Plant Breeding, By Singh, Phundan, Kalyani Publishers Ludhiana/ New Delhi.
2. Plant Breeding, Singh, B.D. Kalyani Publishers. New Delhi / Ludhiana.
3. Principles of Plant Breeding, Allard, R.W.
4. Practical Manual in Plant breeding, Singh, R.K. and Singh B.D. Kalyani Publishers. New Delhi/ Ludhiana.
5. Breeding asian Field Crops, Poehlman, J.N. and Borthakur, D.N., Oxford and IBH Pub. Co., New Delhi, (English & Hindi Edition)

SUBJECT: AGRICULTURE FINANCE AND COOPERATION

THEORY

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

Practical:

1. Factors governing use of Capital and identification of credit needs;
2. Time value of money, Compounding and discounting;
3. Tools of financial management, Balance sheet, Income statement and cash flow analysis;
4. Estimations of credit needs and determining unit costs;
5. Preparations and analysis of loan proposals;
6. Types of repayment loans;
7. Study of financial institutions: PACS, DCCB, Apex Banks, RRBs, CBs, NABARD.

References:

1. Kahion, A.S. and Karam Singh, Managing Agricultural Finance Allied Publishers Pvt., Ltd., New Delhi.
2. Johl S.S. and Moore C. V. Essentials of Farm Financial Management. Today and tomorrow's Printers and publishers.
3. Mathur B.S., Cooperation in India. Sahitya Bhawan, Agra, New Delhi.
4. Kamat, G.S. (1978). New Dimension of Co-operative Management, Himalayan Publishing House, Bombay.
5. Krishnaswami, O.R. (1978). Fundamentals of Cooperation, S. Chand & Company Ltd., New Delhi
6. Lee. F. Warren, Aaron G. Nelson and W.G. Murray (1980). Agricultural Finance. Iowa State University Press Ames. Iowa.
7. Pandey, U.K. (1990). An Introduction to Agricultural Finance, Kalyani Publishers, New Delhi.

SUBJECT: STATISTICS METHOD

Theory:

Introduction: Definition of Statistics and its use and limitations; Frequency Distribution and Frequency Curves; Measures of Central Tendency: Characteristics of Ideal Average, Arithmetic Mean; Merits and Demerits of arithmetic Mean. Measures of Central Tendency: Median, Mode; Measures of Dispersion: Standard Deviation, Variance and Coefficient of Variation; Probability: Definition and concept of probability Normal Distribution and its properties; Introduction to Sampling: Random Sampling; the concept of Standard Error Tests of Significance- Types of Errors, Null Hypothesis, Level of Significance and Degrees of Freedom, Steps involved in testing of hypothesis

Large Sample Test-SND test for Means, Single Sample

Large Sample Test-SND test for Means Two Samples (all types)

Small Sample Test for Means- Student's t-test for Single Sample and two samples

Small Sample Test : F test

Chi-Square Test in 2×2 Contingency Table, Yates Correction for continuity

Correlation: Types of Correlation and identification through Scatter Diagram, Computation of Correlation Coefficient r and its testing.

Linear Regression of Y on X and X on Y. Inter-relation between „ r “ and the regression coefficients, Properties of regression coefficients; Fitting of regression equation

Experimental Designs; Basic Designs, Completely Randomized Design (CRD), Layout and analysis with equal and unequal number of observations; Randomized Block Design (RBD)

Layout and analysis Latin Square Design (LSD), Layout and Analysis

Practical:

- 1 Construction of Frequency Distribution Tables and Frequency Curves
- 2 Computation of Arithmetic Mean for Grouped and Un-Grouped data
- 3 Computation of Median for Un-Grouped and Grouped data
- 4 Computation of Mode for Un-Grouped and Grouped data
- 5 Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data
- 6 Large samples: SND test for Means, Single Sample
- 7 Large samples: SND test for Means, Two Samples
- 8 Student's t-test for Single Sample, two samples (Paired and independent)
- 9 F test
- 10 Chi- Square Test in 2×2 Contingency Table, Yates Correction for continuity
- 11 Computation of Correlation Coefficient „ r “ and its testing
- 12 Fitting of regression equation- Y on X and X on Y
- 13 Analysis of Completely Randomized Design (CRD) (Equal and unequal repetition of observations)
- 14 Analysis of Randomized Block Design (RBD)
- 15 Analysis of Latin Square Design (LSD).

References:

- | | | |
|----|-------------------------------------|--------------------------|
| 1. | Fundamentals of Statistical Methods | S.C. Gupta & V.K. Kapoor |
| 2. | Fundamentals of Applied Statistics | S.C. Gupta & V.K. Kapoor |

SUBJECT: FIELD CROP DISEASES AND MANAGEMENT**Theory:**

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice (blast, brown spot, sheath blight bacterial blight), sorghum (smuts), bajra (green ear, ergot), maize (leaf blight) wheat (rusts, loose smut karnal bunt), sugarcane (red rot, whip smut), turmeric (leaf spot), tobacco (mosaic), groundnut (leaf spot, rust, bud necrosis), sesamum (phyllody), sunflower (head rot, alternaria blight) mustard (white rust, leaf spot) linseed (powdery mildew, rust wilt), cotton (angular leaf spot, wilt) redgram (wilt, sterility mosaic), bengalgram (wilt collar rot, root rot), blackgram (powdery mildew, mosaic), greengram (powdery mildew, yellow mosaic, leaf spot) pea (rust, powdery mildew), and soybean (bacterial pustule, yellow mosaic budnecrosis).

Practical:

1. Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases.
2. Presentation of disease samples survey and collection of Diseases of rice, sorghum;\
3. Diseases of wheat, bajra & maize;
4. Diseases of sugarcane, turmeric & tobacco;
5. Diseases of groundnut, sunflower;
6. Diseases of sesamum & cotton; Diseases of redgram, greengram, blackgram, bengalgram & beans;
7. Field visits at appropriate time during the semester

References:

- | | | |
|----|----------------------------------|-----------------|
| 1. | Pod rog shastra | - S.M. Kumar |
| 2. | Pod rog vigyan | - B.P. Singh |
| 3. | Plant diseases | - R.S. Singh |
| 4. | Plant Pathology | - R.S. Mehrotra |
| 5. | Diseases of Crop Plants in India | - G. Rangaswami |

SUBJECT: INSECT ECOLOGY, INTEGRATED PEST MANAGEMENT & BENEFICIAL INSECTS

THEORY

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

Practical :

1. Visit to meteorological observatory / automatic weather reporting station;
2. Study of terrestrial and pond ecosystems of insects;
3. Studies on behaviour of insects and orientation (repellency, stimulation, deterancy);
4. Study of distribution patterns of insects, sampling techniques for the estimation of insect

population and damage;

5. Pest surveillance through light traps, pheromone traps and field incidence;
6. Practicable IPM practices, Mechanical and physical methods;
7. Practicable IPM practices, Cultural and biological methods, Chemical control, Insecticides and their formulations;
8. Calculation of doses/concentrations of insecticides;
9. Compatibility of pesticides and Phytotoxicity of insecticides;
10. IPM case studies;
11. Identification of common phytophagous mites and their morphological characters;
12. Identification of common plant parasitic nematodes and their morphological characters;
13. Identification of rodents and bird pests and their damage;
14. Identification of earthworms in vermiculture – visit to vermiculture unit;
15. Other beneficial insects- Pollinators, weed killers and scavengers.

Reference:

1. General and Applied Entomology- B.V. David and T.N. Ananthkrishnan.
2. Agricultural Entomology for Indian Students- Khanna, S.S.
3. Agricultural Entomology – Mathur and Upadhyay.
4. Krishi Keet Vigyan – Sharma, J.P.
5. Applied Entomology by P.G. Ferumone and Alka Prakash.
6. A text book of applied Entomology Vol. I & II- K.P. Shrivastava.
7. Pesticide application equipments – O.S. Bindra & Harcharan Singh.
8. Introduction to Insect Pest Management- Metcalf, R.L. and Luchmann, W. John Willy and Sons Pub

SUBJECT: CROP PHYSIOLOGY

Theory:

Introduction, Importance in Agriculture. Seed Physiology, Seed structures, Morphological, physiological and biochemical changes during seed development, Physiological maturity – Morphological and physiological changes associated with physiological maturity in crop, Harvestable maturity, Seed viability and vigour, Factors affecting seed viability and vigour. Methods of testing seed viability and vigour, Germination, Utilization of seed reserves during seed germination, Morphological, physiological and biochemical changes during seed germination, Factors affecting seed germination. Growth and Development, Definition, Determinate and Indeterminate growth, Monocarpic and Polycarpic species with examples. Measurement of growth, Growth analysis Growth characteristics, Definitions and mathematical formulae. Crop Water Relations, Physiological importance of water to plants, Water potential and its components, measurement of water status in plants. Transpiration, significance, Transpiration in relation to crop productivity, Water Use Efficiency, WUE in C₃, C₄ and CAM plants, Factors affecting WUE. Photosynthesis, Energy synthesis, Significance of C₃, C₄ and CAM pathway, Relationship of Photosynthesis and crop productivity, Translocation of assimilates, Phloem loading, apoplastic and symplastic transport of assimilates, Source and sink concept, Photorespiration, Factors affecting Photosynthesis and productivity, Methods of measuring photosynthesis, Photosynthetic efficiency, Dry matter partitioning, Harvest index of crops. Respiration and its significance, Brief account of Growth respiration and maintenance respiration, Alternate respiration – Salt respiration – wound respiration – measurement of respiration. Nutriophysiology – Definition – Mengel's classification of plant nutrients – Physiology of nutrient uptake – Functions of plant nutrients – Deficiency and toxicity symptoms of plant nutrients – Foliar nutrition – Hydroponics. Introduction of Photoperiodism and Vernalisation in relation to crop productivity – Photoperiodism Plant Growth Regulators – Occurrence – Biosynthesis – Mode of action of Auxins, Gibberellins, Cytokinins, ABA, Ethylene. Novel plant growth regulators, Commercial application of plant growth regulators in agriculture. Senescence and abscission – Definition – Classification – Theories of mechanism and control of senescence – Physiological and biochemical changes and their significance. Post Harvest Physiology – Seed dormancy – Definition – types of seed dormancy – Advantages and disadvantages of seed dormancy – Causes and remedial measures for breaking seed dormancy, Optimum conditions of seed storage – Factors influencing seed storage (ISTA standards). Fruit ripening – Metamorphic changes – Climateric and non-climateric fruits – Hormonal regulation of fruit ripening (with ethrel, CCC, Polaris, paclobuterozole).

Practical:

1. Preparation of solutions;
2. Growth analysis: Calculation of growth parameters;

3. Methods of measuring water status in roots, stems and leaves;
4. Measurement of water potential by Chardakov's method;
5. Measurement of absorption spectrum of chloroplastic pigments and fluorescence;
6. Measurement of leaf area by various methods;
7. Stomatal frequency and index – Respirometer – Measurement of respirometer; Leaf anatomy of C₃ and C₄ plants;
8. Transpiration of measurement;
9. Imbibition of seed; Optimum conditions for seed germination; Breaking seed dormancy; (a) Chemical method (b) Mechanical method;
10. Yield analysis;
11. Seed viability and vigour tests;
12. Effect of ethylene on regulation of stomata.

Reference:

- 1 Plant Physiology : S.N. Pandey & B.K. Sinha
- 2 Plant Physiology : P.S. Gill
- 3 Plant Physiology : H.S. Shrivastava
- 4 Fundamentals of Plant Physiology : V.K. Jain
- 5 A Text Book of Plant Physiology : V. Verma
6. Plant Physiology : Frank B. Salisbury and Clean W. Rose
7. Plant Physiology : RM Devlin & F.S. Withan
8. Plant Physiology : RGS Bidwell

SUBJECT: ENTREPRENEURSHIP DEVELOPMENT AND COMMUNICATION SKILLS

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 agriculture sector. Venture capital. Contract farming and joint ventures, public-private partnerships. Overview of agri inputs industry. Characteristics of Indian agricultural processing and export industry. Social Responsibility of Business. Communication Skills: Structural and

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

Practical:

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

Reference:

1. Akhouri, M.M.P., Misra, S.P. and Sengupta, Rita (1989). Trainers Manual on Developing Entrepreneurial motivation, NIESBUD, New Delhi.
2. Betty Gordan B.(1979). Entrepreneurship, Playing to win, Taraporewala, Bombay.
3. Entrepreneurship Development Institute of India (1987). Developing New Entrepreneurs EDII, Ahmedabad, NISIET Library: 338.93/EDI/87/25104.
4. Mancuso, Josheph (1974). The Entrepreneurs Handbook Vol. I & 2 Artech House Inc. USA.
5. Patel V.G. (1987) Entrepreneurships Development Programme in India and its relevance to Developing Countries, Entrepreneurship Development Institute of India, Ahmedabad, NISIET Library: 338.93(540)/PAT/87/25103.
6. Rao, T.V.(1974) Development of an Entrepreneur's Behaviouristic Model, Technical Paper no. 51, (Mimeographed), Ahmedabad, Indian Institute of Management.

SECOND YEAR: 4TH SEMESTER

SR. NO	COURSE CODE	COURSE NAME	CREDITS		
			Total credits	theory	practical
1		Water management	2	1	1
2		Breeding of field and horticulture crops	3	2	1
3		Agriculture marketing ,trade & pricing	2	1	1
4		Diseases of horticulture crops and management	3	2	1
5		Livestock production and management	3	2	1
6		Soil chemistry, fertility& Nutrient management	3	2	1
7		Introduction to computer application	2	1	1
8		Spices, aromatic, medicinal and plantation crops	3	2	1
9		Practical crop production I	1	0	1

SUBJECT: WATER MANAGEMENT

Theory:

Irrigation- definition and objectives, water resources and irrigation development in India and Chhattisgarh; Soil plant water relationships (concept and basic terms); Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, subsurface, sprinkler and drip irrigation; measurement of irrigation water, Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water requirements of different crops. Watershed management- definition and concept. Drainage- importance and methods.

Practical:

1. Determination of bulk density, soil moisture content by gravimetric method, tensiometer, electrical resistance block and moisture meter.
2. Determination of field capacity and infiltration rate.
3. Measurement of irrigation water through flumes and weirs.
4. Calculation of irrigation water requirement (Problems).
5. Demonstration of different methods of irrigation.
6. Visit to farmers field and cost estimation of drip irrigation system.
7. Demonstration of filter cleaning, fertigation, injection and flushing of laterals.
8. Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability.
9. Erection and operation of sprinkler irrigation system;
10. Determination of water quality parameters (EC, pH).

References:

1. Irrigation: Theory & Practices by A.M. Michael.
2. Water Management: Principles and Practices by R.A. Singh and S.R. Singh.
3. Irrigation by A.M. Michael and T.P. Ojha.
4. Conserving Soil – By M.P. Butler.
5. Elements of Soil conservation by H.H. Bennett.
6. Soil conservation in India by Rama Rao.
7. Hand Book of Agriculture – ICAR Publication.
8. Introduction to agronomy and soil and water management by V.G. Vaidya and K.R. Sahatrabudhe.
9. Irrigation practice and Water Management by L.D. Doneen and D.W. Westcot, FAO, 1984.

SUBJECT: BREEDING OF FIELD AND HORTICULTURE CROPS

Breeding objectives and important concepts of breeding self pollinated, cross pollinated and vegetatively propagated crops; Hardy-Weinberg Law; Study in respect of origin, distribution of species, wild relatives and forms, Cereals, (rice, wheat, maize, millets, sorghum, bajra, ragi); Pulses (redgram, greengram / blackgram, soybean); Oilseeds (Groundnut, sesame, sunflower, safflower, castor, mustard) etc. Fibers (Cotton, kenaf, roselle, jute) etc. Major breeding procedures for development of hybrids / varieties of various crops; Plant Genetic Resources, their conservation and utilization in crop improvement; Ideotype concept in crop improvement; Breeding for resistance to biotic and abiotic stresses, Variability in pathogens and pests; Mechanisms of resistance in plant to pathogens and pest; Genetic basis of adaptability to unfavourable environments; Definition of biometrics, assessment of variability i.e., additive, dominance and epistasis and their differentiation; Genotype x Environment interaction and influence on yield/performance. IPR and its related issues. Vegetables (Tomato, bhindi, chilli, cucumbers); Flowers crops (Chrysanthemum, rose, galardia, gerbera & marigold); Fruit crops (aonla, guava, mango, custard apple, banana, papaya); Major breeding procedures for development of hybrids / varieties of various crops.

Practical:

1. Emasculation and Hybridization techniques.
2. Handling of segregating generations, pedigree methods.
3. Handling of segregating generations, bulk methods.
4. Handling of segregating generations, back cross methods.
5. Field layout of experiments; Field trials, maintenance of records and registers.
6. Estimation of Heterosis and inbreeding depression.
7. Estimation of Heritability, GCA and SCA.
8. Estimation of variability parameters.
9. Parentage of released varieties/hybrids.
10. Problems on Hardy, Weinberg Law.
11. Study of quality characters.
12. Sources of donors for different characters.
13. Visit to seed production and certification plots.
14. Visit to AICRP trials and programmes.
15. Visit to grow out test plots; Visit to various research stations; Visit to other institutions.
16. Emasculation and Hybridization techniques; Handling of segregating generations, pedigree methods; Handling of segregating generations, bulk methods; Handling of segregating generations, back cross methods; Field lay out of experiments; Field trials, maintenance of records and registers; Estimation of Heterosis and inbreeding depression; Estimation of Heritability, GCA and SCA; Estimation of variability parameters; Parentage of released varieties/hybrids; Problems on Hardy, Weinberg Law; Study of

quality characters; Sources of donors for different characters; Visit to seed production and certification plots; Visit to AICRP trials and programmes; Visit to grow out test plots; Visit to various research stations; Visit to other institutions

Reference:

1. Essentials of Plant Breeding , By Singh, Phundan, Kalyani Publishers Ludhiana/ New Delhi.
2. Plant Breeding, Singh, B.D. Kalyani Publishers. New Delhi/ Ludhiana.
3. Objectives in genetics and plant breeding By Singh, Phundan, Kalyani Publishers Ludhiana/ New Delhi.
4. Breeding asian Field Crops, Poehlman, J.N. and Borthakur, D.N. , Oxford and IBH Pub. Co., New Delhi, (English & Hindi Edition).
5. Breeding of Horticulture crops : Kumar N. New India Pub. Co.
6. "Seed production technology of vegetables" – Prabhakar Singh and B.S.Asati, Daya Publishing House, New Delhi.
7. "Commercial Flowers" – Bose, T.K. and L.P. Yadav (Eds) 1988. Naya Prokash Calcutta.
8. Vegetable breeding vol. I.II. & III : Dr. G. Kallou, Panima Education book agency, New Delhi.
9. Fruits tropical and subtropical vol. I & II : T. Bose, S.K. Mitra & D. Sanyal, Naya Udyog, Calcutta.

SUBJECT: AGRICULTURE MARKETING ,TRADE & PRICING

Theory:

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

Marketing. Speculations and Hedging, Futures trading, Contract farming.

Practical:

1. Identification of marketing channels;
2. Study of Rythu Bazars, Regulated markets;
3. Study of unregulated markets;
4. Study of livestock markets;
5. Price spread analysis;
6. Visit to market institutions, NAFED;
7. Study of SWC, CWC and STC;
8. Analysis of information of daily prices;
9. Marketed and marketable surplus of different commodities.

References:

1. Acharya, S.S. and Agrawal, N.L. Agricultural Marketing in India, Oxford and IBH Publishing Co, New Delhi
2. Memoria, C.B. and Joshi, R.L., Principles and Practice of marketing in India, Kitab Mahal, Allahabad.
3. Kahlon, A.S, and Tyagi R.S. Agricultural Price Policy in India, Allied Publishers Private Limited, New Delhi.
4. Maji, C.C. and Bhattacharya, A, GATT and Agricultural Exports-Hopes and Realities, NCAP, New Delhi.
5. Tripathi .Export in economic growth, International Book House.
6. Singh, Gursharan Kainth, Export potential of Indian Agriculture. Regency Publications, New Delhi.
7. Nagpal, Current, Issues in the World Trade Policies, International Book House, New Delhi.
8. Kohls, R. L. and N. Uhl. Joseph (1980). Marketing of Agricultural Products, Collier Macmillan, New York.
9. Shephard, G. E. Agricultural Price Analysis. Iowa State University Press, Ames, Iowa. Taha, A and Hamdy (1999). Operations Research : An Introduction. Prentice Hall, New Delhi

SUBJECT: DISEASES OF HORTICULTURE CROPS AND MANAGEMENT

THEORY:

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of: citrus (canker, gummosis, citrus decline) mango (malformation, anthracnose powdery mildew), banana (bunchy top, panama wilt, moko disease), grapevine (powdery mildew, downy mildew), papaya (leaf curl, mosaic, stem rot), guava (wilt), apple (scab, fire blight), chilli (anthracnose, leaf curl), brinjal (blight, wilt, little leaf), zinger (rhizome rot), colocasia (phytophthora blight), bhendi (yellow vein mosaic, leaf spot), coriander (stem gall), potato (early blight, late blight, mosaic) crucifers, (club root, black rot), cucurbits(powdery mildew, downy mildew), tomato (early blight, late blight, leaf curl, wilts), beans (yellow mosaic, anthracnose), (onion purple blotch), coconut (bud rot, stem bleeding), betelvine (phytophthora blight), coffee (rust), tea (blister blight), rose (die back, podery mildew), chrysanthemum (root rot , bacterial blight)

Practical:

1. Diseases of beans, citrus, guava, & sapota;
2. Diseases of papaya, banana, pomegranate & Indian Plum;
3. Diseases of mango, grapes & apple;
4. Diseases of chilli, brinjal & lady finger;
5. Diseases of potato, tomato & crucifers;
6. Diseases of cucurbits, onion & betelvine;
7. Diseases of oil palm, coconut, tea, coffee;
8. Diseases of rose, chrysanthemum.
9. Field visits at appropriate time during the semester.

References

1. Plant diseases – R.S Singh
2. Diseases of crop plants in India- G. Rangaswami

SUBJECT: LIVESTOCK PRODUCTION AND MANAGEMENT

Theory:

Importance of Livestock in Indian Economy.; Important Exotic and Indian breeds of Cattle, Buffalo, Goat, Sheep and Swine. ;Housing for different categories of Livestock; Objectives, Advantages, Selection of site, Different systems of housing with space requirement ; Care and Management of newborn calves, growing heifers, Cows at/after parturition.; Feeding for different categories of livestock; Feed and fodders for animals, Principles of feeding, Different types of ration, Feeding of calves, growing heifers and dairy cows.; Selection and Breeding of livestock; Different systems of breeding, Factors affecting fertility in livestock, Artificial Insemination, Definition, Objectives, Techniques, Advantages of A.I; Milking of Cow; Different type of milking, Measures for clean milk production, Factors affecting milk yield and its composition, Milk Secretion, Milk Let- down; Disease control measures, Management of Infectious and Contagious diseases of livestock and Preventive measures; Cost of production of milk, Economical units of cattle, buffalo, sheep, goat and swine; Poultry Production; Important Indian and foreign breeds of poultry, Different systems of housing and Breeding, Management of chick, Grower and Layer birds, Incubation and hatching, Management of incubator during incubation, Diseases of poultry, vaccination schedule.

Practical:

1. Body parts of different categories of animals.
2. Methods for judging and culling of animals.
3. Methods for identification of farm animals.
4. Computation of ratio for different categories of animals.
5. Design and layout of housing for cattle and poultry.
6. Different methods of injection and procedure.
7. Structure of poultry egg, selection and care of hatching egg.
8. Visit to livestock farms and economics of livestock production.

References:

1. A Textbook of Animal Husbandry - G.C. Banerjee.
2. Handbook of Animal Husbandry - ICAR, Krishi Anusandhan Bhawan, New Delhi.
3. Poultry Production - B. Panda and S.C. Mahapatra.
5. Animal Nutrition in the Tropics - S.K. Ranjhan
6. Poultry Production - R.A. Singh, Kalyani Publicsher, New Delhi
7. Handbook of Animal Husbandry - K.C. Mahanta
9. Livestock Production and Management – N.S.R. Sastry and C.K. Thomas

SUBJECT: SOIL CHEMISTRY, FERTILITY AND NUTRIENT MANAGEMENT

Soil as a source of plant nutrients. Essential and beneficial elements, criteria of essentiality, forms of nutrients in soil, mechanisms of nutrient transport to plants, factors affecting nutrient availability to plants. Measures to overcome deficiencies and toxicities. Problem soils – acid, salt affected and calcareous soils, characteristics, nutrient availabilities. Reclamation – mechanical, chemical and biological methods. Fertilizer and insecticides and their effect on soil water and air. Irrigations water – Quality of irrigation water and its appraisal. Indian standards for water quality. Use of saline water for agriculture. Soil fertility – Different approaches for soil fertility and productivity evaluation. Methods, Soil testing – Chemical methods. critical levels of different nutrients in soil. Plant analysis – DRIS methods, critical levels in plants. Rapid tissue tests. Indicator plants. Biological method of soil fertility evaluation. Soil test based fertilizer recommendations to crops and calculation of nutrient through different fertilizers. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K. Source, method and scheduling of nutrients (macro & micro) for different soils and crops grown under rain fed and irrigated conditions.

Practical:

1. Principles of analytical Instruments (Colorimetric and flame photometry.
2. Atomic absorption spectrometer) and their calibration and applications.
3. Estimation of available N, P, K, S, and Zn in soils.
4. Determination of quality parameters of irrigation water.
5. Determination of Lime requirement and gypsum requirement of problem soils.
6. Estimation of N, P and K in plants.
7. Soil Testing and Analysis: Plant, Water and Pesticides Residues by Pati Ram Atalas Book and Periodicals New Delhi.

Reference:

1. Soil Conditions and Plant Growth by MB Russel Published by English Language Book Society/Longman.
2. Nature and Properties of Soils by NC Brady
3. Management of Soil Quality for Sustainable Agriculture by B Mishra Atlas Book & Periodicals, New Delhi.
4. Fundamentals of Soil Science by ISSS, New Delhi.
5. Soil Chemistry by Bear.
6. Soil Fertility and Fertilizer by Tisdale Nelson and Buston.
7. Soil Fertility and Plant Nutrition by Kanwar and Chopra.
8. Introduction to soil and Plant Growth by Donahue.

SUBJECT: INTRODUCTION TO COMPUTER APPLICATION

THEORY

Introduction to Computers, Anatomy of Computers, Input and Output Devices; Units of Memory, Hardware, Software and Classification of Computers; Personal Computers, Types of Processors, booting of Computer, warm and cold booting, Computer Viruses, Worms and Vaccines Operating System- Disk Operating System (DOS)and WINDOWS: Some fundamental DOS Commands, FORMAT, DIR, COPY, PATH, LABEL, VOL, MD, CD and DELTREE, Rules for naming files in DOS and Types of files. WINDOWS: GUL, Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date, starting and shutting down of WINDOW; Anatomy of a WINDOW, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars Application –MSWORD: Word, processing and units of document, features of word-processing packages. Creating, Editing, Formatting and saving a document in MSWORD; MSEXCEL: Electronic Spreadsheets, concept, packages. Creating, Editing and saving a spreadsheet with MSEXCEL; Use of in-built Statistical and other functions and writing expressions; Use of Date Analysis Tools, Correlation and Regression, t-test for two-sample and ANOVA with one-way Classification, Creating Graphs; MS Power Point: Features of Power Point Package; MSACCESS: Concept of Database, Units of database, creating database; Principles of Programming: Flow Charts and Algorithms, illustration through examples; Internet: World Wide Web (WWW), Concepts, Web Browsing and Electronic Mail.

Practical:

1. Study of Computer Components; Booting of Computer and its Shut Down
2. Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH
3. Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars;
4. WINDOWS Explorer, Creating Folders, COPY and PASTE functions
5. MS WORD: Creating a Document, Saving and Editing in MSWORD, Use of options from Tool Bars, Format Insert and Tools (Spelling & Grammar) Alignment of text in MSWORD, Creating a Table, Merging of Cells, Column and Row width
6. MS EXCEL: Creating a Spreadsheet. Alignment of rows, columns and cells using Format tool bar;
7. MS EXCEL; Entering Expressions through the formula tool bar and use of in built functions, SUM, AVERAGE, STDEV;
8. MS EXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression, Creating Graphs and Saving with & without data.
9. MS ACCESS: Creating Database, Structuring with different types of fields; MS Power Point: Preparation of slides on Power Point;
10. Transforming the data of WORD, EXCEL and ACCESS to other format.
11. Internet browsing: Browsing Web Page and Creating of E-mail ID.

References:

1. Computer Fundamentals by B. Ram
2. Computers Today by Basandra
3. Introduction to Computers by Rajaraman
4. PC Software for Windows 98 Made Simple by R.K. Taxali
5. Computer Fundamentals by Balaguruswamy

SUBJECT: SPICES, AROMATIC, MEDICINAL AND PLANTATION CROPS

Theory:

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

Practical:

1. Botanical description and identification of aromatic plants;
2. Identification of varieties in spices and plantation crops;
3. Identification of medicinal plants;
4. Propagation techniques in aromatic and spice crops;
5. Selection of mother palm, and seed nuts in coconut and oil palm;
6. Study of identification of aromatic plants;
7. Distillation procedures for aromatic crops;
8. Propagation methods in plantation crops;
9. Propagation and planting methods in turmeric;
10. Propagation and planting techniques in ginger;
11. Harvesting procedures in aromatic plants;
12. Processing and curing of spices (ginger, turmeric and black pepper);
13. Training methods in betelvine;
14. Rejuvenation practices in cashewnut;
15. Products – byproducts of spices and plantation crops;
16. Procedures for oleoresin extraction;
17. Visit to local commercial plantations. Aromatic & medicinal plant nurseries and seed spices field

Reference:

1. "Spices and Condiments –" – Purthi,J.S. 2006, National Book Trust India *A.S.Green Park, New Delhi.*
2. "Medicinal and Aromatic Crops", *Aaviskar Publishers Distributors, Jaipur, Rajadthan.*
3. "Spices and Plantation Crops" Shanmugavelu, K.G. and Madhaorao, *Sterling Road, Nungambakkam.*

SUBJECT: PRACTICAL CROP PRODUCTION I

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

Reference:

1. Hand Book of Agriculture: ICAR.
2. Scientific crop production: C. Thakur.
3. Field Crops: Y.M. Iyer.
4. Cereal Crops: W.H. Leonard and J.H. Martin