



BHAGWANT UNIVERSITY

Established by Govt. of Raj. & Recognised by UGC

Sikar Road, Ajmer
RAJASTHAN

Syllabus

B.Sc. (AGRICULTURE)

2012-2013

B.Sc. (AGRICULTURE)

I. Semester.

Subject Code	Name of Subject	Teaching Periods		Credit Points
		T	P	
01AGB101	Principles of Agronomy and Agricultural Meteorology	2	1	3(2+1)
01AGB102	Principles of Genetics	2	1	3(2+1)
01AGB103	Introduction to Soil Science	2	1	3(2+1)
01AGB104	Fundamentals of soil water conservation and engineering	2	1	3(2+1)
01AGB105	Plant Pathogens and Principles of Plant Pathology	3	1	4(2+1)
01AGB106	Production technology of fruit crops	2	1	3(2+1)
01AGB107	Introductory Agriculture (Ancient, Heritage, Agriculture, Scenario and gender equity in Agriculture)	1	0	1(1+0)
01AGB301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		14	7	21

I. Semester

01AGB101- Principles of Agronomy and Agricultural Meteorology 3 (2+1)

Meaning and scope of Agronomy: National and International Agricultural Research Institutes in India, Agro-climatic zones of India and Rajasthan. Tillage, crops stand establishment, Planting geometry and its effect on growth and yield cropping systems, Harvesting.

Agricultural meteorology: Weather and climate, micro-climate, weather elements, Earth's atmosphere, Composition and structure, solar radiation, Nature, properties, depletion, solar constant and energy balance, Atmospheric, temperature, factors affecting, horizontal and vertical distribution, variations 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.

Practical: Study of tillage implements; Practice of ploughing; Practice of puddling; Study of seeding equipments and introduction of remote sensing. Different methods of sowing; Study of manures, fertilizers and green manure crops / seeds (including calculations); Study of intercultivation implements and practice; Practice of methods of fertilizer applications; Participation in ongoing field operations; 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.

Suggested Books reading:

Principles of Agronomy by **S.R. Reddy**

Principles of Agronomy by **S. Sankaran, and T.V.S. Mudaliar**

General meteorology by **H. R. Byers**

Introductory to meteorology by **S. Patterson**

01AGB102-Principles of Genetics 3 (2+1)

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 I 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: Microscopy (Light microscopes and electron microscopes; Preparation and use of fixatives and stains for light microscopy; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of mitosis; Preparation of micro slides and identification of various stages of meiosis; Preparation of micro slides and identification of various stages of meiosis; 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; Linkage – Two point test cross; Linkage – Three point test cross; Induction of polyploidy using colchicines; Induction of chromosomal aberrations using chemicals.

Suggested Books reading:

Genetics And Plant Breeding- By **L.D. Vijendra Das**

Principles of genetics by **Michael J. Simmons**

Concepts of Genetics by **Klug WS and Cummings MR Prentice Hall**

Genetics: a Conceptual Approach by **Pierce BA Freeman**

Genetics: Analysis of Genes and Genomes by **Hartle DL and Jones EW Jones and Bartlett**

Principles of Genetics by **Snus tad DP and Simmons MJ John Wiley & Sons**

An introduction to Genetic Analysis by **Griffith AF, Freeman**

01AGB103-Introduction to Soil Science 3(2+1)

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 soils, Soil temperature, Soil air, Gaseous exchange, Influence of soil temperature and air on plant growth; Soil colloids, Properties, nature, types and significance; Layer silicate clays, their genesis and sources of charges, Adsorption of ions, Ion exchange, CEC & 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 and their beneficial and harmful roles.

Practical: Determination of bulk density and particle density, Aggregate analysis, Soil strength, Soil moisture determination, Soil moisture constants – Field capacity Infiltration rate, water holding capacity, soil texture and mechanical analysis – Soil temperature. Analytical chemistry – Basic concepts, techniques and calculations – Collection and processing of soil for analysis – Organic carbon, pH, EC, soluble cations and anions – Study of a soil profile – Identification of rocks and minerals.

Suggested Books reading:

Introductory to soil science by **Bernard P. K. Yerima**

Elements of the nature and properties of the soil by **Brady and nyle**

Nature and properties of soil by **Brady and nyle**

01AGB104- Fundamentals of Soil, Water and Conservation Engineering 3(2+1)

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 sprinkle irrigation systems; Uniformity of water application in drip and sprinkler systems; Study of soil and water conservation measures

Suggested Books:

Soil and Water Conservation Engineering by **Rodney L. Huffman et al.**

Soil and Water Conservation Engineering by **Glenn O. Schwab and Delmar D.**

Fangmeier

Environmental Soil Physics: Fundamentals, Applications, and Environmental **By Daniel Hillel**

01AGB105- Plant Pathogens and Principles of Plant Pathology 4 (3+1)

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual of Systematic Bacteriology. 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. 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 – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants – Structural and Bio-chemical (pre and postinfection). 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 – Application of biotechnology in plant disease management –Development of disease resistant transgenic plants through gene

cloning. Integrated plant disease management (IDM) – Concept, advantages and importance.

Practical: Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for fungi and bacteria; Isolation techniques, preservation of disease samples; Study of Pythium, Phytophthora and Albugo; Study of Sclerospora, Peronosclerospora, Pseudoperonospora, Peronospora, Plasmopara and Bremia; Study of genera Mucor and Rhizopus. Study of Oidium, Oidiopsis, Ovulariopsis, Erysiphe, Phyllactinia, Uncinula and Podosphaera; Study of Puccinia (different stages), Uromyces, Hemileia; Study of Sphacelotheca, Ustilago and Tolyposporium; Study of Agaricus, Pleurotus and Ganoderma; Study of Septoria, Colletotrichum, Pestalotiopsis and Pyricularia; Study of Aspergillus, Penicillium, Trichoderma, and Fusarium; Study of Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis, Rhizoctonia and Sclerotium; Demonstration of Koch's postulates; Study of different groups of fungicides and antibiotics; Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Chestnut compound; Methods of application of fungicides – seed, soil and foliar; Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; Bio-control of plant pathogens – dual culture technique, seed treatment. Visit to quarantine station and remote sensing laboratory.

Suggested book reading:

Plant pathology by **G. N. Agrios**

Principles of Plant Pathology by **J. G. Manners**

Principles of diagnostic techniques in plant pathology by **R. T. V. Fox**

01AGB106- Production Technology of Fruit Crops 3(2+1)

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, ber, fig, phalsa, jack, pear, plum, peaches and cherry.

Practical: Study of horticultural tools and implements and their uses; Containers, potting mixture, potting, depotting and repotting; Plant propagation, seed propagation, scarification, and stratification; Propagation by cuttings (soft wood, hard wood and semi-hardwood) layering (simple layering, Air layering, stooping in guava); Layout and planting systems (Traditional system and high density planting methods); Methods of pruning and training; Training of ber, grape and pomegranate; Pruning of ber, grape, phalsa, fig, apple, pear, peach; 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 Fertiliser 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.

Suggested book reading:

Cultivation of Fruits, Vegetables and Floriculture By **Niir Board**

Crop Production Technology by **Jesse D Dagoon**

Postharvest Technology of Fruits and Vegetables by **L. R. Verma, Dr. V. K. Joshi**

01AGB107-Introductory Agriculture (Ancient Heritage, Agricultural Scenario and Gender Equity in Agriculture) 1(1+0)

Art, Science and business of crop production, Basic elements of crop production; Factors affecting crop production; History of Agricultural Development; Ancient India Agriculture in Civilization Era, Chronological Agricultural Technology development in India. Indian Agriculture, balance sheet, liabilities; Assets and Contrasting trends (DATA), Agrl. growth, contrasting food chains, Diversity in physiography, Soil groups, marine, livestock and water; Liabilities: Soil factors, weather factors, Economic ecology, dry and irrigation 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, rural women; The nucleus of Agricultural Extension and Training.

Suggested book reading:

Introduction to Agricultural Engineering Technology: A Problem Solving Approach By **Harry Field, John Solie**
Introductory Agriculture by **K.L Nandeha**
Agriculture, past and present by By **John Wilson**

II. Semester

Subject Code	Name of Subject	Teaching Period		CREDIT POINTS
		T	P	
02AGB101	Introductory Nematology	1	1	2(1+1)
02AGB102	Statistics	1	1	2(1+1)
02AGB103	Water management including micro irrigation	2	1	3(2+1)
02AGB104	Principles of Seed Technology	2	1	3(2+1)
02AGB105	Principles of Agril. Economics	2	0	2(2+0)
02AGB106	Dimensions of Agril. Extension	1	1	2(1+1)
02AGB107	Agricultural Microbiology	2	1	3(2+1)
02AGB108	Introduction to computer application	1	1	2(1+1)
02AGB109	Soil Chemistry, Soil Fertility and Nutrient Management	2	1	3(2+1)
02AGB301	Discipline & Co. curricular activity	0	1	1(0+1)
	Total	14	9	23

II. Semester

02AGB101- Introductory Nematology 2 (1+1)

Introduction: History of phytonematology. Economic importance. General characteristics of plant pathogenic nematodes. Nematode general morphology and biology. Classification of nematodes upto family level with emphasis on groups containing economically important genera. Classification of nematodes by habitat. Identification of economically important plant nematodes upto generic level with the help of keys and description. Symptoms caused by nematodes with examples. Interaction between plant parasitic nematodes and disease causing fungi, bacteria and viruses. Different methods of nematode management. Cultural methods (crop rotation, fallowing, soil amendments, other land management techniques), physical methods (soil solarisation, hot water treatment) Biological methods, Chemical methods (fumigants, non fumigants). Resistant varieties. IDM.

Practical: Methods of survey – sampling methods, collection of soil and plant samples; Extraction of nematodes from soil and plant tissues following combined Cobb's decanting – sieving and Baermann funnel technique, counting and estimation of plant parasitic nematodes; Preparation of temporary and permanent mounts; Method of preparation of perineal patterns for identification of species of Meloidogyne; Study and identification of most important plant parasitic nematodes with special reference to their characteristics and symptomatology – Meloidogyne, Pratylenchus; Heterodera, Ditylenchus, Globodera, Tylenchulus, Xiphinema, Radopholus, Rotylenchulus, and Helicotylenchus. Experimental techniques used in pathogenicity studies with root knot nematode.

Suggested Books reading:

Introductory to Nematology by **B.G. Chitwood** and **M.B. Chitwood**

Textbook on Introductory Plant Nematology by **Harish K Bajaj** and **Raman K Walia**

Introductory Nematology by **Kusum Dwivedi** and **K. D. Upadhyay**

Introduction to nematology by **Benjamin Goodwin Chitwood** and **May Belle Hutson Chitwood**

02AGB102- Statistics 2(1+1)

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 (all types); 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.

Practical: 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).

Suggested book reading:

Introductory Statistics by **Prem S. Mann**

Introduction to Mathematical Statistic by **Robert V. Hogg , Joseph W. McKean** and **Allen Craig Deceased**

02AGB103- Water Management Including Micro Irrigation 3(2+1)

Irrigation: definition and objectives, water resources and irrigation development in India and Rajasthan; Soil plant water relationships; Methods of soil moisture estimation, evapotranspiration and crop water requirement; effective rainfall, scheduling of irrigation; Methods of irrigation: surface, 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, sugarcane, mango, banana and tomato); Agricultural drainage.

Practical: Determination of bulk density by field method; 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).

Suggested book reading:

Water Resources Management by **Libor Jansky** and **Juha I Uitto**

Irrigation and Drainage by **D. Lenka**

Water management including micro irrigation by **A. M. Michael**

Water management including micro irrigation by **Megh R. Goyal**

02AGB104-Principles of Seed Technology 3(2+1)

Introduction to Seed Production, Importance of Seed Production, Seed policy, Seed demand forecasting and planning for certified, foundation and breeder seed production, Deterioration of crop varieties, Factors affecting deterioration and their control; Maintenance of genetic purity during seed production, Seed quality; Definition, Characters of good quality seed, Different classes of seed, Production of nucleus & breeder's seed, Maintenance and multiplication of pre-release and newly released varieties in self and cross-pollinated crops; Seed Production, Foundation and certified

seed production in maize (varieties, hybrids, synthetics and composites); Foundation and certified seed production of rice (varieties & hybrids); Foundation and certified seed production of sorghum and bajra (varieties, hybrids, synthetics and composites); Foundation and certified seed production of cotton and sunflower (varieties and hybrids); Foundation and certified seed production of castor (varieties and hybrids); Foundation and certified seed production of tomato and brinjal (varieties and hybrids); Foundation and certified seed production of chillies and bhendi (varieties and hybrids); Foundation and certified seed production of onion, bottle gourd and ridge gourd (varieties and hybrids); Seed certification, phases of certification, procedure for seed certification, field inspection and field counts etc.; Seed Act and Seed Act enforcement, Central Seed Committee, Central Seed Certification Board, State Seed Certification Agency, Central and State Seed Testing Laboratories; Duties and powers of seed inspectors, offences and penalties; Seed control order: Seed Control Order 1983, Seed Act 2000 and other issues related to seed quality regulation. Intellectual Property Rights, Patenting, WTO, Plant Breeders Rights, Varietal Identification through Grow-Out Test and Electrophoresis; Seed Drying: Forced air seed drying, principle, properties of air and their effect on seed drying, moisture equilibrium between seed and air, Heated air drying, building requirements, types of air distribution systems for seed drying, selection of crop dryers and systems of heated air drying, recommended temperature and depth of the seeds, management of seed drying, Planning and layout of seed processing plant; Establishment of seed processing plant. Seed processing: air screen machine and its working principle, different upgrading equipments and their use, Establishing a seed testing laboratory. Seed testing procedures for quality assessment, Seed treatment, Importance of seed treatment, types of seed treatment, equipment used for seed treatment (Slurry and Mist-O-matic treater), Seed packing and seed storage, stages of seed storage, factors affecting seed longevity during storage and conditions required for good storage, General principles of seed storage, constructional features for good seed warehouse, measures for pest and disease control, temperature control, Seed marketing, marketing structure, marketing organization, sales generation activities, promotional media, pricing policy; Factors affecting seed marketing.

Practical: Seed sampling principles and procedures; Physical Purity analysis of Field and Horticultural crops; Germination analysis of Field and Horticultural crops; Moisture tests of Field and Horticultural crops; Viability test of Field and Horticultural crops; Seed health test of Field and Horticultural crops; Vigour tests of Field and Horticultural crops; Seed dormancy and breaking methods; Grow out tests and electrophoresis for varietal identification; Visit to Seed production plots of Maize, Sunflower, Bajra, Rice, Sorghum, Cotton, Chillies and Vegetables. (Add or delete crops of the region); Visit to Seed processing plants; Visit to Seed testing laboratories; Visit to Grow out testing farms; Visit to Hybrid Seed Production farms; Varietal identification in seed production plots; Planting ratios, isolation distance, roguing etc.

Suggested books reading:

Principles of seed science and technology by **Lawrenceo Copland**

Principles of seed science and technology by **M B Mc donald**

The Encyclopedia of Seeds: Science, Technology and Uses by **J. Derek Bewley, Michael Black, Peter Halmer**

02AGB105-Principles of Agricultural Economics 2 (2+0)

Economics: Meaning, Definition, Subject matter, Divisions of Economics, Importance of Economics; Agricultural Economics: Meaning, Definition; Basic Concepts: Goods, Service, Utility, Value, Price, Wealth, Welfare. Wants: Meaning, Characteristics, Classifications of Wants, Importance. Theory of consumption: Law of Diminishing

Marginal utility, Meaning, Definition, Assumption, Limitations, Importance. Consumer's surplus: Meaning, Definition, 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, Classification of Taxes: Canons of Taxation, Public expenditure: Meaning, Principles. Inflation: Meaning, Definition, Kinds of inflation.

Suggested books reading:

Principles of agricultural economics by **David colman**

Principles of agricultural economics by **Tervoryoung**

Principles of agricultural economics by **Subba reddy**

02AGB106- Dimensions of Agricultural Extension 2(1+1)

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 proprogramme. 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 Swarojgar Yojana (SGSY), Prime Minsiter 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: Visits to a village and kisan mandal to study the ongoing development programmes. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (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.

Suggested book reading:

Agricultural Extension Systems: Issues and Approaches by **B.S. Hansra**

New Dimensions in Agricultural Geography: Landuse and agricultural planning by **Noor Mohammad**

Improving Agricultural Extension by **Burton Swanson**

02AGB107- Agricultural Microbiology 3(2+1)

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: viroids, prions. Bacterial genetics; Gene expression; Genetic recombination: transformation, conjugation and transduction, genetic engineering, Plasmids, episomes, genetically modified Organisms. 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, Biodegradable plastics, Plant – Microbe interactions.

Practical: General instructions, Familiarization with instruments, materials, glassware etc. in a microbiology laboratory: Practice of Aseptic methods: I - Evaluation of aseptic technique 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 stab; 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 Differential 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.

Suggested books reading:

Microbiology by **M J Pelczar, E C S Chan and N R Krieg.**

Biology of Microorganisms by **T D Brock**

A Textbook of Microbiology by **S.Chand. R C Dubey and D K Maheshwari**

Agriculture microbiology by **R. D. Hodges**

02AGB108- Introduction to Computer Applications 2(1+1)

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.

Suggested book reading:

Introduction to Computers and Application Software By **Jose Damien, Tci**

Mathematical and Control Applications in Agriculture and Horticulture by **W. Day, Yasushi Hashimoto**

Designing Better Architecture Education: Global Realities and Local Reforms By **Dr Manjari Chakraborty**

02AGB109-Soil Chemistry, Soil Fertility and nutrient Management 3 (2+1)

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 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. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Practical: Principles of analytical Instruments and their calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, and Zn in oils, pH, EC, soluble cations and anions in soil water extracts. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

Suggested books reading:

Soil fertility, soil chemistry and nutrient management by **Macselfaj**

Soil fertility, soil chemistry and nutrient management by **Havlin john L**

Soil Fertility and Fertilizers: An Introduction to Nutrient Management by **John Havlin**

III Semester

Subject Code	Name of Subject	Teaching Period		Credit Points
		L	P	
03AGB101	Principles of Plant Breeding	2	1	3(2+1)
03AGB102	Insect Morphology and Systematics	2	1	3(2+1)
03AGB/ABM103	Agricultural Finance and Co-operation	1	1	2(1+1)
03AGB/ABM104	Farm power and machinery	1	1	2(1+1)
03AGB/ABM105	Production Technology of Vegetables & Flowers	2	1	3(2+1)
03AGB/ABM106	Livestock Production and Management	2	1	3(2+1)
03AGB/ABM107	Organic Farming	2	1	3(2+1)
03AGB/ABM108	Crop Physiology	2	1	3(2+1)
03AGB/ABM109	Practical Crop Production 1(Cereal, Pulses and Fodder Crops)	0	1	1(0+1)
03AGB/ABM301	Discipline & Co. curricular activity	0	1	1(0+1)
	Total	14	10	24

III. Semester

03AGB/ABM101-Principles of Plant Breeding 3(2+1)

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 Johannson'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: 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; Study of male sterility and incompatibility in field plots; 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.

Suggested book reading:

Selection Methods in Plant Breeding By **Izak Bos, Peter D. S. Caligari**

Plant Breeding by **A. L. Hagedoorn**

Advanced methods in plant breeding and biotechnology- by **David Ronald Murray**

Quantitative Genetics, Genomics, and Plant Breeding- by **Manjit S. Kang**

03AGB/ABM102-Insect Morphology and Systematics 3(2+1)

History of Entomology in India. Factors for insects abundance. Classification of phylum Arthropoda upto 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 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 upto Orders. Orthoptera, Acrididae. Dictyoptera, Mantidae, Odonata, Isoptera, Termitidae, Thysanoptera, Thripidae, Hemiptera, Pentatomidae, Coreidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Aleurodidae, Pseudococcidae, Neuroptera, Chrysopidae Lepidoptera, Noctuidae, Spingidae, Pyralidae, Gelechiidae, Arctiidae,

Coleoptera, Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae, Hymenoptera, Tenthredinidae, Apidae, Trichogrammatidae, Ichneumonidae, Braconidae, Diptera, 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 (Grassopher); Dissection of male and female reproductive systems in insects (Grassopher); Study of characters of orders Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera and their families of agricultural importances.

Suggested book reading:

Insect structure and function by **R. F. Chapman**

Insect morphology by **R. E. Snodgrass**

General text book of entomology by **A.d. Imms**

03AGB/ABM103- Agricultural Finance and Co-Operation 2(1+1)

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. Reorganisation of cooperative credit structure in Andhra Pradesh and single window system. Successful cooperative systems in Gujarat, Maharastra. Punjab etc.

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

Suggested book reading:

Agricultural Finance and Managemen by **Reddy, S. and Raghu Ram, P.**

Agricultural Problems of India by **Mamoria, C.B.**

Fundamental of Cooperatio by **Krishnaswami, O.R.**

Agricultural Finance Nelson by **A.G. and Murray, W.G.**

03AGB/ABM104- Farm Power and Machinery 2 (1+1)

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.

Suggested book reading:

Farm machinery and power by **Powar and aware**

Farm power and machinery management by **Donnell hunt**

Farm Tractors, Maintenance and Repair by **Rai and Jain**

Elements of Farm Machinery by **Srivastava**

03AGB/ABM105- Production Technology of Vegetables and Flowers 3(2+1)

Importance of Olericulture, vegetable gardens, vegetable classification. Origin, area, production, varieties, package of practices for fruit vegetables –, tomato, brinjal, chillies, and okera; 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, gogu; 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; Identification of ornamental plants (trees ,shrubs,climbers,house plants,palms etc..) and development of garden features; Transplanting of vegetable seedlings in main field; Layout of lawns and maintenance; Seed extraction in tomato and brinjal; Depotting, repotting and maintenance of house plants; Visit to commercial vegetable farms; Training and pruning of rose (standards, hybrid ‘T’ roses cented roses) and chrysanthemum (pinching and disbudding); Planning and layout of gardens and garden designs for public and private areas; Intercultural operations in vegetable plots; Seed production in vegetable crops; Harvesting indices of different vegetable crops; Grading and packing of vegetables; Prolonging the shelf life of cut flowers.

Suggested book reading:

Vegetables Crops by **Thompson, H. C. and Kelly, W.C.**

Vegetable Production in India by **Chauhan, D.V.S.**

Vegetables by **Bose, T.K.**

Vegetables by **Choudhary, B**

03AGB/ABM106- Livestock Production and Management 3(2+1)

Place of livestock in the national economy, different livestock development programmes of Govt. of India. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and swine. Measures and factors affecting fertility in livestock, reproductive behaviour like oestrus, parturition, farrowing etc. Milk secretion, milking of animals and factors affecting milk yield and composition. Selection and breeding of livestock for higher milk and meat production. Feeding and management of calves, growing heifers and milch animals and other classes and types of animals, housing principles, space requirements for different species of livestock. Disease control measures, sanitation and care, breeding, feeding and production records. Breed characteristics of poultry, their methods of rearing, breeding, feeding and management, incubation, hatching and brooding, vaccination and prevention of diseases, preservation and marketing of eggs, its economics and keeping quality. Cost of production of milk, economical units of cattle, buffalo, sheep, goat and swine.

Practical: Identification, handling and restraining of animals; Judging and culling; Feeding and ration formulation; Hatching, housing and management of poultry; Visit to livestock farms and Economics of livestock production.

Suggested book reading:

Animal Nutrition and Feeding Practices by **Ranjan, SK**

Outlines of dairy technology by **Sukumar, De**

Farm Animal Management and Poultry Production by **Thomus C.K., Sastry NSR and Singh, RA.**

03AGB/ABM107-Organic Farming 3(2+1)

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

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

Suggested book reading:

Production and quality control of carrier based legume inoculants by **Thompson, J.A.**

A complete guide to the sustainable and profitable biological system of farming by **Gary F Zimmer**

Intensive agriculture and sustainability: A farming system analysis by **Glen C Filson**

03AGB/ABM108- Crop Physiology 3(2 + 1)

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: Preparation of solutions; Growth analysis: Calculation of growth parameters; Methods of measuring water status in roots, stems and leaves; Measurement of water potential by Chardakov's method; Measurement of absorption spectrum of chloroplastic pigments and fluorescence; Measurement of leaf area by various methods; Stomatal frequency and index – Respirometer – Measurement of respirometer; Leaf anatomy of C₃ and C₄ plants; Transpiration of measurement; Imbibition of seed; Optimum conditions for seed germination; Breaking seed dormancy; (a) Chemical method (b) Mechanical method; Yield analysis; Seed viability and vigour tests; Effect of ethylene on regulation of stomata.

Suggested book reading:

Plant physiology ecology by **Hans Lambers, F. Stuart Chapin III, Thijs L. Pons**

Introduction to plant physiology by **William G. Hopkins, Norman P. A. Hüne**

Plant Physiology by **G.R. Noggle and G.J. Fritz**

Plant Physiology by **J.B. Salisbury and C.W. Ross**

IV Semester

Subject Code	Name of Subject	Teaching Period		Credit points
		L	P	
04AGB/ABM101	Manures, Fertilizers and Agrochemicals	2	1	3(2+1)
04AGB/ABM102	Insect Ecology & Integrated pest management including beneficial insects	2	1	3(2+1)
04AGB/ABM103	Agricultural marketing, Trade and Prices	1	1	2(1+1)
04AGB/ABM104	Protected cultivation and Post harvest Technology	1	1	2(1+1)
04AGB/ABM105	Diseases of Field Crops and their management	2	1	3(2+1)
04AGB/ABM106	Production technology of spices, Aromatics Medicinal and Plantation Crops	2	1	3(2+1)
04AGB/ABM107	Breeding of Field / Horticultural crops	2	1	3(2+1)
04AGB/ABM108	Practical crop production II (oil seeds & commercial crops)	0	1	1(0+1)
04AGB/ABM301	Discipline & Co. curricular activity	0	1	1(0+1)

Total	12	9	21
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IV Semester

04AGB/ABM101-Manures, Fertilizers and Agro-Chemicals 3(2+1)

Introduction – Raw materials – Manures – Bulky and concentrated – FYM, Composts – Different methods, Mechanical compost plants, Vermicomposting, Green manures, Oil cakes, Sewage and sludge – Biogas plant slurry, Plant and animal refuges. Fertilizers – classifications, Manufacturing processes and properties of major nitrogenous (ammonium sulphate, urea, calcium ammonium nitrate, ammonium nitrate, ammonium sulphate nitrate) phosphatic (single super phosphate, enriched super phosphate, diammonium phosphate, ammonium poly phosphate), potassic and complex fertilizers their fate and reactions in the soil, Secondary and micronutrients fertilizers, Amendments. Fertilizer Control Order, Fertilizer storage; Biofertilizers and their advantage, Organic chemistry as prelude to agro chemicals, Diverse types of agrochemicals, Botanical insecticides (Neem), Pyrethrum, Synthetic pyrethroids. Synthetic organic insecticides, Major classes, Properties and uses of some important insecticides under each class. Herbicides – Major classes – Properties and uses of 2, 4-D, atrazine, glyphosate, butachlor benthocarb; Fungicides – Major classes – Properties and uses of carbendazim, carboxin, captan, tridemorph and copper oxychloride – Insecticides Act, Plant growth regulators.

Practical: Total nitrogen and phosphorus in manures / composts – Ammoniacal and nitrate nitrogen – Water soluble P₂O₅, potassium, calcium, sulphur and zinc contents of fertilizers COD in organic wastes – Adulteration in fertilizer. Argentimetric and iodometric titrations – their use in the analysis of lindane metasystox, endosulfan, malathion, copper and sulphur fungicides – Compatibility of fertilizers with pesticides.

Suggested book reading:

Manure Matters: Historical, Archaeological and Ethnographic Perspectives- -by **Richard Jones**

A Text Book of Manures, Fertilizers and Agrochemicals- by H.K **Kausadikar**

Manures and Fertilizers- By **A.K. Kolay**

04AGB/ABM102-Insect Ecology and Integrated Pest Management Including 3 (2+1) Beneficial Insects

Insect Ecology: Introduction, Environment and its components. Effect of abiotic factors— temperature, moisture, humidity, rainfall, light, atmospheric pressure and air currents. Effect of biotic factors – food competition, natural and environmental resistance. Concepts of Balance of life in nature, biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem. Pest surveillance and pest forecasting. Categories of pests. IPM; Introduction, importance, concepts principles and tools of IPM- Host plant resistance, Cultural, Mechanical, Physical, Legislative, Biological (parasites, predators & transgenic plant pathogens such as bacteria, fungi and viruses) 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, Cyclodiens, 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, repellents, antifeedants, hormones, attractants, gamma radiation and genetic 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, nematology, rodents and birds. Vermiculture

Practical: Visit to meteorological observatory / automatic weather reporting station; Study of terrestrial and pond ecosystems of insects; Studies on behaviour of insects and orientation (repellency, stimulation, deterancy); Study of distribution patterns of insects, sampling techniques for the estimation of insect population and damage; Pest surveillance through light traps, pheromone traps and field incidence; Practicable IPM practices, Mechanical and physical methods; Practicable IPM practices, Cultural and biological methods; Chemical control, Insecticides and their formulations; Calculation of doses/concentrations of insecticides; Compatibility of pesticides and Phytotoxicity of insecticides; IPM case studies; Identification of common phytophagous mites and their morphological characters; Identification of common plant parasitic nematodes and their morphological characters; Identification of rodents and bird pests and their damage; Identification of earthworms in vermiculture – visit to vermiculture unit; Other beneficial insects – Pollinators, weed killers and scavengers.

Suggested books reading:

Applied agriculture entomology by **L. earnek jha**

Insect paste management by **Luckman**

General text book of entomology by **A.d. Imms**

04AGB/ABM103- Agricultural Marketing, Trade and Prices 2 (1+1)

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: Identification of marketing channels; Study of Rythu Bazars, Regulated markets; Study of unregulated markets; Study of livestock markets; Price spread analysis; Visit to market institutions, NAFED; Study of SWC, CWC and STC; Analysis of information of daily prices; Marketed and marketable surplus of different commodities.

Suggested book reading:

Agricultural Commodity Markets and Trade: New Approaches to Analyzing Market-by
Alexander Sarris, David Hallam
Surveillance of Agricultural Price and Trade Policies- By **Alberto Valdés, Barry Schaeffer**
Agricultural Marketing: Structural Models for Price Analysis- By **James Vercammen**

04AGB/ABM104- Protected Cultivation and Post Harvest Technology 2 (1+1)

Green house technology, Introduction, Types of Green Houses; Plant response to Green house environment, Planning and design of greenhouses, Design criteria of greenhouse for cooling and heating purposes. Green house equipment, materials of construction for traditional and low cost green houses. Irrigation systems used in greenhouses, Typical applications, passive solar green house, hot air green house heating systems, green house drying. Cost estimation and economic analysis. Choice of crops for cultivation under greenhouses, problems / constraints of greenhouse cultivation and future strategies. Growing media, soil culture, type of soil required, drainage, flooding and leaching, soil pasteurization in peat moss and mixtures, rock wool and other inert media, nutrient film technique (NFT) / hydroponics. Threshing, threshers for different crops, parts, terminology, care and maintenance. Winnowing, manual and power operated winnowers, care and maintenance. Groundnut decorticators, hand operated and power operated decorticators, principles of working, care and maintenance. Maize shellers & castor shellers. Drying, grain drying, types of drying, types of dryers. Storage, grain storage, types of storage structures. Fruits and vegetables cleaning, machinery for cleaning of fruits and vegetables, care and maintenance. Grading, methods of grading, equipment for grading of fruits and vegetables, care and maintenance. Size reduction. equipment for size reduction care and maintenance. Evaporation, Principle, types of evaporators, quality standards – FAQ, ASTA, FPO, FDA.

Practical: Study of different types of green houses based on shape, construction and cladding materials; Calculation of air rate exchange in an active summer winter cooling system; Calculation of rate of air exchange in an active winter cooling system; Estimation of drying rate of agricultural products inside green house; Testing of soil and water to study its suitability for growing crops in greenhouses; The study of fertigation requirements for greenhouses crops and estimation of E.C. in the fertigation solution; The study of various growing media used in raising of greenhouse crops and their preparation and pasteurization / sterilization; Visit to commercial green houses; Study of threshers, their components, operation and adjustments; Winnowers, their components, operation and adjustments; Study of different components of groundnut decorticator; Study of maize shellers; Study of castor shellers; Study of improved grain storage structure; Study of dryers; Study of cleaners & graders.

Suggested book reading:

Postharvest Handling: A Systems Approach- by **Wojciech and J. Florkowski**
Control Applications in Post-Harvest and Processing Technology -by **J. De Baerdemaeker, J. Vandewalle**
Agricultural Process Engineering by **Henderson, S.M. and R.L. Perry.**
Principles of Agricultural Engineering by **Michael, A.M. and T. P. Ojha**

04AGB/ABM105- Diseases of Field Crops and Their Management 3 (2+1)

Economic importance, symptoms, cause, epidemiology and disease cycle and integrated management of diseases of rice, sorghum, bajra, maize, wheat, sugarcane, turmeric, tobacco, groundnut, sesamum, sunflower, cotton, redgram, bengalgram, blackgram, greengram, tea, soybean.

Practical: Study of symptoms, etiology, host-parasite relationship and specific control measures of the following crop diseases. Presentation of disease samples survey and collection of Diseases of rice, sorghum; Diseases of wheat, bajra & maize; Diseases of sugarcane, turmeric & tobacco; Diseases of groundnut, castor & sunflower; Diseases of sesamum & cotton; Diseases of redgram, greengram, blackgram, bengalgram & beans; Field visits at appropriate time during the semester Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

Suggested book reading:

Diseases of Field Crops and Their Management- Edited By **T. S. Thind**

Postharvest Pathogens and Disease Management- By **P. Narayanasamy**

Diseases of Crop Plants in India- By **G. Rangaswami, A. Mahadevan**

04AGB/ABM106- Production Technology of Spices, Aromatic, Medicinal and Plantation

crops

3 (2+1)

Plantation Crops 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: Botanical description and identification of aromatic plants; Identification of varieties in spices and plantation crops; Identification of medicinal plants; Propagation techniques in aromatic and spice crops; Selection of mother palm, and seed nuts in coconut and oil palm; Study of identification of aromatic plants; Distillation procedures for aromatic crops; Propagation methods in plantation crops; Propagation and planting methods in turmeric; Propagation and planting techniques in ginger; Harvesting procedures in aromatic plants; Processing and curing of spices (ginger, turmeric and black pepper); Training methods in betelvine; Rejuvenation practices in cashewnut; Products – byproducts of spices and plantation crops; Procedures for oleoresin extraction; Visit to local commercial plantations. Aromatic & medicinal plant nurseries and seed spices field.

Suggested book reading:

Cultivation of Tropical, Subtropical Vegetables, Spices, Medicinal plants- By **Niir Board**

Cultivation of Medicinal And Aromatic Crops- By **Farooqi A.A., B.S. Sreeramu, B.S. Sreeramu**

Handbook on Spices and Condiments (Cultivation, Processing and Extraction) - **By H. Panda**

04AGB/ABM107-Breeding of Field / Horticulture Crops 3(2+1)

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. 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; 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.

Practical: 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.

Suggested book reading:

Breeding of Horticultural Crops: Principles and Practices- By **N. Kumar**

Breeding Tropical and Subtropical Fruits- By **P.K. Ray**

Organic Crop Breeding-by **T. Lammerts van Bueren, James R. Myers**

Wild Crop Relatives: Genomic and Breeding Resources: Industrial Crops By **Chittaranjan Kole**

04AGB/ABM108 Practical Crop Production II (*Rabi* Crops) 1(0+1)

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

Suggested book reading:

Principle of field crop production By **J. E. Pratley**

A text book of field crop production by **George Livingston**

V Semester

Subject code	Name of subject	Teaching Periods		Credit Points
		L	P	
05AGB101	Farming Systems and Sustainable Agriculture	1	1	2(1+1)
05AGB102	Principles of Plant Biotechnology	2	1	3(2+1)
05AGB103	Crop Pests and stored grain pests and their management	2	1	3(2+1)
05AGB104	Fundamentals of Farm Business Management (Including product development, Appraisal and Monitoring)	1	1	2(1+1)
05AGB105	Field Crops-I (Kharif)	2	1	3(2+1)
05AGB106	Fundamentals of Rural Sociology and Educational Psychology	2	0	2(2+0)
05AGB107	Post harvest management and value addition of fruits and vegetables	1	1	2(1+1)
05AGB108	Disease of Horticultural crops and their management	2	1	3(2+1)
05AGB301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		13	8	21

V. Semester

05AGB101- Farming Systems and Sustainable Agriculture 2(1+1)

Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservators of natural resources, LEIA & HEIA; Irrigation problems, waste lands and their development; Organic farming: definition, principles and components; Farming systems: definition, principles and components, IFS models for wetland, irrigated dryland and dryland situations.

Practical: Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryland situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Visit to poultry and dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Study of degraded lands.

Suggested book reading:

A complete guide to sustainable and profitable biological system and farming by **Gary F. Zimmer**

Intensive agriculture and sustainability: a farming system analysis by **Glen. C. Filson**

Sustainable agriculture & integrated farming systems by **Thomas C. Edens *et al***

05AGB102-Principles of Plant Biotechnology 3(2+1)

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

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

Suggested book reading:

Basic Biotechnology by **Colin Ratledge, Bjørn Kristiansen**

Molecular Biology and Biotechnology by **John M. Walker, Ralph Rapley**

Principles Of Biotechnology by **B. D. Singh**

Principles of Biochemistry by **Lehninger**

05AGB103-Crop Pests and Stored Grain Pests and Their Management 3(2+1)

Stored grain pests: Coleopteran and Lepidopteran pests, their biology and damage, preventive and curative methods. Distribution, biology, nature and symptoms of damage, and management strategies of insect and non insect pests of rice, sorghum, maize, ragi (*Eleusine coracana*), wheat, sugarcane, cotton, mesta, sunhemp, pulses, groundnut, castor, gingerly, safflower, sunflower, mustard, brinjal, bhendi, tomato, cruciferous and cucurbitaceous vegetables, potato, sweet potato, colacasia, moringa, amaranthus, chillies, mango, citrus, grapevine, cashew, banana, pomegranate, guava, sapota, ber, apple, coconut, tobacco, coffee, tea, turmeric, betelvine, onion, coriander, garlic, curry leaf, pepper, ginger and ornamental plants.

Practical: Identification of pests, their damage symptoms and management of rice, sorghum, maize, wheat, sugarcane, cotton, pulses, Solanaceous and Malvaceous vegetables, cruciferous and cucurbitaceous vegetables, chilli, mango, carbon, citrus and sapota.

Suggested books reading:

An introductory to entomology by **J N Comstock**

Applied agriculture entomology by **L. earnek jha**

South Indian insect pests by **T B Fletcher**

Pests of field crop and pastures: identification and control by **P T Bailey**

05AGB104- Fundamentals of Farm Business Management

(Including Project Development, Appraisal and Monitoring)

2 (1+1)

Agribusiness: Meaning, Definition, Structure of Agribusiness, (Input, Farm, Product Sectors). Importance of Agribusiness in the Indian Economy, Agricultural Policy. Agribusiness Management, Distinctive features, Importance of Good Management, Definitions of Management. Management Functions, Planning, Meaning, Definition, Types of Plans (Purpose or Mission, Goals or Objectives, Strategies, Polices, Procedures, rules, programmes, Budget) characteristics of sound plan, Steps in planning, Organisation, Staffing, Directing, Motivation, Ordering, Leading, Supervision, Communication, control. Capital Management. Financial Management of Agribusiness: Importance of Financial Statements, Balance sheet, Profit and Loss Statement, Analysis of Financial statements. Agro-based Industries: Importance and Need, Classification of Industries, Types of Agro-based Industries, Institutional arrangement, Procedure to set up agro-based industries, Constraints in establishing agro-based industries. Marketing Management: Meaning, Definitions, Marketing Mix, 4Ps of Marketing. Mix, Market segmentation, Methods of Market, Product life cycle. Pricing policy, Meaning, pricing method. Prices at various stages of Marketing. Project, definitions, project cycle, Identification, Formulation, Appraisal, Implementation, Monitoring and evaluation, Appraisal and Evaluation techniques, NPW, BCR, IRR, N/K ratio, sensitivity analysis, characteristics of agricultural projects: preparation of project reports for various activities in agriculture and allied sectors: Dairying, poultry, fisheries, agro-industries etc.

Practical: Study of input markets: seed, fertilizers, pesticides. Study of output markets, grains, fruits, vegetables, flowers. Study of product markets, retail trade commodity trading, and value added products. Study of financing institutions cooperatives commercial banks, RRBs, Agribusiness Finance Limited, NABARD; Preparations of projects, Feasibility reports; Project appraisal techniques; Case study of agro-based industries.

Suggested book reading:

Agriscience: fundamentals and applications by **L De Vere Burton**

Fundamentals of Farm Business Management by **Johl, S.S. & Kapur, T.R.**

Linear Programming and Economic Analysis by **Dorfman, R. and Samuelson and Solow**

Agricultural Production Function by **Heady, E.O. and Dillors, J.L.**

05AGB105- Field Crops-I (Kharif) 3(2+1)

Origin, geographic distribution, economic importance, soil and climatic requirement, varieties, cultural practices and yield of kharif crops, Cereals – rice, maize, sorghum, pearl millet and minor millets; Pulses : pigeonpea, mungbean and urdbean; Oilseeds: groundnut, sesame and soybean; Fibre crops: cotton, jute and sunhemp; and Forage crops: sorghum, maize, cowpea, cluster bean and napier.

Practical: Rice nursery preparation and transplanting/seed bed preparation and sowing of Kharif crops; Calculations on seed rate; Sowing of soybean, pigeonpea, mungbean, maize, groundnut, and cotton; Effect of seed size on germination and seedling vigour of soybean/groundnut; Effect of sowing depth on germination of soybean; Identification of weeds in rice, maize and soybean fields and study of weed control experiments in these crops; Top dressing of nitrogen in maize and rice and study of fertilizer experiments on rice, maize, sorghum and millets; Study of yield contributing characters, yield calculations, harvesting and yield estimation of above crops; Study of crop varieties and important agronomic experiments; Study of forage experiments.

Suggested book reading:

Principle of field crop production By **J. E. Pratley**

A text book of field crop production by **George Livingston**

05AGB106- Fundamentals of Rural Sociology and Educational Psychology 2 (2+0)

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 characteristics. Principles of learning and their implication for teaching.

Suggested book reading:

Fundamentals of Sociology of Education by **Lucy Wairimu Kibera, Agnes C. Kimokot**
Fundamentals of Sociology by **kirkpatrik**

05AGB107- Post Harvest Management and Value Addition of Fruits and Vegetables 2(1+1)

Importance of post harvest technology in horticultural crops. Maturity indices, harvesting and post harvest handling of fruits and vegetables. Maturity and ripening process. Factors affecting ripening of fruits, and vegetables. Pre harvest factors affecting quality on post harvest shelf life of fruits and vegetables. Factors responsible for deterioration of harvested fruits and vegetables. Chemicals used for hastening and delaying ripening of fruits and vegetables. Methods of storage – precooling, prestorage treatments, low temperature storage, controlled atmospheric storage, hypobaric storage, irradiation and low cost storage structures. Various methods of packing, packaging materials and transport. Packing technology for export. Fabrication of types of containers, cushioning material, vacuum packing, poly shrink packing, specific packing for export of mango, banana, grapes kinnow, sweet orange, and mandarin etc. Importance and scope of fruit and vegetable preservation in India. Principles of preservation by heat, low temperature, chemicals and fermentation. Unit layout – selection of site and precautions for hygienic conditions of the unit. Preservation through canning, bottling, freezing, dehydration, drying, ultraviolet and ionizing radiations. Preparation of jams, jellies, marmalades, candies, crystallized and glazed fruits, preserves, chutneys, pickles, ketchup, sauce, puree, syrups, juices, squashes and cordials Spoilage of canned products, biochemical, enzymatic and microbial spoilage. Preservatives, Colours permitted and prohibited in India.

Practical: Practice in judging the maturity of various fruits and vegetables. Conservation of zero energy cool chambers for on farm storage. 3& 4. Determination of physiological loss in weight (PLW), total soluble solids (TSS), total sugars, acidity and ascorbic and content in fruits and vegetables. Packing methods and types of packing and importance of ventilation. Pre cooling packing methods for export or international trade. Methods of prolonging storage life. Effect of ethylene on ripening of banana, sapota, mango, sapota. Identification of equipment and machinery used in preservation of fruits and vegetables. Preservation by drying and dehydration. Preparation of jam, jelly and marmalades. Preparation of squash, cordials and syrups. Preparation of chutneys, pickles sauces and ketchup. Visit to local processing units. Visit to local market yards and cold storage units. Visit to local market and packing industries.

Suggested book reading:

An introduction to physiology and handling of fruit, vegetables and ornamentals by **R. B. H. Wills**
Post harvest management of fruit and vegetable in Asia pacific region by **Rosa Sonya Rolle**

05AGB108- Diseases of Horticultural Crops and Their Management 3(2+1)

Economic Importance, symptoms, cause, disease cycle and integrated management of diseases of: citrus, mango, banana, grapevine, pomegranate, papaya, guava, sapota, apple, chilli, brinjal, bhendi, potato, crucifers, cucurbits, tomato, beans, onion, coconut, oil palm, betelvine, mulberry, coffee, tea, rose, chrysanthemum and jasmine.

Practical: Diseases of beans, citrus, guava, & sapota; Diseases of papaya, banana, pomegranate & ber; Diseases of mango, grapes & apple; Diseases of chilli, brinjal & bhendi; Diseases of potato, tomato & crucifers; Diseases of cucurbits, onion & betelvine; Diseases of oil palm, coconut, tea, coffee & mulberry; Diseases of rose, chrysanthemum and jasmine. Field visits at appropriate time during the semester.

Note: Students should submit 50 pressed, well mounted diseased specimens in three installments during the semester.

Suggested book reading:

Control of Crop Diseases By **W. R. Carlile, A. Coules**

Diseases of crop plants in India by **Rangaswamy, G. and Mahadevan, A.**

Fungal diseases of fungal crops by **Paul holliday**

VI Semester

Subject Code	Name of Subject	Teaching Period		Credit Points
		L	P	
06AGB101	Production Economics & Farm management	1	1	2(1+1)
06AGB102	Extension Methodologies for Transfer of Agricultural Technology	1	1	2(1+1)
06AGB103	Biochemistry	2	1	3(2+1)
06AGB104	Entrepreneurship Development and communication skills	1	1	2(1+1)
06AGB105	Field crops-II (Rabi)	2	1	3(2+1)
06AGB106	Comprehension and Communication Skills in English	1	1	2(1+1)
06AGB107	Environmental Science	1	1	2(1+1)
06AGB108	Weed management	1	1	2(1+1)
06AGB109	Renewable Energy	1	1	2(1+1)
06AGB301	Discipline & Co. curricular activity	0	1	1(0+1)
Total		11	10	21

VI. Semester

06AGB101- Production Economics and Farm Management 2 (1+1)

Production Economics: Meaning, Definition, Nature and Scope of Agricultural Production Economics. Basic concepts and terms. Concepts of Production. Production Functions: Meaning, Definition, Types. Laws of returns: Increasing, Constant and decreasing. Factor Product Relationship. Determination of optimum input and output. Factor relationship. Product relationship. Types of enterprise relationships. Returns to scale: Meaning, Definition, Importance. Farm Management. Economic principles applied to the Organizations of farm business. Types and systems of farming. Farm planning and budgeting. Risk and uncertainty. Farm budgeting. Linear programming: Assumptions, Advantages and Limitations of Linear programming.

Practical: Computation of cost concepts; Methods of computation of depreciation; Analysis of Net worth statement; Farm inventory analysis; Preparation of farm plans and budgets; Types of farm records and accounts; Preparation of profit and loss account; Break, Even analysis; Economics analysis of different crop and livestock enterprises; Application of Farm Management Principles.

Suggested book reading:

Farm Management for Asia: A Systems Approach by **Douglas John McConnell, John L. Dillon**

Agriscience: fundamentals and applications by **L De Vere Burton**

Fundamentals of Farm Business Management by **Johl, S.S. & Kapur, T.R.**

Linear Programming and Economic Analysis by **Dorfman, R. and Samuelson and Solow**

Agricultural Production Function by **Heady, E.O. and Dillors, J.L.**

06AGB102- Extension Methodologies for Transfer of Agricultural Technology 2(1+1)

Communication – Meaning, Definition, Models, Elements and their Characteristics, Types and Barriers in communication. Extension Programme Planning – Meaning, Definitions of Planning, Programme, Project, Importance, Principles and Steps in Programme Development Process, Monitoring and Evaluation of Extension Programmes. Extension Teaching methods – Meaning, Definition, Functions and Classification. Individual contact methods – Farm and Home visit, Result Demonstration, Field trials – Meaning, Objectives, Steps, Merits and Demerits. Group contact methods – Group discussion, Method demonstration, Field Trips – Meaning, Objectives, Steps, Merits and Demerits. Small group discussion techniques – Lecture, Symposium, Panel, Debate, Forum, Buzz group, Workshop, Brain Storming, Seminar and Conference. Mass contact Methods – Campaign, Exhibition, Kisan Mela, Radio & Television – Meaning, Importance, Steps, Merits & Demerits. Factors influencing in selection of Extension Teaching Methods and Combination (Media Mix) of Teaching methods. Innovative Information sources – Internet, Cyber Cafes, Video and Tele conferences, Kisan call centers, Consultancy clinics. Agricultural Journalism – Meaning, Scope and Importance, Sources of news, Types, Merits and Limitations. Diffusion and Adoption of Innovations – Meaning, Definition, Models of adoption Process, Innovation – Decision Process – Elements, Adopter categories and their characteristics, Factors influencing adoption process. Capacity building of Extension Personnel and Farmers – Meaning, Definition, Types of training, Training to farmers, farm women and Rural youth – FTC and KVK. **Practical:** Simulated exercises on communication. Identifying the Problems, Fixing the

Priorities and selecting a most important problem for preparation of a project. Developing a project based on identified problems in a selected village. Organization of Group discussion and Method demonstration. Visit to KVK / FTC. Planning and Writing of scripts for Radio and Television. Audio Visual aids – Meaning, Importance and Classification. Selection, Planning, Preparation, Evaluation and Presentation of visual aids. Planning & Preparation of visual aids – Charts, Posters, Over Head Projector, (OHP) Transparencies, Power Point Slides. Planning and Preparation of Agricultural Information materials – Leaflet, Folder, Pamphlet, News Stories, Success Stories. Handling of Public Address Equipment (PAE) System, Still camera, Video Camera and Liquid Crystal Display (LCD) Projector.

Suggested book reading:

Cooperative Extension Work by **Kelsey, L.D. & Hearne, C.C.**

Extension Communication and Management by **Ray, G.L**

Modernizing Indian Agriculture in 21st Century: Challenges, Opportunities by **B. S. Hansra, G. Perumal, K. Chandrakandan**

06AGB103- Biochemistry 3(2+1)

Biochemistry – Introduction and importance. Plant cell, cell wall and its role in live stock, food and paper industries. Bio-molecules – Structure, properties & applications: Amino acids, peptides and proteins – Plant proteins and their quality. Enzymes – Factors affecting the activity, classification, Immobilisation and other industrial applications. Lipids – Acyl lipids, Their industrial application in soaps, detergents, paints, Varnishes, lubricants, adhesives, plastics, nylon, Bio-diesel, Biodegradable plastics etc. Carbohydrates; 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. Metabolic regulation. Secondary metabolites, Terpenoids, Alkaloids, Phenolics and their applications in food and pharmaceutical industries.

Practical: Amino acid models (atomic); Paper electrophoresis for the separation of plant pigments; Protein denaturation – heat, pH, precipitation of proteins with heavy metals, Protein estimation by Lowry method; Enzyme kinetics, competitive inhibition, enzyme immobilization; Extraction of nucleic acids, column chromatography of RNA hydrolysate; Characterization of lipids by T.L.C.; Extraction of oil from oil seeds; Estimation of fatty acids by G.L.C.; Models of sugars, sucrose & starch; Quantitative determination of sugars; Paper chromatography for the separation of sugars; Determination of phenols.

Suggested book reading:

Biochemistry By **Richard A. Harvey et al.**

Biochemistry By **B. D. Hames and N. M. Hooper**

Principles of Biochemistry by **Lehninger**

06AGB104- Entrepreneurship Development and Communication Skills 2 (1+1)

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. Globalisation 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, projects writing, summarizing, abstracting; individual and group presentations, impromptu presentation, public speaking; Group discussion. Organizing seminars and conferences. **Practical:** Listening and note taking, writing skills, oral presentation skills; field diary and

lab record; indexing, footnote and bibliographic procedures. Reading and comprehension of general and technical articles, projects writing, summarizing, abstracting; individual and group presentations.

Suggested book reading:

Trainers Manual on Developing Entrepreneurial Motivation by **Akhouri et al**

Decision Support Systems: Principles and Practices by **Bidgoli, H**

The Entrepreneurs Handbook by **Mancuso, J.**

06AGB105- Field Crops- II (Rabi) 3(2+1)

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; 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 posta; Commercial crops: potato and tobacco, Forage crops: berseem, lucerne and oat.

Practical: Seed bed preparation and sowing of wheat, sugarcane and sunflower; Calculations on seed rate; Top dressing of nitrogen in wheat and study of fertilizer experiments on wheat and mustard; Identification of weeds in wheat and grain legumes, application of herbicide and study of weed control experiments; Morphological characteristics of wheat, sugarcane, chickpea and mustard; Yield contributing characters of wheat; Yield and quality analysis of sugarcane; Crop distribution in the state and the region; Important agronomic experiments of rabi crops and visit to research stations related to rabi crops.

Suggested book reading:

Principle of field crop production By **J. E. Pratley**

A text book of field crop production by **George Livingston**

06AGB106- Comprehension and Communication Skills in English 2(1+1)

Comprehension: Text for comprehension, Current English for Colleges, By N. Krishnaswamy & T.Sriraman, Macmillan India Limited, Madras, 1995; War Minus shooting – The sporting spirit George Orwell (a) Reading Comprehension (b) Vocabulary – Synonyms – Antonyms – Often confused words and (c) Two exercises to help the students in the enrichment of vocabulary based on TOEFL and GRE and other competitive examinations. A Dilemma – A layman looks at science Raymond B. Fosdick (a) Reading Comprehension (b) Vocabulary – Homonyms and Homophones (c) Exercises on Figurative Language & Idiomatic Language (E.g.: dust and ashes, doorstep of doom, boundaries of knowledge, Apple of one's eye, in a fix etc). 5&6 You and Your English –

Spoken English and Broken English G.B.Shaw (a) Reading Comprehension (b) Language study, Functional Grammar, Agreement of verb with subject. Written Skills: Mechanics of good letter, Effective business correspondence, Personal Correspondence, Preparation of Curriculum vitae and Job applications. The Style, Importance of professional writing – Choice of words and Phrases, precision, conciseness cliché, redundancy, jargon, foreign words, Precis writing and synopsis writing. 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: Listening Comprehension: Listening to short talks, lectures, speeches (scientific, commercial and general in nature)

Practical: listening to at least two tape, recorded conversations aimed at testing the listening comprehension of students; Communication: Spoken English, oral communication, importance stress and intonation. Practical: Spoken English practice by using audiovisual aids, the essentials of good conversations, oral exercises in conversation practice (At the Doctor, at the Restaurant, at the Market Yard); Oral Presentation of Reports: Seminars and conferences, features of oral presentation, regulating speech, physical appearance, body language posture, eye contact, voice, audience, preparation of visual aids. Practical: One presentation by individual on the given topic related to agriculture like W.T.O, Developing new technologies in Agriculture, Bio fertilizers etc.; Evaluation of a Presentation: evaluation sheet, other strategies to be considered for evaluating a presentation, Practical: Mock evaluation of a presentation; Dyadic communication, face to face conversation, Telephonic conversation, rate of speech, clarity of voice, speaking and listening politeness, telephone etiquette, Practical: Practice of Telephonic conversation; Reading skills, using Dictionary, reading dialogues, rapid reading, intensive reading, improving reading skills; Meetings: purpose, procedure participation, chairmanship, physical arrangements, recording minutes of meeting; Practice of Presentation by using power point and LCD projector; Conducting Mock interviews – testing initiative, team spirit, leadership, intellectual ability – potential for development, memory, motivation, objectives, aptitude etc., Group Discussions and Debates on current topics; Review or Feed Back; Practical examination.

Suggested book reading:

A Practical English Grammar by **Thomson and Martinet**

A Practical English Grammar, Exercise Book by **Thomson and Martinet**

A Practical English Grammar by **Michal Swan**

Contemporary English Grammar Structure Composition by **David Green**

06AGB107- Environmental Science 2 (1+1)

Scope and importance of environmental studies. Natural resources: Renewable and renewable resources. Forest, Water, Food, energy and land resources. Ecosystems: Definition, concept, structure and functions. Producers, consumers and decomposers of an ecosystem. Energy flow in the ecosystem. Types of ecosystems. Bio-diversity: Definition, classification, threats to biodiversity and its conservation. Environmental pollution: Causes, effects and control of air, water, soil, thermal, noise and marine pollution. Causes, effects and management of soil nuclear hazards and industrial wastes. Disaster management, Floods, earthquakes, cyclones and land slides. Social issues and the environment, unsustainable to sustainable development. The Environment Protection Act, The Air Act, The water Act, The Wildlife Protection. Act and Forest Conservation Act. Woman and child welfare, HIV/AIDS and Role of information technology on environment and human health.

Practical: Collection, processing and storage of effluent samples; Determination of Bio-

Chemical oxygen demand (BOD) in effluent sample; Determination of chemical oxygen demand (COD) in effluent sample; Estimation of dissolved oxygen in effluent samples; Determination of sound level by using sound level meter; Estimation of respirable and non respirable dust in the air by using portable dust sampler; Determination of total dissolved solids (TDS) in effluent samples; Estimation of species abundance of plants; Estimation of nitrate contamination in ground water; Analysis of temporary and total hardness of water sample by titration; Estimation of pesticide contamination in Agro-Ecosystem; Visit to Social Service Organisation / Environmental Education Centre; Crop adaptation to environmental variables, soils conditions; Study of transpiration and water balance in plants; Visit to a local polluted site. Observations and remedial measures; Assessment of chlorophyll content of fresh water / sea water ecosystem.

Suggested book reading:

Environmental Science: Systems and Solutions by **Michael L. McKinney *et al***

Environmental Science: The Way the World Works by **Bernard J. Nebel and Richard T. Wright**

Fundamentals of Ecology by **Odum E.P. and Barrett G.W**

06AGB108- Weed Management 2 (1+1)

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

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

Suggested book reading:

Modern Weed Management by **Gupta, O.P**

Weed Science : Basics and Applications by **Das, T.K.**

Handbook of Weed Management Systems **By Smith**

06AGB109- Renewable Energy 2 (1+1)

Energy sources, Introduction, Classification, Energy from Biomass, Types of biogas plants, constructional details, Biogas production and its utilization, Agricultural wastes, Principles of combustion, pyrolysis and gasification, Types of gasifiers, Producer gas and its utilization. Briquettes, Types of Briquetting machines, uses of Briquettes, Shredders. Solar energy, Solar flat plate and focussing plate collectors, Solar air heaters, Solar space heating and cooling, Solar energy applications / Solar energy gadgets, Solar cookers, Solar water heating systems, solar grain dryers, Solar Refrigeration system, Solar ponds, Solar photo voltaic systems, solar lantern, Solar street lights, solar fencing, Solar

pumping systems. Wind energy, Types of wind mills, Constructional details & application of wind mills. Liquid Bio fuels, Bio diesel and Ethanol from agricultural produce, its production & uses.

Practical: Constructional details of KVIC & Janatha type biogas plants; Constructional details of Deen Bandu type biogas plants; Field visit to biogas plants; Constructional details of different types of gasifiers; Testing of gasifiers; Briquette preparation from biomass; To study and find the efficiency of solar cooker; To study and find the performance of a solar still; To study and find the performance of a solar dryers; Study and working of solar photovoltaic pumping system; Study and performance evaluation of domestic solar water heater; Study and performance evaluation of solar lantern; Study and performance evaluation of solar street light; To study the performance of different types of wind mills; Field visit to wind mills; To study the processing of Bio-diesel production from Jatropha.

Suggested book reading:

Renewable Energy World by **Paul Hockenos**

Renewable Energy Systems: The Choice and Modeling of 100% Renewable Solutions By **Henrik Lund**

VII Semester

Subject Code	Name of Subject	Teaching Period		Credit Points
		T	P	
07AGB201	Rural Agricultural Work Experience (RAWE)			20(0+20)
A	Crop Production		5	
B	Crop Protection		4	
C	Rural Economics		3	
D	Extension Programme		4	
E	Research Station / KVK / DAATT Center activities and Attachment to the Agro-based industries		4	
	Total		20	20

Rural Agricultural Work Experience (RAWE): Under this programme two models are suggested and colleges could choose any one depending upon need assessment.

Sr.	RAWE Model I	Duration (Week)
1	Orientation	1
2	Village attachment	16
3	Research Station / KVK / DAATT Center activities and attachment to the Agro-based industries	2
4	Project report preparation and examination	1

Sr.	RAWE Model II	Duration (Week)
1	Orientation	1
2	Village attachment	6
3	Agri-clinics / Plant Health Clinics / Experiential learning / Industrial Attachment	12
4	Project report preparation and examination	1

RAWEP Attachment with Agro-based Industries: During RAWEP Programme the students will undergo internship in any one of the following industries / companies / institutes for a period of twelve weeks (the list is only suggestive and need based / location specific industries may be included).

- Seed industries / companies
- Fertilizer industries
- Pesticides industries
- Biotechnological industries (Tissue Culture labs)
- Bio pesticides industries
- Commercial nurseries / landscaping units
- Sericulture units
- Food processing units
- Agricultural finance Institutions / Banks / Credit Societies etc.
- Non - Governmental organizations

Evaluation of RAWEP Programme

Attendance: Minimum attendance for this programme - 85%.

Records: Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them.

Evaluation Procedure: The students shall be evaluated by Course Coordinator as well as by a designated evaluation Committee.

Note: i) The duration of the RAWEP is 20 weeks with a weightage of 20 credits; ii) Wherever facilities are not available for industrial training and / or agri-clinics, the duration of vocational

training may be increased to that extent; iii) RAWEP can be implemented either in the VII or VIII semester as per convenience.

Features of New Curriculum

- Six semesters coursework, one semester RAWEP and one semester electives in interdisciplinary courses for entrepreneurship development. In the electives, students have flexibility to choose courses. These courses have higher practical exercises for skill updation. The proportion of theory and practical is nearly 50:50
- Adequate expertise for agri-clinic embedded.
- Curriculum redundancy removed.
- Course curricula reoriented to develop needed knowledge skills, entrepreneurial mindset of the student to take up self employment
- Three non-credit courses viz., Comprehension and Developing Communication Skills in English and NSS/ NCC / Physical Education are included.
- Each University may provide specialization in 4 or 5 areas keeping in view the facilities and the need.
- Introduced few new courses like Introductory Agriculture, Renewable Energy, Organic farming, Biotechnology, Agribusiness, Project Development Appraisal and Monitoring and Entrepreneurship Development.

II Semester

Subject Code	Name of Subject	Teaching Period		Credit Points
		T	P	
07AGB201	Rural Agricultural Work Experience (RAWE)			20(0+20)
A	Crop Production		5	

B	Crop Protection		4	
C	Rural Economics		3	
D	Extension Programme		4	
E	Research Station / KVK / DAATT Center activities and Attachment to the Agro-based industries		4	
	Total		20	20

Rural Agricultural Work Experience (RAWE): Under this programme two models are suggested and colleges could choose any one depending upon need assessment.

Sr.	RAWE Model I	Duration (Week)
1	Orientation	1
2	Village attachment	16
3	Research Station / KVK / DAATT Center activities and attachment to the Agro-based industries	2
4	Project report preparation and examination	1

Sr.	RAWE Model II	Duration (Week)
1	Orientation	1
2	Village attachment	6
3	Agri-clinics / Plant Health Clinics / Experiential leaning / Industrial Attachment	12
4	Project report preparation and examination	1

RAWEP Attachment with Agro-based Industries: During RAWEP Programme the students will undergo internship in any one of the following industries / companies / institutes for a period

of twelve weeks (the list is only suggestive and need based / location specific industries may be included).

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- Bio pesticides industries
- Commercial nurseries / landscaping units
- Sericulture units
- Food processing units
- Agricultural finance Institutions / Banks / Credit Societies etc.
- Non - Governmental organizations

Evaluation of RAWEP Programme

Attendance: Minimum attendance for this programme - 85%.

Records: Students shall complete the record work based on daily field observation notebooks and weekly diaries maintained by them.

Evaluation Procedure: The students shall be evaluated by Course Coordinator as well as by a designated evaluation Committee.

Note: i) The duration of the RAWEP is 20 weeks with a weightage of 20 credits; ii) Wherever facilities are not available for industrial training and / or agri-clinics, the duration of vocational training may be increased to that extent; iii) RAWEP can be implemented either in the VII or VIII semester as per convenience.

Features of New Curriculum

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- Three non-credit courses viz., Comprehension and Developing Communication Skills in English and NSS/ NCC / Physical Education are included.

- Each University may provide specialization in 4 or 5 areas keeping in view the facilities and the need.
- Introduced few new courses like Introductory Agriculture, Renewable Energy, Organic farming, Biotechnology, Agribusiness, Project Development Appraisal and Monitoring and Entrepreneurship Development.

VIII. Semester:

Courses for Experiential Learning: A student has to register 20 credits with major load in one area of electives (14 Credits) and rest from among one / two areas (6 Credits) of electives in the eighth Commercial seed production technologies semester.

Subject Code		Name of Subject	Teaching Period			Credit Points
			L	T	P	
Group I (Crop Production)	08AGB101	Seed Production Technology Integrated Farming System Water Management (Watershed Micro-irrigation Problematic Water) Soil Management (conservation Problematic soil, Soil quality)	3	0	0	3
Group II Crop Protection	08AGB102	IPM and IDM (Pest Disease Scouting). Management of Post Harvest insect-pests and diseases Non-insect pests and their Management Apiculture Mushroom (cultivation) Bio-control agencies and bio-pesticide (mass multiplication and uses) Pesticides and Plant Protection equipment	3	1	0	4
Group III Horticulture	08AGB103	Commercial Vegetable Production Commercial Floriculture Commercial Fruit Production Nursery management of horticultural crops Protected cultivation of horticultural	3	1	0	4

		crops and Seed production of vegetables and flowers Processing and value addition of horticultural crops				
Group IV Post Harvest Technology and Value addition	08AGB104	Post harvest Technology of Horticultural crops Unit operation for quality value addition processing and development of new products Post harvest technology of spices, plantation crops, medicinal and aromatic crops Integrated storage management of fruits, flowers and vegetables Post harvest handling of cut flowers and dry flowers Processing of cereals, pulses and oilseed crops including biodiesel	3	0	0	3
Group V Agri-Business Management	08AGB105	Information & Communication Management Management of Agro-based industry Marketing Management (Agricultural Import-Export Policy of Govt. of India & Business Laws) Financial Management of Agri-Business Natural Resources Economics and Management Project formulation, Evaluation and Monitoring	3	0	0	3
Group VI Social Sciences	08AGB108	Agricultural Journalism Visuals and Graphic Communications Cyber Extension Behavioral Skills Livestock, Poultry and Fish Marketing Farm Planning and Budgeting Government Policies and Programmes Related to Agriculture	3	0	0	3
Group VII Basic Sciences	08AGB107	Molecular Breeding Plant tissue culture Recombinant DNA Technology Bio informatics Microbial & Environmental Technology	5	0	0	5

		Molecular Diagnostics				
Group VIII Commercial Agriculture	08AGB108	Commercial floriculture Commercial fruit production Nursery management of horticultural crops Cultivation of commercially important medicinal & aromatic plants Commercial spices production Production technology of economic forest plants Commercial seed production technologies	3	0	0	3

Courses for Experiential Learning: A student has to register 20 credits with major load in one area of electives and rest from among one / two areas of electives in the eighth semester.

Sr.	Title of the module	Credits
I	Crop Production	
1	Seed Production Technology	3(1+2)
2	Remote Sensing GIS and Land use Planning	3(1+2)
3	Integrated Farming System	3(1+2)
4	Water Management (Watershed Micro-irrigation Problematic Water)	4(1+3)
5	Soil Management (conservation Problematic soil, Soil quality)	4(1+3)
II	Crop Protection	
1	IPM and IDM (Pest Disease Scouting)	4(2+2)
2	Management of Post Harvest insect- pests and diseases	3(1+2)
3	Non-insect pests and their Management	3(1+2)
4	Apiculture	2(0+2)
5	Mushroom (cultivation)	2(0+2)
6	Bio-control agencies and bio-pesticide (mass multiplication and uses)	3(1+2)
7	Pesticides and Plant Protection equipment	3(1+2)
III	Horticulture	
1	Commercial Vegetable Production	3(1+2)
2	Commercial Floriculture	3(1+2)
3	Commercial Fruit Production	3(1+2)
4	Nursery management of horticultural crops	4 (1+3)
5	Protected cultivation of horticultural crops and Seed production of vegetables and flowers	4(1+3)
6	Processing and value addition of horticultural crops	3(1+2)
IV	Post Harvest Technology and Value addition	
1	Post harvest Technology of Horticultural crops	3(1+2)
2	Unit operation for quality value addition processing and development of new products	4(1+3)
3	Post harvest technology of spices, plantation crops, medicinal and aromatic crops	4(1+3)
4	Integrated storage management of fruits, flowers and vegetables	3(1+2)
5	Post harvest handling of cut flowers and dry flowers	3(1+2)
6	Processing of cereals, pulses and oilseed crops including biodiesel	3(1+2)
V	Agri-Business Management	

1	Information & Communication Management	3 (1+2)
2	Management of Agro-based industry	4 (1+3)
3	Marketing Management (Agricultural Import-Export Policy of Govt. of India & Business Laws)	3 (1+2)
4	Financial Management of Agri-Business	4 (1+3)
5	Natural Resources Economics and Management	3 (1+2)
6	Project formulation, Evaluation and Monitoring	3 (1+2)
VI	Social Sciences	
1	Agricultural Journalism	3 (1+2)
2	Visuals and Graphic Communications	3 (1+2)
3	Cyber Extension	2 (1+1)
4	Behavioral Skills	3 (1+2)
5	Livestock, Poultry and Fish Marketing	3 (1+2)
6	Farm Planning and Budgeting	3 (1+2)
7	Government Policies and Programmes Related to Agriculture	3 (1+2)
VII	Basic Sciences	
1	Molecular Breeding	3 (1+2)
2	Plant tissue culture	4 (1+3)
3	Recombinant DNA Technology	3 (1+2)
4	Bio informatics	3 (1+2)
5	Microbial & Environmental Technology	4 (1+3)
6	Molecular Diagnostics	3(1+2)
VIII	Commercial Agriculture	
1	Commercial floriculture	3(0+3)
2	Commercial fruit production	3(0+3)
3	Nursery management of horticultural crops	3 (1+2)
4	Cultivation of commercially important medicinal & aromatic plants	2 (1+1)
5	Commercial spices production	3 (1+2)
6	Production technology of economic forest plants	3 (1+2)
7	Commercial seed production technologies	3 (1+2)

Selective courses running in VIII semester:

Subject Code	Name of Subject	Teaching Period		CREDIT POINTS
		L	P	
08AGB101	Seed Production Technology	1	2	3(1+2)
08AGB102	Integrated Farming System	1	2	3(1+2)
08AGB103	Water Management (Watershed Micro-irrigation Problematic Water)	1	3	4(1+3)
08AGB104	Soil Management (conservation Problematic soil, Soil quality)	1	3	4(1+3)
08AGB105	Molecular Breeding	1	2	3(1+2)
08AGB106	Plant tissue culture	1	3	4(1+3)
08AGB301	DECA	0	1	1(0+1)
	Total	6	16	22

08AGB101 Seed Production Technology 3(1+2)

Theory: Introduction and history of seed industry in India. Definition of seed. Differences between grain and seed. Importance and scope of vegetable seed production in India. Principles of vegetable seed production. Role of temperature, humidity and light in vegetable seed production. Methods of seed production of cole crops, root vegetables, solanaceous vegetables, cucurbits, leafy vegetables, bulb crops, leguminous vegetables and exotic vegetables. Seed germination and purity analysis. Field and seed standards. Seed drying and extraction. Seed legislation.

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

Reference

Principles of seed science and technology by **Lawrenceo Copland**

Principles of seed science and technology by **M B Mc donald**

The Encyclopedia of Seeds: Science, Technology and Uses by **J. Derek Bewley, Michael Black, Peter Halmer**

08AGB102 Integrated Farming Systems 3(1+2)

Theory: Sustainable agriculture: Introduction, definition, goal and current concepts, factors affecting ecological balance and ameliorative measures; Land degradation and conservators of natural resources, LEIA & HEIA; Irrigation problems, waste lands and their development; Organic farming: definition, principles and components; Farming systems: definition, principles and components, IFS models for wetland, irrigated dryland and dryland situations, Pheromones IPM and its components.

Practical: Preparation of cropping scheme for irrigated situations; Preparation of cropping scheme for dryland situations; Study of existing farming systems in nearby villages; Preparation of integrated farming system model for wetlands; Preparation of integrated farming system model for drylands; Preparation of enriched Farm Yard Manure; Preparation of Vermicompost; Visit to urban waste recycling unit; Study of profitable utilization of agricultural wastes; Visit to poultry and dairy units to study resource allocation, utilization and economics; Visit to an organic farm to study various components and utilization; Study of degraded lands.

Suggested book reading:

Production and quality control of carrier based legume inoculants by **Thompson, J.A.**

A complete guide to the sustainable and profitable biological system of farming by **Gary F Zimmer**

Intensive agriculture and sustainability: A farming system analysis by **Glen C Filson**

Ecology and integrated farming systems by **D. M. Glen et al**

08AGB103 Water Management : 4 (1+3)

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).

Suggested book reading:

Water Resources Management by **Libor Jansky** and **Juha I Uitto**

Irrigation and Drainage by **D. Lenka**

Water management including micro irrigation by **A. M. Michael**

Water management including micro irrigation by **Megh R. Goyal**

08AGB104 Soil Management:4(1+3)

Theory : 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 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. Factors influencing nutrient use efficiency (NUE) in respect of N, P, K, S, Fe and Zn fertilizers. Source, method and scheduling of nutrients for different soils and crops grown under rainfed and irrigated conditions.

Practical: Principles of analytical Instruments and their calibration and applications, Colorimetry and flame photometry. Estimation of available N, P, K, S, and Zn in oils, pH, EC, soluble cations and anions in soil water extracts. Lime requirement and gypsum requirement of problem soils. Estimation of N, P and K in plants.

Suggested book reading:

Soil fertility, soil chemistry and nutrient management by **Macselfaj**

Soil fertility, soil chemistry and nutrient management by **Havlin john L**

Soil Fertility and Fertilizers: An Introduction to Nutrient Management by **John Havlin**

08AGB105 Molecular Breeding :3(1+2)

Theory: Totipotency, application of tissue culture for plant improvement, cryopreservation. Protoplasm fusion. General principles of gene cloning. Isolation and characterization of plant genes and promoters. Different methods of gene transfer –direct

and vectormediated. Gene silencing. Site directed mutagenesis. Molecular analysis of transformants. Potential applications of plant genetic engineering for crop improvement – insect-pest resistance (insect, viral, fungal and bacterial diseases). Abiotic stress tolerance, herbicide resistance, storage protein quality improvement, increasing shelf-life, oil quality. Biosafety and IPR issues.

Molecular Breeding Genetic markers in plant breeding: Conceptions, types and application, DNA markers, RFLP markers: RAPD markers AFLP markers SSR markers SNP markers Marker-assisted selection. QTL mapping

Practical: Molecular Breeding Genetic markers in plant breeding: Conceptions, types and application, DNA markers, RFLP markers: RAPD markers AFLP markers SSR markers SNP markers Marker-assisted selection. QTL mapping

Suggested book reading:

Plant Molecular Breeding by **H. J. Newbury**

Advances in Molecular Breeding Toward Drought and Salt Tolerant Crops by **Matthew A. et al**

08AGB106 Plant tissue culture :4(1+3)

Theory: Principles of optical, phase contrast, fluorescence and electron microscopy, spectrophotometry, UV and VIS, fluorimetry, turbidometry and atomic absorption spectrophotometry. Radioisotopic techniques – scintillation counters and autoradiography and their application in biological sciences. Electrophoresis – general principles and application, gel electrophoresis, isoelectric focusing, pulsed field gel electrophoresis, immunoelectrophoresis. Chromatographic techniques - paper, thin layer, column chromatography, GC and HPLC. Centrifugation - principles of sedimentation in various rotors, differential centrifugation, density gradient centrifugation and ultracentrifugation. Cell tissue and organ culture. Cryopreservation, PCR and application of RFLP, RAPD, AFLP, microsatellite and mitochondrial and ribotyping techniques. Southern, Northern and Western blotting, ELISA. Microarray and DNA chips. Preliminary methods of statistical analysis as applied to agricultural data – standard deviation, standard error, ANOVA, correlation and regression. Totipotency, application of tissue culture for plant improvement, cryopreservation. Protoplasm fusion.

Practical: Tissue culture for plant. general principles and application, gel electrophoresis, isoelectric focusing, pulsed field gel electrophoresis, immunoelectrophoresis. Chromatographic techniques - paper, thin layer, column chromatography, GC and HPLC. Centrifugation - principles of sedimentation in various rotors, differential centrifugation, density gradient centrifugation and ultracentrifugation. Cell tissue and organ culture. Cryopreservation, PCR and application of RFLP, RAPD, AFLP, microsatellite and mitochondrial and ribotyping techniques. Southern, Northern and Western blotting,

Suggested book reading:

Plant Tissue Culture: Techniques and Experiments By **Roberta H. Smith**

Experiments in Plant Tissue Culture By **John H. Dodds**