

B.Sc.(Ag.)

AGRICULTURE

w.e.f. Academic Session 2016-17

II Semester		
AGRO 5121	Agriculture Water Management	2 (1+1)
APB 5121	Fundamentals of Genetics	3 (2+1)
AMB 5121	Agricultural Microbiology	2 (1+1)
AENGG 5121	Soil and Water Conservation Engineering	2 (1+1)
ACP 5121	Fundamentals of Crop Physiology	2 (1+1)
APP 5121	Fundamentals of Plant Pathology	4 (3+1)
ABT 5121	Fundamentals of Plant Biochemistry and Biotechnology	3 (2+1)
AEXT 5121	Fundamentals of Extension Education	3 (2+1)
AEC 5121	Farm Management, Production & Resource Economics	2 (1+1)
AENT 5121	Fundamentals of Entomology-II	2 (1+1)
<b>Total</b>		<b>25 (15+10)</b>

AGRON 5121	Agriculture Water Management	2 (1+1)
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**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 and explain with suitable exaple. Drainage- importance and methods.

**Theory (periodwise)**

1. Irrigation- definition and objectives
2. Water resources and irrigation development in India and Chhattisgarh
3. Soil plant water relationships (concept and basic terms)
4. Methods of soil moisture estimation, evapo-transpiration and crop water requirement
5. Effective rainfall, scheduling of irrigation
6. Methods of irrigation: surface, subsurface, sprinkler and drip irrigation
7. measurement of irrigation water
8. Irrigation efficiency and water use efficiency, conjunctive use of water, irrigation water quality and its management-2
9. Water requirements of different crops.
10. Watershed management- definition and concept.
11. Drainage- importance and methods.

**Practical:**

1. Determination of bulk density, soil moisture content by gravimetric method, tensiometer, electrical resistance block, TDR and moisture meter. 2
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).
11. Planning of second crop in rainfed area under watershed programme

**References:**

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

APB-5121	Fundamentals of Genetics	3(2+1)
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### 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.

### 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.

### Theory

- 1 Pre and Post Mendelian concepts of heredity,
- 2 Mendelian principles of heredity.
- 3 Architecture of chromosome; chromonemata, chromosome matrix, chromomeres, centromere, secondary constriction and telomere; special types of chromosomes.
- 4 Chromosomal theory of inheritance- cell cycle and cell division- mitosis and meiosis.
- 5 Probability and Chi-square. Dominance relationships,
- 6 Epistatic interactions with example.
- 7 Multiple alleles, pleiotropism and pseudoalleles,
- 8 Sex determination and sex linkage, sex limited and sex influenced traits,
- 9 Blood group genetics,
- 10 Linkage and its estimation, crossing over mechanisms, chromosome mapping.
- 11 Structural and numerical variations in chromosome and their implications,
- 12 Use of haploids, dihaploids and doubled haploids in Genetics.
- 13 Mutation, classification,
- 14 Methods of inducing mutations & CIB technique, mutagenic agents and induction of mutation.
- 15 Qualitative & Quantitative traits,
- 16 Polygenes and continuous variations, multiple factor hypothesis,
- 17 Cytoplasmic inheritance.
- 18 Genetic disorders.



- 19 Nature, structure & replication of genetic material.
- 20 Protein synthesis,
- 21 Transcription and translational mechanism of genetic material,
- 22 Gene concept:
- 23 Gene structure, function.
- 24 Gene regulation

### Practical

- 1 Study of microscope.
- 2 Study of cell structure. Mitosis and Meiosis cell division.
- 3 Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross,
- 4 Experiments on epistatic interactions including test cross and back cross-2
- 5 Practice on mitotic and meiotic cell division, Experiments on probability and Chi-square test.
- 6 Determination of linkage and cross-over analysis (through two point test cross and three point test cross data)-3
- 7 Study on sex linked inheritance in *Drosophila*.
- 8 Study of models on DNA and RNA structures-2

### Suggested Reading:

- Gardner E J, Simmons M J & Snustard D P. *Principles of Genetics (VIII Edn)*. John Wiley & Sons, New York.
- Strickberger. *Genetics*. Macmillan Publishing Company, New York.
- William D. Stansfield. *Theory and Problems of Genetics (3<sup>rd</sup> Ed)*. Schaum's Outline series - McGraw-Hill Inc.
- Benjamin Lewin. *Genes (II edn)*. John Wiley & Sons, New York.
- Phundan Singh. *Elements of Genetics*. Kalyani publishers, New Delhi.
- Swanson & Webster. *The Cell (V edn)*. Prentice Hall of India Pvt. Ltd, New Delhi
- Norman, V. Rothwell. *Understanding Genetics (IV Ed.)*. Oxford University Press, Oxford.
- Sinnut, Dunn & Dobzhansky. *Principles of Genetics XIX reprint*. Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
- Griffiths, Miller, Suzuki Lewontin & Gelbart. *An introduction to Genetic Analysis (V Ed.)*. W.H. Freeman & Company, New York
- Robert Schief. *Genetics & Molecular Biology (1986)*. The Benjamin/cummings publishing Co, Inc, California.
- Swanson, Merz & Young. *Cytogenetics (II ed.)*. Prentice Hall of India Pvt. Ltd. New Delhi.
- Joseph Jahier & INRA working group. *Techniques of Plant Cytogenetics (1986)*. Oxford & IBH Publishing Co Pvt. Ltd., New Delhi
- Loewy & Siekevitz. *Cell Structure & Function (II Ed.)*. Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.
- Stent & Calendar. *Molecular Genetics (II Ed.)*. CBS Publishers, New Delhi
- Singh B D. *Fundamentals of Genetics*. Kalyani Publishers, New Delhi
- Srivastava & Tyagi. *Selected Problems in Genetics (Vol. 1-3)*. Anmol Publications Pvt. Ltd., New Delhi
- Khanna VK. *Genetics-Numerical Problems*. Kalyani Publishers, New Delhi.
- Farook & Khan. *Genetics & Cytogenetics (I Ed.)*. Premier Publishing House, Hyderabad.
- Shukla. *Cell Biology (2001)*. Dominant publishers, New Delhi
- George Acquaah. *Principles of Plant Genetics and Breeding*. Blackwell
- B.D. Singh. *Fundamental of Genetics*. Kalyani. India
- Gupta, P.K. 1985. *Cytology, genetics and cytogenetics*. Rastogi Publication, India.



AMB 5121	Agricultural Microbiology	2(1+1)
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### Theory

Introduction. Microbial world: Prokaryotic and eukaryotic microbes. Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon.

Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles. Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere. Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste.

### Practical

Introduction to microbiology laboratory and its equipments; Microscope- parts, principles of microscopy, resolving power and numerical aperture. Methods of sterilization. Nutritional media and their preparations. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. Methods of isolation and purification of microbial cultures. Isolation of *Rhizobium* from legume root nodule. Isolation of *Azotobacter* from soil. Isolation of *Azospirillum* from roots. Isolation of BGA. Staining and microscopic examination of microbes.

### Theory

S. No.	Lecture	Period
1	Introduction. Microbial world: Prokaryotic and eukaryotic microbes	2
2	Bacteria: cell structure, chemoautotrophy, photo autotrophy and growth	2
3	Bacterial genetics: Genetic recombination- transformation, conjugation and transduction, plasmids, transposon	2
4	Role of microbes in soil fertility and crop production: Carbon, Nitrogen, Phosphorus and Sulphur cycles	2
5	Biological nitrogen fixation- symbiotic, associative and asymbiotic. Azolla, blue green algae and mycorrhiza. Rhizosphere and phyllosphere	2
6	Microbes in human welfare: silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste	2

### Practical

S. No.	Lecture	Period
1	Introduction to microbiology laboratory and its equipments	1
2	Microscope- parts, principles of microscopy, resolving power and numerical aperture	2
3	Methods of sterilization	1
4	Nutritional media and their preparations	1
5	Enumeration of microbial population in soil- bacteria, fungi, actinomycetes	2
6	Methods of isolation and purification of microbial cultures	1
7	Isolation of <i>Rhizobium</i> from legume root nodule	1
8	Isolation of <i>Azotobacter</i> from soil.	1
9	Isolation of <i>Azospirillum</i> from roots. Isolation of BGA	1
10	Staining and microscopic examination of microbes	1



AENGG 5121	Soil and Water Conservation Engineering	2(1+1)
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### Theory

General status of soil conservation in India Introduction to Soil and Water Conservation, causes of soil erosion. Definition and agents of soil erosion, water erosion: Forms of water erosion. Gully classification and control measures. Soil loss estimation by universal Loss Soil Equation. Soil loss measurement techniques. Principles of erosion control: Introduction to contouring, strip cropping. Contour bund. Graded bund and bench terracing. Grassed water ways and their design. Water harvesting and its techniques. Wind erosion: mechanics of wind erosion, types of soil movement. Principles of wind erosion control and its control measures.

### Practical

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. Problem on wind erosion.

### Theory

S. No.	Lecture	Period
1	General status of soil conservation in India and introduction to Soil and Water Conservation, causes of soil erosion.	1
2	Definition and agents of soil erosion, water erosion	1
3	Forms of water erosion	1
4	Gully classification and control measures	1
5	Soil loss estimation by universal Loss Soil Equation	1
6	Soil loss measurement techniques	1
7	Principles of erosion control: Introduction to contouring, strip cropping. Contour bund	1
8	Graded bund and bench terracing	1
9	Grassed water ways and their design	1
10	Water harvesting and its techniques	1
11	Wind erosion: mechanics of wind erosion, types of soil movement	1
12	Principles of wind erosion control and its control measures	1

### Practical

S. No.	Lecture	Period
1	Calculation of erosion index	1
2	Estimation of soil loss	1
3	Measurement of soil loss	1
4	Preparation of contour maps	2
5	Design of grassed water ways	1
6	Design of contour bunds	2
7	Design of graded bunds	2
8	Design of bench terracing system	1
9	Problem on wind erosion	1



ACP 5121	Fundamentals of Crop Physiology	2(1+1)
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### Theory

Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview; function of different cell organelles, Process of Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms; Photosynthesis: Light and Dark reactions, C<sub>3</sub>, C<sub>4</sub> and CAM plants; Respiration: Glycolysis, TCA cycle and electron transport chain; Fat Metabolism: Fatty acid synthesis and Breakdown; Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops: Growth analysis, Role of Physiological growth parameters in crop productivity. Introduction of plant stresses, types, mechanism of stress resistance, tolerance and avoidance. Seed dormancy, germination, types of dormancy and germination, biochemical changes during seed germination. Source sink relationship, translocation of photo assimilate, efficient partitioning and crop productivity, Plant water relations, water potential, Osmotic potential, turgor pressure, Biochemical and physiological properties of water.

### Practical

Preparation of different types of solutions, Study of plant cells, Fractionation of cellular components, structure and distribution of stomata, imbibitions, osmosis, plasmolysis, measurement of root pressure, rate of transpiration, Separation of photosynthetic pigments through paper chromatography, Rate of transpiration, photosynthesis, respiration, tissue test for mineral nutrients, estimation of relative water content, Measurement of photosynthetic CO<sub>2</sub> assimilation by Infra Red Gas Analyser (IRGA). Seed viability, seed germination and vigour test, breaking of seed dormancy with chemicals and growth regulators. Growth analysis. Bioassay of plant hormones.

### Theory

S. No.	Lecture	Period
1	Introduction to crop physiology and its importance in Agriculture; Plant cell: an Overview, function of different cell organelles	1
2	Mechanism of Diffusion and osmosis, types and significance in plant physiology; Absorption of water, transpiration and Stomatal Physiology and mechanism of its regulation	1
3	Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient uptake mechanisms	1
4	Photosynthesis: Light and Dark reactions; C <sub>3</sub> , C <sub>4</sub> and CAM plants, difference in between them	1
5	Respiration: Glycolysis; TCA cycle and electron transport chain	1
6	Fat Metabolism: Fatty acid synthesis and Breakdown	1
7	Plant growth regulators: Physiological roles and agricultural uses, Physiological aspects of growth and development of major crops	1
8	Growth analysis, Role of Physiological growth parameters in crop productivity	1
9	Mechanism of photorespiration and its significance	1
10	Introduction of plant stresses, types, mechanism of stress resistance,	1



	tolerance and avoidance; Seed dormancy, germination, types of dormancy and germination, biochemical changes during seed germination	
11	Source sink relationship, translocation of photo assimilate, efficient partitioning and crop productivity	1
12	Plant water relations, water potential, Osmotic potential, turgor pressure Biochemical and physiological properties of water	1
		<b>12</b>

### Practical

S. No.	Practical	Period
1	Preparations of various types of solutions, Molar, Molal, Normal, ppm, Percent etc.	1
2	Study of plant cells, Fractionation of cellular components	1
3	Structure and distribution of stomata, Counting of stomatal frequency	1
3	Demonstration of imbibition, Osmosis and its types	1
4	Demonstration of Plasmolysis; Measurement of root pressure, rate of transpiration	1
5	Separation of photosynthetic pigments through paper chromatography	1
6	Estimation of chlorophyll and other chloroplast pigments	1
7	Measurement of Rate of transpiration	1
7	Measurement of Photosynthesis; Measurement of Respiration rate	1
8	Diagnosis of nutrient deficiencies for mineral nutrient through Rapid Tissue Test	1
9	Estimation of relative water content (RWC)	1
10	Measurement of photosynthetic CO <sub>2</sub> assimilation by Infra Red Gas Analyser (IRGA)	1
11	Seed Viability, Seed germination and Seed vigour test	1
12	Bioassay of plant hormones	1
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APP 5121	Fundamentals of Plant Pathology	4(3+1)
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### 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. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them. Diseases and symptoms due to abiotic causes.

**Fungi:** general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes.

**Bacteria and mollicutes:** general morphological characters. Basic methods of classification and reproduction.

**Viruses:** nature, structure, replication and transmission. Study of phanerogamic plant parasites.

**Nematodes:** General morphology and reproduction, classification, symptoms and nature of damage caused by plant nematodes (*Heterodera*, *Meloidogyne*, *Anguina*, *Radopholus* etc.)

Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. Types of parasitism and variability in plant pathogens. Pathogenesis. Role of enzymes, toxins and growth regulators in disease development. Defense mechanism in plants. Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics.

### Practical

Acquaintance with various laboratory equipments and microscopy. Collection and preservation of disease specimen. Preparation of media, isolation and Koch's postulates. General study of different structures of fungi. Study of symptoms of various plant diseases. Study of representative fungal genera. Staining and identification of plant pathogenic bacteria. Transmission of plant viruses. Study of phanerogamic plant parasites.

Study of morphological features and identification of plant parasitic nematodes. Sampling and extraction of nematodes from soil and plant material, preparation of nematode mounting. Study of fungicides and their formulations. Methods of pesticide application and their safe use. Calculation of fungicide sprays concentrations.

### Theory

S. No.	Lecture	Period
1.	<b>Introduction:</b> Importance of plant diseases, scope and objectives of Plant Pathology	2
2.	History of Plant Pathology with special reference to Indian work	2
3.	Terms and concepts in Plant Pathology. Pathogenesis. Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant	3



	diseases	
4.	Important plant pathogenic organisms, different groups: fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viroids, algae, protozoa, phanerogamic parasites and nematodes with examples of diseases caused by them	3
5.	Diseases and symptoms due to abiotic causes	2
6.	<i>Fungi</i> : general characters, definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction (asexual and sexual)	3
7.	Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions, sub-divisions, orders and classes	3
8.	<i>Bacteria and mollicutes</i> : general morphological characters. Basic methods of reproduction	2
9.	<i>Viruses</i> : nature, structure, replication and transmission.	2
10.	<i>Nematodes</i> : General morphology and reproduction, symptoms of damage caused by plant nematodes	2
11.	Liberation / dispersal and survival of plant pathogens.	2
12.	Pathogenesis. Role of enzymes, toxins and growth regulators in disease development.	3
13.	Defense mechanism in plants	2
14.	Epidemiology: Factors affecting disease development	2
15.	Methods of pesticide application and their safe use.	1
16.	Nature, classification of fungicides and antibiotics	2
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### Practical

S. No.	Lecture	Period
1.	Acquaintance with various laboratory equipments and microscopy.	1
2.	Collection and preservation of disease specimen	2
3.	Preparation of media, isolation and Koch's postulates.	3
4.	General study of different structures of fungi.	1
5.	Study of symptoms of various plant diseases. Study of representative fungal genera	2
6.	Study of fungicides and their formulations	1
7.	Methods of pesticide application and their safe use	1
8.	Calculation of fungicide sprays concentrations.	1
		12



### Theory

Importance of Biochemistry. Properties of Water, pH and Buffer. Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation; Structure of Disaccharides and Polysaccharides. Lipid: Importance and classification; Structures and properties of fatty acids; storage lipids and membrane lipids. Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids; Structural organization of proteins. Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots; Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure. Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain. Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids. Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture, anther culture, pollen culture and ovule culture and their applications; Micro-propagation methods; organogenesis and embryogenesis, Synthetic seeds and their significance; Embryo rescue and its significance; somatic hybridization and cybrids; Somaclonal variation and its use in crop improvement; cryo-preservation; Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods; Transgenics and its importance in crop improvement; PCR techniques and its applications; RFLP, RAPD, SSR; Marker Assisted Breeding in crop improvement; Biotechnology regulations.

### Practical

Preparation of solution, pH & buffers, Qualitative tests of carbohydrates and amino acids. Quantitative estimation of glucose/ proteins. Titration methods for estimation of amino acids/lipids, Effect of pH, temperature and substrate concentration on enzyme action, Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides. Sterilization techniques. Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium. Callus induction from various explants. Micro-propagation, hardening and acclimatization. Demonstration on isolation of DNA. Demonstration of gel electrophoresis techniques and DNA finger printing.

### Theory

S. No.	Lecture	Period
1	Importance of Biochemistry.	1
2	Properties of Water, pH and Buffer.	1
3	Carbohydrate: Importance and classification. Structures of Monosaccharides, Reducing and oxidizing properties of Monosaccharides, Mutarotation	1
4	Structure of Disaccharides and Polysaccharides.	1
5	Lipid: Importance and classification	1
6	Structures and properties of fatty acids; storage lipids and membrane lipids	1
7	Proteins: Importance of proteins and classification; Structures, titration and zwitterions nature of amino acids	1
8	Structural organization of proteins	1



9	Enzymes: General properties; Classification; Mechanism of action; Michaelis & Menten and Line Weaver Burk equation & plots	1
10	Introduction to allosteric enzymes. Nucleic acids: Importance and classification; Structure of Nucleotides, A, B & Z DNA; RNA: Types and Secondary & Tertiary structure	1
11	Metabolism of carbohydrates: Glycolysis, TCA cycle, Glyoxylate cycle, Electron transport chain	1
12	Metabolism of lipids: Beta oxidation, Biosynthesis of fatty acids	1
13	Concepts and applications of plant biotechnology: Scope, organ culture, embryo culture, cell suspension culture, callus culture	1
14	Another culture, pollen culture and ovule culture and their applications	1
15	Micro-propagation methods; organogenesis and embryogenesis	1
16	Synthetic seeds and their significance	1
17	Embryo rescue and its significance; somatic hybridization and cybrids	1
18	Somaclonal variation and its use in crop improvement	1
19	Cryo-preservation	1
20	Introduction to recombinant DNA methods: physical (Gene gun method), chemical (PEG mediated) and Agrobacterium mediated gene transfer methods	1
21	Transgenics and its importance in crop improvement	1
22	PCR techniques and its applications; RFLP, RAPD, SSR	1
23	Marker Assisted Breeding in crop improvement	1
24	Biotechnology regulations	1
		24

### Practical

S. No.	Lecture	Period
1	Preparation of solution, ph & buffers	1
2	Tests of carbohydrates and amino acids	1
3	Quantitative estimation of glucose/ proteins	1
4	Titration methods for estimation of amino acids/lipids	1
5	Effect of ph, temperature and substrate concentration on enzyme action	1
6	Paper chromatography/ TLC demonstration for separation of amino acids/ Monosaccharides	1
7	Sterilization techniques	1
8	Composition of various tissue culture media and preparation of stock solutions for MS nutrient medium	1
9	Callus induction from various explants	1
10	Micro-propagation, hardening and acclimatization	1
11	Demonstration on isolation of DNA	1
12	Demonstration of gel electrophoresis techniques and DNA finger printing	1
		12



AEXT 5121	Fundamentals of Agricultural Extension Education	3(2+1)
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### 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; extension teaching methods: meaning, classification, individual, group and mass contact methods, ICT Applications in TOT (New and Social Media), media mix strategies; communication: meaning and definition; Principles and Functions of Communication, models and barriers to communication. Agriculture journalism; diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories.

### Practical

To get acquainted 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; A visit to village to understand the problems being encountered by the villagers/ farmers; to study 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; exposure to mass media: visit to community radio and television studio for understanding the process of programme production; script writing, writing for print and electronic media, developing script for radio and television.

### Theory

S. No.	Lecture	Period
1	<b>Education:</b> Meaning, definition & Types	1
2	Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education	1
3	Extension Programme planning- Meaning, Process	1
4	Principles and Steps in Programme Development	1
5	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,	2



	Nilokheri Experiment, etc.)	
6	Various extension/ agriculture development programmes launched by ICAR/ Govt. Of India (IADP, IAAP, HYVP, KVK, IVLP, ORP, ND, NATP, NAIP, etc.)	1
7	New trends in agriculture extension: privatization extension, cyber extension/ e-extension, market-led extension, farmer-led extension, expert systems, etc.-	2
8	Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. Of India	2
9	Community Dev.-meaning, definition, concept & principles, Philosophy of C.D. Rural Leadership	1
10	Concept and definition, types of leaders in rural context	1
11	Extension administration: meaning and concept, principles and functions	1
12	Monitoring and evaluation: concept and definition, monitoring and evaluation of extension programmes	1
13	Transfer of technology: concept and models	1
14	Capacity building of extension personnel	1
15	Extension teaching methods: meaning, classification, individual, group and mass contact methods	1
16	ICT Applications in TOT (New and Social Media), media mix strategies	1
17	Communication: meaning and definition	1
18	Principles and Functions of Communication, models and barriers to communication	1
19	Agriculture journalism	1
20	Diffusion and adoption of innovation: concept and meaning, process and stages of adoption, adopter categories	2
		24

### Practical

S. No.	Lecture	Period
1	To get acquainted with university extension system	2
2	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	3
3	A visit to village to understand the problems being encountered by the villagers/ farmers; to study organization and functioning of DRDA and other development departments at district level	3
4	Visit to NGO and learning from their experience in rural development	1
5	Understanding PRA techniques and their application in village development planning; exposure to mass media	1
6	Visit to community radio and television studio for understanding the process of programme production	1
7	Script writing, writing for print and electronic media, developing script for radio and television	1
		12



AEC 5121	Farm Management, Production & Resource Economics	2 (1+1)
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### Theory

Meaning and concept of farm management, objectives and relationship with other sciences. Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage. Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income. Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency farm inventory, balance sheet, profit and loss accounts. Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks.

### Practical

Determination of cost of fencing of a farm. Computation of depreciation cost of farm assets. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. Determination of most profitable level of inputs use in a farm production process. Determination of least cost combination of inputs. Selection of most profitable enterprise combination. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. Preparation of farm plan and budget and profit & loss accounts. Collection and analysis of data on various resources in India.

### Theory

- 1 Meaning and concept of farm management, objectives and relationship with other sciences
- 2 Meaning and definition of farms, its types and characteristics, factor determining types and size of farms. Principles of farm management: concept of production function and its type, use of production function in decision-making on a farm, factor-product, factor-factor and product-product relationship, law of equi-marginal/or principles of opportunity cost and law of comparative advantage-2.
- 3 Meaning and concept of cost, types of costs and their interrelationship, importance of cost in managing farm business and estimation of gross farm income, net farm income, family labor income and farm business income-2
- 4 Farm business analysis: meaning and concept of farm income and profitability, technical and economic efficiency measures in crop and livestock enterprises
- 5 Importance of farm records and accounts in managing a farm, various types of farm records needed to maintain on farm, farm inventory, balance sheet, profit and loss accounts - 2
- 6 Meaning and importance of farm planning and budgeting, partial and complete budgeting, steps in farm planning and budgeting-linear programming, appraisal of farm resources, selection of crops and livestock's enterprises
- 7 Concept of risk and uncertainty occurs in agriculture production, nature and sources of risks and its management strategies, Crop/livestock/machinery insurance – weather based crop insurance, features, determinants of compensation



- 8 Concepts of resource economics, differences between NRE and agricultural economics, unique properties of natural resources
- 9 Positive and negative externalities in agriculture, Inefficiency and welfare loss, solutions, Important issues in economics and management of common property resources of land, water, pasture and forest resources etc.

**Practical**

- 1 Preparation of farm layout.
- 2 Determination of cost of fencing of a farm.
- 3 Computation of depreciation cost of farm assets.
- 4 Application of equi-marginal returns/opportunity cost principle in allocation of farm resources-2.
- 5 Determination of most profitable level of inputs use in a farm production process.
- 6 Determination of least cost combination of inputs.
- 7 Selection of most profitable enterprise combination.
- 8 Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises-2
- 9 Preparation of farm plan and budget, farm records and accounts and profit & loss accounts.
- 10 Collection and analysis of data on various resources in India





AENT 5121	Fundamentals of Entomology-II	2 (1+1)
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### Theory

S.No.	Lecture	Period
	<b>Part -I</b>	
1	Categories of pests; Concept of IPM, Practices, scope and limitations of IPM	1
2	Classification of insecticides, toxicity of insecticides and formulations of insecticides; Chemical control- importance, hazards and limitations	1
	<b>Part -II</b>	
3	Recent methods of pests control, repellents, antifeedants, hormones, attractants, gamma Radiation	1
4	Insecticides Act 1968- Important provisions	
5	Application techniques of spray fluids; Symptoms of poisoning, first aid and antidotes	1
	<b>Part -III</b>	
6	Systematics: Taxonomy – importance, history and development and binomial Nomenclature; Definitions of Biotype, Sub-species, Species, Genus, Family and Order	1
7	Classification of class Insecta upto Orders, basic groups of present day insects with special Emphasis to orders and families of Agriculture importance like Orthoptera: Acrididae, Tettigonidae, Gryllidae, Gryllotalpidae	1
8	Dictyoptera: Mantidae, Blattidae, Odonata; Isoptera: Termitidae; Thysanoptera: Thripidae	1
	<b>Part-IV</b>	
9	Hemiptera: Pentatomidae, Coreidae, Cimicidae, Pyrrhocoridae, Lygaeidae, Cicadellidae, Delphacidae, Aphididae, Coccidae, Lophophidae, Aleurodidae, Pseudococcidae	1
10	Neuroptera: Chrysopidae; Lepidoptera: Pieridae, Papiloidae, Noctuidae, Sphingidae, Pyralidae, Gelechiidae, Arctiidae, Saturnidae, Bombycidae	1
11	Coleoptera: Coccinellidae, Chrysomelidae, Cerambycidae, Curculionidae, Bruchidae, Scarabaeidae	1
12	Hymenoptera: Tenthridinidae, Apidae. Trichogrammatidae, Ichneumonidae, Braconidae, Chalcididae; Diptera: Cecidomyiidae, Tachinidae, Agromyziidae, Culicidae, Muscidae, Tephritidae	1
		12

### Practical

S.No.	Lecture	Period
1	Study of characters of orders and their families of agricultural importance	1
2	Orthoptera, Dictyoptera, Odonata, Isoptera, Thysanoptera, Hemiptera, Lepidoptera, Neuroptera, Coleoptera, Hymenoptera, Diptera	6
3	Insecticides and their formulations	1
4	Pesticide appliances and their maintenance	2
5	Sampling techniques for estimation of insect population and damage	2
		12

