

COURSE STRUCTURE AND SYLLABI

B.Sc. (Agriculture)

(1st year)—2013-14



Centurion

UNIVERSITY

**DEPARTMENT OF AGRICULTURE ENGINEERING
SCHOOL OF AGRICULTURAL SCIENCE
CENTURION UNIVERSITY OF TECHNOLOGY & MANAGEMENT
Odisha-761211, INDIA,**

Web Site: - www.cutm.ac.in

Syllabus for B.Sc. (Agriculture)

School of Agriculture Science, CUTM

SEMESTER – I

COURSE TITLE	CREDIT HOURS L-P-T	COURSE NO.
Introductory Agriculture	1+0+0	BGAG1101
Principles of Agronomy	2+1+0	BGAG1102
Principles of Genetics	2+1+0	BGPG1101
Introduction to Soil Science	2+1+0	BGAC1101
Production Technology of Vegetables	2+1+0	BGHO1101
Fundamentals of Microbiology	1+1+0	BGPP1101
Statistics	1+0+1	BGAS1101
Fundamentals of Soil, Water and Conservation Engineering	2+1+0	BGAE1101
Insect Morphology and Systematic	2+1+0	BGEN1101
TOTAL	15+7+1 = 23	

Physical Education – PE – 111 /NCC – 111 / NSS – 111

(Non – Credit)

1(0+1)

Pre – requisite – Mathematics

(Non – Credit)

BM – 111 (A) 3 (2+1)

Botany

(Non – Credit)

BB – 111 (A) 3 (2+1)

SEMESTER – II

COURSE TITLE	CREDIT HOURS L-P-T	COURSE NO.
Water Management	2+1+0	BGAG1204
Agricultural Meteorology	1+1+0	BGAG1203
Principles of Plant Breeding	2+1+0	BGPG1202
Agricultural Microbiology	1+1+0	BGAC1202
Introductory Nematology	1+1+0	BGNE1201
Crop Physiology – I	1+1+0	BGPH1201
Principles of Agricultural Economics	2+0+0	BGEC1201
Dimensions of Agricultural Extension	1+1+0	BGEE1201
Introduction to Computer Application	1+1+0	BGAS1202
Farm Power & Machinery	1+1+0	BGAE1202
TOTAL	13+9+0 = 22	

Comprehension & Communication skills in English (Non – credit) SE – 121 2 (1+1)

Pre requisite – Mathematics (Non – credit) BM – 122 (A) 3 (2+1)

Zoology (Non – credit) BZ – 121 (A) 3 (2+1)

SEMESTER – I

1. Introductory Agriculture [BGAG 1101]

1(1+0+0)

Theory: Art, Science and business of crop production. Factors affecting crop production. Brief history of agricultural development:- Chronological Agricultural Technology development in India. Indian Agriculture, Agricultural growth, Balance sheet (DATA). Diversity in Physiography, Soil groups, Marine, Livestock and Water. Dry land agriculture; Farming Systems approach; value addition requirements in new 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- the nucleus of agricultural extension and training.

Reference Book:

1. History of Agriculture in India, Vol.I-IV –(Ed.)M.S.Randhawa
2. Rainfed Agriculture in India:Research and development Scenario. J. Venkataswarelu
3. Concise History of Science in India, Agriculture - S.P. Rayachaudhury, D.M. Bose, S.N. Sen and B.V.A. Subbarayappa
4. Women in Agriculture – B. Wasnik

2. Principles of Agronomy [BGAG 1102]

3(2+1+0)

Theory: Meaning and scope of Agronomy: National and International Agricultural Research Institutes located in India, Agro-climatic zones of India and Orissa. Classification of crops. Crop rotation principles and advantages, cropping pattern, cropping schemes, multiple cropping and mixed cropping principles and advantages, intercropping types and advantages and assessment. Relay cropping, paira cropping and crop interactions. Crop growth and development, and factors affecting yield. Crop stand establishment, planting geometry and its effect on growth and yield. Selection of seed, sowing methods, tillage and it's objectives, types and effect of tillage on soil, tillage implements and harvesting. Yield and it's estimation. Soil fertility and productivity, maintenance of fertility, essential elements, their sources and availability and uptake by crops. Manures and fertilizers- organic and inorganic, green manuring, bio-fertilizers, balanced fertilizers, principles governing time and method of fertilizer application, integrated nutrient management.

Practical: Identification of field crops and under utilized crops and their growth stages; Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments; Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of inter-cultivation implements and practice; Practice of methods of fertilizer application; Preparation of fertilizers mixture and spray solutions; Compost making; Participation in ongoing field operations.

Reference Book:

1. Principles of Agronomy - T.Y. Reddy and G. H. SankarReddi
2. Principles of Agronomy - S. R. Reddy
3. The Nature and Properties of Soil - N.C.Brady and Ray R. Weil
4. Manures and Fertilizers - K. S. Yawalkar, J.P. Agrawal and S. Bokde
5. Soil Conditions and Plant Growth –E.W.Russell and E.J. Russell

3. Principles of Genetics [BGP 1101]

3(2+1+0)

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, it's characteristic features and difference between chromosomal and cytoplasmic inheritance; Mutation and it's characteristic features; Methods of inducing mutations and C / B technique; molecular basis of gene mutation; Mechanisms of sex determination; Gene expression and differential gene activation; operon concept and Fine structure of Gene; DNA and it's 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; Hardy-Weinberg equilibrium; Changes in gene and genotype frequencies; Genetic disorders and gene therapy.

Practical: Gametogenesis and fertilization; Monohybrid ratio and its modifications; Dihybrid ratio and its modifications; Trihybrid ratio; Chi-square analysis and Interaction of factors; Epistatic factors, Supplementary factors and Duplicate factors; Complementary factors, Additive factors and Inhibitory factors; Blood grouping and PTC test in human; Linkage – Two point test cross; Linkage – Three point test cross; gene order and genetic map.

Reference Book:

1. Genes - B. Lewin
2. Fundamentals of Genetics -B. D. Singh
3. Genetics - M. W. Strickberger
4. Principles of Genetics - E.W.Sinnott, L.C.Dunn, T.Dobzhansky
5. Principles of Genetics - E. J.Gardner, M. J.Simmons and D. P. Snustad

4. Introduction to Soil Science [BGAC 1101]

3(2+1+0)

Theory: *Soil* : Pedological 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, textural classes, particle size analysis, soil structure, classification, soil aggregates, significance, soil consistency, soil crusting, Bulk density and particle density of soils & porosity, their significance and manipulation, soil compaction, soil colour, elementary knowledge of soil classification and soils of India; soil water, Retention and potentials, soil moisture constants, movement of soil water, Infiltration, Percolation, Permeability, Drainage, Methods of determination of soil moisture. Thermal properties of soil, soil temperature, Soil air, Gaseous exchange, influence of soil temperature and air on plant growth; Soil colloids, properties, Nature, Types & significance; Layer silicate clays, their genesis and sources of charges, adsorption of ions, ion exchange, CEC and AEC ,factors influencing ion exchange and its significance. Soil organic matter, composition, decomposability, Humus, Fractionation of organic matter, carbon cycle, C:N ratio, Soil biology, Biomass, Soil Organisms & their beneficial & harmful roles.

Practical: Determination of Bulk density & Particle density, Aggregate analysis, Soil strength, soil moisture determination, Soil moisture constants-Field capacity, Infiltration rate, Water holding capacity, Soil Texture & Mechanical analysis-Soil temperature, Analytical chemistry-Basic concepts, Techniques & calculations-collection & processing of soil for analysis-Organic carbon, pH, EC, Soluble cations and anions-Study of a soil profile-Identification of rocks and minerals.

Reference Book:

- a. The nature and properties of soils-N.C.Brady and Ray R.Weil
- b. A text book of Soil Science – T.D. Biswas& S.K. Mukherjee
- c. Fundamentals of Soil Science – Indian Society of Soil Science
- d. Conception,Application of Pedology – J.L. Sehgal
- e. Soil Physics – B.P.Ghildyal and R.P.Tripathy

5. Production Technology of Vegetables [BGHO 1101]

3(2+1+0)

Theory: Importance and scope of the vegetable cultivation, classification of vegetables, types of vegetable farming, Study of vegetable crops with respect to their origin, distribution, climate and soil requirement, sowing and planting ,varieties, nutrient requirement, irrigation, intercultural operations,harvesting , important insect pests diseases and disorders crop improvement and seed production techniques of Solanaceous vegetables (tomato, Brinjal and chilli,Capsicum) Cole crops (cauliflower and cabbage and Knolkhol), Cucurbits (Pumpkin, Cucumber, gourd and melons). Legumes (pea, beans, Cowpea and Guanr), Okra, Bulb crops (onion and garlic),Root crops (radish, turnip, beet and carrot), Potato, Topical tuber crops (sweet potato yams, colocasia, cassava and amorphophallus) Leafy vegetables (amaranthus, basela, spinach and fenugreek), perennials (drum stick, curry leaf).

Practical: Raising of vegetable seedlings in the nursery, seed germination planning and layout of kitchen garden. Identification of vegetable seeds and plant parts, Seed rate, fertilizer calculation Physiological disorders, transplanting, irrigation, weeding and intercultural operations of vegetable crops. Use of growth regulators in vegetable crops, seed extraction of tomato, brinjal, visit to commercial vegetable farms, Research Stations, Vegetable Markets.

Reference Book:

1. Vegetable Crops -T.K.Bose and M.G.Som
2. Vegetable for the tropical region -PremNath, S.Velayadhan and D.P.Singh
3. Technology for vegetable production and improvement -P.Hazra and M.G.Som.
4. Principles of Vegetable production -S.P.Singh
5. Text book of Vegetable Tuber Crops and spices -S.Thamburaj and N. Singh

6. Fundamentals of Microbiology [BGPP 1101]

2(1+1+0)

Theory: History of Microbiology: Spontaneous generation theory, Role of microbes in fermentation, Germ theory of disease, protection against infections. Applied areas of Microbiology: Metabolism in bacteria; ATP generation, chemoautotrophy, photo autotrophy, respiration, fermentation. Bacteriophages: structure and properties of Bacterial viruses- Lytic and Lysogenic cycles: virioids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified organism.

Practical: General instruction, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory: Practice of Aseptic methods: I- Evaluation of aseptic techniques with Nutrient broth tubes, II-Evaluation of aseptic technique with a Nutrient agar plate. Methods of Sterilization and preparation of media I-Preparation of nutrient broth, nutrient agar plates, nutrient agar slant and nutrient agar stablimg; II-Sterilization of glassware by Dry heating; III-Sterilization of nutrient broth by Filtration: Plating methods for Isolation and Purification of bacteria I- Isolation of bacteria by Streak plate method. II- Isolation of aerobic spore forming bacteria by Enrichment using Streak plate method. III- Checking of purity of a bacterial culture by Streak plating method. Identification of bacteria by staining methods and Biochemical tests: I-Morphological examination of bacteria by simple and different staining. II-Different biochemical tests for identification of bacterial culture; Enumeration of bacteria: I- Enumeration of bacteria by stain slide method. II- Enumeration of bacteria by most

probable number method. III- Enumeration of bacteria by pour plate method and spread plate method.

Reference Book:

1. Microbiology - M. J. Pelczar, E.C.S. Chan, N.R. Kreig
2. Microbiology - N. P. Saxena and D. K. Awasthi
3. Microbiology - R.P. Singh

7. Statistics [BGAS 1101]

2(1+0+1)

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; Median, Mode, Merits and Demerits of Arithmetic Mean; 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 and Two Samples; Small Sample Test for Means - Student's t-test for Single Sample, Two Samples and Paired t test. F test; Chi-Square Test in 2x2 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, fitting of regression equations. 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.

Tutorial: Construction of Frequency Distribution Tables and Frequency Curves; Computation of Arithmetic Mean for Un-Grouped and Grouped data; Computation of Median for Un-Grouped and Grouped data; Computation of Mode for Un-Grouped and Grouped data; Computation of Standard Deviation, Variance and Coefficient of Variation for Un-Grouped and Grouped data; SND test for Means, Single Sample; SND test for Means, Two Samples; Student's t-test for Single Sample; Student's t-test for Two Samples; Paired t test and F test; Chi-Square Test in 2x2 Contingency Table, Yates' Correction for continuity; Computation of Correlation Coefficient 'r' and its testing; Fitting of regression equations- Y on X and X on Y; Analysis of Completely Randomized Design (CRD); Analysis of Randomized Block Design (RBD); Analysis of Latin Square Design (LSD).

Reference Book:

1. A First Course in Statistics with Applications- AKPC Swain
2. A Text Book of Agricultural Statistics – R.Rangaswamy
3. Fundamentals of Statistics, Vol. I & II – A.M.Goon, M.K.Gupta and B.Dasgupta

8. Fundamentals of Soil, Water and Conservation Engineering [BGAE 1101]

3(2+1+)

Theory: Surveying: survey equipment, chain survey, cross staff survey, plotting procedure, calculations of area of regular and irregular fields. Levelling - levelling equipment, terminology, methods of calculation of reduced levels, types of levelling, 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: Acquaintance with chain survey equipment; Ranging and measurement of offsets; Chain triangulation; Cross staff survey; Plotting of chain triangulation; Plotting of cross staff survey; Levelling equipment - dumpy level, levelling staff, temporary adjustments and staff reading; Differential leveling; Profile leveling; Contour survey grid method; Plotting of contours; Study of centrifugal pumping system and irrigation water measuring devices; Study of different components of sprinkler irrigation systems; Study of different components of drip and sprinkler irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures.

Reference Book:

1. A Text Book of Surveying and Levelling – P.C. Purnima
2. Land & Water Management Engineering – V.V.N. Murty
3. Soil Erosion and Conservation – R.P. Tripathy and H.P. Singh

9. Insect Morphology and Systematic [BGEN 1101]

3(2+1+0)

Theory: History of Entomology in India. Factors for insects abundance. Classification of Phylum Arthropoda up to 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 of 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 insects. Types of reproduction in insects, Systematics: Taxonomy importance, history and development and binomial nomenclature, Definitions of Biotype, Sub – species, species, Genus, Family and Order. Classification of class Insecta up to Orders. Orthoptera, Acrididae, Dictyoptera, Mantidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae, Hemiptera, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellida, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae, Lepidoptera, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptra, Cecidomyiidae, Trypetidae, Tachinidae, Agromyziidae.

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

Reference Book:

1. Insects, Structure and Function – R.F. Chapman
2. A General Text book of Entomology – A. D. Imms
3. General and Applied Entomology – B.V. David and T.N. Anantha Krishnan.

SEMESTER-II

1. Water Management and Micro Irrigation [BGAG 1204]

3(2+1+0)

Theory: Irrigation: definition and objectives, water resources and irrigation development in India and Orissa; Soil plant water relationships; Methods of soil moisture estimation, soil water movement, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface and subsurface, Micro irrigation, sprinkler and drip irrigation; Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management. Water management of different crops (rice, wheat, maize, groundnut, sun flower, mustard, pulses, sugarcane, cotton, potato, mango, banana and tomato); Agricultural drainage, Onfarm water management.

Practical: Determination of bulk density; Determination of soil moisture content by gravimetric method, tensiometer, electrical resistance block and neutron moisture meter; Determination of field capacity by field method; Determination of permanent wilting point; Measurement of irrigation water through flumes and weirs; Calculation of irrigation water requirement (Problems); Determination of infiltration rate; Demonstration of furrow method of irrigation; Demonstration of check basin and basin method of irrigation; Visit to farmers field and cost estimation of drip irrigation system; Demonstration of filter cleaning, fertigation, injection and flushing of laterals; Erection and operation of sprinkler irrigation system; Measurement of emitter discharge rate, wetted diameter and calculation of emitter discharge variability; Determination of EC, pH, carbonates, bicarbonates, Ca⁺⁺ and Mg⁺⁺ in irrigation water (quality parameters)

Reference Book:

1. Irrigation Principles and Practices - O.W. Israelsen and V.E. Hansen
2. Irrigation and Drainage - D. Lenka
3. Irrigation, Theory and Practices - A. M. Michael
4. Agricultural Drainage : Principles and Practices – U.S.Kadam
5. Micro-irrigation for cash crops – M.L. Choudhary
6. Handbook on pressurized irrigation techniques – A. Phocaides (FAO)

2. Agricultural Meteorology [BGAG 1203]

2(1+1+0)

Theory: Agricultural meteorology: Weather and climate, micro-climate, weather elements, Earths' atmosphere, Composition and structure, solar radiation, Nature, properties, depletion, solar constant and energy balance, Atmospheric, temperature, factors affecting, horizontal and vertical distribution, variations, climate change : causes, effect on ecosystem , crop production ,remedial measures and global warming, Air Pressure variations; Wind: factors affecting, cyclones and anticyclones and general circulation, Atmospheric humidity, vapour pressure and saturation, Process of condensation, formation of dew, fog, mist, snow, rain and hail; Formation and classification of clouds, Introduction to monsoon, Basics of weather forecasting, Introduction to remote sensing and their application. Crop weather relationship, evapotranspiration. Agro climatic zones of India and Orissa.

Practical: Site selection for Agromet observatory; Measurement of temperature; Measurement of rainfall; Measurement of evaporation (atmospheric/soil); Measurement of atmospheric pressure; Measurement of sunshine duration and solar radiation; Measurement of wind direction and speed and relative humidity; Study of weather forecasting and synoptic charts: Study of remote sensing.

Reference Book:

1. Agrometeorology and remote sensing - D.D. Sahu
2. Text book of Agricultural Meteorology - Edited by M.C. Varshney
3. Introduction to Agrometeorology - H.S.Mavi
4. Crops and Weather – S. Venkataraman and A. Krishnan (ICAR)
5. Climate, Weather and Crops in India – D. Lenka

3. Principles of Plant Breeding [BGPG 1202]**3(2+1+0)**

Theory: Classification of plants. 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; Variation – heritable and non-heritable, Methods of breeding – introduction and acclimatization. Selection, Mass selection, Johannson's pure line theory, genetic basis of pure line selection; Hybridization, Aims and objectives, types of hybridization; Methods of handling of segregating generations, pedigree method, bulk method, back cross method and 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; significance in crop improvement.

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

Reference Book:

1. Principles of Plant Breeding - R.W. Allard
2. Plant Breeding Principles and Methods - B. D. Singh
3. Plant Breeding - (Ed.) V. L. Chopra
4. Plant Breeding. Analysis and Exploitation of Variation - D. Roy

4. Agricultural Microbiology [BGAC 1202]**2(1+1+0)**

Theory: Soil microbiology, Microbial groups in soil, microbial transformations of carbon, nitrogen, phosphorus and sulphur. Biological nitrogen fixation, Microflora of Rhizosphere and phyllosphere microflora, microbes in composting, microbiology of water, Microbiology of food; microbial spoilage and principles of food preservation. Beneficial microorganisms in Agriculture; Biofertilizer (Bacterial, Cyanobacterial and fungal), microbial insecticides, Microbial agents for control of plant diseases, Biodegradation, biogas production

Practical: Acquittance with microbial equipments and their use. Enumeration of microbial population in soil. Isolation, multiplication and preservation of bacteria. Gram staining of bacteria and measurement of microbial growth. Microscopic study of heterocyst in BGA. Experiments on ammonification, nitrification, denitrification, organic matter decomposition and evolution of CO₂ in soil, Experiment in urea hydrolysis. Morphological study of nitrogen fixing nodules. Methods of application of Biofertilizers in the field.

Reference Book:

1. Introduction to soil Microbiology – M Alexander
2. Agricultural Microbiology – G. Rangaswami and Bagyaraj
3. Soil microorganism and plant growth – N.S. Subbarao
4. Biofertilizers in Agriculture – N.S. Subbarao.

5. Introductory Nematology [BGNE 1201]**2(1+1+0)**

Theory: Introduction on Nematode. Economic Importance of Nematodes, History of Phytonematology, Structure of a typical plant parasitic nematode. General morphology on various organ systems and organelles. Modification of stoma and oesophagous in soil and plant nematodes. Biology of nematode, Classification of economically important nematode genera up to family level with identification marks.

Practical: Study of Nematological laboratory appliances, study of bionocular stereoscopic and Research Microscopes, collection of soil and plant samples, Extaction of nematodes from soil by Cobb's sieving and decantation technique followed by modified Baermann technique, killing and fixing of nematodes, processing and mounting of nematodes, mouth parts and *oesophagous* of soil and plant nematodes. Identification of *Hoplolaimus*, *Helicotylenchus*, *Tylenchorhynchus*, *Criconemella*, *Caloosia*.

Reference Book:

1. Text book on Introductory Plant nematology – R.K. Walia and H.K. Bajaj
2. A Treatise on Phytonematology –P.P. Reddy
3. Introduction to Plant Nematology –V.H. Dropkin

6. Crop Physiology-I [BGPH 1201]**2(1+1+0)**

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 crops. Harvest maturity, seed viability and vigour. Factors affecting seeds 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. 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 condition for seed storage, factors Influencing seed storage (ISTA standards). Crop water relationship, 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 pathways. relationship of photosynthesis and crop productivity, photorespiration. Factors affecting photosynthesis and productivity. Method of measuring photosynthesis. Photosynthetic efficiency. Respiration and its significance, brief account of growth respiration and maintenance respiration, alternate respiration, salt respiration, wound respiration-measurement of respiration.

Practical: Preparation of solutions, measurement of water status in roots, stems and leaves, measurement of water potential by Chardakov's method, measurement of Osmotic potential by Plasmolytic method, measurement of water potential by Gravimetric method, measurement of absorption spectrum of chloroplastic pigments and fluorescence, measurement of chlorophyll a, b and total chlorophyll, measurement of carotenoid pigments, measurement of stomatal

frequency and index, measurement of respiration, study of leaf anatomy of C₃, and C₄ plants, measurement of transpiration, imbibitions of seed, optimum conditions of seed germination. Seed viability test, breaking of seed dormancy by chemical and mechanical methods, yield analysis, seed Vigour test.

Reference Book:

1. Principles of seed technology - G.N.Kulkarni
2. Plant physiology - R.G.S. Bidwell
3. A text book of plant physiology - C.P.Mallick and A.K.Srivastav
4. The germination of seeds - A.M. Mayer and A.Poljakoff-Mayber
5. Plant physiology - R.K.Shinha
6. Plant Physiology -K.N.Vatia and A.N.Parasar
7. The physiology and biochemistry of seed development, dormancy and germination - A.A.Khan
8. Seed Physiology – K. Vanangamudiet *al*

7. Principles of Agricultural Economics [BGEC 1201]

2(2+0+0)

Theory: Introduction to economic theory: Micro Economics: Definition, subject matter, division of economics, scope and importance of economics. Basic terms and concepts used in economics. Demand theory : Characteristics of human wants, classification of wants, law of diminishing marginal utility, law of equi-marginal utility, consumer's surplus, meaning and kinds of demand, law of demand, elasticity of demand and measurement of elasticity of demand. Production and supply: Nature and factors of production, meaning, importance and characteristics of land, meaning and characteristics of labour, labour efficiency, importance of capital, capital formation, stags of capital formation. Organization: Importance and functions of entrepreneur, different forms of business organization definition, meaning and law of supply. Market: Characteristics of perfect and various imperfect markets, equilibrium conditions of firm, price determination under perfect competition. Macro economics: concepts, importance and measurement of national income. Inflation: Kinds of inflation, causes and consequences of inflation and role of monetary and fiscal policy to check inflation. Public finance: meaning of public finance, distinction between public and private finance, importance and functions of public finance, sources of govt. finance. Public expenditure: classification of public expenditure, principles of public expenditure, importance and role of public expenditure on economy. Public revenue: canons of taxation, characteristics of a good tax system, kinds of taxes, advantages and disadvantages of different types of taxes, incidences of taxation.

Reference Book:

1. Elementary economic theory - K.K. Dewett and J.D. Verma
2. International Economics - B. Mishra
3. Fundamentals of Agricultural Economics - A.N. Sadhu and A. Singh
4. Economics - Paul A. Samelson and W.D. Nordhans

8. Dimensions of Agricultural Extension [BGEE 1201]

2(1+1+0)

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 PanchayatRaj,three tiers of Panchayat Raj system. Power, 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) , SwarnaJayanthi Gram SwarojgarYojana (SGSY) , Prime Minister Employment Yojana (PMEY). New trends in extension, privatization. Women Development programmes-Development of Women and Children in Rural Areas (DWCRA), RashtriyaMahilaKosh(RMK), Integrated Child Development Scheme (ICDS) and MahilaSamridhiYojana (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: Visits to a village and kisanmandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & ZillaPrajaParishad (ZPP). Visit and study the District Rural Development Agency (DRDA). Participation in monthly workshops of Training and Visit (T&V) System. Visit to Watershed Development Project area. Visit to a village to study the Self Help Groups (SHGs) of DWCRA. Visit to a voluntary organization to study the developmental activities. Organizing PRA techniques in a village to identify the agricultural problems. Visit to villages.

Reference Book:

1. Education & Communication for Development- O.P.Dahama& O.P. Bhatnagar
2. Extension Communication & Management- G.L.Ray
3. Defining Agricultural Extension for 1990s- D.C. Misra
4. Agricultural Extension- A.W. Van Den Ban & H.S. Hawkins
5. Hand book of Extension Education- O.S.Rathore *et al*
6. Rural Extension Hand book- V. Singh & M.S. Vasistha
7. New Dimension and Approaches in Extension – J. Vasanthakumar

9. Introduction to computer application [BGAS 1202]

2(1+1+0)

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 – DOS and WINDOWS. Disk Operating System (DOS): 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: GUI, Desktop and its elements, WINDOWS Explorer, working with files and folders; setting time and date, starting and shutting down of WINDOWS. Anatomy of a WINDOW, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars. Applications – 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 Data Analysis Tools, Correlation and Regression, t-test for two-samples 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: Study of Computer Components; Booting of Computer and its Shut Down; Practice of some fundamental DOS Commands, TIME, DATE, DIR, COPY, FORMAT, VOL, LABEL, PATH; Practicing WINDOWS Operating System, Use of Mouse, Title Bar, Minimum, Maximum and Close Buttons, Scroll Bars, Menus and Tool Bars; WINDOWS Explorer, Creating Folders, COPY and PASTE functions; MSWORD: Creating a Document, Saving and Editing; MSWORD, Use of options from Tool Bars, Format, Insert and Tools (Spelling & Grammar) Alignment of text; MSWORD, Creating a Table, Merging of Cells, Column and Row width; MSEXCEL: Creating a Spreadsheet, Alignment of rows, columns and cells using Format tool bar; MSEXCEL: Entering Expressions through the formula tool bar and use of inbuilt functions, SUM, AVERAGE, STDEV; MSEXCEL: Data Analysis using inbuilt Tool Packs, Correlation & Regression; MSEXCEL: Creating Graphs and Saving with & without data; MSACCESS: Creating Database, Structuring with different types of fields; MS Power Point: Preparation of slides on Power Point; Transforming the data of WORD, EXCEL and ACCESS to other formats; Internet Browsing: Browsing a Web Page and Creating of E-Mail ID.

Reference Book:

1. Computer Studies – a First course – J. Shelly and R. Hunt.
2. Programming in BASIC – E.Balagurusamy
3. Microsoft Windows XP Manual.
4. Microsoft Office XP Manual.

10. Farm Power and Machinery [BGAE 1202]

2(1+1+0)

Theory: Farm power in India: sources, I.C engines, working principles, two stroke and four stroke engines, I.C. engine terminology, different systems of I.C. engine. Tractors, Types, Selection of tractor and cost of tractor power. Tillage implements: Primary and Secondary tillage implements, Implements for intercultural operations, seed drills, paddy transplanters, plant protection equipment and harvesting equipment; Equipment for land development and soil conservation.

Practical: Study of different components of I.C. Engine; Study of working of four stroke engine; Study of working of two stroke engine; Study of M.B. plough, measurement of plough size different parts, horizontal and vertical suction, determination of line of pull etc.; Study of disc plough; Study of seed--cum-fertilizer drills-furrow opener, metering mechanism and calibration; Study, maintenance and operation of tractor; Learning of tractor driving; Study, maintenance and operation of power tiller; Study of different parts, registration alignment and operation of mower. Study of different inter cultivation equipment in terms of efficiency, field capacity; Repairs and adjustments and operation of sprayers; Repairs and adjustments and operation of dusters; Study of paddy transplanters.

Reference Book:

1. Principles of Farm Machinery – Roy Bainer, R.A. Kepner, E.L. Barger
2. Farm Machinery and Equipment – C.P. Nakra
3. Elements of Farm Machinery – J. Sahay

