

## Distribution of Courses and Credits for B.Sc. (Hons.) Agriculture

### 2<sup>nd</sup> Semester

Sl. No.	Course No.	Title of Course	Credit(s)
1	AGR 151	Fundamentals of Agronomy II	2(1+1)
2	AGR 152	Crop Production Technology I ( <i>Rabi</i> crops)	2(1+1)
3	ACSS 153	Fundamentals of Soil Science II	2(1+1)
4	AEN 154	Fundamentals of Agricultural Entomology II	2(1+1)
5	PPA 155	Fundamentals of Plant Pathology II	2(2+0)
6	GPB 156	Fundamentals of Genetics	3(2+1)
7	PPH 157	Fundamentals of Crop Physiology	2(1+1)
8	AEC 158	Fundamentals of Agricultural Economics	2(2+0)
9	AEX 159	Fundamentals of Agricultural Extension Education	3(2+1)
10	SWC 160	Soil and Water Conservation	2(1+1)
11	ASC 161	Livestock and Poultry Management	3(2+1)
12	ET 162	Educational Tour	1(0+1)**
		Total	25+1**

\*\*NC (Non-Gradual Course) preferably during summer vacation

**Theory**

Water resources and irrigation development in India and West Bengal; Irrigation: definition and objectives; Soil-water and plant-water relationships; Soil moisture tension, Soil water classification and constants; Crop water requirement, Effective rainfall, Water use efficiency, Evapo-transpiration; Irrigation scheduling and criteria; Surface irrigation methods, drip and sprinkler irrigation; Irrigation efficiencies; Water management of rice, wheat, maize, groundnut and sugarcane crops; Quality of irrigation water; Water logging and drainage; Definition of tillage and tilling; different types of tillage, factors affecting tillage operations, modern concept of tillage

**Practical**

Study on soil moisture measuring devices, Measurement of field capacity, bulk density and infiltration rate, Methods of moisture estimation, Measurement of irrigation water and determination of irrigation efficiency; Calculation on water requirement; Use of tillage implements-reversible plough, one way plough, harrow, leveler, seed drill.

**AGR 152      Crop Production Technology-I (*Rabi* crops)**

**2 (1+1)**

**Theory**

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of *Rabi* crops; cereals – wheat and barley, pulses- chickpea, lentil, peas, lathyrus, french bean; oilseeds- rapeseed and mustard, sunflower and linseed; Commercial crop- tobacco.

**Practical**

Field preparation, sowing of *rabi* cereals, pulses, oilseed crops and tobacco, and multiple cropping; Calculations on seed rate and fertilizers; Use of bio-fertilizers, top dressing of nutrients, identification of weeds and their control measures, important intercultural operations and water management; Morphological and yield attributing characteristics, estimation of yield, harvesting, threshing, winnowing and storage of *rabi* field crops; Cost of cultivation; Crop distribution in West Bengal and its ecological regions; Visit to research stations for related multiple cropping.

**Theory**

Soil organic matter: composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects; Soil pollution - behaviour of pesticides and inorganic contaminants, prevention and mitigation of soil pollution. Irrigation water– quality of irrigation water and its appraisal. Indian standard for water quality. Use of saline water for irrigation/agriculture. Different approaches for soil fertility evaluation, soil testing–chemical methods, critical levels of nutrients in soil and plants, DRIS method, Biological method of soil fertility evaluation. Nutrient use efficiency.

**Practical**

Principles of analytical instruments and their calibration and applications, colorimetry and flame photometry. Estimation of available N, P, K, S and Zn in Soils, pH, EC, soluble cations and anions in Soil water extracts. Estimation of N, P, K, and S in plants. Rapid test.

**Theory**

Introduction of ecology, definition and its biotic & abiotic components. Effect of abiotic factors- temperature, RH, rainfall, light, atmospheric pressure & air current. Effect of biotic factors- intra & inter specific relationship, food competition. Natural and environmental resistance. Concept and definition of Pests, its categorization. Insects and mite pests of crops. Survey and surveillance, sampling, and estimation of pest population. Concept & definition of IPM, importance, principles and tools of IPM. Clarification of tools and their application in IPM system. Bio-control agents including predators, parasitoids, mite predators, microbial and their application in IPM. Chemical control- definition, importance, hazards and limitations. Classification of insecticides, label and formulation of insecticides. Synthetic chemical insecticides in plant protection. Botanical insecticides- definition, scope and limitation of botanicals. Recent methods of pests control- repellents, antecedents, sex pheromones and IGRs. Insecticides act 1968- Important provisions. Application techniques of spray fluids- high, low and ultra low volume spray. Symptoms of poisoning- first aids and antidotes for important group of insecticides.

**Practical**

Study of distribution pattern of insects in crop ecosystem. Sampling techniques for the estimation of insect population and damage. Habit, habitat, distribution, sampling and identification of mite pests. Survey on pests and forecasting of pest incidence. Pest surveillance through light trap, pheromone traps and forecasting of pest incidence. Identification of pests and their estimation. Identification of bio-control agents and their qualitative and quantitative estimation. Label and toxicity of insecticides. Acquaintance of insecticides formulations. Calculation of doses/concentration of different insecticides. Plant protection equipments and spray droplet size. Compatibility of pesticides with other agro-chemicals and phytotoxicity of insecticides. Study of insect pollinators, weed killers and scavengers. Commonly used acaricides, rodenticides and nematicides. Microbial insecticides and IGRs. Application of IPM techniques, integration and case studies.

**Theory**

Introduction: Importance of plant diseases, scope and objectives of Plant Pathology. History of Plant Pathology with special reference to Indian work. Terms and concepts in Plant Pathology. Pathogenesis. Cause and classification of plant diseases. Diseases and symptoms due to abiotic causes. Phenomenon of Infection, Pre penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxin, growth regulators and polysaccharides: Defense mechanism in plants – structural and biochemical (pre and post infection), Plant disease epidemiology Plant disease forecasting, remote sensing, Principles and methods of plant disease management. Application of Biotechnology in plant disease management- development of disease resistant transgenic plants through gene cloning IDM concept, advantage and importance. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

**Theory**

Pre and Post Mendelian concepts of heredity, Mendelian principles of heredity, Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes. Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis. Probability and Chi-square. Dominance relationships, Epistatic interactions with example. Multiple alleles, pleiotropism and pseudoalleles, Sex determination and sex linkage, sex limited and sex influenced traits, Blood group genetics, Linkage and its estimation, crossing over mechanisms, chromosome mapping. Structural and numerical variations in chromosome and their implications, Use of haploids, dihaploids and doubled haploids in Genetics. Mutation, classification, Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation. Qualitative & Quantitative traits, Polygenes and continuous variations, multiple factor hypothesis, Cytoplasmic inheritance. Genetic disorders. Nature, structure & replication of genetic material. Protein synthesis, Transcription and translational mechanism of genetic material, Gene concept: Gene structure, function and regulation, Lac and Trp operons.

**Practical**

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

*[Common course for Faculty of Agriculture and Horticulture]*

**Theory**

Role of water in plant metabolism, diffusion and osmosis, imbibition, water potential and its components, absorption of water, stomata structure and physiology, transpiration. Mineral nutrition of plants: Essentiality, Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms. Photosynthesis: Structure and function of chloroplast, Light and Dark reactions, cyclic and non-cyclic electron transfer, CO<sub>2</sub> fixation : C<sub>3</sub>, C<sub>4</sub> and CAM plants, Photorespiration and its implications. Respiration: Glycolysis, TCA cycle and electron transport chain. Plant growth regulators: Physiological roles and use in agricultural and horticultural crops. Growth analysis, role of physiological growth parameters in crop productivity, physiological aspects of growth and development of major crops. Secondary metabolites: Brief introduction; major classes of secondary metabolites with examples and their roles in plant defense.

**Practical**

Preparation of solutions and buffers. Study of plant cells. Structure and distribution of stomata. Imbibition, osmosis, plasmolysis, Determination of osmotic potential of tissue. Separation of photosynthetic pigments through paper chromatography. Rate of transpiration, rate of photosynthesis, rate of respiration, effect of respiratory inhibitor. Estimation of relative water content. Study of deficiency symptoms of mineral nutrients



**Theory**

**Economics:** Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.

**Agricultural Economics:** meaning, definition, characteristics of agriculture, importance and its role in economic development. Agricultural planning and development in the country.

**Demand:** meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship.

**Laws of returns:** Law of variable proportions and law of returns to scale.

**Cost:** Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

**Market structure:** meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

**Distribution theory:** meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

**National income:** Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement. Concept of money and inflation.

**Population:** Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control.

**Tax:** public revenue and public expenditure meaning, direct and indirect taxes, agricultural taxation, VAT.

**Economic systems:** Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

**AEX 159                      Fundamentals of Agricultural Extension Education                      3 (2+1)**

### **Theory**

Education: Meaning, definition & types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education; Extension Programme planning- Meaning, Process, Principles and Steps in Programme Development. Extension systems in India: extension efforts in pre-independence era (Sriniketan, Marthandam, Firka Development Scheme, Gurgaon Experiment, etc.) and post-independence era (Etawah Pilot Project, Nilokheri Experiment, etc.); various extension/ agriculture development programmes launched by ICAR/ Govt. of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND,NATP, NAIP, etc.). New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.

Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership: concept and definition, types of leaders in rural context; extension administration: meaning and concept, principles and functions. Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes; transfer of technology: concept and models, capacity building of extension personnel. Agriculture journalism. Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

### **Practical**

Acquaintance with university extension system. Group discussion- exercise; Handling and use of audio visual equipments and digital camera and LCD projector; Preparation and use of AV aids, preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories; Presentation skills exercise; micro teaching exercise; Visit to village to understand the problems being encountered by the villagers/ farmers; Study the organization and functioning of

DRDA and other development departments at district level; Visit to NGO and learning from their experience in rural development; Understanding PRA techniques and their application in village development planning.

## **Theory**

Introduction to soil and water conservation; Causes of soil erosion; Definition of soil erosion and agents of soil erosion; Different forms of water erosion; Classification of gully erosion and control measures; Universal soil loss equation; Soil loss measurement techniques; Principles of erosion control; Introduction to contouring & strip cropping; Contour bund, graded bund & bench terracing; Grassed water ways and their design; Water harvesting and its techniques; Wind erosion : Introduction; Mechanics of wind erosion; Types of soil movement by wind; Principles of wind erosion control; Different control measures for wind erosion.

## **Practical**

General status of soil conservation in India. Calculation of Erosion Index. Estimation of Soil Loss; Measurement of Soil Loss. Preparation of contour maps. Design of grassed water ways. Design of contour bunds. Design of graded bunds. Design of bench terracing system. Problems of wind erosion.

**\*\* ‘Preparation of contour map’ – Theoretical part should be included as suggested by Mr. Bidyut Das, College of Agriculture, Chhatna, Bankura.**

**ASC 161      Livestock and Poultry Management****3 (2+1)****Theory**

Role of livestock in the national economy. Common animal husbandry terms. Important exotic and Indian breeds of cattle, buffalo, sheep, goat and pig. Selection and breeding of livestock and poultry for improved production. General information about reproductive behavior (like oestrus, gestation, parturition) and artificial insemination. Measures to improve reproductive efficiency. Feeds and feeding of different categories of farm animals. Housing principles, space requirements for different species of livestock. Care and Management of animals. Animal products- milk, its composition, biosynthesis and let-down; factors affecting yield and composition of milk, clean milk production; nutritive value of egg. Introduction to livestock and poultry diseases, prevention (including vaccination schedule) and control of important diseases of livestock and poultry. Important breeds of poultry, their systems of rearing, feeding management and hatching of egg. Economics of livestock and poultry production.

**Practical**

External body parts of cattle, buffalo, sheep, goat, swine and poultry. Handling and restraining of livestock. Identification methods of farm animals and poultry. Visit to IDF and IPF to study breeds of livestock and poultry and daily routine farm operations and farm records. Layout of housing for different types of livestock. Formulation of concentrate mixtures. Thumb rule method of feeding dairy cows. Milking methods. Determination of specific gravity, fat and SNF of milk. Determination of common adulterant of milk. Structure of egg, selection of eggs for hatching. Hatchery operations, incubation and hatching equipments. Management of chicks, growers and layers. Methods of drug administration including vaccination. Economics of dairy and poultry farm.

**ET 162      Educational Tour      (*Non-Gradiual Course*)****1 (0+1)**



## Syllabus of B. Sc. (Hons.) Hort. Second Semester (New)

### Courses offered by F/Agriculture

#### 1. Introductory Economics

Credits : 2 (2+0)

##### Theory (32 Classes minimum)

**Economics:** Meaning, scope and subject matter, definitions, activities, approaches to economic analysis; micro and macro economics, positive and normative analysis. Nature of economic theory; rationality assumption, concept of equilibrium, economic laws as generalization of human behavior. Basic concepts: Goods and services, desire, want, demand, utility, cost and price, wealth, capital, income and welfare.

**Demand:** meaning, law of demand, demand schedule and demand curve, determinants, utility theory; law of diminishing marginal utility, equi-marginal utility principle. Consumer's equilibrium and derivation of demand curve, concept of consumer surplus. Elasticity of demand: concept and measurement of price elasticity, income elasticity and cross elasticity. Production: process, creation of utility, factors of production, input output relationship.

**Laws of returns:** Law of variable proportions and law of returns to scale.

**Cost:** Cost concepts, short run and long run cost curves. Supply: Stock v/s supply, law of supply, supply schedule, supply curve, determinants of supply, elasticity of supply.

**Market structure:** meaning and types of market, basic features of perfectly competitive and imperfect markets. Price determination under perfect competition; short run and long run equilibrium of firm and industry, shut down and break even points.

**Distribution theory:** meaning, factor market and pricing of factors of production. Concepts of rent, wage, interest and profit.

**National income:** Meaning and importance, circular flow, concepts of national income accounting and approaches to measurement, difficulties in measurement.

**Population:** Importance, Malthusian and Optimum population theories, natural and socio-economic determinants, current policies and programmes on population control.

**Money:** Barter system of exchange and its problems, evolution, meaning and functions of money, classification of money, money supply, general price index, inflation and deflation.

**Banking:** Role in modern economy, types of banks, functions of commercial and central bank, credit creation policy. Agricultural and public finance: meaning, micro v/s macro finance, need for agricultural finance,

**Tax:** Public revenue and public expenditure meaning, direct and indirect taxes, agricultural taxation, VAT.

**Economic systems:** Concepts of economy and its functions, important features of capitalistic, socialistic and mixed economies, elements of economic planning.

**Importance of Economics in Horticulture:** Characteristics of agriculture and Horticulture, importance and its role in economic development. Agricultural and Horticultural planning for development of the country.



## **Theory**

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

## **Practical**

Breeding objectives and techniques in important horticultural crops. Floral biology – its measurement, emasculation, crossing and selfing techniques in major crops. Determination of mode of reproduction in crop plants, handling of breeding material, segregating generations (pedigree, bulk and back cross methods), Field layout, and maintenance of experimental records in self and cross pollinated crops. Demonstration of hybrid variation and production techniques. Hardy Weinberg Law and calculation, male sterility and incompatibility studies in horticultural crops calculation of inbreeding depression, heterosis, heterobeltioses, GCA, SCA, GA, heritability.

## **Theroy**

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

## **Practical**

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

### **Theory (16 Classes minimum)**

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

### **Practical (16 Classes)**

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. Green synthesis of nano particles and their size characterization.

### **5. PPH(H)-15? Introductory Crop Physiology**

**2(1+1)**

**[Common course for Faculty of Agriculture and Horticulture]**

### **Theroy (16 Classes minimum)**

Role of water in plant metabolism, diffusion and osmosis, imbibition, water potential and its components, absorption of water, stomata structure and physiology, transpiration. Mineral nutrition of plants: Essentiality, Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms. Photosynthesis: Structure and function of chloroplast, Light and Dark reactions, cyclic and non-cyclic electron transfer, CO<sub>2</sub> fixation : C<sub>3</sub>, C<sub>4</sub> and CAM plants, Photorespiration and its implications. Respiration: Glycolysis, TCA cycle and electron transport chain. Plant growth regulators: Physiological roles and use in agricultural and horticultural crops. Growth analysis, role of physiological growth parameters in crop productivity, physiological aspects of growth and development of major crops. Secondary metabolites: Brief introduction; major classes of secondary metabolites with examples and their roles in plant defense.

### **Practical (16 Classes)**

- Preparation of solutions and buffers
- Study of plant cells
- Structure and distribution of stomata
- Imbibition, osmosis, plasmolysis, Determination of osmotic potential of tissue
- Separation of photosynthetic pigments through paper chromatography
- Rate of transpiration, rate of photosynthesis, rate of respiration, effect of respiratory inhibitor
- Estimation of relative water content
- Study of deficiency symptoms of mineral nutrients

### **MATH 121? Engineering Mathematics – II 3(2+1) ?**

#### **Theory**

Ordinary differential equations: Exact and Bernoulli's differential equations, equations reducible to exact form by integrating factors, equations of first order and higher degree, Clairaut's

equation, Differential equations of higher orders, methods of finding complementary functions and particular integrals, method of variation of parameters, Cauchy's and Legendre's linear equations, simultaneous linear differential equations with constant coefficients, series solution techniques, Bessel's and Legendre's differential equations. Functions of a Complex variable: Limit, continuity and analytic function, Cauchy-Riemann equations, Harmonic functions. Infinite series and its convergence, periodic functions, Fourier series, Euler's formulae, Dirichlet's conditions, functions having arbitrary period, even and odd functions, half range series, Harmonic analysis. Fourier Sine and Cosine Series, Fourier series for function having period  $2L$ , Elimination of one and two arbitrary function. Partial differential equations: Formation of partial differential equations Higher order linear partial differential equations with constant coefficients, solution of non-linear partial differential equations, Charpit's method, application of partial differential equations (one dimensional wave and heat flow equations, Laplace Equation.

### **Practical**

Tutorials on solution of ordinary differential equations of first and higher orders. Series solutions of differential equations. Bessel's and Legendre's differential equations, Convergence of infinite series. Fourier series, harmonic analysis, analytical functions, Cauchy-Riemann equations, harmonic functions, Solution of partial differential equations, Application of partial differential equations.

## **AEX 201/EXT 121? Communication Skills and Personality Development 2(1+1)**

### **Theory**

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

### **Practical**

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

## **Economics and Marketing ????????**

### **Theory**

Economics – Terms and definitions - Consumption, Demand and Supply. Factors of production. Gross Domestic Product – Role of Poultry Sector in National GDP – Marketing- definition – Marketing Process – Need for marketing – Role of marketing — Marketing functions – Classification of markets – Marketing of various channels – Price spread – Marketing Efficiency – Integration – Constraints in marketing of agricultural produce. Market intelligence – Basic guidelines for preparation of project reports- Bank norms – Insurance – SWOT analysis – Crisis management.

### **Practical**

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

The contents given above are suggestive. It was decided by the Committee these contents be adjusted in courses and credit hours as per their relevance to the concern

## **AEX 301/ECO 121 Entrepreneurship Development and Business Communication 2(1+1) / 3(2+1) ?**

### **Theory**

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

### **Practical**

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

### Suggested references:

#### Principles of Plant Breeding

3 (2+1)

#### Suggested Reading:

1. R.W. Allard. *Principles of plant breeding*. John Wiley & Sons, New York.
6. V.L. Chopra. *Plant breeding: Theory and Practice*. Oxford & IBH Publishing CO. Pvt. Ltd., New Delhi.
7. Phundan Singh. *Essentials of plant breeding*. Kalyani Publishers
8. J.R. Sharma. *Principles and practices of plant breeding*. Tata McGraw Publishing Company Ltd., New Delhi
9. B.D. Singh. *Plant breeding : principles and methods*. Kalyani Publishers, Ludhiana.
10. R.C. Chaudhary. *Plant Breeding*
11. Hays and Garber. *Breeding crop plants*. Mc Graw Hill Publications, New York
12. G K Kallo. *Breeding of vegetables*. Panima publishers, New Delhi
13. W.R. Fehr. *Principles of cultivar development: theory and technique (Vol. 1)*. Macmillan Publishing Company, New York.
14. D.S. Falconer. *Introduction to quantitative genetics*. Longman Scientific & Technical, Longman Group, UK, Ltd., England.
15. R.K. Singh and B.D. Chaudhary. *Biometrical methods in quantitative genetic analysis*. Kalyani Publishers, Ludhiana.
16. K. Mather and J.L Jinks. *Introduction to Biometrical genetics*. Chapman and Hall, London
17. B D Singh. *Fundamental of Plant breeding*. Kalyani. India.
18. Pundan Singh. *Essentials of plant breeding*. Kalyani. India
19. G. S. Chahal and S.S. Gosal. 2002. *Principles and Procedures of Plant Breeding*. Narosa Publishing House, New Delhi.
20. Poehlman, J.M. and Borthakar, D. 1995. *Breeding Asian Field Crops*. Oxford & IBH Publishing Co., New Delhi

#### Soil Fertility and Nutrient Management

2 (1+1)

#### Suggested reading:

Yawalkar K S, Agarwal JP and Bokde S, 1992. *Manures and Fertilizers*. Agri. Horticultural Publishing House, Nagpur.

Tandon HLS, 1994. *Fertilizers Guide*. Fertilizers Development Consultation Organization, New Delhi..

Seetharaman S, Biswas B C, Yadav D S and Matheswaru S. Usage 1996. *Hand Book on Fertilizers*. Oxford and IBH Publishing Company, New Delhi.

The fertilizer Association of India, Shaheed Jit singh marg, New Delhi, 1985. Fertilizer control order

Ranjan Kumar Basak , 2000. *Fertilizers A Text book*. Kalyani publishers, New Delhi.

British Crop Production Council, U.K., 1995. The Pesticide Manual, A – World Compendium.

Sree Ramulu US, 1991. *Chemistry of Insecticides*. Oxford and IBH Publishing and Fungicides Company, New Delhi.

Nene Y L and Thapliyal P N, 1991. *Fungicides in plant disease control*. Oxford and IBH Publishing company, New Delhi.

Havlin *et al.* 2014. *Soil Fertility and Fertilizers: An Introduction to Nutrient Management* (8<sup>th</sup> Edition), PHI Learning Pvt. Ltd., Delhi.

Binkley, D. and R. Fisher, 2012. *Ecology and Management of Forest Soils* (4<sup>th</sup> Edition), John Wiley & Sons Singapore Pvt. Ltd., Singapore

Reddy M. V., 2001. *Management of Tropical Plantation Forests and Their Soil Litter System-Litter, Biota and Soil Nutrient Dynamics*, Science Publishers, U. S.

Khan, T. O., 2013. *Forest Soils: Properties and Management*. Springer International Publishing, Switzerland

Brady, N. C. and Weil, R. R., 2010. *Elements of the Nature and Properties of Soils* (3<sup>rd</sup> Edition.), Pearson Education, New Delhi

Das, D .K., 2011. *Introductory Soil Science* (3<sup>rd</sup> Edition), Kalyani Publisher, Ludhiana (India).

Indian Society of Soil Science, 2002. *Fundamentals of Soil Science*. Indian Society of Soil Science, IARI, New Delhi.

Pritchett and Fisher RF, 1987. *Properties and Management of Forest Soils*. John Wiley, New York.

Gupta, P.K., 2009. *Soil, Plant, Water and Fertilizer Analysis* (2<sup>nd</sup> Edition), AGROBIOS, Jodhpur (India).

Jaiswal, P.C., 2006. *Soil, Plant and Water Analysis* (2<sup>nd</sup> Edition), Kalyani Publishers, Ludhiana.

Jackson, M. L., 2012. *Soil Chemical Analysis: Advanced Course*, Scientific Publisher

[J. Benton Jones, Jr.](#), 2012. *Plant Nutrition and Soil Fertility Manual* (2<sup>nd</sup> Edition), CRC Press, USA.

Mengel, *et al.*, 2001. *Principles of Plant Nutrition* (5<sup>th</sup> Edition), Springer

Kanwar, J.S. (Ed), 1976. *Soil Fertility: Theory and Practice*, ICAR, New Delhi

Bear, F.E., 1964. *Chemistry of the Soil*. Oxford and IBH Publishing Co., New Delhi

Richards, L.A., 1968. *Diagnosis and Improvement of Saline and Alkaline Soils*. Oxford & IBH Publishing Co. New Delhi (USDA Hand Book No. 60)

Chopra, S. C. and Kanwar, J.S., 1976. *Analytical Agricultural Chemistry*. Kalyani Publishers, Ludhiana.

Tisdale, S.L. Nelson, W.L. and Beaton, J.D., 1993. *Soil Fertility and Fertilizers*. Macmillan Publishing Company, New York

Yawalkar, K.S. Agarwal, J.P. and Bokde, S., 1977. *Manures and Fertilizers*. Agri-



Horticultural Publishing House, Nagpur

Seetharaman, S. Biswas, B. C. Maheswari, S. and Yadav, D. S., 1986.  
*Hand Book on Fertilizers Technology*. The Fertilizers Association of India, New Delhi

**Elementary Plant Biotechnology 2(1+1)**

**Suggested Reading:**

Singh, B D, 2004. *Biotechnology Expanding Horizons* 2<sup>nd</sup> Edn. Kalyani Publishers, New Delhi.

Gupta, P.K., 2015. *Elements of Biotechnology* 2<sup>nd</sup> Edn. Rastogi and Co., Meerut.

Razdan M K, 2014. *Introduction to plant Tissue Culture* 2<sup>nd</sup> Edn. Science Publishers, inc. USA.

Gautam V K, 2005. *Agricultural Biotechnology*. Sublime Publications

Thomar, R.S., Parakhia, M.V., Patel, S.V. and Golakia, B.A., 2010. *Molecular markers and Plant biotechnology*, New Publishers, New Delhi.

Purohit, S.S., 2004. *A Laboratory Manual of Plant Biotechnology* 2<sup>nd</sup> Edn. Agribios, India.

Singh, B.D. 2012. *Plant biotechnology*. Kalyani publishers, Ludhiana

Bilgrami, K.S. and Pandey, A.K. 1992. *Introduction to biotechnology*. CBS Pub. New Delhi

Gupta, P.K. 1994. *Elements of biotechnology*. Rastogi Pub. Meerut.

Chahal, G.S. and Gosal, S.S. 2003. *Principles and procedures of plant approaches breeding Biotechnological and conventional*. Narosa Publishing House, New Delhi

**Introductory Crop Physiology 2(1+1)**

**Suggested Reading:**

Salisbury, 2007. *Plant Physiology*. CBS. New Delhi.

Taiz, L. 2010. *Plant Physiology*. SINAUR. USA.

Zeiger. 2003. *Plant Physiology*. PANIMA. New Delhi.

Edward E. Durna. 2014. *Principles Of Horticultural Physiology*. CABI, UK.

Delvin, R.M . 1986. *Plant Physiology*. CBS. Delhi.

Richard, N. Arteca. 2004. *Plant Growth Substances*. CBS. New Delhi.

Jacobs, W. P. 1979. *Plant Hormones And Plant Development*. Cambridge Univ. London.

Basra, A. S. 2004. Plant Growth Regulators in Agriculture & Horticulture. HAWARTH press. New York.

Lincoln Taiz and Eduards Zeiger (5<sup>th</sup> Edition). Plant physiology

Noggle G.R and Fritz T.G. Introductory Plant Physiology

Pandey and Sinha. Plant Physiology

Salisbury and Ross. Plant Physiology

Carl fedtke. Biochemistry and Physiology of Herbicide Action

Aswani pareek, S.K. Sopory, Hans Bohnert Govindjee. Abiotic stress adaptation in plants: Physiological, Molecular and Genomic foundation

Horst Marschner, Mineral Nutrition of Higher plants