

**Syllabus of B.Sc Agriculture
Biotechnology Maulana Abul Kalam
Azad University Of Technology, WB**

**Curriculum Structure of B.Sc Agriculture
Biotechnology Maulana Abul Kalam Azad
University of Technology, WB**

**Course Curriculum Structure (CBCS) of
B.Sc in Agriculture Biotechnology
Duration of Course – 03 years , 06 Semesters
Year of Commencement: 2021**

Aim & Objective : Indian Agriculture and Biotechnology sector together contributes around 18% in the GDP. It provides employment to more than 65% of the population. The sector is facing an increasing complex business environment due to integration of world market, technological advancement, development of the derivative market etc. To cater to this complexity skilled manpower is required to respond to the current situation and take quick and right decision. Agriculture and Biotechnology and Agriculture Biotechnology are being the prime focus on today's date for Indian economy requires skilled manpower across India.. Above all, there are huge self employment opportunities in Agriculture , Biotechnology and Agriculture Biotechnology Sector. To cater to this complexity skilled manpower in Agriculture Biotechnology is required to respond to the current situation and take quick and right decision with help of knowledge and skills they gain by pursuing the course .

Programme Outcomes : On Completion of the Course students will be able to

- **PO 1 :** Develop/ Apply knowledge related to planning, formulation, monitoring and evaluation of Agriculture , Biotechnology and Agriculture Biotechnology development projects and programmes
- **PO 2 :**Develop/ Apply Skills to address the demands of the agrorural business , Agri Biotech and Biotech and allied sectors which are experiencing frequent changes.
- **PO 3 :**Develop/ Apply knowledge to use of latest techniques and tools in Agriculture , Biotechnology & Agriculture Biotechnology sector.
- **PO 4 :**Develop/ Apply the basic aspects of Agro Biotech research and project work
- **PO 5 :**Develop/ Apply knowledge and skills providing an integrated perception of Biotechnology and Agriculture encompassing various aspects of rural life.
- **PO 6 :**Develop/ Apply to acquire the competency to function as effective Agro Biotech managers.
- **PO 7 :**Develop/ Apply Skills to implement latest technology in the field.
- **PO 8 :**Develop/ Apply ability to observe and understand the problems arising in the sector with a view of solving the same.
- **PO 9 :**Develop/ Apply the techno-managerial competence of extension functionaries.
- **PO 10 :**Develop/ Apply managerial functionaries on the latest developments in the field
- **PO 11 :**Develop/ Apply necessary Skills for participatory decision making.
- **PO 12 :**Develop/ Apply Knowledge and skills to organise various marketing activity.
- **PO 13 :**Develop/ Apply Ability Skills to assist effectively in managerial decision making.
- **PO 14 :**Develop/ Apply skills to work independently and lead teams.
- **PO 15 :**Develop/ Apply Knowledge and Techniques for effective handling of assigned tasks.

Curriculum Structure
BSc in Agriculture Biotechnology (CBCS) Curriculum , Credit and Marks Division
throughout Semester

Year	Semester	Course Type	Credit	Marks		
				CA	ESE	Total
I	I	Core Course – 1 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 2 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Ability Enhancement Compulsory Course – 1 (2 Credits) [Any One]	02	30	70	100
		Generic Elective Course -1 (06 Credits) (Any One)	04 Theory	30	70	100
			02 Practical/ Tutorial	40	60	100
		Total Semester Credit			20	Total Marks
Year	Semester	Course Type	Credit	Marks		
				CA	ESE	Total
I	II	Core Course – 3 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 4 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Ability Enhancement Compulsory Course – 2 (2 Credits) [Any One]	02	30	70	100

		Generic Elective Course -2 (06 Credits) (Any One)	04 Theory	30	70	100
			02 Practical/ Tutorial	40	60	100
Total Semester Credit			20	Total Marks		700
Year	Semester	Course Type	Credit	Marks		
				CA	ESE	Total
II	III	Core Course – 5 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 6 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 7 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Skill Enhancement Course - 1 (2 Credits) [Any One]	02	30	70	100
		Generic Elective Course -3 (06 Credits) (Any One)	04 Theory	30	70	100
02 Practical/ Tutorial	40		60	100		
Total Semester Credit			26	Total Marks		900
Year	Semester	Course Type	Credit	Marks		
				CA	ESE	Total
II	IV	Core Course – 8 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 9 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100
		Core Course – 10 (06 Credits)	04 Theory	30	70	100
			02 Practical	40	60	100

		Skill Enhancement Course - 2 (2 Credits) [Any One]	02	30	70	100		
		Generic Elective Course -4 (06 Credits) (Any One)	04 Theory	30	70	100		
			02 Practical/ Tutorial	40	60	100		
Total Semester Credit			26	Total Marks		900		
III	V	Core Course – 11 (06 Credits)	04 Theory	30	70	100		
			02 Practical	40	60	100		
		Core Course – 12 (06 Credits)	04 Theory	30	70	100		
			02 Practical	40	60	100		
		Discipline Specific Elective - 1 (06 credits) [Any One From A Group]	04 Theory	30	70	100		
			02 Practical	40	60	100		
		Discipline Specific Elective - 2 (06 credits) [Any One From B Group]	04 Theory	30	70	100		
			02 Practical	40	60	100		
		Total Semester Credit			24	Total Marks		800
		III	VI	Core Course – 13 (06 Credits)	04 Theory	30	70	100
02 Practical	40				60	100		
Core Course – 14 (06 Credits)	04 Theory			30	70	100		
	02 Practical			40	60	100		
Discipline Specific Elective - 3 (06 credits) [Any One From A Group]	04 Theory			30	70	100		
	02 Practical			40	60	100		
Discipline Specific Elective - 2 (06 credits) [Dissertation/ Project]	06					100		
Total Semester Credit				24	Total Marks		700	

Total course Credit – 140 , Total marks – 3800 C = Core Course , AE = Ability Enhancement Compulsory Course , GE = Generic Elective , SEC = Skill Enhancement

Course , DSE = Discipline Specific Elective , CA= Continuous Assessment , ESE= End Semester Examination

Credit wise Contact Hours

Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
I	I	Core Course – 1 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Core Course – 2 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Ability Enhancement Compulsory Course – 1 (2 Credits) [Any One]	02	02	0	0
		Generic Elective Course -1 (06 Credits) (Any One)	04 Theory	04	0	0
			02 Practical/ Tutorial	0	0	02
		Total Semester Credit			20	
Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
I	II	Core Course – 3 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Core Course – 4 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Ability Enhancement Compulsory Course – 2 (2 Credits) [Any One]	02	02	0	0

		Generic Elective Course -2 (06 Credits) (Any One)	04 Theory	04	0	0
			02 Practical	0	0	02
Total Semester Credit			20			
Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
II	III	Core Course – 5 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Core Course – 6 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Core Course – 7 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Skill Enhancement Course - 1 (2 Credits) [Any One]	02	02	0	0
		Generic Elective Course -3 (06 Credits) (Any One)	04 Theory	04	0	0
			02 Practical	0	0	02
		Total Semester Credit			26	
Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
II	IV	Core Course – 8 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Core Course – 9 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02

		Core Course – 10 (06 Credits)	04 Theory	04	0	0
			02 Practical	0	0	02
		Skill Enhancement Course - 2 (2 Credits) [Any One]	02	30	70	100
		Generic Elective Course -4 (06 Credits) (Any One)	04 Theory	04	0	0
			02 Practical	02	0	0
Total Semester Credit			26			
Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
III	V	Core Course – 11 (06 Credits)	04 Theory	04	0	0
			02 Practical	02	0	0
		Core Course – 12 (06 Credits)	04 Theory	04	0	0
			02 Practical	02	0	0
		Discipline Specific Elective - 1 (06 credits) [Any One From A Group]	04 Theory	04	0	0
			02 Practical	02	0	0
		Discipline Specific Elective - 2 (06 credits) [Any One From B Group]	04 Theory	04	0	0
			02 Practical	02	0	0
Total Semester Credit			24			
Year	Semester	Course Type	Credit	Contact Hours (Period / Week)		
				Lecture	Tutorial	Practical
		Core Course – 13 (06 Credits)	04 Theory	04	0	0
			02 Practical	02	0	0

III	VI	Core Course – 14 (06 Credits)	04 Theory	04	0	0
			02 Practical	02	0	0
		Discipline Specific Elective - 3 (06 credits) [Any One From A Group]	04 Theory	04	0	0
			02 Practical	02	0	0
		Discipline Specific Elective - 2 (06 credits) [Dissertation/ Project]	06	0	01	05
		Total Semester Credit			24	

Year & Semesterwise Subject details
Year – I
Semester – I

CORE COURSE(4+2 credits)		ABILITY ENHANCEMENT COMPULSORY(2 credits) [Any One]		GENERIC ELECTIVE(4+2 credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Concept of Plant Biology & Crop Physiology	CAGBT-101	English Communication	AGBT-103A	Fundamentals of Biotechnological Application in Agriculture	GGBT-104A
Lab on Concept of Plant Biology & Crop Physiology	CAGBT-191	Environmental Studies	AGBT-103B	Lab on Fundamentals of Biotechnological Application in Agriculture	GGBT-194A
Principles of Cell Biology	CAGBT-102	Values and Ethics in Profession	AGBT-103C	Fundamentals of Bioanalytical Techniques	GGBT-104B
Lab on Principles of Cell Biology	CAGBT-192			Lab on Fundamentals of Bioanalytical Techniques	GGBT-194B

Year – I Semester – II

CORE COURSE (4+2 Credits)		ABILITY ENHANCEMENT COMPULSORY (2 Credits) [Any One]		GENERIC ELECTIVE (4+2 Credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Principles of Soil Science Nutrient Management & Soil Microbiology	CAGBT-201	Fundamentals of Computer	AGBT- 203A	Farm Power , Farm Machinery & Post Harvest Technology	GGBT-204A
Lab on Principles of Soil Science Nutrient Management & Soil Microbiolog	CAGBT-291			Lab on Farm Power , Farm Machinery & Post Harvest Technology	GGBT-294A
				Environmental Studies	AGBT- 203B
Fundamentals of Biochemistry	CAGBT-202	Values and Ethics in Profession	AGBT- 203C	Lab on Principles of Agriculture Meteorology	GGBT-294B
Lab on Fundamentals of Biochemistry	CAGBT-292				

Year – II
Semester – III

CORE COURSE (4+2 Credits)		SKILL ENHANCEMENT COURSE (2 Credits) [Any One]		GENERIC ELECTIVE(4+2 Credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Crop Production Technology – I (Kharif)	CAGBT-301	GMOs , Biosafety , Bioethics & IPR	SGBT-304A	Principles of Food Processing Technology	GGBT-305A
Lab on Crop Production Technology – I (Kharif)	CAGBT-391			Lab on Principles of Food Processing Technology	GGBT-395A
Fundamentals of General Immunology & Plant’s Protection Mechanism	CAGBT-302	Photochemistry & Secondary Metabolites	SGBT-304B	Principles of Farm Management	GGBT-305B
Lab on Fundamental s of General Immunology & Plant’s Protection Mechanism	CAGBT-392			Lab on Principles of Farm Management	GGBT-395B
Principles of Microbiology	CAGBT-303	Research Methodology & Biostatistics	SGBT-304C	Food & Dairy Microbiology	GGBT-305C
Lab on Principles of Microbiology	CAGBT393				

Year – II
Semester – IV

CORE COURSE(4+2 credits)		SKILL ENHANCEMENT COURSE (2 credits)[Any One]		GENERIC ELECTIVE(4+2 credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Crop Production Technology – II (Rabi)	CAGBT-401	Organic Farming	SGBT-404A	Fundamentals of Horticulture	GGBT-405A
Lab on Crop Production Technology – II (Rabi)	CAGBT-491	Plant Metabolic Engineering & Molecular Farming	SGBT-404B	Lab on Fundamentals of Horticulture	GGBT-495A
Concepts of Molecular Biology	CAGBT402	Advanced Concepts of Application of Biotechnology in Agriculture & Human Welfare	SGBT-404C	Floriculture and Landscaping	GGBT-405B
Lab on Concepts of Molecular Biology	CAGBT492			Lab on Floriculture & Landscaping	GGBT-495B
Fundamentals of Irrigation & Water Management	CAGBT403			Fundamentals of Poultry & Fishery Management	GGBT -405C
Lab on Fundamentals of Irrigation & Water Management	CAGBT493			Lab on Fundamentals of Poultry & Fishery Management	GGBT 495C

Year – III
Semester – V

CORE COURSE (4+2 credits)		DISCIPLINE SPECIFIC ELECTIVE (4+2credits) [Any One (T+P)from A group and one from B group]	
Paper Name	Paper Code	Paper Name	Paper Code
Seed Science & Technology	CAGBT-501	Pest Management in Crops	DGBT-503A
Lab on Seed Science & Technology	CAGBT -591	Lab on Pest Management in Crops	DGBT -593A
Genetics & Plant Breeding	CAGBT -502	Fundamentals of Bioinformatics	DGBT -504A
Lab on Genetics & Plant Breeding	CAGBT -592	Lab on Fundamentals of Bioinformatics	DGBT 594 A
		Plant Tissue Culture	DGBT-503B
		Lab on Plant Tissue Culture	DGBT-593B
		Agrobiodiversity Management	DGBT - 504B
		Lab on Agrobiodiversity Management	DGBT - 594B

Year – III
Semester – VI

CORE COURSE(4+2 credits)		DISCIPLINE SPECIFIC ELECTIVE(4+2 credits) [Any One (T+P) from A group, Project / Dissertation is compulsory]	
Paper Name	Paper Code	Paper Name	Paper Code
Recent Trends in Agriculture	CAGBT-601	Agriculture Extension Management	DGBT-603A
Lab on Recent Trends in Agriculture	CAGBT -691	Lab on Agriculture Extension Management	DGBT-693A
Disease Management in Crops	CAGBT -602	Business Scope in Agriculture Biotechnology & allied field	DGBT-604A
Lab on Disease Management in Crops	CAGBT -692	Lab Business Scope in Agriculture Biotechnology & allied field	DGBT-694A
		Project/ Dissertation	DGBT-681

Note :

- **Mode of Delivery of Programme : Offline , Online and Blended**
- **MOOCS and MAR for Obtaining Honours Degree as per MAKAUT Norms and Regulation**



Detailed Syllabus

Year – I
Semester – I

CORE COURSE(4+2 credits)		ABILITY ENHANCEMENT COMPULSORY(2 credits) [Any One]		GENERIC ELECTIVE(4+2 credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Concept of Plant Biology & Crop Physiology	CAGBT-101	English Communication	AGBT-103A	Fundamentals of Biotechnological Application in Agriculture	GGBT-104A
Lab on Concept of Plant Biology & Crop Physiology	CAGBT-191	Environmental Studies	AGBT-103B	Lab on Fundamentals of Biotechnological Application in Agriculture	GGBT-194A
Principles of Cell Biology	CAGBT-102	Values and Ethics in Profession	AGBT-103C	Fundamentals of Bioanalytical Techniques	GGBT-104B
Lab on Principles of Cell Biology	CAGBT-192			Lab on Fundamentals of Bioanalytical Techniques	GGBT-194B

Semesterwise Detailed Syllabus

Year – I

Semester- I

Paper Name : Concept of Plant Biology & Crop Physiology (Theory) Paper

Type : Core Paper Code : CAGBT- 101 Credit : 04 L: 4 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of Plant Biology & Crop Physiology and understand its association with Agriculture Biotechnology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of Plant Biology

CO 2 : learn and gain knowledge about Concept of Crop Physiology

CO 3 : Comprehend the systems , components , types , process of operation demands of the Plant biology & Crop Physiology and its association with Agriculture Biotechnology

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Plant biology & Crop Physiology and its association with Agriculture Biotechnology

CO 5 : Learns to analyse the governing principles and sciences of Plant biology & Crop Physiology and its association with Agriculture Biotechnology

CO 6 : Synthesize required techno managerial process solution and application required in Plant biology & Crop Physiology and its association with Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

Content :

Unit 1: Introduction to the living world, diversity and characteristics of life, Origin of life, Evolution and Eugenics, Cell and cell division, Binomial nomenclature and classification , Plant systematic- viz; Brassicaceae, Fabaceae and Poaceae, Morphology of flowering plants , Concept of Seed and seed germination. (08 L)

Unit 2 : Introduction to crop physiology and its importance in Agriculture (08 L)

Unit 3 : Plant cell: an Overview; Diffusion and osmosis; Absorption of water, transpiration and Stomatal Physiology; Photosynthesis: Light and Dark reactions, C₃, C₄ and CAM plants, Respiration: Glycolysis, TCA cycle and electron transport chain (08 L)

Unit 4 : 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 (08 L)

Unit 5 : Mineral nutrition of Plants: Functions and deficiency symptoms of nutrients, nutrient

uptake mechanisms; (08 L)

Suggested Readings

1. A C Dutta , Botany for the Degree Students , Oxford University Press
2. Hait , Bhattacharya , Ghosh , A Text Book of Botany , Vol 1, New Central Book Agency Pvt Ltd
3. Hait , Bhattacharya , Ghosh , A Text Book of Botany , Vol 2, , New Central Book Agency Pvt Ltd
4. Hait , Bhattacharya , Ghosh , A Text Book of Botany , Vol 3, , New Central Book Agency Pvt Ltd
5. J . N . Mitra , S.K. Chowdhury, Studies in Botany Moulik Library
6. A C Dutta , A Class Book of Botany , Oxford University Press
7. V.K. Jain , Fundamentals of Plant Physiology , S Chand & Company Ltd

**Paper Name : Lab On Concept of Plant Biology & Crop Physiology
(Practical) Paper Type : Core Paper Code : CAGBT- 191 Credit : 02
L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: This course is designed to impart necessary Practical knowledge and skill on understanding the Concepts of Plant Biology & Crop Physiology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge by doing hands on Practical and Filed & Farm level study about Concept of Plant Biology

CO 2 : learn and gain knowledge by doing hands on Practical and Filed & Farm level study about Concept of Crop Physiology

CO 3 : Comprehend the systems , Practical know how , components , types , process of Practical operation demands of the Plant biology & Crop Physiology and its practical association with Agriculture Biotechnology by doing hands on Practical sessions and Filed & Farm level study

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Practical parts of the Plant biology & Crop Physiology and its association with Agriculture Biotechnology by doing hands on Practical sessions and Filed & Farm level study

CO 5 : Learns to analyse the governing principles and sciences of Practical parts of Plant biology & Crop Physiology and its association with Agriculture Biotechnology by doing hands on Practical sessions and Filed & Farm level study

CO 6 : Synthesize required techno managerial process solution and application required in Practical field of Plant biology & Crop Physiology and its association with Agriculture Biotechnology by doing hands on Practical sessions and Filed & Farm level study

CO 7 : Evaluate the situation and present status prevailing in the Practical field and act accordingly by doing hands on Practical sessions and Filed & Farm level study

Content

1. Morphology of flowering plants – root, stem and leaf and their modifications. (3 P)
2. Study of Inflorescence, flower and fruits. (3 P)
3. Study of Internal structure of root, stem and leaf. (Specimens and slides) (4 P)
4. Description of plants - Brassicaceae, Fabaceae and Poaceae. (4 P)
5. Study of plant cells (3 P)
6. Study of structure and distribution of stomata, imbibitions, osmosis, plasmolysis. (4 P)
7. measurement of root pressure, rate of transpiration, (4 P)
8. Separation of photosynthetic pigments through paper chromatography, (4 P)
9. Study of rate of transpiration, photosynthesis, respiration (4 P)
10. Tissue test for mineral nutrients (4 P)
11. Estimation of relative water content. (3 P)

Paper Name : Principles of Cell Biology (Theory)

**Paper Type : Core Paper Code : CAGBT- 102 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of Cell Biology and understand its association with Agriculture Biotechnology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of Cell Biology

CO 2 : learn and gain knowledge about Concept and components of Cell , Tissue , Cellular structure and functions , Cellular components , Cell cycle etc

CO 3 : Comprehend the systems , components , types , process of operation demands of the Cell Biology and its association with Agriculture Biotechnology

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Cell biology and its association with Agriculture Biotechnology

CO 5 : Learns to analyse the governing principles and sciences of Cell biology and its association with Agriculture Biotechnology

CO 6 : Synthesize required techno managerial process solution and application required in Cell biology and its association with Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

Content :

Unit 1 : Basics of Cell Biology (structure & function) – Discovery of cell and Cell Theory; Comparison between plant and animal cells; cytosol, compartmentalization of eukaryotic cells, cell fractionation. Cell Membrane and Permeability: Chemical components of biological membranes, organization and Fluid Mosaic Model, membrane as a dynamic entity, cell recognition and membrane transport. Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton; Protoplasm; Mitochondria; Chloroplast; ER; Golgi complex; (8L)

Unit 2: Membrane Vacuolar system, cytoskeleton and cell motility : Structure and function of microtubules, Microfilaments, Intermediate filaments. Endoplasmic reticulum: Structure, function including role in protein segregation. Golgi complex: Structure, biogenesis and

functions including role in protein secretion. (8L)

Unit 3 : Lysosomes: Vacuoles and micro bodies: Structure and functions Ribosomes: Structures and function including role in protein synthesis. Mitochondria: Structure and function, Genomes, biogenesis. Chloroplasts: Structure and function, genomes, biogenesis Nucleus: Structure and function, chromosomes and their structure. (8L)

Unit 4 : Extracellular Matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extra cellular matrix, macromolecules, regulation of receptor expression and function. Signal transduction. (8L)

Unit 5 : Cell cycle - An overview of cell cycle; Components of cell cycle control system; Intracellular and Extra-cellular control of cell division, Programmed cell death (Apoptosis), intrinsic & extrinsic pathways of cell death, Apoptosis in relation with Cancer, Cancer: Carcinogenesis, agents promoting carcinogenesis, characteristics and molecular basis of cancer. (8L)

Suggested Readings

1. Cell Biology , C.B.Power , Himalaya
2. Pren Singh Verma/Vinod Kr Agarwal , 1973, Cell Biology, Genetics and Ecology, S. Chand And Co Pvt.Ltd
3. Cellular & Biochemical Sciences , G Tripathi , IK International
4. Biological Science , Taylor , Green & Stout , Cambridge University Press
5. Cell & Molecular Biology , De Robertis , CCH

**Paper Name : Lab On Principles of Cell Biology (Practical) Paper Type :
Core Paper Code : CAGBT- 192 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: This course is designed to impart Practical knowledge and skill on understanding the Concepts of Cell Biology and understand its association with Agriculture Biotechnology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain by doing hands on Practical on Practical knowledge about Concept of Cell Biology

CO 2 : learn and gain knowledge by doing hands on Practical about Concept and components of Cell , Tissue , Cellular structure and functions ,Cellular components , Cell cycle etc

CO 3 : Comprehend the systems , components , types , process of operation demands of the Cell Biology and its association with Agriculture Biotechnology by doing hands on Practical

CO 4 : Learn to apply Practical and technical knowledge and skills required for understanding and application of the Cell biology and its association with Agriculture Biotechnology

CO 5 : Learns to analyse the governing principles and sciences of Cell biology and its association with Agriculture Biotechnology by doing hands on Practical

CO 6 : Synthesize required techno managerial process solution and Practical application

required in Cell biology and its association with Agriculture Biotechnology by doing hands on Practical

CO 7 : Evaluate the Practical situation and present status prevailing in the field and act accordingly by doing hands on Practical

Content :

1. Preparation of Mitotic Chromosome from onion root tip. (6 P)
2. Study of different cells under Microscope (Slide Observation) (5 P)
3. Preparation of Meiotic Chromosome from Rhoeo discolor or onion sp. (6 P)
4. Preparation and study of polytene chromosome from Drosophila salivary gland. (6 P)
5. Study of sex chromatin through preparation of Barr body from buccal epithelium. (6 P)
6. Study of chromosomal aberration induced by pesticide in onion root tips. (6 P)
7. Study of plasmolysis and de-plasmolysis. (5 P)

Paper Name : English Communication (Theory)

Paper Type : Ability Enhancement Compulsory

Paper Code:AGBT-103A Credit : 02 L: 2 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objective: The course is designed to develop the student's communicative competence in English by giving adequate exposure in the four communication skills - LSRW - listening, speaking, reading and writing and the related sub- skills, thereby, enabling the student to apply the acquired communicative proficiency in social and professional contexts.

COURSE OUTCOMES: On Completion of the Course, Students will be able to:

CO1: Explain the basic terms used by the patients in conveying their problems

CO2: Generate a summary of the patient's problems for onward transmission to the doctor

CO3: Interpret the advice of the doctor which is generated in the form of a prescription

CO4: Explain the prescription to the patient

CO5: Apply techniques of communication by minimal physical input in repetitive scenarios

Unit 1 : Basic Introduction to English : Nouns , Pronouns , Articles , Introduction to Adjectives , Degrees of Comparison , Types of Adjectives , Introduction to Verbs , Forms of Verbs , Types of Verbs, Types of Adverbs , Comparison of Adverbs , Simple Present Tense , Simple Past Tense, Simple Future Tense, Types of Prepositions , Punctuation, Basics of sentence construction- Conjunctions , Interjections , Sentence Construction , Verb Conjugation , Rules of Subject- Verb Conjugation , Types of Tenses , Verb Conjugation for Regular or Irregular Verbs, Voice , improvement of sentences, rearrangement of sentences. Vocabulary: usage, synonyms, antonyms Punctuation - The full stop , The question mark , The comma , Capital letters , The apostrophe , The exclamation mark (04 L)

Unit 2 : Writing:- Writing a Business Letter , Reply to the letter, Conducting Meetings, Writing Minutes, Sending Memos and Notices; Effective E - mail Communication; Telephone Etiquette before and while appearing for an interview, Job Application and CV writing , Basics of Greeting , Writing The Essay, Writing The Precis, Writing The Report (04 L)

Unit 3 : Listening , speaking, writing, interpreting - Techniques for listening actively & effectively , Practice Paraphrasing for clarity , Responding methods to deliver message , Writing for target audience, Ways to write clearly Strategies for reading better - survey semantic markers notes , survey a text to predict the content , recognise the functions of discourse markers, and take notes from a passage efficiently , Performing language functions - Making an apology , Seeking clarification , Describing objects, processes, etc (**04 L**)

Unit 4 : Business Presentation and Public speaking in English: Business presentations - what/why/when , Technicalities of a business presentation , Tips and practise on delivering a business presentation , Language - Dos and donts (**04 L**)

Unit 5 : Communication Skill: Meaning of Communication; Role of Communication in Business ; Basic elements of the Communication process, level of Communication, forms, models and media of Communications, Verbal and non-verbal , Inter-Cultural and group communications Communication-functions and types. Barriers to effective , Communication. Overcoming barriers in communication (**04 L**)

Spoken English (Class Practice on a daily basis) Making an Impactful Professional Introduction , Phonetics, Asking for help or offering help & Talking to the senior colleague or reporting authority , Talking to Co- workers , Talking to different clients , Debate on topics of interest , Effective Expressions while delivery of specific sentences requesting answers , Sentence making competition , Performance Review - Interactive Session & Role Plays , Requesting Leave (Vacation) , Use vocal inflection for greater interest and effectiveness - Business Phone Call , How to converse during Presentations - Interactive Session , Certificate of Appreciation , Interview your partner for a Job in front of the class, Greetings in the Classroom , Greetings before a Conversation , Introducing yourself and others, Talking about Role Model , Speech - with your trainer, and in front of your mirror at home, Role Plays ,Group Discussions , Making Presentation in front of classmates and trainer

Suggested Readings :

1. Sharmila ,2013 , Essentials Of Communicative English, Vrinda Publications Pvt.Ltd
2. P.K.De Sarkar, 1997, Higher Secondary English Grammer & Composition , Calcutta Book House Pvt.Ltd
3. R.V. Bady,Mrs Aruna Kothan Daram , 2014 , Business Communication , Vrinda Publications Pvt.Ltd
4. Petes S. J., 2011 , Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw -Hill Education
5. Laxminarayanan , 2012, English for Technical communication, , Scitech
6. Balasubramanyam, M. 1985. Business Communication. Vani Education Books
7. Krishna Mohan and Meera Banerjee. 1990. Developing Communication Skills. McMillan India
8. Dangi K.L.,S.S. Sisoda, Pravesh Singh Chauhan and Yogita Ranavat. A Text Book of Communication Skills. Agrotech Publications
9. Shivaraman K. 2009. Communication Skills. APH publications

Paper Name : Environmental Studies (Theory)
Paper Type : Ability Enhancement Compulsory
Paper Code : AGBT-103B Credit : 02 L: 2 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objective: The course is designed to provide a working knowledge of environment, ecology and physical sciences for problem solving. The learner will be able to remember, understand and apply the taught concepts and methods involving social and environmental processes for betterment of environmental health and safety

COURSE OUTCOMES: On Completion of the Course, Students will be able to:

CO 1 : comprehend and understand the basic concepts related to environment & ecology

CO 2 : comprehend and understand the scientific problem related to air, water, noise & land pollution

CO 3 : comprehend and understand different environmental laws , regulations , guidelines and applying those for maintaining quality of environmental health and safety .

CO 4 : Gain in-depth knowledge on natural processes that sustain life, and governing the resource distribution and resource management

CO 5 : Predict the consequences of human actions on the web of life, global economy , environment and quality of human life.

CO 6 : . Develop critical thinking for shaping strategies (scientific, social, economic, environmental and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.

CO 7 : Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.

CO 8 : Adopt sustainability as a practice in life, society and industry

Unit 1 : Environment: Environment , Scope and importance of Environmental Studies. Components of environment - i) Atmosphere, composition of atmosphere, ii) lithosphere – structure of lithosphere, soil formation, soil composition and properties of soil. iii)Hydrosphere – distribution of water on earth, global water balance and hydrological cycle. (3 L)

Unit 2 : Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (3 L)

Unit 3 : Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems,

changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles (3 L)

Unit 4 : Environment problems: i.Air pollution – concept, source of air pollution, major atmospheric pollutants, air quality standards monitoring of major air pollutants. ii.Water pollution – sources of water pollution, river pollution, underground water pollution, oil pollution, thermal pollution, water pollution due to sewage, effects of water pollution , waste water treatment iii.Noise pollution – sources of noise, effects of noise pollution, noise pollution, noise pollution control equipment silencers and noise absorbing devices, noise standards and industrial noise control. iv.Soil pollution – causes of soil pollution major soil pollutants, industrial waste and their role in soil pollution. v.Radiation pollution – sources of radioactive pollution, effects of radioactive pollution on health (3 L)

Unit 5 : Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation.Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity (3 L)

Unit 6 : Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents (3 L)

Unit 7 : Different Environmental Movements wrt India , Concept of Water & soil Conservation, Different Acts and Laws wrt Environmental Protection , Environmental Ethics , Sustainable Development , Different global summits wrt Environment , Millenium Goals (2 L)

Suggested Readings

1. R.K. Ghosh, Ananta Das , 2002, Environmental Study, Oriental Book Compani Pvt.Ltd
2. H S Bhatia , 2003, A Text Book on Environmental Pollution And Control, Galgotia Publication Pvt.Ltd
3. S.C.Santra , 2001, Environmental Science, New Central Book Agency pvt.Ltd
4. Mohan P Arora ,2004, Ecology , Himalaya Publishing House
5. Y Anjaneyulu , 2004, Introduction To Environmental Science , B S Publications
6. P.D.Sharma , 2003, Ecology and Environment, Rastogi Publications

Paper Name : Values and Ethics in Profession (Theory)

Paper Type : Ability Enhancement Compulsory

Paper Code : AGBT-103C Credit : 02 L: 2 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objective: The course is designed to create an awareness on Ethics and Human Values with an aim to instill Moral and Social Values and Loyalty amongst professionals and to appreciate the rights of others ensuring to create awareness on assessment of safety and risk

COURSE OUTCOMES: On Completion of the Course, Students will be able to:

CO 1 : Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field

CO 2 : Identify the multiple ethical interests at stake in a real-world situation or practice

CO 3 : Articulate what makes a particular course of action ethically defensible.

CO 4 : Assess their own ethical values and the social context of problems

CO 5 : Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human.

CO 6 : . Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

CO 7 : integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Content :

Unit 1 : Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation, Sensitivity, Success, Selfless Service, Case Study of Ethical Lives, Positive Spirit, Body, Mind and Soul Attachment and Detachment, Spirituality Quotient. (5 L)

Unit 2 : Ethics of Profession: Ethical issues in practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies. (5 L)

Unit 3 : Profession and Human Values: Values Crisis in contemporary society Nature of values: Value Spectrum of a good life Psychological values: Integrated personality; mental health Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. (5 L)

Unit 4 : Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility. (5 L)

Suggested Readings :

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. A N Tripathy, 2003, Human Values, New Age International Publishers
3. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

**Paper Name : Fundamentals of Biotechnological Application in Agriculture
(Theory)**

Paper Type : Generic Elective Paper Code : GGBT- 104A

Credit : 04 L: 4 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of diversified Biotechnological application in the field of Agriculture .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of application of diversified biotechnological applications in the field of Agriculture

CO 2 : learn and gain knowledge about Concept , types , components , production and application and impacts of Biofertilizers, Biopesticides , Mushrooms , GMOs , Genetic Engineering , Recombinant DNA Technology , Tissue culture , Biofuel etc

CO 3 : Comprehend the systems , components , types , process of operation demands of the Agriculture Biotechnology Industry

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Agriculture Biotechnology

CO 5 : Learns to analyse the governing principles and sciences of Agriculture Biotechnology

CO 6 : Synthesize required techno managerial process solution and application required in Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

Content :

Unit 1 : Principles of Biotechnological Application in Agriculture , Introduction to microbial world , Prokaryotic and eukaryotic microbes. Microbial growth in models of bacterial, yeast and mycelia growth curve. (6 L)

Unit 2 : Bacteria: cell structure, chemoautotrophy, photo autotrophy, growth. Bacterial genetics: Genetic recombination transformation, conjugation and transduction, plasmids, transposon (6 L)

Unit 3: 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. (6 L)

Unit 4 : Microbes in human welfare and silage production, biofertilizers, biopesticides, biofuel production and biodegradation of agro-waste. (6 L)

Unit 5 : Sterilization methods – Physical and chemical, Isolation of pure cultures and preservation of cultures (**6 L**)

Unit 6 : Mushrooms- edible and poisonous types, nutritive values, Culturing and production techniques. (**4 L**)

Unit7 : Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Genetic modification in Agriculture – transgenic plants, genetically modified foods, application, future applications, ecological impact of transgenic plants. (**6 L**)

Suggested Books

1. Naveen Kango , 2010, Text Book of Microbiology , I.K. International Publishing House Pvt.Ltd
2. G. Rangaswami, D.J. Bagyaraj , 2016 , Agricultural Microbiology, PHI Learning Pvt.Ltd
3. Shiva Aithal, Nikhilesh Kulkarni , 2010, Modern Approaches Soil Agriculture & Environmental Microbiology , Himalaya Publishing House
4. Ahindra Nag , 2008 , Text Book Of Agricultural Biotechnology, PHI Learning
5. Alexander N. Glazer, Hiroshi Nikaido , 2008 , Microbial Biotechnology Fundamentals Of Applied Microbiology , Cambridge University Press
6. Microbiology. Pelczar, J.r.,M.J.E.C.S.Chan and Krieg, N.R, 2009, McGraw Hill Publishers
7. Microbiology. Prescott, L.M, Harley, J.P. and Klein, D.A., 2008, McGraw Hill Publishing Ltd
8. Brock Biology of Microorganisms. Madigan, M.,Martinko, J.M. and Parker, J. 2009, . Prentice Hall of India Pvt. Ltd.
9. Soil Microbiology: Subba Rao, N.S.(4th Ed.) 2014. Oxford & IBH Publishing Co.Pvt. Ltd.

Paper Name : Lab On Fundamentals of Biotechnological Application in Agriculture (Practical)

Paper Type : Generic Elective Paper Code : GGBT- 194A

Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart necessary Practical knowledge and skill on understanding the Concepts of diversified Biotechnological application in the field of Agriculture .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain Practical knowledge about Concept of application of diversified biotechnological applications in the field of Agriculture by doing necessary hands on Practical and industry sessions

CO 2 : learn and gain Practical knowledge about Concept , types , components , production and

application and impacts of Biofertilizers, Biopesticides , Mushrooms , GMOs , Genetic Engineering , Recombinant DNA Technology , Tissue culture , Biofuel etc by doing necessary hands on Practical and industry sessions

CO 3 : Comprehend the systems , components , types , process of operation demands of the Agriculture Biotechnology Industry by doing necessary hands on Practical and industry sessions

CO 4 : Learn to apply Practical technical knowledge and skills required for understanding and application of the Agriculture Biotechnology by doing necessary hands on Practical and industry sessions

CO 5 : Learns to analyse the governing principles and sciences of Agriculture Biotechnology by doing necessary hands on Practical and industry sessions

CO 6 : Synthesize required techno managerial process solution and application required in Agriculture Biotechnology by doing necessary hands on Practical and industry sessions

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly by doing necessary hands on Practical and industry sessions

Content :

1. Introduction to microbiology laboratory and its equipments; (1 P)
2. Microscope- parts, principles of microscopy, resolving power and numerical aperture. (2 P)
3. Methods of sterilization. (2 P)
4. Nutritional media and their preparations. (3P)
5. Broth culture, agar slopes, streak plates and pour plats, turbid metric estimation of microbial growth (3P)
6. Enumeration of microbial population in soil- bacteria, fungi, actinomycetes. (3P)
7. Methods of isolation and purification of microbial cultures. (3P)
8. Isolation of Rhizobium from legume root nodule. (3P)
9. Isolation of Azotobacter from soil. (3P)
10. Isolation of Azospirillum from roots. (3P)
11. Isolation of BGA. Staining and microscopic examination of microbes. (3P)
12. examination of stained cells by simple staining and Gram staining. (3P)
13. mushroom culture- Spawn production, Culture and production techniques, harvesting, packing and storage. (4P)
14. Hands on Experience on Biofertilizer , Biopesticide production in relevant Industry and submission of Project (4P)

Paper Name : Fundamentals of Bioanalytical Techniques (Theory) Paper

Type : Generic Elective Paper Code : GGBT- 104B

Credit : 04 L: 4 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of Bioanalytical Techniques and its application in Agriculture Biotechnology . This course is introduced to bridge the gap between academics, research and industry. This course aims to provide indepth knowledge of basic bio analytical techniques and machinaries and

general terminologies. This course aims to address different bio analytical techniques along with their theory, working principal, common instrumentation and possible applications.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop the skills to understand the theory and practice of bio analytical techniques.

CO 2 : provide scientific understanding of analytical techniques and detail interpretation of results.

CO 3 : learn and gain knowledge about diversified machineries and equipments , their principle of operations and technique of application and application of them in Agriculture Biotechnology

CO 4 : learn and gain knowledge about Concept , types , components , governing scientific principles and application methods of different Bioanalytical Techniques like Microscopy , Spectroscopy , Centrifugation , Chromatography etc

CO 5 : be able to use selected analytical techniques.

CO 6 : gain Familiarity with working principals, tools and techniques of analytical techniques.

CO 7 : To understand the strengths, limitations and creative use of techniques for problem-solving.

CO 8 : Synthesize required techno managerial process solution and application required

CO 9 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 10 : Analyse the error, repeatability , precision and accuracy of the instrument and process

CO 11 : Apply the process in Agriculture Biotechnology Industry

Content :

Unit 1: Simple microscopy, phase contrast microscopy, fluorescence and electron microscopy (TEM and SEM), pH meter , Conductivity meter , Weighing Balance (**5 L**)

Unit 2 : Absorption Spectroscopy – Simple theory of the absorption of light by molecules, Beer-Lambert law, Instrumentation for measuring the absorbance of visible light, Factors affecting the absorption properties of a Chromophore. Principle of absorption fluorimetry, Principles of Flame Photometry (**6 L**)

Unit 3 : Centrifugation – Basic Principle of Centrifugation, Instrumentation of Ultracentrifuge (Preparative, Analytical), Factors affecting Sedimentation, Standard Sedimentation Coefficient, Rate-Zonal centrifugation, sedimentation equilibrium Centrifugation. Cell fractionation techniques, isolation of sub-cellular organelles and particles. (**5 L**)

Unit 4 : Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC. Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS- PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis, isoelectric focusing, Western blotting. (**6 L**)

Unit 5: Mass spectrometry(MALDI, ESI) and Introduction to Biosensors and Nanotechnology and their applications. Radioactive labeling & counting, Autoradiography. (**6 L**)

Unit 6 : X-Ray Crystallography – X-ray diffraction, Bragg equation, Reciprocal lattice, Miller indices & Unit cell, Concept of different crystal structure, determination of crystal structure [concept of rotating crystal method, powder method]. (6 L)

Unit 7 : NMR Spectroscopy – Basic principle of NMR spectroscopy, Experimental technique & instrumentation, Chemical shift, hyperfine splitting, Relaxation process. (6 L)

Suggested Books

1. Biophysical Chemistry , Upadhyaya , Nath , Himalaya
2. Essentials of Biophysics , P Narayanana , New Age International
3. Biophysics and Biophysical Chemistry , D Das , Academic
4. Essentials of Biochemistry, U Satyanarayan, Books & Allied Ltd

Paper Name : Lab On Fundamentals of Bioanalytical Techniques (Practical)

Paper Type : Generic Elective Paper Code : GGBT- 194B

Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart Practical knowledge and skills on different Bioanalytical Techniques and their application in Agriculture Biotechnology by integration of necessary Hands on Practical sessions and Industry Integration . This course is introduced to bridge the gap between academics, research and industry. This course aims to provide indepth Practical knowledge of basic bio analytical techniques and machinaries and general terminologies. This course aims to address Practical aspects of different bio analytical techniques along with their theory, working principal, common instrumentation and possible applications in the field of Agriculture Biotechnology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop the Practical skills to understand the theory and practice of bio analytical techniques by integration of necessary Hands on Practical sessions and Industry Integration

CO 2 : provide scientific understanding of analytical techniques and detail interpretation of results by integration of necessary Hands on Practical sessions and Industry Integration

CO 3 : learn and gain Practical knowledge about diversified machinaries and equipments , their principle of operations and technique of application and application of them in Agriculture Biotechnology by integration of necessary Hands on Practical sessions and Industry Integration

CO 4 : learn and gain Practical knowledge about Practical Concept , types , components , governing scientific principles and application and Operational methods of Weighing Balance , Hot air oven , Water bath , photocolimeter , spectrophotometer , pH meter , Flame Photometer, Incubator , pH meter , Vortex Mixer , Conductivity meter by integration of necessary Hands on Practical sessions and Industry Integration

CO 5 : be able to use selected analytical techniques by integration of necessary Hands on Practical sessions and Industry Integration

CO 6 : gain Familiarity with working principals, tools and techniques of analytical techniques by integration of necessary Hands on Practical sessions and Industry Integration

CO 7 : To understand the strengths, limitations and creative use of techniques for problem-solving by integration of necessary Hands on Practical sessions and Industry Integration

CO 8 : Synthesize required techno managerial process solution and application required by integration of necessary Hands on Practical sessions and Industry Integration

CO 9 : Evaluate the situation and present status prevailing in the field and act accordingly by integration of necessary Hands on Practical sessions and Industry Integration

CO 10 : Analyse the error, repeatability , precision and accuracy of the instrument and process by integration of necessary Hands on Practical sessions and Industry Integration

CO 11 : Apply the practical knowledge gained in Agriculture Biotechnology Industry

Content :

1. To study general laboratory safety rules. (1 P)
2. To demonstrate glasswares, apparatus and plasticwares used in laboratory. (2 P)
3. Learn to know the principles and hands on operation of Weighing Balance , Hot air oven , Water bath , photocolormeter , spectrophotometer , pH meter , Flame Photometer, Incubator , pH meter , Vortex Mixer , Conductivity meter etc (12 P)
4. To perform Paper Chromatography (4 P)
5. To Perform Thin Layer Chromatography (3 P)
6. Microscopy-light microscopy: principles, , parts and function, operation (3 P)
7. Observe given slides under Microscope (3 P)
8. Determination pH of unknown solution (3 P)
9. To Demonstrate Gel Electrophoresis (3 P)
10. To identify lipids in a given sample by TLC. (3 P)
11. Separation of amino acids by paper chromatography (3 P)

Year – I Semester – II

CORE COURSE (4+2 Credits)		ABILITY ENHANCEMENT COMPULSORY (2 Credits) [Any One]		GENERIC ELECTIVE (4+2 Credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Principles of Soil Science Nutrient Management & Soil Microbiology	CAGBT-201	Fundamentals of Computer	AGBT- 203A	Farm Power , Farm Machinery & Post Harvest Technology	GGBT-204A
Lab on Principles of Soil Science Nutrient Management & Soil Microbiolog	CAGBT-291			Lab on Farm Power , Farm Machinery & Post Harvest Technology	GGBT-294A
				Environmental Studies	AGBT- 203B
Fundamentals of Biochemistry	CAGBT-202	Values and Ethics in Profession	AGBT- 203C	Lab on Principles of Agriculture Meteorology	GGBT-294B
Lab on Fundamentals of Biochemistry	CAGBT-292				

Year – I
Semester- II

**Paper Name : Principles of Soil Science Nutrient Management & Soil
Microbiology (Theory)**

**Paper Type : Core Paper Code : CAGBT- 201 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of Soil Science , Nutrient Management and Soil Microbiology .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of Soil Science , Nutrient Management and Soil Microbiology

CO 2 : learn and gain knowledge about To be able about physical and chemical properties of soil and their effect on plant's health

CO 3 : Comprehend the Knowledge about soil forming rocks and minerals, their weathering and soil forming processes and climatic factors affect them

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Agriculture Biotechnology

CO 5 : Learns to describe the various mineral and organic components of soils, including how changes in various quantities affect soil physical and chemical properties.

CO 6 : Synthesize required techno managerial process solution and application required in Soil Science , Nutrient Mangement & Soil Microbiology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : develop a basic understanding of soil chemistry, including pH and CEC, especially how they relate to nutrient availability and, when feasible, adjustments, such as liming, that can improve conditions for plant growth.

CO 9 : To understand the basics of Soil Formation , Soil Profile , Soil Components , properties , microorganisms of Soil, soil pollution and its control

CO 10 : To prepare the students with necessary employability skills required for taking soil analyst as a profession or for setting up STL as part of entrepreneurship

CO 11 : to understand role & various types of nutrients , manures , Chemical & Biofertilisers and their production & Application procedure

Content :

Unit 1 : Soil as a natural body, Pedological and edaphological concepts of soil; Soil genesis: soil forming rocks and minerals; weathering, processes and factors of soil formation; Soil Profile, components of soil (5 L)

Unit 2 : Soil physical properties: soil-texture, structure, density and porosity, soil colour, consistence and plasticity; Elementary knowledge of soil taxonomy classification and soils of India; Soil water retention, movement and availability; soil air, composition, gaseous exchange, problem and plant growth; source, amount and flow of heat in soil; soil temperature and plant growth (6 L)

Unit 3 : Soil reaction-pH, soil acidity and alkalinity, buffering, effect of pH on nutrient availability; soil colloids - inorganic and organic; silicate clays: constitution and properties; sources of charge ion exchange, cation exchange capacity, base saturation (6 L)

Unit 4 : Soil organic matter & Microbiology : composition, properties and its influence on soil properties; humic substances - nature and properties; soil organisms: macro and micro organisms, their beneficial and harmful effects (5 L)

Unit 5 : Macro and Micro-elements essential for plant growth , Primary, secondary and micronutrients , Plant nutrient availability, Types of Nutrients and their role in crop production , Nutrient deficiency and toxicity symptoms, critical limits of plant nutrient elements and hunger signs, plant nutrient mobility in plant and symptom appearance location on plant/crop (6 L)

Unit 6 ; : Introduction to soil fertility and productivity , Manures: definition, profile of manure, importance Different groups/types , preparation , importance & Applications of bulky and concentrated manures, FYM , Green manure (6 L)

Unit 7 : Fertilizers: Importance ,sources , impact & Types , Fertilizer Application methods – Broadcasting, side placement, deep placement, foliar spraying etc., N. P.K. carrying fertilizers – their agronomic efficiency, Secondary nutrient (Cu, Mg, S) supplying fertilizers , Fertilizer management, Fertiliser calculation , Fertilizer estimation and recommendation , mixing compatibility , role of Plant Growth Regulators , subsidy on fertilizers both chemical & organic , Concept of Direct Benefit Transfer (DBT) (6 L)

Suggested Readings

1. Das,D.K. 2015, Introductory soil science, Kalyani Publishers.
2. A. K. Kolay , 2008 , Basic Concepts Of Soil Science , New Age International
3. V.N. Sahai , 2015 , Fundamentals Of Soil Science . Kalyani Publisher
4. Nikhil Krishna De, Paramartha Ghosh , 2013, Geography Of Soils, Sribhumi Publishing House
5. M M Rai , 2002, Principles Of Soil Science, Macmillan India Ltd
6. Indian Society of Soil Science 2012. Fundamentals of Soil Science. IARI
7. P . C. Das , Soils in India 8. B.A.Yagodin , 1994 , Agricultural Chemistry (Vol 1), Mir Publishers Moscow
8. B.A.Yagodin , 1994 , Agricultural Chemistry (Vol 2), Mir Publishers Moscow 1.
9. John L. Havlin, Samuel L. Tisdale, Werner L. Nelson, James D. Beaton , 2015, Soil Fertility & Fertilizers, Pearson
10. Sumit Saha, Dibyendu Sarkar ,2017, Micronutrients In Soil & Crops Of West Bengal, Bckv
11. Ranjan Kumar Basak , 2007, Fertilizers A Text Book, Kalyani Publisher
12. Kaushik Batabyal, Sidhu Murmu, Amrit Tamang , 2016, Nutrient Management Practices For Common Root & Tuber Crops(Carrot,Radish & Elephant Foot Yam) Of West Bengal, Bckv
13. Samuel Tisdale, Nelson Werner L, Beaton James D And Havlin John L. 2005.Soil

- Fertility And Fertilizers: An Introduction To Nutrient Management, Macmillan Publishing Co., New York
14. Yawalkar, K.S., Agarwal, T.P. And Bokde, S. 1995. Manures And Fertilizers. Agril. Publishing House
 15. G. Rangaswami, D.J. Bagyaraj, 2016, Agricultural Microbiology, PHI
 16. Ahindra Nag, 2008, Text Book Of Agricultural Biotechnology, PHI Learning
 17. Shiva Aithal, Nikhilesh Kulkarni, 2010, Modern Approaches Soil Agriculture & Environmental Microbiology, Himalaya Publishing House

Paper Name : Lab On Principles of Soil Science Nutrient Management & Soil Microbiology (Practical)

**Paper Type : Core Paper Code : CAGBT- 291 Credit : 02 L: -, T: -, P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: This course is designed to impart necessary Practical knowledge and skill on understanding the Concepts of Soil Science, Nutrient Management and Soil Microbiology with an aim to prepare the students with necessary employability skills required for taking soil analyst as a profession or for setting up STL as part of entrepreneurship

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain Practical knowledge about analysis of Physical, Chemical and Biological Properties of soil

CO 2 : learn and gain knowledge about carrying out analysis of physical and chemical properties of soil, Manure and Fertilizers to find out their effect on plant's health

CO 3 : Learn to apply Practical technical knowledge and skills required for understanding and application of Principles of Soil Science, Nutrient Management & Soil Microbiology in Agriculture Biotechnology

CO 4 : Synthesize required Practical techno managerial process solution and application required in Soil Science, Nutrient Management & Soil Microbiology

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : develop a basic understanding of soil chemistry, including pH and CEC, N,P,K Content especially how they relate to nutrient availability and, when feasible, adjustments, such as liming, that can improve conditions for plant growth

CO 7 : To prepare the students with necessary employability skills required for taking soil analyst as a profession or for setting up STL as part of entrepreneurship

CO 8 : to understand role & various types of nutrients, manures, Chemical & Biofertilisers and their production & Application procedure and their quality control process and steps

Content :

1. Making models of Soil profile by using Soil Profile Cards/ Making Collage/Poster/ Chart on Soil Profile (2 P)
2. Visit a soil testing laboratory (STL) and learn by hands on training and or demonstration method on different soil sampling tools, process collection of representative soil sample, its processing and storage. (1 P)
3. Visit farmers field, Collection of Soil samples maintaining Standard Process, uniformity

- and depth, its processing and storage and analyse the following in STL (Soil Testing Laboratory) following standard analytical procedure a. soil colour b. density c. moisture content d. porosity e. soil texture f. Soil structure g. Soil Water holding capacity h. Organic Matter Content i. j. Studies of capillary rise phenomenon of water in soil column and water movement in soil. (10 P)
4. Visit farmers field , Collection of Soil samples maintaining Standard Process , uniformity and depth, its processing and storage and analyse the following in STL (Soil Testing Laboratory) following standard analytical procedure a. pH b. EC c. Cation Exchange Capacity (3 P)
 5. Study of Soil Map (1 P)
 6. Visit a STL and carry out hands on learning of analysis of collected Soil samples in lab following standard analytical methods for determination of – a. Organic C b. Available N.P.K. , S , Ca Mg (8 P)
 7. Visiting market & or commercial manufacturing unit and carry out Identification & Collection of different manures, fertilizers & Bio- fertilizers (2 P)
 8. Making Chart on Classification of manures, fertilizers (1 P)
 9. Visit the farm field to see & document the process of Green manuring (Planning , Procedure , Growth and management) (2 P)
 10. Visiting respective Compost making Industry and hands on training through demonstration and practical operation on production process of Composting (Any One Type) (2 P)
 11. Calculation of fertilizer, measurement according to the recommended nutrient dose, crop nutrients requirement (2 P)
 12. Visit a STL and carry out hands on training following standard analytical protocol on Gypsum requirement of saline and alkali soils. Lime requirement of acid soils (3 P)
 13. Visiting of fertilizer testing laboratory and learn by hands on on Estimation of Physical and Chemical properties of organic manure and fertilizers. (3 P)

Paper Name : Fundamentals of Biochemistry (Theory)

Paper Type : Core Paper Code : CAGBT- 202 Credit : 04

L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon knowledge of biochemical principles. The course shall make the students aware of biochemical and molecular basis of various plant processes and plant growth regulatory substances..

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge in biochemistry and understand molecular basis of various plant processes

CO 2 : learn and gain knowledge about biological Macromolecules & and their function

CO 3 : Comprehend the Knowledge about Understanding of metabolic pathways (catabolism as well as anabolism), their diversity and how these are specifically regulated and interrelated in different cells

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the principles of Biochemistry in Agriculture Biotechnology

CO 5 : Learns the Concepts of enzyme kinetics, regulation and specificity.

CO 6 : Synthesize required techno managerial process solution and application required in

Biochemistry & its relation with Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : develop a comprehensive understanding about structure , types , properties , role and mechanism of action of Carbohydrate , Protein , Lipid , Nucleic Acid

CO 9 : To understand the concepts of Phytohormones , Secondary Metabolites , Biochemistry of seed germination & Fruit ripening

Content :

Unit 1 : Introduction to Biochemistry: A historical prospective Carbohydrates:- Structural aspects – Introduction & Occurrence, Classification of Mono-, Diand Polysaccharides, Reducing & Non-reducing Sugars, Constitution of Glucose & Fructose, Osazone formation, Pyranose & Furanose forms, Determination of ring size, Inter-conversion of monosaccharides. (7 L)

Unit 2 : Amino acids & Proteins: Structure & Function. Structure and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape. Different Level of structural organization of proteins, Protein Purification. Denaturation and renaturation of proteins. Fibrous and globular proteins (6 L)

Unit 3 : Lipids: Structural aspects – General introduction, Classification & Structure of Simple & Compound lipids, Properties of Lipid aggregates (elementary idea), Biological membrane, membrane protein – structural aspects, Lipoproteins (elementary idea). (6 L)

Unit 4 : Nucleic acids: Structure and functions: Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidines,. Biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA, denaturation and renaturation of DNA (7 L)

Unit 5 : Chemical & Enzymatic Kinetics - An introduction to enzyme; How enzyme works; Reaction rate; Thermodynamic definitions; Principles of catalytic power and specificity of enzymes; Enzyme kinetics – Approach to mechanism. (7 L)

Unit 6 : Scope and importance of biochemistry in Agriculture , Phytohormones – synthesis and mode of action. Role of auxin, gibberellins, ethylene, cytokinins, ABA and brassinosteroids; Secondary metabolites - introduction, types and role of secondary metabolites in plant system; Biochemistry of nitrogen fixation and nitrate assimilation, sulphate reduction and incorporation of sulphur into amino acids; Biochemistry of seed germination and development; Biochemistry of fruit ripening. (7 L)

Suggested Readings

1. Fundamentals of Biochemistry , A.C.Deb , New Central Book Agency
2. Fundamentals of Biochemistry , J L jain , S.Chand
3. Biochemistry , S C Rastogi , Tata Mcgraw Hill
4. Essentials of Biochemistry, U Satyanarayan, Books & Allied Ltd
5. Text book of Medical Biochemistry , D M Vasudevan , Jaypee Publishers
6. Text book of Medical Biochemistry , M N Chatterjea & Rana Shinde , Jaypee Publishers
7. Principles of Biochemistry, Lehninger, W H Freeman

Paper Name : Lab On Fundamentals of Biochemistry (Practical)
Paper Type : Core Paper Code : CAGBT- 292 Credit : 02
L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon Practical knowledge of biochemical analytical principles. The course shall make the students aware of biochemical and molecular basis of analysis .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge in Practical biochemistry and understand molecular basis of various plant processes

CO 2 : learn and gain Practical knowledge about biological Macromolecules & and their function

CO 3 : Comprehend the Knowledge about preparing different solutions

CO 4 : Learn to apply Practical technical knowledge and skills required for understanding and application of the principles of Biochemistry in Agriculture Biotechnology

CO 5 : Learns the Qualitative and Quantitative method of estimation of Amino Acid , Protein , Carbohydrate ec.

CO 6 : Synthesize required Practical techno managerial process solution and application required in Biochemistry & its relation with Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : develop a comprehensive understanding about Practical process of carrying out different types of Chromatography

CO 9 : To understand the estimation of DNA and RNA from Plant samples

Content :

1. Preparation of solution and reagents, normal solution, molar solutions, percent solution, buffer solution, dilutions, w/v, v/v, standard solution, aqueous solutions (5 L)
2. Estimate amino Acid and Protein from Plant sample (Qualitative & Quantitative) (6 L)
3. Estimate Carbohydrate from Plant sample(Qualitative & Quantitative) (6 L)
4. Perform Paper Chromatography (5 L)
5. Perform Thin Layer Chromatography (6 L)
6. Estimate DNA from Plant sample (6 L)
7. Estimate RNA from Plant sample (6 L)

Paper Name : Fundamentals of Computer (Theory)
Paper Type : Ability Enhancement Compulsory Paper Code:AGBT-203A
Credit : 02 L: 2 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon knowledge of fundamental principles of Computer which are required by an Agriculture Biotechnologist . This course introduces the concepts of computer basics & Word , Excel , Powerpoint (MS Office) so that the students will have a basic concept for understanding and using computer.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge in basic computers

CO 2 : learn and gain knowledge about Word , Excel , Powerpoint (MS Office)

CO 3 : Learn to apply technical knowledge and skills required for understanding and application of the fundamental knowledge of computer in Agriculture Biotechnology

Content :

Unit 1: Introduction to Computer - Machines and advantages of machines , Origin of Computer , Classification of computers , Overview of computer system , Peripherals , Working with computers , Commonly used computer terms , Summary (2 L)

Unit 2 : Introduction to Windows Operating System - Operating System , Windows and their control , Desktop , The Task Bar , Control Panel , Drives, Files & Folders , Assignment & Practice , Change the view , Search , Back up , Keyboard extras , Task Manager , Windows Help , Assessment (3 L)

Unit 3 : Introduction to Internet and Purposive Surfing - Introduction to the Internet , How Internet Works , Domain Name & Address , World Wide Web , Popular Web Browsers , Internet Explorer , Google account , Google Hangouts & Google Talk , Summarize (3 L)

Unit 4 : Introduction to Microsoft Office Word - Introduction to Microsoft Office Word , Basic Features , Saving file , Format features , Windows menu , Insert File , Auto shapes and word art , Template , Mail Merge , Labels , Assessment & Summary (4 L)

Unit 5 : Introduction to Microsoft office Powerpoint - Introduction to Microsoft office PowerPoint , Adding & Editing the content , Working with designs , Designs , Graphics , Objects , Animation , Transition , Sound & Narration , Videos , Charts , SmartArt , Linking Objects , Web presentation , Printing , Slide show , Saving file , Dos & Don'ts , Assessment & Summarization (4 L)

Unit 6 : Introduction to MS. Excel- Introduction to spreadsheet , Basic Functions, Editing Data, Editing Rows & columns , Saving File , Format Cell , Functions & formulas, Basic Formula - Add, Subtract, Multiply,Divide, Calculate percentage , Date & Time , Conversion , Counting , Mean , Text , Conditional , Less than/ Greater than , Hide or show Zero , Lookup , Pivot, Conditional formatting , Practice Exercise , Assessment & summary (4 L)

Practical : Hands on Practice on topics as mentioned above

Suggested Readings

1. Computer Fundamentals, Ms-Office, Internet & Soft Skills, NIMI Publication
2. Rapidex Computer Course ,2016 , Rapidex Publication
3. Davinder Singh Minhas , 2016 , Dynamic Memory Computer Course , Diamond Book
4. Rajiv Mathur , 2013 , Modern Computer Application , Orient Black Swan
5. Loveleen Gaur ,2013, Essentials Of Computer Fundamentals, Vrinda Publication
6. Laha , 2009 , Managerial Computing. , Vrinda Publication
7. Loveleen Gaur , 2013, Fundamental Of Computers, Vrinda Publication

Paper Name : Environmental Studies (Theory)
Paper Type : Ability Enhancement Compulsory
Paper Code : AGBT-203B Credit : 02 L: 2 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objective: The course is designed to provide a working knowledge of environment, ecology and physical sciences for problem solving. The learner will be able to remember, understand and apply the taught concepts and methods involving social and environmental processes for betterment of environmental health and safety

COURSE OUTCOMES: On Completion of the Course, Students will be able to:

- CO 1 : comprehend and understand the basic concepts related to environment & ecology
- CO 2 : comprehend and understand the scientific problem related to air, water, noise & land pollution
- CO 3 : comprehend and understand different environmental laws , regulations , guidelines and applying those for maintaining quality of environmental health and safety .
- CO 4 : Gain in-depth knowledge on natural processes that sustain life, and governing the resource distribution and resource management
- CO 5 : Predict the consequences of human actions on the web of life, global economy , environment and quality of human life.
- CO 6 : . Develop critical thinking for shaping strategies (scientific, social, economic, environmental and legal) for environmental protection and conservation of biodiversity, social equity and sustainable development.
- CO 7 : Acquire values and attitudes towards understanding complex environmental-economic social challenges, and participating actively in solving current environmental problems and preventing the future ones.
- CO 8 : Adopt sustainability as a practice in life, society and industry

Unit 1 : Environment: Environment , Scope and importance of Environmental Studies. Components of environment - i) Atmosphere, composition of atmosphere, ii) lithosphere – structure of lithosphere, soil formation, soil composition and properties of soil. iii)Hydrosphere – distribution of water on earth, global water balance and hydrological cycle. (3 L)

Unit 2 : Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem,

Producers, consumers and decomposers, Energy flow in the ecosystem. Ecological succession, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (3 L)

Unit 3 : Natural Resources: Renewable and non-renewable resources, Natural resources and associated problems. a) Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer- pesticide problems, water logging, salinity, case studies. e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies. f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles (3 L)

Unit 4 : Environment problems: i. Air pollution – concept, source of air pollution, major atmospheric pollutants, air quality standards monitoring of major air pollutants. ii. Water pollution – sources of water pollution, river pollution, underground water pollution, oil pollution, thermal pollution, water pollution due to sewage, effects of water pollution , waste water treatment iii. Noise pollution – sources of noise, effects of noise pollution, noise pollution, noise pollution control equipment silencers and noise absorbing devices, noise standards and industrial noise control. iv. Soil pollution – causes of soil pollution major soil pollutants, industrial waste and their role in soil pollution. v. Radiation pollution – sources of radioactive pollution, effects of radioactive pollution on health (3 L)

Unit 5 : Biodiversity and its conservation: - Introduction, definition, genetic, species & ecosystem diversity and biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels, India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity (3 L)

Unit 6 : Natural Disasters- Meaning and nature of natural disasters, their types and effects. Floods, drought, cyclone, earthquakes, landslides, avalanches, volcanic eruptions, Heat and cold waves, Climatic change: global warming, Sea level rise, ozone depletion. Man Made Disasters- Nuclear disasters, chemical disasters, biological disasters, building fire, coal fire, forest fire, oil fire, air pollution, water pollution, deforestation, industrial waste water pollution, road accidents, rail accidents, air accidents, sea accidents (3 L)

Unit 7 : Different Environmental Movements wrt India , Concept of Water & soil Conservation, Different Acts and Laws wrt Environmental Protection , Environmental Ethics , Sustainable Development , Different global summits wrt Environment , Millenium Goals (2 L)

Suggested Readings

1. R.K. Ghosh, Ananta Das , 2002, Environmental Study, Oriental Book Company Pvt.Ltd
2. H S Bhatia , 2003, A Text Book on Environmental Pollution And Control, Galgotia Publication Pvt.Ltd
3. S.C.Santra , 2001, Environmental Science, New Central Book Agency pvt.Ltd
4. Mohan P Arora ,2004, Ecology , Himalaya Publishing House
5. Y Anjaneyulu , 2004, Introduction To Environmental Science , B S Publications
6. P.D.Sharma , 2003, Ecology and Environment, Rastogi Publications

Paper Name : Values and Ethics in Profession (Theory)

Paper Type : Ability Enhancement Compulsory

Paper Code : AGBT-203C Credit : 02 L: 2 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objective: The course is designed to create an awareness on Ethics and Human Values with an aim to instill Moral and Social Values and Loyalty amongst professionals and to appreciate the rights of others ensuring to create awareness on assessment of safety and risk

COURSE OUTCOMES: On Completion of the Course, Students will be able to:

CO 1 : Identify and analyze an ethical issue in the subject matter under investigation or in a relevant field

CO 2 : Identify the multiple ethical interests at stake in a real-world situation or practice

CO 3 : Articulate what makes a particular course of action ethically defensible.

CO 4 : Assess their own ethical values and the social context of problems

CO 5 : Identify ethical concerns in research and intellectual contexts, including academic integrity, use and citation of sources, the objective presentation of data, and the treatment of human.

CO 6 : . Demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

CO 7 : integrate, synthesize, and apply knowledge of ethical dilemmas and resolutions in academic settings, including focused and interdisciplinary research.

Content :

Unit 1 : Values and Ethics-An Introduction. Goal and Mission of Life. Vision of Life. Principles and Philosophy. Self Exploration. Self Awareness. Self Satisfaction. Decision Making. Motivation, Sensitivity, Success, Selfless Service, Case Study of Ethical Lives, Positive Spirit, Body, Mind and Soul Attachment and Detachment, Spirituality Quotient. (5 L)

Unit 2 : Ethics of Profession: Ethical issues in practice, Conflicts between business demands and professional ideals. Social and ethical responsibilities of Technologists. Codes of professional ethics. Whistle blowing and beyond, Case studies. (5 L)

Unit 3 : Profession and Human Values: Values Crisis in contemporary society Nature of values:

Value Spectrum of a good life Psychological values: Integrated personality; mental health
Societal values: The modern search for a good society, justice, democracy, secularism, rule of law, values in Indian Constitution. (5 L)

Unit 4 : Aesthetic values: Perception and enjoyment of beauty, simplicity, clarity Moral and ethical values: Nature of moral judgements; canons of ethics; ethics of virtue; ethics of duty; ethics of responsibility. (5 L)

Suggested Readings :

1. R R Gaur, R Sangal, G P Bagaria, 2009, A Foundation Course in Human Values and Professional Ethics.
2. A N Tripathy, 2003, Human Values, New Age International Publishers
3. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

**Paper Name : Farm Power , Farm Machinery & Post Harvest Technology
(Theory) Paper Type : Generic Elective Paper Code : GGBT- 204A**

Credit : 04 L: 4 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon knowledge of Farm Power sources , Farm Machineries and Post Harvest Management Technologies . The course shall make the students aware of equipments, implements , technologies , inner governing processes and role , importance , technologies and management of PHT.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge in Farm Power sources , Farm Machineries and Post Harvest Management Technologies and their association with Agriculture and Agriculture Biotechnology

CO 2 : learn and gain knowledge about importance and contribution of various sources of farm power and their availability in India.

CO 3 : Comprehend the Knowledge about different Components of IC Engines and various system associated with it such as cooling system, lubrication system fuel system and its components

CO 4 : Learn to apply technical knowledge and skills required for understanding various primary and secondary tillage systems which can operated manually or the help of animals and also power operated with their components

CO 5 : Learns the Concepts of different types of sowing , instruments used and various plant protection equipments such as seed drill, planter, sprayers and duster.

CO 6 : Synthesize required techno managerial process solution and application required in operating and maintaining various harvesting and threshing equipment

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : develop a comprehensive understanding about structure , types , properties , role and mechanism of operation and Management of Post Harvest Technologies

Contents :

Unit 1 : Status of Farm Power in India, Sources of Farm Power , I.C. engines, working principles of I C engines, comparison of two stroke and four stroke cycle engines , Study of different components of I.C. engine, I.C. engine terminology and solved problems (7 L)

Unit 2 : Familiarization with different systems of I.C. engines: Air cleaning, cooling, lubrication ,fuel supply and hydraulic control system of a tractor, Familiarization with Power transmission system : clutch, gear box, differential and final drive of a tractor , Tractor types, Cost analysis of tractor power and attached implement (7 L)

Unit 3 : Familiarization with Primary and Secondary Tillage implement, Implement for hill agriculture, implement for intercultural operations (7 L)

Unit 4 : Familiarization with sowing and planting equipment, calibration of a seed drill and solved examples, Familiarization with Plant Protection equipment, Familiarization with harvesting and threshing equipment. (6 L)

Unit 5 : Definition , Importance of Post Harvest Operations , Post harvest losses in different farm produce , Post harvest losses in different farm produce (6 L)

Unit 6 : Cleaning, grading and drying of farm produce (Types , Principles of Operation , Methods and Machinaries Used) , Farm storage structures and storage of farm produce , Principles of processing of farm produce (7 L)

Suggested Readings

1. Michael, A.M. and Ojha, T.P. 2004. Principles of Agricultural Engineering, Vol. I, Jain Brothers
2. Jain, S.C. And Rai, C.R. 2001. Farm Tractor – Maintenance & Repair.
3. John Deere, 2000, The Operation, Care & Repair Of Farm Machinery (2nd Edition), Lyons Press
4. Kepner, R.A., Bainer, R. and Barger, E.L. 1987. Principles of Farm Machinery, C.B.S. Publishers and Distributors, New Delhi.
5. Smith, H.P. and Wilkes, L.H. 1979. Farm Machinery and Equipment, Tata McGraw-Hill Publishing Co. Ltd., New Delhi
6. Jagdiswar Sahay, 2013, Elements of Agricultural Engineering, Standard Publisher Distributor
7. Surendra Singh, 2010, Farm machinery –Principles and applications, ICAR,
8. R. Suresh, Sanjay Kumar , 2004, Farm Power & Machinery Engineering, Standard Publishers Distributors
9. D.N. Sharma, S. Mukesh , 2013, Farm Power & Machinery Management (Principles & Practice) (Vol 1), Jain Brothers
10. S.C. Jain, Grace Philip , 2015, Farm Machinery An Approach, Standard Publishers Distributors
10. Michael, A.M. and Ojha, T.P. 2004. Principles of Agricultural Engineering, Vol. II, Jain Brothers, New Delhi
11. P.H. Pandey , 2009, Post Harvest Technology & Management, Kalyani Publisher

12. P.H.Pandey , 2015, Principles & Practices Of Post Harvest Technology , Kalyani Publisher
13. N.K. Dhamsaniya , 2016, Guide To Post Harvest Unit Operations, Kalyani Publisher
14. Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices
Hosahalli S. Ramaswamy, Arun S. Mujumdar, Amalendu Chakraverty

**Paper Name : Lab On Farm Power , Farm Machinery & Post Harvest
Technology (Practical) Paper Type : Generic Elective
Paper Code : GGBT- 294A Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to build upon Practical knowledge of governing principles, operation , maintenance of Farm Power sources , Farm Machineries and Post Harvest Management Technologies . The course shall make the students aware of practical use of equipments, implements , technologies , inner governing processes and role , importance , technologies and management of PHT.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental Practical knowledge & technologies used in Farm Power sources , Farm Machineries and Post Harvest Management Technologies and their association with Agriculture and Agriculture Biotechnology alongwith operational principles , governing science , maintenance and use .

CO 2 : learn and gain Practical knowledge about importance and contribution of various sources of farm power and their availability in India.

CO 3 : Comprehend the Practical Knowledge about different Components of IC Engines and various system associated with it such as cooling system, lubrication system fuel system and its components

CO 4 : Learn to apply technical Practical knowledge and skills required for understanding various primary and secondary tillage systems which can operated manually or the help of animals and also power operated with their components

CO 5 : Learns the Practical Concepts of different types of sowing , instruments used and various plant protection equipments such as seed drill, planter, sprayers and duster.

CO 6 : Synthesize required techno managerial process solution and application required in operating and maintaining various harvesting and threshing equipment

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : develop a comprehensive Practical Knowledge about structure , types , properties , role and mechanism of operation and Management of Post Harvest Technologies

Content :

1. Visit commercial Farm Unit and learn by hands on and or demonstration method on identification and uses of different farm equipments , farm machinery and implements (**3 P**)
2. Visit commercial Farm Unit and learn by hands on and or demonstration method on Identification of Study of different components of I.C. engine. (**2 P**)
3. Visit commercial Farm Unit and learn by hands on and or demonstration method on air cleaning and cooling system of engine (**2 P**)

4. Visit commercial Farm Unit and learn by hands on and or demonstration method on clutch, transmission, differential and final drive of a tractor (2 P)
5. Visit commercial Farm Unit and learn by hands on and or demonstration method on lubrication and fuel supply system of engine (2 P)
6. Visit commercial Farm Unit and learn by hands on and or demonstration method on brake, steering, hydraulic control system of engine (2 P)
7. Visit commercial Farm Unit and learn by hands on and or demonstration method on tractor driving (2 P)
8. Visit commercial Farm Unit and learn by hands on and or demonstration method on operation of power tiller, Implements for hill agriculture, different types of primary and secondary tillage implements: mould plough, disc plough and disc harrow . (3 P)
9. Visit commercial Farm Unit and learn by hands on and or demonstration method on seedcum-fertilizer drills their seed metering mechanism and calibration, planters and transplanter (3 P)
10. Visit commercial Farm Unit and learn by hands on and or demonstration method on different types of sprayers and dusters (2 P)
11. Visit commercial Farm Unit and learn by hands on and or demonstration method on different inter- cultivation equipment (2 P)
12. Visit commercial Farm Unit and learn by hands on and or demonstration method on harvesting and threshing machinery (3 P)
13. Generation of market information for agri- commodities like arrival, rate, different grades of produce etc (2 P)
14. Collecting information on supply position of crop produce (1 P)
15. Visit to Cold Storage and understand the operational principles (2 P)
16. Visit to Rice Mill and understand the operational principles (2 P)
17. Identification of packaging material (1 P)
18. Visit to agricultural marketing societies, cooperative societies, mandies, fruits and vegetables (2 P)
19. Making a Project on selling agri-produce in nearest mandi (2 P)

Paper Name : Agriculture Meteorology (Theory)
Paper Type : Generic Elective Paper Code : GGBT- 204B
Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon knowledge of to discover and define the meteorological, climatological and hydrological parameters which are relevant to agricultural production & apply this knowledge of the atmosphere and soil to practical agricultural use with an attempt to enhance agricultural production by controlling physical environment & by forecasting weather and crop yield accurately.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about impact of weather and climate on agricultural production system

CO 2 : learn and gain knowledge about different types of Atmospheric weather variables , atmospheric temperature , pressure , wind speed & direction , solar radiation , humidity ,

precipitation etc CO 3 : Comprehend the Knowledge about roles of agro-meteorology in agriculture and impact of abiotic factors in crop production

CO 4 : Learn to apply technical knowledge and skills for forecasting of weather and crop planning

CO 5 : Learns the Concepts of behavior of the weather elements that have direct relevance to agriculture and their effect on crop production.

CO 6 : Synthesize required techno managerial process solution & develop weather based agro advisories to sustain crop production utilizing various

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : By necessary Industry integration learn and understand different measurement techniques of meteorological parameters and integrating the obtained data for agricultural productivity

Contents :

Unit – 1 Earth atmosphere- its composition, extent and structure; Atmospheric weather variables; Atmospheric pressure, its variation with height; Wind, types of wind, daily and seasonal variation of wind speed, cyclone, anticyclone, land breeze and sea breeze; Nature and properties of solar radiation, solar constant, depletion of solar radiation, short wave, longwave and thermal radiation, net radiation, albedo (10 L)

Unit 2 : Atmospheric temperature, temperature inversion, lapse rate, daily and seasonal variations of temperature, vertical profile of temperature, Energy balance of earth; Atmospheric humidity, concept of saturation, vapor pressure, process of condensation, formation of dew, fog, mist, frost, cloud; Precipitation, process of precipitation, types of precipitation such as rain, snow, sleet, and hail, cloud formation and classification; Artificial rainmaking. Monsoon mechanism and importance in Indian agriculture (10 L)

Unit 3 : Weather hazards - drought, floods, frost, tropical cyclones and extreme weather conditions such as heat-wave and cold-wave (10 L)

Unit 4 : Agriculture and weather relations; Modifications of crop microclimate, climatic normals for crop and livestock production. Weather forecasting- types of weather forecast and their uses. Climate change, climatic variability, global warming, causes of climate change and its impact on regional and national Agriculture (10 L)

Suggested Books

1. G.S.L.H.V Prasada Rao , Agricultural Meteorology , PHI Learning Pvt Ltd
2. M.C.Varshneya, P Balakrishna Pillai , Text Book Of Agricultural Meteorology , ICAR
3. H.S. Mavi , Introduction to Agrometeorology, Oxford & IBH
4. B.M Mote , D.D.Sahu , Principles Of Agricultural Meteorology, Scientific Publisher India
5. D.D. Sahu, M.C. Chopada, H.R.Patel , Agrometeorology At A Glance , Agrobios India
6. D.S . Lal , Climatology , Sharda Pustak Bhawan
7. Howard J. Critchfield , General Climatology , Prentice & Hall of India
8. S.R.Reddy , Introduction to Agriculture and Agrometeorology. Kalyani Publishers

Paper Name : Lab On Agriculture Meteorology (Practical)

Paper Type : Generic Elective Paper Code : GGBT- 294B

Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon Practical knowledge of meteorological, climatological and hydrological parameters which are relevant to agricultural production & apply this Practical knowledge of the atmosphere and soil to practical agricultural use with an attempt to enhance agricultural production by controlling physical environment & by forecasting weather and crop yield accurately.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental Practical knowledge about impact of weather and climate on agricultural production system

CO 2 : learn and gain Practical knowledge about different types of Atmospheric weather variables , atmospheric temperature , pressure , wind speed & direction , solar radiation , humidity , precipitation etc

CO 3 : Comprehend the Practical Knowledge about operation , governing principles, operational mechanism , maintenance and data interpretation obtained from agro meteorological instruments

CO 4 : Learn to apply Practical technical knowledge and skills for forecasting of weather and crop planning

CO 5 : By necessary Industry integration learn and understand different measurement techniques of meteorological parameters and integrating the obtained data for agricultural productivity

Content :

1. Visiting Agriculture meteorological unit and by having hands on and or demonstration training document and understand the reason of a. Site selection for Agromet observatory b. understand Layout plan of Agromet observatory (Agromet field unit) (3 P)
2. Visiting Agriculture meteorological unit and by having hands on and or demonstration training undergo exposure of instruments and weather data recording (2 P)
3. Visit to meteorological observatory and by having hands on and or demonstration training understand the procedure of recording data favorable for different crops (2 P)
4. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn to measure soil temperature & correlate with agriculture output (2 P)
5. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the procedure of Measurement of maximum and minimum air temperatures, its tabulation, trend and variation analysis & correlate with agriculture output (2 P)
6. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn process of Measurement of evaporation & correlate with agriculture output(2 P)
7. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of atmospheric pressure & correlate with

agriculture output (**3 P**)

8. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of sunshine duration & correlate with agriculture output (**3 P**)
9. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Determination of vapor pressure and relative humidity(**3 P**)
10. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Determination of dew point temperature(**2 P**)
11. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of atmospheric pressure and analysis of atmospheric conditions (**3 P**)
12. Visit Agriculture meteorological unit Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of wind speed and wind direction, preparation of windrose. (**3 P**)
13. Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement, tabulation and analysis of rain. (**3 P**)
14. Visit Agriculture meteorological unit Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of air temperature & correlate with agriculture output (**2 P**)
15. Visit Agriculture meteorological unit Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of Measurement of relative humidity & correlate with agriculture output (**3 P**)
16. Visit Agriculture meteorological unit Visit Agriculture meteorological unit and by having hands on and or demonstration training learn the process of measurement of dew & correlate with agriculture output (**2 P**)

Year – II
Semester – III

CORE COURSE (4+2 Credits)		SKILL ENHANCEMENT COURSE (2 Credits) [Any One]		GENERIC ELECTIVE(4+2 Credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Crop Production Technology – I (Kharif)	CAGBT-301	GMOs , Biosafety , Bioethics & IPR	SGBT-304A	Principles of Food Processing Technology	GGBT-305A
Lab on Crop Production Technology – I (Kharif)	CAGBT-391			Lab on Principles of Food Processing Technology	GGBT-395A
Fundamentals of General Immunology & Plant’s Protection Mechanism	CAGBT-302	Photochemistry & Secondary Metabolites	SGBT-304B	Principles of Farm Management	GGBT-305B
Lab on Fundamental s of General Immunology & Plant’s Protection Mechanism	CAGBT-392			Lab on Principles of Farm Management	GGBT-395B
Principles of Microbiology	CAGBT-303	Research Methodology & Biostatistics	SGBT-304C	Food & Dairy Microbiology	GGBT-305C
Lab on Principles of Microbiology	CAGBT393				

Paper Name : Crop Production Technology – I (Kharif) (Theory)
Paper Type : Core Paper Code : CAGBT- 301 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon knowledge of Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops of India .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops

CO 2 : Comprehend the Knowledge about Analysis of comparative benefits of the different kharif crops

CO 3 : Learn to apply technical knowledge and skills for cultivation of Kharif crops

CO 4 : Learns the Concepts of Production technology of kharif cereals and millets and how to fulfill the need of human consumption and livestock ensuring food safety & food security

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : know various crop production practices in India and understand the different crops cultivated in kharif season in India and their production technology and techniques to ensure crop productivity

Content :

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Kharif crops.

Unit 1 : Cereals – rice, maize, sorghum, pearl millet and finger millet (7 L)

Unit 2 : pulses-pigeonpea, mungbean and urdbean (7 L)

Unit 3 : oilseeds- groundnut, sesame and soybean (7 L)

Unit 4 : fibre crops- cotton , Jute, mesta and sunhemp (7 L)

Unit 5 : forage crops-sorghum, cowpea, cluster bean and napier.dinanath grass and paragrass (6 L)

Unit 6 : Application of Biotechnological Methods as a part of Crop production technology (6 L)

Suggested Readings

1. George Acquaaah , 2005 , Principles of Crop Production , PHI Learning
2. Reddy, S.R. 2016. Introduction To Agronomy & Principles Of Crop Production. Kalyani Publishers
3. B N Chatterjee, S Maity , 1984 , Cropping System (Theory & Practical) , Oxford & IBH

4. Handbook of Agriculture , ICAR
5. Arun Katyayan , 2017, Fundamentals of Agriculture (Vol I) , Kalyani Publisher
6. Arun Katyayan , 2017 , Fundamentals of Agriculture (Vol II) , Kalyani Publisher
7. N.R. DAS, 2007 , Crops of India , Scientific Publisher
8. A Shiv Raj , 1978 , An Introduction to Physiology of Field Crops , Oxford & IBH
9. S S Singh , Crop Management , 2005 , Kalyani Publisher
10. Mukund Joshi , 2005 , Field Crop Production , PHI
11. Rajendra Prasad (ed.), 2006. Text Book of Field Crop Production, ICAR, New Delhi.
12. Reddy, S.R. and Reddi Ramu. 5th edition. Agronomy of Field Crops, Kalyani Publishers
13. GururajHunsigi and Krishna K.R. 2007. Scientific Field Crop Production, Oxford & IBH Publishing Co

Paper Name : Lab On Crop Production Technology – I (Kharif) (Practical)
Paper Type : Core Paper Code : CAGBT- 391 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon Practical knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield management of Kharif crops of India .

Course Outcomes: On Completion of the Course, Students will be able to:

- CO 1 : gain fundamental Practical knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield Maintenance and management of Kharif crops
- CO 2 : learn and gain knowledge about will be acquainted with the knowledge of profitable & socially , economically and environmentally sustainable crop production technology.
- CO 3 : Comprehend the Practical Knowledge about Analysis of comparative benefits of the different kharif crops
- CO 4 : Learn to apply Practical technical knowledge and skills for cultivation of Kharif crops
- CO 5 : Learns the Practical Concepts of Production technology of kharif cereals and millets and how to fulfill the need of human consumption and livestock ensuring food safety & food security ..
- CO 6 : Evaluate the situation and present status prevailing in the field and act accordingly
- CO 7 : know various Practical ways of Traditional and Modern crop production practices in India and understand the different crops cultivated in kharif season in India and their production technology and techniques to ensure crop productivity
- CO 8 : to adopt diversified farming system according to available farming situation.

Content :

1. Rice nursery preparation, transplanting of Rice (4 P)
2. sowing of soybean, pigeonpea and mungbean. maize, groundnut and cotton (4 P)
3. effect of seed size on germination and seedling vigour of kharif season crops (4 P)

4. effect of sowing depth on germination of kharif crops (4 P)
5. identification of weeds in kharif season crops (3 P)
6. top dressing and foliar feeding of nutrients (3 P)
7. study of yield contributing characters and yield calculation of kharif season crops, (3 P)
8. study of crop varieties and important agronomic experiments at experimental farm. (3 P)
9. study of forage experiments (3 P)
10. morphological description of kharif season crops (3 P)
11. visit to research centres of related crops (3 P)
12. Make a project on Application of Biotechnological Methods as a part of Crop production technology (3 P)

Paper Name : Fundamentals of General Immunology & Plant's Protection Mechanism (Theory)

Paper Type : Core Paper Code : CAGBT- 302 Credit : 04 L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students learn about the structural features of the components of the immune system as well as their function. The major emphasis of this course is on the development of the immune system and mechanisms by which the system elicit the immune response. It aims to address the plants immune system and disease resistance mechanisms . It also provides the conceptual framework for the development of immuno- and molecular diagnostics and their applications in agricultural sciences.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about immunology and Plant Immune system and disease resistance mechanisms

CO 2 : Comprehend the Knowledge about sequential and conceptual thinking and paradigms of cellular and molecular basis of immune system and their applications

CO 3 : Evaluate the usefulness of immunology in different spheres of Agriculture biotechnology

CO 4 : Learns the Concepts of how plants and pathogens interact to result in disease or resistance

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : know how plants immune system works and disease resistance mechanisms works

Content :

Unit – 1: General concepts of the immune system, innate and adaptive immunity; active and passive immunity; primary and secondary immune response. Cell and organs of immune system, Phagocytosis (6 L)

Unit-2: Antigens and haptens : Properties ,foreignness, molecular size, heterogeneity, B and T cell epitopes; T dependent and T independent antigens. (6 L)

Unit- 3 : Antibodies: Historical perspective of antibody structure; structure, function and properties of the antibodies; different classes, subclasses and biological activities of antibodies; concepts of antibody diversity, isotype, allotype, Introduction of hybridoma technology, monoclonal antibodies, polyclonal antibody (7 L)

Unit – 4 : Mechanism of humoral and cell mediated immune response. Introduction of Major Histocompatibility Complex, organization of MHC and inheritance in humans; Antigen presenting cells, antigen processing and presentation Complements, Vaccines (7 L)

Unit-5 : Types of Antigen and Antibody reactions , Hypersensitivity and its types Introduction to Allergy and its laboratory test, Laboratory tests for demonstration of antigen – antibody reaction such as agglutination, precipitation, ELISA, RIA, Immunofluorescence, (7 L)

Unit 6: Plant immune system , Disease Resistance in Plants (Disease resistance , Disease escape , Disease endurance , Types of Resistance , Genetics of Resistance) , Defence Mechanism in Plants , Resistant varieties in Plant Disease management (7 L)

Suggested Readings

1. Textbook of Immunology , Seemi , Farghat Basir , PHI
2. Immunology & Immune Technology , Ashok Kr Chakravarty, OUP
3. Immunology , C Vaman Rao , Narosa
4. Elements of Immunology , Fahim Halin Khan , Pearson
5. Kuby's Immunology , Kindt, Goldsby, Osborne , W H Freeman
6. Immunology , Georgy Pinchuk , TaTa Mcgraw Hill Publishing Company Ltd.
7. Immunology , I Knnan, MJP
8. Cellular and Molecular Immunology, A.K.Abbas , AH Lichtman , S Pillai , Saunders Publication

Paper Name : Lab On Fundamentals of General Immunology& Plant's Protection Mechanism (Practical)

Paper Type : Core Paper Code : CAGBT- 392 Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students learn about the structural features of the components of the immune system as well as their function. The major emphasis of this course is on the development of the immune system and mechanisms by which the system elicit the immune response.It aims to address the plants immune system and disease resistance mechanisms . It also provides the conceptual framework for the development of immuno- and molecular diagnostics and their applications in agricultural sciences.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about immunology and Plant Immune system and disease resistance mechanisms

CO 2 : Comprehend the Knowledge about sequential and conceptual thinking and paradigms of cellular and molecular basis of immune system and their applications

CO 3 : Evaluate the usefulness of immunology in different spheres of Agriculture biotechnology

CO 4 : Learns the Concepts of how plants and pathogens interact to result in disease or resistance
CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly
CO 6 : know how plants immune system works and disease resistance mechanisms works
CO 7 : gain knowledge about system , operating principles, Process , Standards of carrying out different immunological technology and tests and interpret and analyse the test results

Contents :

1. Identification of human blood groups. (2 P)
2. Perform Total Leukocyte Count of the given blood sample. (2 P)
3. Perform Differential Leukocyte Count of the given blood sample. (2 P)
4. Separate serum from the blood sample (demonstration). (2 P)
5. Immunoelectrophoresis (3 P)
6. Antigen- antibody reaction (Coomb's test) (2 P)
7. ELISA. (4 P)
8. Antibody and antigen (Ouchterlony method) (3 P)

Paper Name : Principles of Microbiology (Theory)

**Paper Type : Core Paper Code : CAGBT- 303 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to make students learn about the variety and variability of Microbial world including its systematic and classification ; address the process and types of Staining , Isolation , Culture methods and growth , reproduction and metabolic pathways and impact on human health and agriculture

Course Outcomes: On Completion of the Course, Students will be able to:

- CO 1 : gain fundamental knowledge about variety and variability of Microbial world including its systematic and classification
CO 2 : Comprehend the Knowledge about process and types of Staining , Isolation , Culture methods and growth , reproduction and metabolic pathways and impact on human health and agriculture
CO 3 : Evaluate the usefulness of of the discipline of Microbiology and the contributions made by prominent scientists in this field
CO 4 : understand the characteristics of different types of microorganisms, methods to organize/classify these into and basic tools to study these in the laboratory
CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly
CO 6 : explain the useful and harmful activities of the microorganisms
CO 7 : study the growth and control of microbes as well as different bacteriological techniques involved in microbiology

Content :

Unit 1 : Overview of history of Microbiology - Biogenesis and abiogenesis Contributions of Redi, Spallanzani, Needham, Pasteur, Tyndal, Joseph Lister, Koch [Germ Theory], Edward Jenner and Flemming [Penicillin], Scope of Microbiology. Classification of Microbes - Systems

of classification, Numerical taxonomy, Identifying characters for classification, General properties and principles of classification of microorganisms Systematics of bacteria, General properties of Archae and Eubacteria (8 L)

Unit 2 : Staining: Concept of auxochrome, chromophore, dyes, Mechanism of gram staining, acid fast staining, negative staining, capsule staining, flagella and endospore staining (8 L)

Unit 3 : Methods of isolation: Cultivation and Maintenance of microorganisms, Concept of Sterilization - Definition of sterilization, dry and moist heat, pasteurization, tyndalization; radiation, ultrasonication, filtration. Physical and Chemical methods of sterilization; disinfection sanitization, antiseptics sterilants and fumigation. Determination of phenol coefficient of disinfectant, Chemotherapeutic agents (8 L)

Unit 4 : Microbial growth: Growth curve, Generation time, synchronous batch and continuous culture, measurement of growth and factors affecting growth of bacteria. Nutritional types [Definition and examples]. Classification on the basis of oxygen requirement Microbial Metabolism: Metabolic pathways, amphi- catabolic and biosynthetic pathways Bacterial Reproduction: Transformation, Transduction and Conjugation. Endospores and sporulation in bacteria. (8 L)

Unit 5 : Water Microbiology: Bacterial pollutants of water, coliforms and non coliforms. Sewage composition and its disposal. (8 L)

Suggested Readings

1. Naveen Kango , 2010, Text Book of Microbiology , I.K. International Publishing House Pvt.Ltd
2. Microbiology. Pelczar, J.r.,M.J.E.C.S.Chan and Krieg, N.R, 2009, McGraw Hill Publishers
3. Microbiology. Prescott, L.M, Harley, J.P. and Klein, D.A., 2008, McGraw Hill Publishing Ltd
4. Brock Biology of Microorganisms. Madigan, M.,Martinko, J.M. and Parker, J. 2009, . Prentice Hall of India Pvt. Ltd.
5. Comprehensive Microbiology , Mitra, Dutta & Roy , Current Book International
6. Text Book of Microbiology , R.Ananthanarayan,C.K.Jayaran Paniker , Orient Longman
7. Text Book of Microbiology , P Chakrabarti , New Central Book Agency
8. Microbiology , P.D.Sharma , Rastogy Publication

Paper Name : Lab On Principles of Microbiology (Practical)

Paper Type : Core Paper Code : CAGBT- 393 Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students learn about the variety and variability of Microbial world including its systematic and classification .; address the process and types of Staining , Isolation , Culture methods and growth , reproduction and

metabolic pathways and impact on human health and agriculture

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about variety and variability of Microbial by microscopic study

CO 2 : Comprehend the Knowledge about Practical process and types of Staining , Isolation , Culture methods and growth , reproduction and metabolic pathways and impact on human health and agriculture

CO 3 : Prepare different types of culture media & carry out inoculation of culture media from different samples

CO 4 : understand the practical process of carrying out simple staining, differential staining, acid fast staining, capsule staining, spore staining and motility

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : Preparation and use of culture media, Pure culture and cultural characteristics & preservation methods of microbes

Content :

1. Microscopic Study of different microscopic organism (Slide study) (4 P)
2. Sampling and quantification of microorganisms in air, soil and water. (4 P)
3. Study of hot-air-oven for dry heat sterilization (4 P)
4. Study of autoclave for moist heat sterilization(3 P)
5. Study of Incubator , Colony Counter , Laminar Air Flow (3 P)
6. Preparation of different types of culture media. (4 P)
7. Methods of inoculation of culture media from different samples (4 P)
8. Methods of colony count & morphological identification of bacteria by colony characters, staining & motility tests (4 P)
9. Isolation of bacteria [Streak plate, spread plate, pour plate, serial dilution] (4 P)
10. Identification of microorganisms from the habitats [simple staining, differential staining, acid fast staining, capsule staining, spore staining and motility] (6 P)

Paper Name : GMOs , Biosafety , Bioethics & IPR (Theory)

Paper Type : Skill Enhancement Paper Code : SGBT-304A Credit : 02 L: 2 ,

T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide basic knowledge on Genetically Modified Organisms, their impact on human health and environment ; intellectual property rights and their implications in biological research and product development; India's IPR Policy ; to learn biosafety and risk assessment of products derived from biotechnology and regulation of such products ; to become familiar with ethical issues in biological research.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about GMO's , Biosafety , Bioethics and Intellectual

Property Right

CO 2 : Comprehend the Knowledge about Genetically Modified Organisms, their impact on human health and environment ;

CO 3 : understand intellectual property rights issues, process and concerns and their implications in biological research and product development; including India's IPR Policy ;

CO 4 : to learn biosafety and risk assessment of products derived from biotechnology and regulation of such products and become familiar with ethical issues in biological research.

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

Content :

Unit – 1: Genetically Modified Organisms and their effect . Genetically Modified Food (4 L)

Unit – 2 : Introduction and Overview of Biosafety, Categories and Cartagena protocol .Good laboratory biosafety practices (3 L)

Unit – 3 : Introduction to Intellectual property Rights- Concept of IPR, different forms of IPR (3 L)

Unit – 4 : Classification of patents, Special patents, Patenting biological products, Patentable and non patentable inventions in India, grant of patents, Grant process and requirements (4 L)

Unit – 5 : Ethical issues – ethical issues against the molecular technologies. (3 L)

Unit –6 : Bioethics – Necessity of Bioethics, Scope of bioethics, different paradigms of Bioethics – National & International. (3 L)

Suggested Readings

1. Intellectual Property Right , Pandey & Dharni , PHI
2. IPR, Biosafety and Bioethics, Goel And Parashar , Pearson
3. Bioethics and Biosafety , M.K.Sateesh , Willey
4. GMO : Myths and Truths , Michael Antoniou , Earthcare

Paper Name : Phytochemistry & Secondary Metabolite (Theory)

Paper Type : Skill Enhancement Paper Code : SGBT-304B

Credit : 02 L: 2 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide comprehensive knowledge on phytochemistry & Secondary metabolites including their types , forms , systems of production , functions and utility .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain comprehensive knowledge about phytochemistry & Secondary metabolites

including their types , forms , systems of production , functions and utility

CO 2 : Comprehend the Knowledge about basic metabolic pathways of plants and formation of different secondary metabolites through various biosynthetic pathways in plants

CO 3 : understand & evaluate source, chemistry, therapeutic uses of various secondary metabolites containing drugs;

CO 4 : Apply latest techniques for analysis of phytoconstituents.

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : Explain source, chemistry, therapeutic uses of various secondary metabolites containing drugs.

CO 7 : Describe methods of extraction, analysis and commercial application of various secondary metabolites containing drugs.

Content :

Unit – 1 : Fundamental concepts of Phytochemistry (2 L)

Phytochemistry/ Pharmaceutical Importance of the following

Unit 2 : Carbohydrates – sugar alcohols, starch, cellulose derivatives, gums and mucilages. (2 L)

Unit 3 : Glycosides: general account, biosynthesis, glycosidal drugs; Cyanogenic glycosides and glucosinolate compounds. (2 L)

Unit 4 : Alkaloids: definition, properties, classification, alkaloidal drugs – Daturastramonium, Atropabelladona, opium, Cinchona, tea, ergot, Rauwolfia, Holarrhena, Catharanthus– alkaloidal constituents, uses. (2 L)

Unit 5 : Phenolic compounds produced by plants: types, biological activity, drugs – Senna, Aloe, Hypericum, Capsicum. (2 L)

Unit 6 : Steroidal compounds: different types, biological activity and general pharmaceutical importance Carotenoids: chemistry, types, apocarotenoids, bioactivities. (2 L)

Unit 7 : Volatile oils: composition, drugs – clove, Mentha, Eucalyptus, Foeniculum, Cinnamomum, citronella (2 L)

Unit 8 : Resins: chemistry, different types, uses Lipids: fatty acids, nomenclature, fats, fixed oils, waxes (2 L)

Unit 9 : Secondary Metabolite : Introduction , Classification , Structure and Function , Influence of biotic and abiotic factors on the production of secondary metabolites, Mechanism of formation of Secondary Metabolite in Plants , Secondary Metabolism , Induction of Secondary Metabolism Methods of extraction, separation, isolation (Chromatographic techniques) and characterisation of secondary metabolites (Spectroscopic techniques) (4 L)

Paper Name : Research Methodology & Biostatistics (Theory)

Paper Type : Skill Enhancement Paper Code : SGBT-304C

Credit : 02 L: 2 , T: - , P: - 0

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objective of this course is to develop a research orientation among the learners and to acquaint them with fundamentals of research methods. Specifically, the course aims at introducing the students to the basic concepts used in research and methods of approach. It includes discussions on sampling techniques, research designs and techniques of analysis. The course aims to equip the learners with necessary comprehensive knowledge and Principles of statistical analysis of biological data

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain comprehensive knowledge about Research methodology and Biostatistics and their applications in the field of Biological and Agricultural Sciences

CO 2 : Comprehend the Knowledge about basic framework , types , methods of carrying out a Research including research processes

CO 3 : understand & evaluate Develop understanding of various research designs and techniques

CO 4 : Identify various sources of information for literature review and data collection.

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : Develop understanding of the ethical dimensions of conducting applied research

CO 7 : carry out sampling techniques, research designs and techniques of analysis

CO 8 : carry out statistical analysis of biological data

Content :

Unit 1: Foundations of Research Meaning, Objectives, Motivation: Research Methods vs Methodology, Types of Research: Analytical vs Descriptive, Quantitative vs Qualitative, Basic vs Applied (4 L)

Unit 2: Research Design Need for research design: Features of good design, Important concepts related to good design- Observation and Facts, Prediction and Explanation, Development of Models. Developing a research plan: Problem identification, Experimentation, Determining experimental and sample designs (4 L)

Unit 3: Data Collection, Analysis and Report Writing Observation and Collection of Data- Methods of data collection- Sampling Methods, Data Processing and Analysis Strategies, Technical Reports and Thesis writing, Preparation of Tables and Bibliography. Data Presentation using digital technology (4 L)

Unit 4: Ethical Issues Concepts of Copy Right, Royalty, Patent law, Plagiarism, Citation, Acknowledgement (4 L)

Unit 5 : Principles of statistical analysis of biological data. Concepts of Mean, Median, Mode from grouped and ungrouped Data set Sampling parameters. Difference between sample and

Population, Sampling Errors, Small sample test based on t-test, Z- test and F test; Distribution-free test - Chi-square test (4 L)

Suggested Books

1. Dutta, N. K. (2004). Fundamentals of Biostatistics, Kanishka Publishers.
2. Gurumani N. (2005) . An Introduction to Biostatistics, MJP Publishers.
3. Daniel, W. W. (2007). Biostatistics- A Foundation for Analysis in the Health Sciences,Wiley.
4. Rohatgi, V.K.& Saleh, A.K.Md. (2001). An Introduction to Probability and Statistics, John Wiley & Sons.
5. Sundaram, K.R.(2010) Medical Statistics-Principles & Methods, BI Publications,New Delhi
6. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to Research Methodology, RBSA Publishers.
7. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.
8. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications.
5. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing.
9. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.

Paper Name : Principles of Food Processing Technology (Theory)

Paper Type : Generic Elective Paper Code : GGBT- 305A Credit : 04

L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain knowledge of food processing technologies alongwith knowledge on the microbes associated with food spoilage, food borne illness and rapid detection of pathogens; enable the learners to gain knowledge to differentiate food spoilage and fermentation, learn the process of fermentation to prepare value added food and microbial enzymes involved in food industry and bio-preservation and learn regulatory aspects in food processing technology & biotechnology

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain comprehensive knowledge about Food Processing Technology

CO 2 : To understand about food preservation

CO 3 : To learn about To know the different methods of processing of foods.

CO 4 : To learn about the bakery product manufacturing process.

CO 5 : To understand about identification of sources for procurement of raw material.

CO 6 : To learn about production and quality analysis of fruits and vegetables products at commercial scale.

CO 7 : To learn about packaging, labeling, pricing and marketing of products

CO 8 : have a comprehensive knowledge on principles of preparation of juices and squashes.

Preparation of jam and jelly, food spoilage and its control

CO 9 : By necessary Industry integration to learn and understand different preparation ,processing , preservation , packaging , storing , marketing of preserved food

CO 10 : To enable learner with adequate employability skills so that he/she can get gainful employment in food processing and or preservation industry as well as can become an entrepreneur

Content :

Unit 1 : Properties of food – physical and chemical properties , Food groups – balanced diet, food pyramid, macro and micro nutrition. Nutrients-role of nutrients in the body, nutrient deficiencies and requirements for Indians. (8 L)

Unit 2 : Importance & principles of food preservation , Importance & principles of Food processing (8 L)

Unit 3 : Different methods of Preservation of fruits and vegetables , Different methods of Preservation of processed foods Unit 4 : Principles of preparation of juices and squashes , Principles of preparation of Jam & Jelly , Spoilage in foods and their control strategies (8 L)

Unit 4 : Storage and marketing of processed and preserved products (8 L)

Unit 5 : Food Safety – Definition, Importance, Scope and Factors affecting Food Safety. Hazards and Risks, Types of hazards - Biological, Chemical, Physical hazards.Management of hazards - Need.Control of parameters.Temperature control. Management Tools- Basic concepts.PRPs, GHPs, GMPs, SSOPs etc.HACCP.ISO series , Genetically modified foods\ transgenics .Organic food (8 L)

Suggested Books

1. Romeo T.Toledo , 2000 , Fundamentals Of Food Process Engg., CBS Pulishers & Distributors
2. Norman W.Desrosier, James N.Desrosier ,2004 , Technology of food Preservation , CBS Pulishers & Distributors
3. B.Srilakshmi , 2003 ,Food Science , New Age International Pvt.Ltd,publishers
4. M.Swaminathan , 1974 , Essentials of Food And Nutrition , Ganesh & Company
5. NPCS Board , 2009, Meat, Poultry and Fish processing , NIIR Project Consultancy Services
6. B. Srilakshmi,2002, Food science, New Age Publishers
7. Meyer, 2004 , Food Chemistry, New Age Publisher
8. M R Adams, M O Moss , 2008 , Food Microbiology , New Age International Pvt.ltd
9. James M.Jay , 2002, Modern Food Microbiology , CBS Pulishers & Distributors
10. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
11. Raina U, Kashyap S, Narula V, Thomas S, Suvira, Vir S, Chopra S ,2010, Basic Food Preparation: A Complete Manual, Orient Black Swan Ltd.
12. Manay S. and Shadaksharaswamy M ,2002, Foods–Facts and Principles. WilleyLtd.

Paper Name : Lab On Principles of Food Processing Technology (Practical)
Paper Type : Generic Elective Paper Code : GGBT- 395A
Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain practical knowledge of food processing technologies alongwith knowledge on the microbes associated with food spoilage, food borne illness and rapid detection of pathogens; enable the learners to gain knowledge to differentiate food spoilage and fermentation, learn the process of fermentation to prepare value added food and microbial enzymes involved in food industry and bio-preservation and learn regulatory aspects in food processing technology & biotechnology

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain comprehensive Practical knowledge about Food Processing Technology

CO 2 : To understand about techniques and standards of food preservation

CO 3 : To learn about the different methods of processing of foods.

CO 4 : To learn about the bakery product manufacturing process.

CO 5 : To understand about identification of sources for procurement of raw material.

CO 6 : To learn about production and quality analysis of fruits and vegetables products at commercial scale.

CO 7 : To learn about packaging, labeling, pricing and marketing of products

CO 8 : have a comprehensive knowledge on principles of preparation of juices and squashes. Preparation of jam and jelly, food spoilage and its control

CO 9 : By necessary Industry integration to learn and understand different preparation ,processing , preservation , packaging , storing , marketing of preserved food

CO 10 : To enable learner with adequate employability skills so that he/she can get gainful employment in food processing and or preservation industry as well as can become an entrepreneur

Content :

1. Visit to food processing industry and identify , learn and documentation of the real life food processing principle and operations (4 P)
2. Visit to Short-term storage and cold storage and getting hands on experience on their process of operation , operating principles and applications in food preservation (4 P)
3. Visiting relevant industries and hands on training on (10 P)
 - a. pasteurization
 - b. sterilization
 - c. Blanching
 - d. drying and dehydration
 - e. canning
4. Visit industry and learn with hands on training for Preparation of (6 P)
 - a. squashes
 - b. RHS
 - c. syrups.

5. Visit to Bakery to study of its product, bread, biscuit and submission of report on the process (4 P)
6. Visit industry and learn with hands on training for Preparation & Preservation of (6 P)
 - a. Jam
 - b. Jelly
 - c. Marmalade
7. Visit industry and learn with hands on training for Preparation & Preservation of (6 P)
 - a. Pickles
 - b. Chutney
 - c. Sauce

Paper Name : Principles of Farm Management (Theory)
Paper Type : Generic Elective Paper Code : GGBT-305B Credit : 04
L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain knowledge of Traditional and Modern methods of farm management

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive understanding treatment of the traditional agricultural production economics topics.

CO 2: Focus on the neoclassical factor-product, factor-factor and product- product models

CO 3 : Understand limited resources available in the economy. Realize the need to exploit and utilize through development and improvement of production techniques.

CO 4 : Make them aware of the availability of rich natural endowments to achieve sustainable agricultural development with this knowledge they can challenge the problems of unemployment inequality shortage of food productions, poverty and be useful to compete advanced agricultural economies.

CO 5 : Gain knowledge of the causes of regional variations in productivity and production, social and economic inequality, size of land holdings and lack of quality inputs etc. And suggest appropriate measures for the whole economy.

Content :

Unit 1 : Definition , Resources , Meaning and definition of farms, its types and characteristics, factor determining types and size of farms, Principles of farm management: ,Nature & Characteristics of Farm Management , Scope of Farm Management (4 L)

Unit 2 : Farm management decision making process , Production, operational, strategic, administrative and marketing management decisions. (4 L)

Unit 3 : Production, types of resources, choice indicators, costs, revenue, profit, total, average & marginal concepts. (4 L)

Unit 4: Factor - Product relationship - Production function - definition & types - linear, quadratic

& Cobb- Douglas functions - Impact of technology. (4 L)

Unit 5 : Law of diminishing returns - regions of production Cost concepts & interrelations - Optimum level of input use and optimum production (4 L)

Unit 6 : Economies of scale - external and internal economies and diseconomies - Returns to scale – Economies (4 L)
of size Factor - Factor relationship - Principle of substitution - isoquant, isoclines (4 L)

Unit 7 : Expansion path, ridgeline and least cost combination of inputs Product - Product relationship - types. Production possibility curve, iso revenue line and optimum combination of outputs . Equi-marginal returns and Opportunity cost - comparative advantage (4 L)

Unit 8: Concepts of Risk and uncertainty - types of uncertainty in agriculture - managerial decisions to reduce risks in production process (4 L)

Unit 9: Management of Important Farm Resources Farm Financial Analysis - Balance sheet - Income statement- Cash flow analysis - Ratio analysis. Farm Investment Analysis - Time comparison principles - Discounted and undiscounted measures. Farm planning and control - Elements of planning, objectives, steps and formulation of farm plans - Farm level management information systems. Farm Budgeting partial, enterprise and complete budgeting. (4 L)

Unit 10 : Application of Biotechnological approach in Farm Management (4 L)

Suggested Readings

1. Economics Of Farm Production & Management by Raju, V.T.,Shanker Rao, Oxford & IBH
2. Economics of Agricultural Production and Farm Management, J. M. Dhaka , Aaviskar

Paper Name : Lab On Principles of Farm Management (Practical) Paper

Type : Generic Elective Paper Code : GGBT- 395B

Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain Practical knowledge of Traditional and Modern methods of farm management

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive Practical understanding about traditional and modern methods of far management

CO 2: carry out CBA , ROI , Opportunity cost principles

CO 3 : have an understanding about CACP concept

Content :

1. Visiting a commercial farm and make a project report on Farm input , Input management , operation , Post Harvest and Cost benefit analysis (4 P)
2. Preparation of farm layout. (4 P)
3. Determination of cost of fencing of a farm. (3 P)
4. Computation of depreciation cost of farm assets. (3 P)
5. Application of equi-marginal returns/opportunity cost principle in allocation of farm resources. (3 P)
6. Determination of most profitable level of inputs use in a farm production process. (3 P)
7. Determination of least cost combination of inputs. (4 P)
8. Selection of most profitable enterprise combination. (4 P)
9. Application of cost principles including CACP concepts in the estimation of cost of crop and livestock enterprises. (4 P)
10. Preparation of farm plan and budget, farm records and accounts and profit & loss accounts. (4 P)
11. Collection and analysis of data on various resources in India. (4 P)

Paper Name : Food & Dairy Microbiology (Theory)

Paper Type : Generic Elective Paper Code : GGBT-305C Credit : 04

L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain knowledge of food and dairy microbiology including the microbes associated with food spoilage, food borne illness , dairy product spoilage and rapid detection of pathogens; Gain knowledge to differentiate food & dairy product spoilage and fermentation and dairy technology , learn the process of fermentation to prepare value added food and microbial enzymes involved in food industry and bio-preservation; Learn regulatory aspects in food & Dairy Microbiology.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive understanding treatment of the traditional & modern methods of Food and Dairy microbiology

CO 2: Focus on microbes associated with food spoilage, food borne illness , dairy product spoilage and rapid detection of pathogens

CO 3 : Understand regulatory aspects in food & Dairy Microbiology.

CO 4 : Determine microorganisms and their products in foods and dairy , understand causes of food and dairy product spoilage and predict the microorganisms that can spoil a given material, when prepared, processed and stored under given conditions

CO 5 : Obtain a good understanding of food & Dairy microbiology and become qualified for a food biotechnologist / microbiologist position in food and or dairy industry

CO 6 : understand and evaluate different standards and quality control technologies used in food and dairy industry

Content :

Unit 1 Foods as a substrate for microorganisms Intrinsic and extrinsic factors that affect growth

and survival of microbes in foods, natural flora and source of contamination of foods in general, Water in food, water activity and shelf life of food, Carbohydrates-chemical reactions, functional properties of sugars and polysaccharides in foods, Lipids: classification, and lipids-chemical reactions in foods, Protein and amino acids distribution, Protein - chemical reactions and functional properties of proteins in foods. (8 L)

Unit 2. Microbial spoilage of various foods Food contaminants and spoilage of vegetables, fruits, meat, eggs, milk and butter, bread, canned Foods. (6 L)

Unit 3. Milk and dairy products Types of Milk, cream, eggnog, buttermilk, butter, cheese, ice-cream. Reactions of milk, Microorganisms present in the milk and their characteristics. milk standards, pasteurization, milk born infections (6 L)

Unit 4 Principles and methods of food preservation Physical methods of food preservation: temperature (low, high, canning, drying), additives, irradiation, hydrostatic pressure, high voltage pulse, extrusion cooking, microwave processing dielectric heating, and aseptic packaging, Chemical methods of food preservation: salt, sugar, organic acids, SO₂, nitrite and nitrates, ethylene oxide, antibiotics and bacteriocins (7 L)

Unit 5. Food borne diseases (causative agents, foods involved, symptoms and preventive measures) Food intoxications: *Staphylococcus aureus*, *Clostridium botulinum* and *mycotoxins*; Food infections: *Bacillus cereus*, *Vibrio parahaemolyticus*, *Escherichia coli*, *Salmonellosis*, *Shigellosis*, *Yersinia enterocolitica*, *Listeria monocytogenes* and *Campylobacter jejuni* (7 L)

Unit 6 Food sanitation and control HACCP, Indices of food sanitary quality and sanitizers (6 L)

Suggested Readings

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P)Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
3. Davidson PM and Brannen AL. (1993). Antimicrobials in Foods. Marcel Dekker, New York.
4. Dillion VM and Board RG. (1996). Natural Antimicrobial Systems and Food Preservation. CABInternational, Wallingford, Oxon.
5. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
6. Gould GW. (1995). New Methods of Food Preservation. Blackie Academic and Professional, London.
7. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
8. Tortora GJ, Funke BR, and Case CL. (2008). Microbiology: An Introduction. 9th edition. PearsonEducation

Paper Name : Food & Dairy Microbiology (Practical)

Paper Type : Generic Elective Paper Code : GGBT- 395C Credit : 02
L: - , T: - , P: -2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objective of this course are to make the learners gain sufficient Practical knowledge of food and dairy microbiology including the microbes associated with food spoilage, food borne illness , dairy product spoilage and rapid detection of pathogens; Gain knowledge to differentiate food & dairy product spoilage and fermentation and dairy technology , learn the process of fermentation to prepare value added food and microbial enzymes involved in food industry and bio-preservation.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive practical understanding treatment of the traditional & modern methods of Food and Dairy microbiology

CO 2: Focus on identification and control of microbes associated with food spoilage, food borne illness , dairy product spoilage and rapid detection of pathogens

CO 3 : Obtain a good understanding of food & Dairy microbiology and become qualified for a food biotechnologist / microbiologist position in food and or dairy industry

CO 6 : understand and evaluate different standards and quality control technologies used in food and dairy industry

Content :

1. Test for quality control checking of Milk (**4P**)
2. MBRT of milk samples and their standard plate count. (**4P**)
3. Alkaline phosphatase test to check the efficiency of pasteurization of milk. (**4P**)
4. Isolation of food borne bacteria and fungi from food products. (**4P**)
5. Isolation of spoilage microorganisms from spoiled vegetables/fruits. (**4P**)
6. Isolation of spoilage microorganisms from bread. (**4P**)
7. Preparation of Yogurt/Dahi. (**6P**)
8. Visit a dairy and submit a project on hands on experience (**4P**)
9. Visit a food processing industry and submit a project on hands on experience (**6P**)

Year – II
Semester – IV

CORE COURSE(4+2 credits)		SKILL ENHANCEMENT COURSE (2 credits)[Any One]		GENERIC ELECTIVE(4+2 credits) [Any One (T+P)]	
Paper Name	Paper Code	Paper Name	Paper Code	Paper Name	Paper Code
Crop Production Technology – II (Rabi)	CAGBT-401	Organic Farming	SGBT-404A	Fundamentals of Horticulture	GGBT-405A
Lab on Crop Production Technology – II (Rabi)	CAGBT-491	Plant Metabolic Engineering & Molecular Farming	SGBT-404B	Lab on Fundamentals of Horticulture	GGBT-495A
Concepts of Molecular Biology	CAGBT402	Advanced Concepts of Application of Biotechnology in Agriculture & Human Welfare	SGBT-404C	Floriculture and Landscaping	GGBT-405B
Lab on Concepts of Molecular Biology	CAGBT492			Lab on Floriculture & Landscaping	GGBT-495B
Fundamentals of Irrigation & Water Management	CAGBT403			Fundamentals of Poultry & Fishery Management	GGBT -405C
Lab on Fundamentals of Irrigation & Water Management	CAGBT493			Lab on Fundamentals of Poultry & Fishery Management	GGBT 495C

Year – II

Semester- IV

Paper Name : Crop Production Technology – II (Rabi) (Theory)

**Paper Type : Core Paper Code : CAGBT- 401 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to build upon knowledge of Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops of India .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops

CO 2 : Comprehend the Knowledge about Analysis of comparative benefits of the different Rabi crops

CO 3 : Learn to apply technical knowledge and skills for cultivation of Rabi crops

CO 4 : Learns the Concepts of Production technology of Rabi cereals and other crops and how to fulfill the need of human consumption and livestock ensuring food safety & food security

CO 5 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 6 : know various crop production practices in India and understand the different crops cultivated in Rabi season in India and their production technology and techniques to ensure crop productivity

Content :

Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield of Rabi crops;

Unit 1 : cereals –wheat and barley (6 L)

Unit 2 : Pulses-chickpea, lentil, peas, French bean (6 L)

Unit 3 : Oilseeds-rapeseed, mustard , sunflower and safflower, linseed (6 L)

Unit 4 : sugar crops- sugarcane and sugarbeet (6 L)

Unit 5 : other crops- potato, tobacco (6 L)

Unit 6 : Forage crops-berseem, lucerne and oat. (6 L)

Unit 7 : Application of Biotechnology in crop Production technology (Rabi Crops) (4 L)

Suggested Readings

1. George Acquaah , 2005 , Principles of Crop Production , PHI Learning

2. Reddy, S.R. 2016. Introduction To Agronomy & Principles Of Crop Production. Kalyani Publishers
3. B N Chatterjee, S Maity , 1984 , Cropping System (Theory & Practical) , Oxford & IBH
4. Handbook of Agriculture , ICAR
5. Arun Katyayan , 2017, Fundamentals of Agriculture (Vol I) , Kalyani Publisher
6. Arun Katyayan , 2017 , Fundamentals of Agriculture (Vol II) , Kalyani Publisher
7. N.R. DAS, 2007 , Crops of India , Scientific Publisher
8. A Shiv Raj , 1978 , An Introduction to Physiology of Field Crops , Oxford & IBH
9. S S Singh , Crop Management , 2005 , Kalyani Publisher
10. Mukund Joshi , 2005 , Field Crop Production , PHI
11. Rajendra Prasad (ed.), 2006. Text Book of Field Crop Production, ICAR, New Delhi.
12. Reddy, S.R. and Reddi Ramu. 5th edition. Agronomy of Field Crops, Kalyani Publishers
13. GururajHunsigi and Krishna K.R. 2007. Scientific Field Crop Production, Oxford & IBH Publishing Co

Paper Name : Lab On Crop Production Technology – II (Rabi) (Practical)
Paper Type : Core Paper Code : CAGBT- 491 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to build upon Practical knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield management of Rabi crops of India .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : gain fundamental Practical knowledge about Origin, geographical distribution, economic importance, soil and climatic requirements, varieties, cultural practices and yield Maintenance and management of Rabi crops

CO 2 : learn and gain knowledge about will be acquainted with the knowledge of profitable & socially , economically and environmentally sustainable crop production technology.

CO 3 : Comprehend the Practical Knowledge about Analysis of comparative benefits of the different Rabi crops

CO 4 : Learn to apply Practical technical knowledge and skills for cultivation of Rabi crops

CO 5 : Learns the Practical Concepts of Production technology of Rabi cereals and other crops and how to fulfill the need of human consumption and livestock ensuring food safety & food security ..

CO 6 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 7 : know various Practical ways of Traditional and Modern crop production practices in India and understand the different crops cultivated in Rabi season in India and their production technology and techniques to ensure crop productivity

CO 8 : to adopt diversified farming system according to available farming situation.

Content:

1. Sowing methods of wheat and sugarcane (4 P)
2. Identification of weeds in rabi season crops and making Herbarium (4 P)
3. study of morphological characteristics of rabi crops (4 P)
4. study of yield contributing characters of rabi season crops (4 P)
5. yield and juice quality analysis of sugarcane (4 P)
6. study of important agronomic experiments of rabi crops at experimental farms (4 P)
7. Study of rabi forage experiments (4 P)
8. oil extraction of medicinal crops (4 P)
9. visit to research stations of related crops (4 P)
10. Make a project on Application of Biotechnology in Crop production Technology (Rabi) (4 P)

Paper Name : Concepts of Molecular Biology (Theory)

**Paper Type : Core Paper Code : CAGBT- 402 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to make students understand how molecular machines are constructed and regulated so that they can accurately copy, repair, and interpret genomic information in prokaryotes and eukaryotic cells. Further, to appreciate the subject of molecular biology as a dynamic and ever-changing experimental science.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : acquire basic knowledge on molecular architecture of prokaryotic and eukaryotic genomes and learn various molecular events that lead to duplication of DNA, recombination of genes, gene expressed into transcripts and translated into proteins following a central dogma

CO 2 : Comprehend and understand the mechanisms by which DNA could be damaged and repairs itself

CO 3 : understand molecular mechanisms behind different modes of gene regulation in bacteria and eukaryotes at both pre- and post-transcriptional levels and methods to study DNA and protein interactions

CO 4 : understand structural levels of nucleic acids- DNA and RNA and genome organization in prokaryotes and eukaryotes.

CO 5 : Understanding the concept of Gene and the gene architecture.

CO 6 : Evaluate the central dogma of life and various molecular events

CO 7 : carry out different techniques of molecular biology

Content :

Unit 1: Structure And Organization Of The Genetic Material: Nucleic acids: Structure of Nucleotides, Nucleotides as source of energy, component of coenzymes, second messengers. DNA structure – Watson- Crick model. A, B & Z forms of DNA, Supercoiled and relaxed DNA, quadruplex DNA, denaturation and renaturation of DNA, melting temperature (T_m), UV absorption and hyperchromic effect. Nucleosome structure and Genome organization. Structure of major types of RNA. DNA as a store of information: Genes are mutable units, one

gene-one protein hypothesis, DNA is the almost universal genetic material (Griffith's experiment, Avery, MacLeod and McCarty's experiment, Hershey-Chase experiment), Central Dogma of Molecular Biology. (8 L)

Unit 2: Replication of DNA : Semiconservative nature of DNA replication (Messelson and Stahl's experiment), Mechanism of bidirectional DNA replication in prokaryotes, Bacterial DNA Polymerases, Pre-priming proteins, Primosome and Replisome. (6 L)

Unit 3: DNA Damage, Repair And Mutation: Definition of mutation, gain of function and Loss of function mutation, Forward and Reverse mutation, Point mutation (Transitions, transversions, Missense mutation, Nonsense mutation, silent mutation, Frame shift mutation), Spontaneous mutation and Induced mutation, Mutagen – physical (Ionizing radiation, UV radiation), chemical (Base analogs, Nitrous acid, Acridine dyes, Alkylating agents), Ames test. Causes and types of DNA damage, DNA repair-Photo reactivation, mismatch repair, base excision and nucleotide excision repair, SOS repair. (7 L)

Unit 4: Gene Expression And Regulation : Transcription: Transcription in prokaryotes with E. coli as model system: RNA polymerase, initiation, elongation and termination of transcription, rho dependent and independent termination. Inhibitors of transcription Actinomycin D and α -Amanitin. (6 L)

Unit 5 : Genetic code: Features of Genetic code, Wobble hypothesis. (6 L)

Unit 6: Translation in prokaryotes: Role of m-RNA, t-RNA and r-RNA in protein synthesis, ribosome structure and assembly, Charging of t-RNA, aminoacyl t-RNA synthetases, initiation, elongation and termination of protein synthesis in bacteria, Action of antibiotics that act as protein synthesis inhibitors - Streptomycin, Tetracycline, Kanamycin, Chloramphenicol and Puromycin. Regulation of transcription: Operon model of gene regulation, negative and positive regulation in prokaryotes, lac operon. (7 L)

Suggested Readings

1. Cell and Molecular Biology , Rastogi SC , New Age
2. Essentials Of Molecular Biology , David Freifelder , Narosa Publisher
3. A Text Book Of Molecular Biotechnology , Asoke K. Chauhan, Ajit Varma, I.K .International
4. Principles of Genetics , Gardner E J, Simmons M J, Snustad DP , Wiley India
5. Fundamentals of Molecular Biology , Jayanta Kr Pal, Saroj S. Ghaskadbi , OUP
6. Human Genetics For Medical & Life Sciences , Bheem Prasad , Current Book International
7. Essentials of Medical Genetics , A.K. Datta , ARK Publication
8. Genetics , Verma & Agarwal , S Chand
9. Principles of Genetics , Robert H. Tamarin , Tata Mcgraw Hill Publishing Company Ltd.
10. Genetics , Monroe W . Strickberger , Prentice Hall of India Pvt. Ltd
11. Solving Problems In Genetics , Richard Kowles , Springer

12. Molecular Biotechnology , Bernard R.Glick and Jack J.Pasternak , ASM Press
Washington DC
13. Gene, Pearson Publication

Paper Name : Lab On Concepts of Molecular Biology (Practical)
Paper Type : Core Paper Code : CAGBT- 492 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students understand how molecular machines are constructed and regulated so that they can accurately copy, repair, and interpret genomic information in prokaryotes and eukaryotic cells. Further, to appreciate the subject of molecular biology as a dynamic and ever-changing experimental science.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : carry out different techniques of molecular biology

CO 7 : operate different machineries and equipments required to carry out tests for molecular biology

CO 3 : Prepare of buffers and solutions , Isolate DNA and RNA , carry out Plasmid DNA isolation , perform Electrophoresis Gel Documentation and photography , Study of absorption spectra of DNA and Extraction of chromosomal DNA

CO 4 : analyse , interpret the data .

Content :

1. Preparation of buffers and solutions for molecular biology experiments (3 P)
2. DNA isolation from Cabbage leaves/ goat liver/Human blood and Microbes (5 P)
3. Plasmid DNA isolation (5 P)
4. Agarose gel Electrophoresis of genomic DNA and plasmid DNA (5 P)
5. Preparation of restriction digestion of DNA samples (5 P)
6. Gel Documentation and photography (4 P)
7. Quantitative estimation of RNA by orcinol method using colorimeter (5 P)
8. Study of absorption spectra of DNA and protein using UV-Visible spectrophotometer(4 P)
9. Extraction of chromosomal DNA from *E. coli* or from plant tissue (4 P)

Paper Name : Fundamentals of Irrigation & Water Management (Theory)
Paper Type : Core Paper Code : CAGBT- 403 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students understand about process , systems , types , governing principles , operational principles , scheduling mechanism , need and function of irrigation and water management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : acquire comprehensive knowledge on process , systems , types , governing principles ,

operational principles , scheduling mechanism , need and function of irrigation and water management .

CO 2 : understand the importance and different methods of irrigation

CO 3 : know about conveyance of irrigation , irrigation scheduling , irrigation water quality management

CO 4 : know about integrated irrigation management.

CO 5 : Evaluate the suitability and efficiency of different irrigation methods and water management strategies .

Content :

Unit 1: Irrigation: Definition and objectives , Importance of irrigation in crop production , water resources, irrigation projects (major, medium and minor) in India , Soil Plant Water relationships , Methods of soil moisture estimation; Evapotranspiration and Crop water requirement; Duty of water; Conjunctive use of water , Irrigation efficiency and Water use efficiency (**8 L**)

Unit 2 : Methods of irrigation: a) Surface irrigation – i) Border-strip, ii) Cheek basin, iii) Furrow, iv) Ring method (for chards) b) Sub Surface , c) Sprinkler and d) Drip irrigation (**8 L**)

Unit 3 : Conveyance of irrigation: a) Conventional, b) Unlined & lined open channels, c) Fixed & Flexible pipes, d) Underground pipe system (**8 L**)

Unit 4 : Irrigation Scheduling: i) Time of irrigation, ii) Physiological stages of the crop, iii) Soil moisture status, iv) Soil-water tension, v) Evapo-transpiration (**8 L**)

Unit 5 : Poor quality irrigation water and their management , Integrated irrigation management , Water shed Management, Concepts of Fertigation (**8 L**)

Suggested Readings

1. U.S.Sree Ramulu , 1998 , Management Of Water Resources In India , New Age International
2. Reddy, S.R. 2016. Irrigation Agronomy, 3rd Edition, Kalyani Publishers
3. S K Mazumder , 2015 , Irrigation Engineering , Galgotia Publication
4. Micheal,A.M. 2007. Irrigation Theory and Practice. Second edition. Vikas Publishing House, Pvt. Ltd.
5. Sankara Reddy, G.H. and Yellamanda Reddy, T. 2006. Efficient Use of Irrigation Water. Kalyani Publishers
6. Majumdar, D.K. 2013. Irrigation Water Management: Principles and Practices. PHI Learning
7. Handbook of Agriculture , ICAR
8. Misra R.D. and M. Ahmed , 2010, Manual on irrigation agronomy , Oxford and IBH Publishing Co

Paper Name : Lab On Fundamentals of Irrigation & Water Management (Practical) Paper Type : Core Paper Code : CAGBT- 493 Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students understand about different Practical aspects of process , systems , types , governing principles , operational principles , scheduling mechanism , need and function of irrigation and water management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : acquire comprehensive practical knowledge on process , systems , types , governing principles , operational principles , scheduling mechanism , need and function of irrigation and water management .

CO 2 : carry out and guide the farmers on different irrigation procedure by hands on training

CO 3 : understand and carry out the quality of water by laboratory analysis of irrigation water

CO 4 : Evaluate the suitability and efficiency of different irrigation methods and water management strategies .

Content :

1. Visiting farm and Study of Utilisation of water for irrigation in farm (3 P)
2. Visit farm and Study through demonstration and self operation of
 - a. different methods of application of irrigation water and irrigation channels,
 - b. surface and sub-surface irrigation method
 - c. Sprinkler Method
 - d. Drip irrigation methods (5 P)
3. Visit farmers field & carry out Study of irrigation scheduling –
 - a. Time of irrigation based on phenological stages and soil moisture status of the crop.
 - b. Amount of water to be irrigated .
 - c. Irrigation schedules for different important crops (any two of locally available). (4 P)
4. Visit the farm field to see & self Measurement of irrigation water through
 - a. 'V' notch
 - b. meter gate (3 P)
5. Visiting the farm field , collecting and storing samples of irrigation water and hands on training on testing quality of irrigation water by use of water testing kit / Lab for the following parameters following Standard operating Procedure
 - a. TDS
 - b. EC
 - c. Salinity
 - d. pH
 - e. Alkalinity and or Acidity
 - f. Sodicity (7 P)
6. Study of soil moisture measuring devices (3 P)
7. Determination of field capacity and permanent wilting point (3 P)
8. Measurement of infiltration rate (3 P)

9. Scheduling of irrigation by IW/CPE ratio method (3 P)
10. Calculation on soil moisture (3 P)
11. Calculation of irrigation water needs, duty of water and irrigation efficiencies (3 P)

Paper Name : Organic Farming (Theory)

**Paper Type : Skill Enhancement Paper Code : SGBT-404A Credit : 02 L: 2 ,
T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to make students understand about process , systems , types , governing principles , operational principles of Organic Farming . It also aims to address the identified areas of organic farming to create job opportunities in organic sector particularly in the area of organic production, on-farm resource management, input production and quality control, certification and marketing of organic produce and to create work force which will help/guide/learn the techniques for doubling farmer's income at village level like reducing input cost/inputs management, multilayer cropping, crop waste management, nutrient management, water management etc.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1: acquainted with the knowledge of concept and principles of organic production technology and Role of organic farming in National economy.

CO 2 : Select crops and varieties and organic agri inputs for organic farming and increase production of organic products

CO 3 : get practical knowledge of Vermicompost , Biofertilizer , Biopesticide production methodology

CO 4 : gain details knowledge on Indigenous technology knowledge (ITK); Quality analysis of organic inputs and products; Relative economics of organic production programmes Socio-economic impacts

CO 5 : understand certification process and standard of organic produce

CO 6 : Evaluate the organic management practices with special focus on soil health base crop management, nutrient management and plant protection including formulation techniques for traditional Biofertilizer, Biopesticides and Soil health promoters

CO 7 : Identify and explain the key principles and practices involved in maintaining soil fertility and plant productivity and health in organic farming systems;

CO 8 : Explain the role of livestock and forage production in organic farming systems and identify the key principles and practices underpinning the management, productivity, health and welfare of organic livestock;

CO 9 : Assess the contribution of organic farming to food quality, environmental and social policy objectives and outline the policy measures which have a direct influence on the extent and adoption of organic farming in India

Content :

Unit 1: Organic farming, principles and its scope in India; Initiatives taken by Government (central/state), NGOs and other organizations for promotion of organic agriculture; Organic ecosystem and their concepts; Organic nutrient resources and its fortification; Restrictions to

nutrient use in organic farming (5 L)

Unit 2 : Choice of crops and varieties in organic farming; Fundamentals of insect, pest, disease and weed management under organic mode of production; Operational structure of NPOP; Certification process and standards of organic farming; Processing, leveling, economic considerations and viability, marketing and export potential of organic products. (5 L)

Unit 3 : Principles and Concepts of Sustainable Agriculture, Sustainable agriculture-problems and its impact on agriculture, indicators of sustainability, adaptation and mitigation, conservation agriculture strategies in agriculture, HEIA, LEIA and LEISA and its techniques for sustainability, Integrated farming system-historical background (5 L)

Unit 4 : Objectives and characteristics, components of IFS and its advantages, Site specific development of IFS model for different agro-climatic zones, resource use efficiency and optimization techniques, Resource cycling and flow of energy in different farming system, farming system and environment. (5 L)

Suggested Readings

1. Arun Kumar Sharma. 2006. A Handbook of Organic Farming. Agrobios (India)
2. Palaniappan, SP. and Annadurai, K. 1999. Organic Farming: Theory and Practice, Scientific Publishers
3. Mukund Joshi and Prabhakarsetty, T.K. 2006. Sustainability through organic farming. Kalyani Publishers
4. Balasubramanian, R., Balakrishnan, K. and Siva Subramanian, K. 2013. Principles and Practices of organic Farming. Satish Serial Publishing House
5. Tarafdar, J.C., Tripathy, K.P. and Mahesh Kumar. 2009. Organic Agriculture. Scientific Publishers

Paper Name : Plant Metabolic Engineering & Molecular Farming (Theory)

Paper Type : Skill Enhancement Paper Code : SGBT-404B Credit : 02

L: 2 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to make students understand about process , systems , types , governing principles , operational principles of Plant metabolic engineering and molecular farming . It also aims to address the identified areas of Basic concepts of Metabolic Engineering , cellular metabolism , different models , biochemical pathways , Genetic manipulation , Secondary Metabolites , Metabolic Profiling & Transcription Factors , Metabolic flux , Applications of Metabolic Engineering etc.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive understanding about plant primary and secondary metabolites, regulation of metabolic pathways, metabolic flux analysis and applications of metabolic flux analysis, methods for the experimental determination of metabolic fluxes.

CO 2 : gain insight into the fundamentals of metabolic engineering in strain and plant improvement programs to increase the yield of a target product or reduce or eliminate the

production of undesired impurities.

CO 3 : have knowledge on applications of metabolic engineering in agriculture and industry

Content :

Unit 1 : Basic concepts of Metabolic Engineering – Overview of cellular metabolism; Different models for cellular reaction. Primary Metabolites giving special attention to sugars, amino acids and lipids: The basic structure, The biochemical pathway, Carbon flow, Different regulatory points (regulation at enzyme level and whole cell level, Alteration of feed back regulation, Limiting accumulation of end products), Genetic manipulation of starch, amino acids and oil content in plants and their value addition with significance in horticulture, agriculture and medicine (**4 L**)

Unit 2 : Secondary Metabolites giving special emphasis to following components of Flavanoid pathway, Terpenoid pathway, Polyketoid pathway: The basic structure, The biochemical pathway, Carbon flow, Different regulatory points (regulation at enzyme level and whole cell level, Alteration of feed back regulation, Limiting accumulation of end products), Genetic manipulation of flavonoid pathway, Terpenoid and Polyketoid pathways in plants and their value addition with significance in horticulture, agriculture and medicine (**4 L**)

Unit 3: Metabolic Profiling & Transcription Factors for Metabolic Engineering Metabolic Engineering to improve tolerance of plants to abiotic factors/climate change (**4 L**)

Unit 4 : Metabolic flux - Integration of anabolism and catabolism, metabolic flux distribution analysis bioprocess, material balance, kinetic types, equilibrium reaction. Experimental determination method of flux distribution, metabolic flux analysis and its applications, Metabolic engineering with Bioinformatics, Analysis of metabolic control and the structure, metabolic networks, metabolic pathway synthesis algorithms (**4 L**)

Unit 5: Applications of Metabolic Engineering - in pharmaceuticals (edible vaccines, plantibodies etc), chemical bioprocess, food technology, nutraceuticals, agriculture, biofuels, and biomass conversion. Bioenergy generation, Bioethanol and biohydrogen (**4 L**)

Suggested Books

1. Gregory N. Stephanopoulos, Aristos A. Aristidou, Metabolic Engineering – Principles and Methodologies, Jens Nielsen Academic Press, 1998
2. Jaiwal P K, Plant Genetic Engineering: Vol 8-9, Metabolic Engineering and Mol Farming , Studium Press. USA
3. Gerhard Gottschalk, Bacterial Metabolism, SpringerVerlag
4. S. A. Teukolsky, W. T. Vetterling, B. P. Flannery, W. H. Press, Numerical Recipes in C, Cambridge University Press

**Paper Name : Advanced Concepts of Application of Biotechnology in
Agriculture & Human Welfare (Theory)**

**Paper Type : Skill Enhancement Paper Code : SGBT-404C Credit : 02 L: 2 ,
T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of diversified Biotechnological application in the field of Agriculture .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of application of diversified biotechnological applications in the field of Agriculture

CO 2 : learn and gain knowledge about Concept , types , components , production and application and impacts of Biofertilizers, Biopesticides , Mushrooms , GMOs , Genetic Engineering , Recombinant DNA Technology , Tissue culture , Biofuel etc

CO 3 : Comprehend the systems , components , types , process of operation demands of the Agriculture Biotechnology Industry

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Agriculture Biotechnology

CO 5 : Learns to analyse the governing principles and sciences of Agriculture Biotechnology

CO 6 : Synthesize required techno managerial process solution and application required in Agriculture Biotechnology

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

Content :

Unit 1 : Industrial production of Alcohol and antibiotic (Penicilin) (4 L)

Unit 2 : Application of biotechnology in agriculture, N₂ fixation, transfer of pest resistance genes to plants. (4 L)

Unit 3 : Application of biotechnology in environments: e.g. chlorinated and non-chlorinated organic pollutant degradation; degradation of hydrocarbons and agricultural wastes, stress management, development of biodegradable polymers such as PHB. (4 L)

Unit 4 : Application of biotechnology in forensic science: e.g. solving violent crimes such as murder and rape; solving claims of paternity and theft etc. using various methods of DNA finger printing. (4 L)

Unit 5 : Application of biotechnology in health, Basic concept of therapy. Attenuated , DNA and mRNA Vaccine Technology (4 L)

Suggested Books

1. Casida LE. (1991). Industrial Microbiology. 1st edition. Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology. 2nd edition. Panima Publishing Co. New Delhi.

3. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
5. Ashim Kr Chakravarty, Introduction to Biotechnology, OUP
6. S.N. Jogdand, Advances In Biotechnology, Himalaya
7. A . K . Chatterjee, Environmental Biotechnology, PHI
8. H.D.Kumar, Modern Concepts of Biotechnology, Vikash Publication
9. T Srinivas, Environmental Biotechnology, New Age International

Paper Name : Fundamentals of Horticulture (Theory)

Paper Type : Generic Elective Paper Code : GGBT- 405A Credit : 04

L: 4, T: -, P: - CA – 30 Marks, ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of diversified concepts of horticulture .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of application of diversified principles, processes, product, their importance in the field of Horticulture

CO 2 : identify plant vegetative structure

CO 3 : Comprehend & understands basic principles, processes and plant propagation methods, understands how to propagate plant, manage and harvest a variety of plant and manage a horticulture nursery

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Horticulture principles in Agriculture Biotechnology

CO 5 : understand how to produce quality planting material and how commercialize horticulture crops for enhancement of the economy

CO 6 : Synthesize required techno managerial process solution and application required Horticulture

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : learn and execute techniques of micro propagation, Modern field preparation and planting methods of horticultural crops

CO 9 : know more about protected cultivation: advantages, controlled conditions, method and techniques.

CO 10 : have comprehensive idea and understanding of species and condiments, kitchen gardening, lawn making, medicinal and aromatic plants, principles, types, processes of orchard establishment and management

Content :

Unit 1 : Horticulture-Its definition and branches, importance and scope; Contribution of Horticulture in Indian economy, horticultural and botanical classification (6 L)

Unit 2 : climate and soil for horticultural crops; Principles of nursery Raising of Horticultural crops: Propagation and practices /methods and propagating structures (6 L)

Unit 3 : Nursery management of selected Horticulture crops (8 L)

Unit 4 : principles of orchard establishment; Principles and methods of training and pruning, juvenility and flower bud differentiation; unfruitfulness; pollination, pollinizers and pollinators; fertilization and parthenocarpy (7 L)

Unit 5 : kitchen gardening; garden types and parts; lawn making; medicinal and aromatic plants; species and condiments; use of plant bio-regulators in horticulture. Irrigation & fertilizers application-method and quantity (7 L)

Unit 6 : Application of Biotechnological Application in Horticulture (6 L)

Suggested Books

1. Chadha,K.L.2001. Handbook of Horticulture,ICAR
2. S N Gupta , 2016 , Instant Horticulture , Jain brothers
3. Jitendra Singh, 2012, Fundamentals of Horticulture, Kalyani Publishers
4. Randhawa,G.S. and Mukhopadhyaya, A.1994. Floriculture in India. Allied Publishers Pvt. Ltd
5. Kumar, N. 1997. Introduction to Horticulture. Rajyalakshmi Publications.
6. C.R. Adams, M.P. Early, 2005 , Principles Of Horticulture , Butterworth-Heinemann Publisher
7. Jitendra Singh, 2012, Basic Horticulture, Kalyani Publishers
8. Dr Gauri Shankar ,2013 , Handbook of Horticulture , Agro India Publication
9. V.M. Prasad, S.B. Lal, P.K.Karhana, Fundamentals of Horticulture , Kitab Mahal
10. V Kumasesan , N Arumugam , Fundamentals of Horticulture & Plant Breeding , 2015 , Saras Publication.

Paper Name : Lab On Fundamentals of Horticulture (Practical) Paper Type : Generic Elective Paper Code : GGBT- 495A Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart necessary Practical knowledge and skill on understanding the Concepts of Horticulture and its application . It aims to provide proper practical knowledge on identification of plant vegetative structure , enabling the learner to know and carry out different propagation methods , manage and harvest a variety of horticulture crops , manage a horticulture nursery , produce quality planting material , provide efficiency in the techniques of micro propagation , species and condiments , kitchen gardening , lawn making , medicinal and aromatic plants cultivation and extraction valuable products from them , principles , types , processes of orchard establishment and management by necessary industry integration .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Practical Concept of application of diversified principles, processes , product , their importance in the field of Horticulture

CO 2 : identify plant vegetative structure

CO 3 : Comprehend & understands practical principles, processes and plant propagation & Micropropagation methods, understands how to propagate & micropropagate plant, manage and harvest a variety of plant and manage a horticulture nursery

CO 4 : Learn to apply Practical technical knowledge and skills required for understanding and application of the Horticulture principles in Agriculture Biotechnology

CO 5 : understand practical process of production of quality planting material and how commercialize horticulture crops for enhancement of the economy

CO 6 : Synthesize required techno managerial process solution and application required Horticulture

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : know more about protected cultivation: advantages, controlled conditions, method and techniques.

CO 9 : have comprehensive Practical idea on establishment , cultivation and management of species and condiments , kitchen gardening , lawn making , medicinal and aromatic plants , principles , types , processes of orchard establishment and management

Contents

1. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Identification of different garden tools and their operational principles and uses. (**3 P**)
2. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on different Identification of horticultural crops. (**3 P**)
3. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Preparation of seed bed/nursery bed. (**4 P**)
4. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Preparation of seed bed , soil treatment, methods of planting and sowing of seeds, Preparation of potting mixtures and potting of plants (**5 P**)
5. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Practice of sexual and asexual methods of propagation. (**5 P**)
6. Visit commercial Orchard Unit and learn by hands on and or demonstration method on Layout and planting of orchard plants. (**3 P**)
7. Visit commercial Orchard Unit and learn by hands on and or demonstration method on Training and pruning of fruit trees. (**3 P**)
8. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Transplanting and care of vegetable seedlings. (**5 P**)
9. Making of herbaceous and shrubbery borders. (**3 P**)
10. Visit commercial Horticulture Unit and learn by hands on and or demonstration method on Fertilizer application in different crops. (**3 P**)
11. Make a project on Application of Biotechnology in Horticulture (**3 P**)

Paper Name : Floriculture & Landscaping (Theory) Paper Type : Generic
Elective Paper Code : GGBT- 405B Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skill on understanding the Concepts of Floriculture and Landscaping , MAP , Cutflower and Ornamental plant production and process management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain knowledge about Concept of application of diversified principles, processes , product , their importance in the field of floriculture and landscaping

CO 2 : develop an understanding of the plant material in Landscape Design and examine the characteristics of Plants with reference to the plant material in design

CO 3 : Comprehend & understands basic of the profession of landscape architecture through a dynamic, interactive pathway and gain knowledge about types and management of garden.

CO 4 : Learn to apply technical knowledge and skills required for understanding and application of the Floriculture , landscaping and MAP and set up business related to medicinal, aromatic and landscaping

CO 5 : understand about plant propagation-methods ornamental plants.and Principles and methods of training and pruning

CO 6 : Synthesize required techno managerial process solution and application required in floriculture and landscaping

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : learn and execute techniques of scientific cultivation methods of different ornamentals crops like rose, gerbera, carnation, liliun and orchids under normal and protected conditions & scientific cultivation methods of Medicinal crops like asparagus, aloe, costus, cinnamomum, periwinkle, isabgol etc & aromatic crops like lemongrass, mint, lemongrass, citronella, palmarosa, ocimum, geranium, vetiver etc

CO 9 : know more about origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield.

CO 10 : have comprehensive idea and understanding of knowledge about the production technology of ornamental crops grown in India

Content :

Unit 1 : Definition of Floriculture , Its scope and prospects , Factors affecting growing of floricultural plants (8 L)

Unit 2 : Principles and practices for growing elite plants, cut flowers production of seeds, plant material, bulbs etc, Storage and marketing of cut flowers, seeds and bulbs , Dry Flower Technology , Application of Tissue culture (8 L)

Unit 3 : Concept of landscaping , Principles and designs of landscaping, Different types of gardens , Flower arrangement : Western and Japanese (8 L)

Unit 4 : Medicinal and aromatic crops such as mentha, lemon grass, citronella, palma rosa, isabgol and other important species (8 L)

Unit 5 : Application of Biotechnology in Floriculture (8 L)

Suggested Books

1. Bose T.K.1999. floriculture and Landscaping. Naya Prakash, Kolkatta.
2. Bose, T.K. and Yadav, L.P. 1992. Commercial Flowers. Naya Prakash, Kolkatta
3. Randhawa, G.S. and Mukhopadhyaya, A.1994. Floriculture in India. Allied Publishers Pvt. Ltd.,
4. Chattopadhyay,S.K. 2007. Commercial Floriculture. Gene-Tech Book
5. Srivastava,H.C.2014.Medicinal and Aromatic Plants, ICAR, New Delhi.

**Paper Name : Lab On Floriculture & Landscaping (Practical) Paper Type :
Generic Elective Paper Code : GGBT- 495B Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: This course is designed to impart Practical knowledge and skills on understanding the Practical Concepts of Floriculture and Landscaping , MAP , Cutflower and Ornamental plant production and process management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : learn and gain Practical knowledge about Concept of application of diversified principles, processes , product , their importance in the field of floriculture and landscaping

CO 2 : develop an Practical understanding of the plant material in Landscape Design and examine the characteristics of Plants with reference to the plant material in design

CO 3 : Comprehend & understands profession of landscape architecture through a dynamic, interactive pathway by necessary industry interaction and gain knowledge about types and management of garden.

CO 4 : Learn to apply Practical technical knowledge and skills required for understanding and application of the Floriculture , landscaping and MAP and set up business related to medicinal, aromatic and landscaping

CO 5 : understand about plant propagation-methods ornamental plants.and Principles and methods of training and pruning

CO 6 : Synthesize required techno managerial process solution and application required in floriculture and landscaping

CO 7 : Evaluate the situation and present status prevailing in the field and act accordingly

CO 8 : learn and execute techniques of scientific cultivation methods of different ornamentals crops like rose, gerbera, carnation, liliun and orchids under normal and protected conditions & scientific cultivation methods of Medicinal crops like asparagus, aloe, costus, cinnamomum, periwinkle, isabgol etc & aromatic crops like lemongrass, mint, lemongrass, citronella, palmarosa, ocimum, geranium, vetiver etc

CO 9 : gain practical kn aboutowledge origin, area, climate, soil, improved varieties and cultivation practices such as time and methods of sowing, transplanting techniques, planting distance, fertilizer requirements, irrigation, weed management, harvesting and yield.

CO 10 : have comprehensive idea and understanding of knowledge about the production technology of ornamental crops grown in India

Content :

1. Visit to commercial flower Unit and Identification of Ornamental plants. (3 P)
2. Visit to commercial MAP Unit and Identification of Medicinal and Aromatic Plants. (3 P)
3. Visit to commercial flower Unit and learn by hands on practice on Nursery bed preparation and seed sowing, Training and pruning of Ornamental plants. (6 P)
4. Visit Nursery and hands on learning on Methods of nursery raising and cultivation of 1-2 medicinal plants and Ornamental Plants (7 P)
5. Visit a commercial Landscaping company and learn by hands on and or demonstration of Planning and layout of garden. (3 P)
6. To visit different gardens & parks and study landscaping in Gardens and parks (3 P)
7. Carry out a Market survey and calculation of demand and supply of different types of flowers and occasions (3 P)
8. Visit a flower market and carry out market survey (3 P)
9. Visit to commercial MAP Unit and understand the harvesting and post harvesting operations (3 P)
10. Collection of MAP plants and preparation of herbarium. (3 P)
11. Make a project on Application of Biotechnology in Floriculture (3 P)

Paper Name : Fundamentals of Poultry & Fishery Management (Theory)

Paper Type : Generic Elective Paper Code : GGBT- 405C Credit : 04

L: 4 , T: - , P: - CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge and skills on understanding the Concepts of Poultry & Fishery management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : understand the importance of Poultry & Fishery in the national economy.

CO 2 : identify Important Indian and exotic breeds of poultry

CO 3 : understand Housing principles, space requirements for different species of poultry

CO 4 : know about feeding system , diseases , Prevention and control of poultry

CO 5 : understand the different Systems , Process , Types , operational management of of aquaculture

CO 6 : Understand about Pre-stocking and post stocking pond management

CO 7 : comprehend about candidate species , Monoculture, polyculture and integrated culture systems.

CO 8 : gain knowledge about Water and soil quality in relation to fish production.

CO 9 : know about Physical, chemical and biological factors affecting productivity of ponds

Content :

Unit 1. Fundamentals of poultry , role of poultry in economy, Important Indian and Exotic breeds (5 L)

Unit 2 . Reproduction in Poultry (5 L)

Unit 3 Housing principles, space requirements for different species of poultry (5 L)

Unit 4 . Incubation, hatching and brooding. Management of growers and layers , Feeding management in poultry (7 L)

Unit 5 . different diseases , symptoms , effects , their prevention and control (6 L)

Unit 6 Systems of aquaculture - pond culture, pen culture, cage culture, running water culture and zero water exchange system,. Extensive, semi-intensive, intensive and super intensive aquaculture in different types of water bodies viz., freshwater, brackish water inland saline and marine water. (6 L)

Unit 7 :Pre-stocking and post stocking pond management. Carrying capacity of pond, factors influencing carrying capacity. Criteria for selection of candidate species for aquaculture. Major candidate species for aquaculture: freshwater, brackish-water and marine. Monoculture, polyculture and integrated culture systems. Water and soil quality in relation to fish production.Physical, chemical and biological factors affecting productivity of ponds. Principles of organic aquaculture (6 L)

Suggested Books

1. Meat, Poultry and Fish processing , NPCS Board
2. A Textbook of Animal Husbandry – G.C. Benerjee
3. A Handbook of Animal Husbandry – ICAR
4. Shukla & Upadhyaya, 2012, Economic Zoology , Rastogi Publication
5. Aquaculture: Principles and Practices, 2nd Edition, T. V. R. Pillay, M. N. Kutty
6. Handbook of fisheries and Aquaculture: ICAR
7. Handbook of fisheries and Aquaculture: NIR Board of Consultants(Asia Pacific Pres)

Paper Name : Fundamentals of Poultry & Fishery Management (Practical)

Paper Type : Generic Elective Paper Code : GGBT- 495C Credit : 02

L: - , T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart Practical knowledge and skills on understanding the Concepts of Poultry & Fishery operation and management .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : identify Important Indian and exotic breeds of poultry .

CO 2 : understand Housing principles, space requirements for different species of poultry

CO 3 : know about feeding system , diseases , Prevention and control of poultry

CO 4 : Know & understand the process of identification , project planning , farm layout , trading

, breeding of fishes and understand the impact of fishery as an alternative livelihood option to rural youth and women

CO 5 : understand the different Systems , Process , Types , operational management of aquaculture

CO 6 : Understand about Pre-stocking and post stocking pond management

CO 7 : comprehend about candidate species , Monoculture, polyculture and integrated culture systems.

CO 8 : gain knowledge about Water and soil quality testing and management in relation to fish production.

Content :

1. Visit commercial unit and study External body parts & process of identification of poultry breeds and make chart (2 P)
2. Visit commercial unit and study the process of Handling of Poultry birds (3 P)
3. Visit commercial unit and study daily routine farm operations and farm records. (2 P)
4. Visit commercial unit and study the process of Culling. (2 P)
5. Visit commercial unit and study the process of Planning and layout of housing and feeding system for different types of Poultry Breeds. (2 P)
6. Visit commercial unit and study the process of Computation of rations. (2 P)
7. Visit commercial unit and study the process of Hatchery operations, incubation and hatching equipments. (3 P)
8. Visit commercial unit and study the process of Management of chicks, growers and layers. (3 P)
9. Visit commercial unit and study the process of Debeaking, dusting and vaccination. (2 P)
10. Visit of Commercial farms and by hands on training know and document the method of identification of major poultry diseases , their Prevention and control strategies (3 P)
11. Make Chart / Poster / Project on Aquaculture production statistics- world and India. (2 P)
12. Make Chart / Poster / Project on Aquaculture resources of world and India. (2 P)
13. Visit an aquaculture Unit and having hands on experience on Components of Aquaculture farms, Procedure of aquaculture , maintenance of aquaculture Unit , Harvesting and post harvesting . (5 P)
14. Visit an aquaculture Unit and having hands on experience on procedure of Estimation of carrying capacity. (2 P)
15. Visit an aquaculture Unit and having hands on experience on procedure and Practices on pre-stocking and post stocking management. (2 P)
16. Visit an aquaculture Unit and having hands on experience on Growth studies in aquaculture system. (3 P)

Year – III
Semester – V

CORE COURSE (4+2 credits)		DISCIPLINE SPECIFIC ELECTIVE (4+2credits) [Any One (T+P)from A group and one from B group]	
Paper Name	Paper Code	Paper Name	Paper Code
Seed Science & Technology	CAGBT-501	Pest Management in Crops	DGBT-503A
Lab on Seed Science & Technology	CAGBT -591	Lab on Pest Management in Crops	DGBT -593A
Genetics & Plant Breeding	CAGBT -502	Fundamentals of Bioinformatics	DGBT -504A
Lab on Genetics & Plant Breeding	CAGBT -592	Lab on Fundamentals of Bioinformatics	DGBT 594 A
		Plant Tissue Culture	DGBT-503B
		Lab on Plant Tissue Culture	DGBT-593B
		Agrobiodiversity Management	DGBT - 504B
		Lab on Agrobiodiversity Management	DGBT - 594B

Year 3
Semester- V

Paper Name : Seed Science & Technology (Theory)

**Paper Type : Core Paper Code : CAGBT- 501 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: This course is designed to impart knowledge and skills of seeds and their role in agriculture ; principles followed during seed production, conditioning, testing, and marketing ; seed laws, regulations, and organizations relating to seed distribution and use and seed certification

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an understanding of seed development, germination, vigor, deterioration and the relationship between laboratory tests and field performance.

CO 2 : understand the principles of seed production for agronomic and horticultural crops within and outside of the region of adaptation and the techniques used in seed conditioning

CO 3 : understand seed increase systems, seed testing and the laws and regulations related to marketing high quality seed

CO 4 : evaluate the quality seed & assuring supply the disease free seed in the market thereby ensuring increase the farm income by producing high yielding disease free quality seed and decrease the cost of cultivation

CO 5 : store the pure variety seed to avoid the availability crises of pure variety seed due to adverse environmental conditions

CO 6 : understand the Quality control issues with seed Production, Post-harvest handling

CO 7 : learn and understand different seed production technology for variety of field crops , Seed Packaging , storing and transport mechanism , Hybrid seed production seed testing and seed

certification by necessary industry interaction.

CO 8 : gain knowledge about about seed vigour, seed viability and seed germination.

Content :

Unit 1 : Introduction, definition and importance of seed and seed technology Seed – its importance in agricultural development , Introduction of seed industry in India, Seed morphology, development & classification , difference between seed and grain (**5 L**)

Unit 2 : Deterioration causes of crop varieties and their control; Maintenance of genetic purity during seed production, seed quality; Definition, Characters of good quality seed, different classes of seed. Foundation and certified seed production of important cereals, pulses, oilseeds, fodder and vegetables. (**7 L**)

Unit 3 : Seed certification, phases of certification, procedure for seed certification, field inspection. Seed Act and Seed Act enforcement. Duty and powers of seed inspector, offences and penalties. Seeds Control Order 1983 (**5 L**)

Unit 4 : Varietal Identification through Grow Out Test and Electrophoresis, Molecular and Biochemical test. Detection of genetically modified crops, Transgene contamination in non-GM crops, GM crops and organic seed production. Hybrid seed production technology in Selected Kharif and Rabi Crops and Vegetables (**7 L**)

Unit 5 : Seed drying, processing and their steps, seed testing for quality assessment, seed treatment, its importance, method of application and seed packing. Seed storage; general principles, stages and factors affecting seed longevity during storage. Measures for pest and disease control during storage. (**6 L**)

Unit 6 : Seed marketing: structure and organization, sales generation activities, promotional media. Factors affecting seed marketing, Role of WTO and OECD in seed marketing. (**5 L**)

Unit 7 : Application of Biotechnology in Seed technology (**5 L**)

Suggested Readings

1. Nempal Singh, Singh,D.K., Singh, Y.K. and Virendra Kumar. 2006. Vetetable Seed Production Technology. Internaltional Book Distributing Co
2. Agarwal,P.K.1994.Principles of seed technology.ICAR, New Delhi
3. Agarwal,P.K. and Dadlani,M.1986. techniques of Seed Science and Technology. South Asian Publishers,
4. Agarwal,R.L.1995. Seed Technology. Oxford and IBH Publication Co., New Delhi
5. Dhrendra Khare and Mohan S. Bhale. 2007. Seed Technology. Scientific Publishers (India),
6. Thomson, J.R.1979. An introduction of seed technology. Leonard Hill, London

Paper Name : Lab On Seed Science & Technology (Practical) Paper Type :
Core Paper Code : CAGBT- 591 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart Practical knowledge and skills of seeds and their role in agriculture ; principles followed during seed production, conditioning, testing, and marketing ; seed laws, regulations, and organizations relating to seed distribution and use and seed certification .

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop a practical understanding of seed development, germination, vigor, deterioration and the relationship between laboratory tests and field performance.

CO 2 : understand the principles of seed production for agronomic and horticultural crops within and outside of the region of adaptation and the techniques used in seed conditioning

CO 3 : understand seed increase systems, seed testing and the laws and regulations related to marketing high quality seed

CO 4 : evaluate the quality seed & assuring supply the disease free seed in the market thereby ensuring increase the farm income by producing high yielding disease free quality seed and decrease the cost of cultivation

CO 5 : store the pure variety seed to avoid the availability crises of pure variety seed due to adverse environmental conditions

CO 6 : understand the Quality control issues with seed Production, Post-harvest handling

CO 7 : learn and understand different seed production technology for variety of field crops , Seed Packaging , storing and transport mechanism , Hybrid seed production seed testing and seed certification with help of necessary industry integration .

CO 8 : gain knowledge about about seed vigour, seed viability and seed germination.

CO 9 : carry out identification of different groups of seed

CO 10 : carry out Genetic purity test (Grow out test and electrophoresis) , Seed sampling and testing (Physical purity, germination, viability, etc) , Seed and seedling vigour test , analyse and interpret result

CO 11 : carry out Seed Certification

Seed certification: Procedure, Field inspection, Preparation of field inspection report

Content :

1. Visiting agro farm and or seed production unit & Identification of different groups of seed and seed sampling and making chart / herbarium with collected seeds (2 P)
2. Visiting agro farm and or seed production unit & Study and preparing report on Seed production in major cereals: Wheat, Rice, Maize, Sorghum and Bajra. (5 P)
3. Visiting agro farm and or seed production unit & Study and preparing report on Seed production in major pulses: Urd, Mung, Pigeonpea, Lentil, Gram, Field pea. (5 P)
4. Visiting agro farm and or seed production unit & Study and preparing report on Seed production in major oilseeds: Soybean, Rapeseed and Mustard. (5 P)

5. Visiting agro farm and or seed production unit & Study and preparing report on Seed production in vegetable crops. (5 P)
6. Seed sampling and testing: Physical purity, germination, viability, etc. (4 P)
7. Seed and seedling vigour test. (2 P)
8. Genetic purity test: Grow out test and electrophoresis. (3 P)
9. Seed certification: Procedure, Field inspection, Preparation of field inspection report. (2 P)
10. Visit to seed production farms, seed testing laboratories and seed processing plant (2 P)
11. to seed producing farms and gain knowledge by watching the demonstration of hybrid seed production techniques (3 P)
12. Make a project on Application of Biotechnology in Seed Technology (2 P)

Paper Name : Genetics & Plant Breeding (Theory)

**Paper Type : Core Paper Code : CAGBT- 502 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: This course is designed to impart knowledge and skills of genetics and plant breeding and their role in agriculture Biotechnology

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive, detailed understanding of the scientific basis of heredity specially in crop plants to improve and develop the new varieties of plants.

CO 2 : have an understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc

CO 3 : have knowledge required to design, execute, and analyze the results of genetic experimentation in plant systems.

CO 4 : evaluate the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.

CO 5 : Understanding the role of genetic technologies in industries related to biotechnology, pharmaceuticals, energy, and other fields

CO 6 : understand the basic principles of Mendelian inheritance , cell division & chromosome segregation , explore the multifactorial inheritance.

CO 7 : learn the concepts of Linkage concept of sex determination and sex linked inheritance.

CO 8 : understand about concept , process , method , systems of plant breeding.

CO 9 : establish the commercial plant breeding unit and to developed new superior crops varieties.

CO 10 : understand the concept of self -incompatibility and male sterility & components of genetic variations.

CO 11 : know about the different farmer and plant breeder right rights

CO 12 : develop the insect and disease resistant varieties for environment friendly management of disease and insect.

Content :

Unit 1 :Pre Mendelian concepts of heredity.Mendelian principles of heredity and Post Mendelian concepts. Dominance relationships, gene interaction; pleiotropism and pseudoalleles. Epistatic interactions with examples. Multiple alleles. (4 L)

Unit 2 : Blood group genetics. Sex determination and sex linkage; sex limited and sex influenced traits. Linkage and its estimation, crossing over mechanisms and chromosome mapping. Structural and numerical changes in chromosome, Mutation, classification. Methods of inducing mutation & CIB technique; mutagenic agents and induction of mutation. (4 L)

Unit 3 : Qualitative & Quantitative traits, Polygenes and continuous variations; multiple factor hypothesis, Cytoplasmic inheritance and maternal effect. Genetic disorders. (4 L)

Unit 4 : Principles , concepts and numerical problems on Population Genetics (4 L)

Unit 5 : Concept, nature, role , scope & Objectives of plant breeding, major achievements and future prospects; Genetics in relation to plant breeding, modes of reproduction and apomixes, self – incompatibility and male sterility- genetic consequences, cultivar options. (4 L)

Unit 6 : Domestication, Acclimatization, introduction; Centre of origin/diversity, component of Genetic variation; Heritability and genetic advance; Genetic basis and breeding methods in self pollinated crops-mass and pure line selection, hybridization techniques and handling of segregating population; Multiline concept. (4 L)

Unit 7 : Genetic basis and methods of breeding cross pollinated crops, modes of selection; Heterosis and inbreeding depression, development of inbred lines and hybrids, composite and synthetic varieties (4 L)

Unit 8 : Breeding methods in asexually propagated crops, clonal selection and hybridization; Wide hybridization and pre-breeding; Polyploidy in relation to plant breeding, mutation breeding-methods and uses; Breeding for important biotic and abiotic stresses (4 L)

Unit 9 : Biotechnological tools-DNA markers and marker assisted selection. Participatory plant breeding; Intellectual Property Rights, Patenting, Plant Breeders and & Farmer's Rights. (4 L)

Unit 10 : Breeding for disease resistance – Nature , causes and resistance breeding methods , Concepts objectives of crop improvement , Different Conventional & non conventional methods of Crop improvement. (4 L)

Suggested Readings

1. Principles of Genetics , Gardner E J, Simmons M J, Snustad DP , Wiley India
2. Human Genetics For Medical & Life Sciences , Bheem Prasad , Current Book International
3. Essentials of Medical Genetics , A.K.Datta , ARK Publication
4. Genetics , Verma & Agarwal , S Chand
5. Principles of Genetics , Robert H.Tamarin , Tata Mcgraw Hill Publishing Company Ltd.
6. Genetics , Monroe W .Strickberger , Prentice Hall of India Pvt.Ltd
7. Solving Problems In Genetics , Richard Kowles , Springer
8. Phundan Singh, 2014. Essentials of Plant Breeding. Kalyani Publishers

9. Singh, B.D.2015. Plant Breeding: Principles and Methods. Kalyani Publishers
10. Gupta, S.K.2010. Plant Breeding Theory and Techniques, Wiley India Pvt. Ltd
11. Allard, R.W.2010. Principles of Plant Breeding , John Wiley and Sons,
12. Sharma, J.r.1994, Principles and Practice of Plant Breeding. Tata McGraw Hill, Publishing Company Ltd., New Delhi.

**Paper Name : Lab On Genetics & Plant Breeding (Practical) Paper Type :
Core Paper Code : CAGBT- 592 Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: This course is designed to impart Practical knowledge and skills of genetics and plant breeding and their role in agriculture Biotechnology

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : have a comprehensive, detailed practical understanding of the scientific basis of heredity specially in crop plants to improve and develop the new varieties of plants.

CO 2 : have an understanding of how genetic concepts practically affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc

CO 3 : have knowledge required to design, execute, and analyze the results of genetic experimentation in plant systems.

CO 4 : evaluate the mathematical, statistical, and computational basis of genetic analyses that use genome-scale data sets in systems biology settings.

CO 5 : understand the basic principles of Mendelian inheritance , cell division & chromosome segregation , explore the multifactorial inheritance

CO 6 : learn the concepts of Linkage concept of sex determination and sex linked inheritance

CO 7 : understand the Practical concept , process , method , traditional & modern technologies of plant breeding

CO 8 : establish the commercial plant breeding unit and to developed new superior crops varieties.

CO 9 : have a thorough practical idea on Plant Breeder's kit , germplasm of various crops , floral structure of self-pollinated and cross pollinated crops, emasculation and hybridization techniques in self & cross pollinated crops, inbreeding on genetic structure of resulting populations

CO 10 : understand the concept of self -incompatibility and male sterility & components of genetic variations.

CO 11 : know about the different farmer and plant breeder right rights

CO 12 : develop the insect and disease resistant varieties for environment friendly management of disease and insect.

Content :

1. Demonstration of Plant Breeder's kit (2 P)
2. Visit a commercial Plant Breeding Industry and get hands on experience on Study of germplasm of various crops. (3 P)
3. Visit a commercial Plant Breeding Industry and get hands on experience on Study of floral structure of self-pollinated and cross pollinated crops. (3 P)

4. Visit a commercial Plant Breeding Industry and get hands on experience on Emasculation and hybridization techniques in self & cross pollinated crops. (6 P)
5. Visit a commercial Plant Breeding Industry and get hands on experience on Consequences of inbreeding on genetic structure of resulting populations. (4 P)
6. Visit a commercial Plant Breeding Industry and get hands on experience on Study of male sterility system. (2 P)
7. Visit a commercial Plant Breeding Industry and get hands on experience on Handling of segregation populations. (2 P)
8. Visit a commercial Plant Breeding Industry and get hands on experience on Methods of calculating mean, range, variance, standard deviation, heritability. (3 P)
9. Visit a commercial Plant Breeding Industry and get hands on experience on Designs used in plant breeding experiment, analysis of Randomized Block Design. (3 P)
10. Visit a commercial Plant Breeding Industry and get hands on experience on mode of pollination in a given crop and extent of natural out crossing , Prediction of performance of double cross hybrids. (3 P)
11. Experiments on monohybrid, dihybrid, trihybrid, test cross and back cross (3 P)
12. Experiments on epistatic interactions including test cross and back cross (3 P)
13. 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). (3 P)

Paper Name : Pest Management in Crops (Theory)
Paper Type : Discipline Specific Elective Paper Group – A
Code : DGBT- 503A Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: This course is designed to impart knowledge on Pest , types , infestation , importance , impact and management of pests ; to get familiarized with various categories of pest To understand how Pest Management including IPM decisions are made and factors that influence the decision-making process , including biological, cultural, regulatory, mechanical and chemical/bio-pesticidal, pest monitoring, and decision making based on the symptoms from various pests and recommend the management practices.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : Understand how insects affect animal and Plant health and agricultural production, and be able to safely manipulate populations of beneficial and destructive species in habitats and in production agro-ecosystems with minimal environmental impact.

CO 2 : identify morphological characteristics, feeding habit and habitat of agriculturally important insect-pest & identify pests at field, horticulture, ornamentals, vegetables and stored grains at the field level

CO 3 : categorize insects based on basic ecological, behavioural, morphological, physiological, or developmental attributes..

CO 4 : examine insects deeply within a biological level of analysis and make strategies for successful pest management strategy.

CO 5 : understand about different families and orders of class Insecta which cause economic losses for human beings

CO 6 : understand effects of biotic and abiotic factors on insect development, population growth, species interactions, physiological requirements and insect behaviour.

CO 7 : learn determining pest levels and impact on plant and animal hosts and the management of these pests by Integrated Pest Management approach.

CO 8 : understand about concept , process , method , systems of plant breeding.

CO 9 : evaluate the biology, diversity, distribution of insects, and their relationships to crop and the environment condition of a particular area

CO 10 : address complex problems facing entomology or toxicology professionals taking into account related ethical, social, legal, economic, and environmental issues..

CO 11 : surveillance and forecasting of insect pests and assessment of insect pest population and recent pest outbreaks and manage them by using different tools and recent methods pest management

CO 12 : understand about different classes of insecticides, their formulation, toxicity, poisoning, first aid and antidotes and their effect on plants, animals and environment

Content :

Unit 1 :. Pests, Categories of pests . 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, Biotic potential and environmental resistance and causes for outbreak of pests in agro-ecosystem (**6 L**)

Unit 2 : Economic importance of insects, nature and extent of damage, life history and management of the major insect pests of following crops Cereals, Pulses , Oilseeds, Sugarcrops , Fibre Crops (**6 L**)

Unit 3 : Economic importance of insects, nature and extent of damage, life history and management of the major insect pests of following crops as mentioned against them - Fruit crops , Vegetable crops , StoredGrains (**9 L**)

Unit 4 : Classification of insecticides, toxicity of insecticides and formulations of insecticides. Chemical control-importance, hazards and limitations.. Insecticides Act 1968-Important provisions. Application techniques of spray fluids.Symptoms of poisoning, first aid and antidotes (**7 L**).

Unit 5 : Pest surveillance and pest forecasting. Components/ tools of IPM, Cultural, Mechanical, Physical, Legislative, Biological.. Beneficial insects: parasites and predators used in pest control and their mass multiplication techniques. Beneficial insects: Important species of pollinators, weed killers and scavengers, their importance. (**6 L**)

Unit 6 : Application of Biotechnological methods in Pest Control . Recent methods of pest control, repellents, antifeedants, hormones, attractants, gamma radiation , Genetic Control, Role of Transgenic Plant Pathogen in control Pest (**6 L**)

Suggested Books

1. Dhaliwal, G.S. and Ramesh Arora 2001. Integrated pest management: Concepts and approaches, Kalyani Publishers
2. Metcalf, R.L. and Luckman, W.H.1982. Introduction to insect pest management Wiley inter science publishing
3. Larry P Pedigo 1991. Entomology and pest management, Prentice Hall of India Pvt. Ltd
4. Venugopala Rao, N., Umamaheswari, T., Rajendraprasad, P., Naidu,V.G. and Savithri,P.2004.Integrated Insect Pest Management, Agrobios (India) Limited
5. Nair KK, Anantha Krishnan TN and BV David 1976. General and applied entomology,Tata Mc Graw Hill publishing co. Ltd,
6. Atwal, A.S. 1976. Agricultural Pests of India and South East Asia. Kalyani Publishers, Ludhiana.
7. Butani, D.K. and Jotwani, M.G. 1984. Insects in Vegetables. Periodical Export Book Agency,New Delhi.
8. Butani, D. K. 1984. Insects and Fruits. Periodical Export Book Agency, New Delhi..
9. Dennis S Hill 1987 Agricultural Insect Pests of tropics and their control, Cambridge Universtiy Press , New York.

Paper Name : Lab On Pest Management in Crops (Practical)

Paper Type : Discipline Specific Elective Paper Group – A

Code : DGBT- 593A Credit : 02 L: -, T: -, P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: This course is designed to impart practical knowledge on Pest , types , infestation , importance , impact and management of pests ; to get familiarized with various categories of pest , to understand how Pest Management including IPM decisions are made and factors that influence the decision-making process , including biological, cultural, regulatory, mechanical and chemical/bio-pesticidal, pest monitoring, and decision making based on the symptoms from various pests and recommend the management practices.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : Understand how insects affect animal and Plant health and agricultural production, and be able to safely manipulate populations of beneficial and destructive species in habitats and in production agro-ecosystems with minimal environmental impact.

CO 2 : identify morphological characteristics, feeding habit and habitat of agriculturally important insect-pest & identify pests at field, horticulture, ornamentals, vegetables and stored grains at the field level

CO 3 : categorize insects based on basic ecological, behavioural, morphological, physiological, or developmental attributes..

CO 4 : examine insects deeply within a biological level of analysis and make strategies for successful pest management strategy.

CO 5 : understand about different families and orders of class Insecta which cause economic losses for human beings

CO 6 : understand effects of biotic and abiotic factors on insect development, population growth, species interactions, physiological requirements and insect behaviour.

CO 7 : learn determining pest levels and impact on plant and animal hosts and the management

of these pests by Integrated Pest Management approach.

CO 8 : understand about concept , process , method , systems of plant breeding.

CO 9 : evaluate the biology, diversity, distribution of insects, and their relationships to crop and the environment condition of a particular area

CO 10 : address complex problems facing entomology or toxicology professionals taking into account related ethical, social, legal, economic, and environmental issues..

CO 11 : surveillance and forecasting of insect pests and assessment of insect pest population and recent pest outbreaks and manage them by using different tools and recent methods pest management

CO 12 : understand about different classes of insecticides, their formulation, toxicity, poisoning, first aid and antidotes and their effect on plants, animals and environment

Content :

1. Study and distribution patterns of insects in crop eco systems(**2 P**)
2. Methods of collection and preservation of insects including immature stages and Identification of different types of damage. (**2 P**)
3. Sampling techniques for the estimation of insect population and damage , Determination of insect infestation by different methods., Assessment of losses due to insects. (**2 P**)
4. Calculations on the doses of insecticides application technique. (**2 P**)
5. Pest surveillance through light traps, pheromone traps and fore casting of pest incidence (**2 P**)
6. Calculation of doses/ concentrations of different insecticidal formulations (**2 P**)
7. Acquintance of insecticide formulations. (**2 P**)
8. Compatibility of pesticides with other agrochemicals and phytotoxicity of insecticides (**2 P**)
9. acquaintance of mass multiplication techniques of important predators(**2 P**)
10. Study of insect pollinators, weed killers and scavengers (**2 P**)
11. Identification of major non insect pests Viz., birds, crabs, snails , slugs and mammalians. House hold and veterinary insect pests. (**2 P**)
12. Assessment of crop yield losses, calculations based on economics of IPM (**2 P**)
13. Identification of biocontrol agents, different predators and natural enemies. (**2 P**)
14. Plan & assess preventive strategies (IPM module) and decision making. crop monitoring attacked by insect, pest and diseases. Awareness campaign at farmers fields. (**2 P**)
15. Identification of different types of damage. Identification and study of life cycle and seasonal history of various insect pests attacking crops and their produce: Cereals, Pulses ,Oilseeds, Sugarcrops , Fibre Crops (**4 P**)
 - a. Fruit crops , Vegetable crops , Stored Grains
 - b. Fumigation of grain store / godown.
 - c. Identification of rodents and rodent control operations in godowns.
 - d. Identification of birds and bird control operations in godowns.
16. Determination of moisture content of grain. (**2 P**)
17. Methods of grain sampling under storage condition (**2 P**)
18. Visit to FCI godowns (**2 P**)
19. Make a project on Application of Biotechnology in Pest Management (**2 P**)

Paper Name : Fundamentals of Bioinformatics (Theory)
Paper Type : Discipline Specific Elective Paper Group – A
Code : DGBT- 504A Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide students with the theory and practical experience of the use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts. ; analyse the human genome, identify the targets for drug discovery, development of new algorithms and analysis methods, the study of structural and functional relationships, and molecular evolution

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an understanding of the basic theory of these computational tools.

CO 2 : gain working knowledge of different computational tools and methods & evaluate their relevance for investigating specific contemporary biological questions & critically analyse and interpret the results of the data

CO 3 : concepts of Bioinformatics and test its significance in Biological data analysis..

CO 4 : evaluate methods to characterise and manage the different types of Biological data.

CO 5 : understand how to classify different types of Biological Databases

CO 6 : carry out sequence alignment and analysis.

CO 7 : learn different methods used in protein and nucleic acid sequence analysis using bioinformatics software.

CO 8 : predict the structure for given protein sequence using Software , Identify recent trends in proteomics, genomics, toxico-genomics and systems biology.

Content :

Unit 1: Introduction to bioinformatics and data generation Bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, BLAT, RASMOL), databases(GENBANK, Pubmed, PDB) and software(RASMOL,Ligand Explorer). Data generation; Generation of large scale molecular biology data. (Through Genome sequencing, Protein sequencing, Gel electrophoresis, NMR Spectroscopy, X-Ray Diffraction, and microarray). Applications of Bioinformatics. (**8 L**)

Unit 2: Biological Database and its Types Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genome databases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum) (**8 L**)

Unit 3: Data storage and retrieval and Interoperability Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE. (**8 L**)

Unit 4: Sequence Alignments and Visualization Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm). Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization. (8 L)

Unit 5: Gene Expression and Representation of patterns and relationship General introduction to Gene expression in prokaryotes and eukaryotes, transcription factors binding sites. SNP, EST, STS. Introduction to Regular Expression, Hierarchies, and Graphical models (including Markov chain and Bayes notes). Genetic variability and connections to clinical data. (8 L)

Suggested Readings

1. Teresa K Attwood and David J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, 2001
2. Bexavanis & Francis, Bioinformatics-A practical guide to the analysis of genes and proteins, John Wiley and Sons, 2001
3. Rushidi, Basics of Bioinformatics, CRC Publications, 2001
4. Irfan Khan and Atiya Khanum, Emerging trends in Bioinformatics, Ukaaz Publishers, 2002
5. David M. Hill, Craig Martiz and Barke Mable, Molecular systematics
6. Khan Imtiyaz alam ,Rai University, Hyderabad:- Elementry Bioinformatics
7. N. Gautam Bioinformatics- Databases and algorithm
8. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

Paper Name : Lab On Fundamentals of Bioinformatics (Practical)
Paper Type : Discipline Specific Elective Paper Group – A Code : DGBT-594A Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide students with the practical experience , knowledge and skills of the use of common computational tools and databases which facilitate investigation of molecular biology and evolution-related concepts. ; analyse the human genome, identify the targets for drug discovery, development of new algorithms and analysis methods, the study of structural and functional relationships, and molecular evolution

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an practical understanding of the different computational tools.

CO 2 : gain practical knowledge of different computational tools and methods & evaluate their relevance for investigating specific contemporary biological questions & critically analyse and interpret the results of the data

CO 3 : practical concepts of Bioinformatics and test its significance in Biological data analysis..

CO 4 : evaluate practical methods to characterise and manage the different types of Biological

data.

CO 5 : understand how to classify different types of Biological Databases

CO 6 : carry out sequence alignment and analysis.

CO 7 : learn different methods used in protein and nucleic acid sequence analysis using bioinformatics software.

CO 8 : predict the structure for given protein sequence using Software , Identify recent trends in proteomics, genomics, toxico-genomics and systems biology.

CO 9 : have practical knowledge on Data Mining and Sequence Retrieval , databases and database searching , RASMOL , SWISS-PDB , Chimera , Genbank , NCBI , Expasy , PDB , Sequence Analysis (BLAST,FASTA, CLUSTAL W)

Content :

1. Biological databases and database searching (3 P)
2. Data Mining and Sequence Retrieval (3 P)
3. Motif & Domain assignment (3 P)
4. Hands on session with RASMOL (3 P)
5. Hands on session with SWISS-PDB (3 P)
6. Hands on session with Chimera (3 P)
7. Searches on medline and bibliographic databases. (3 P)
8. Hands on session with NCBI (3 P)
9. Hands on session with Genbank (4 P)
10. Hands on session with Expasy (4 P)
11. Hands on session with PDB. (4 P)
12. Sequence Analysis (BLAST,FASTA, CLUSTAL W) (4 P)

Paper Name : Plant Tissue Culture (Theory) Paper Type : Discipline Specific Elective Paper Group – B

**Code : DGBT- 503B Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the theory and practical knowledge on various techniques of plant tissue culture and plant genetic transformation and their application in crop improvement , laboratory organization for plant tissue culture. , knowledge of callus, organ, anther and pollen culture Technique. , suspension, protoplast culture and micropropagation Technique

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an understanding of the technique of preparation of plant tissue culture media.

CO 2 : gain working knowledge of basics with an insight to laboratory practices along with exposure to “lab- to-land” transfer by necessary industry integration.

CO 3 : understand about various techniques for plant tissue culture and application of plant tissue culture..

CO 4 : evaluate callus culture and various micropropagation culture Techniques.

CO 5 : understand how to carry out large scale plant propagation, disease elimination, plant improvement (e.g., grain quality, fiber quality, disease resistance, insect resistance, herbicide

resistance etc) etc

CO 6 : carry out/ execute/ accomplish micro propagation through budculture, organogenesis and somatic embryogenesis.

CO 7 : evaluate and analyse the role of plant growth regulators in PTC technique , how to regenerate plants using the different techniques of PTC , recognize the possible reasons for failure of a specific plant tissue or organ culture and find out solution, analyse and interpret the in vitro data and draw sensible conclusions from such data

CO 8 : start or work in commercial plant tissue culture laboratory.

Content :

Unit 1 : Introduction to Plant Tissue culture, Terms and definitions, Historical background, Laboratory organization, Tools and techniques, methods of sterilization. Laboratory contaminants- it's control and measures. (5 L)

Unit 2 : Basic concepts in cell culture - cell culture, Cellular Totipotency (5 L)

Unit 3 : Role of Micro and macro nutrients, Vitamins and carbon source in tissue culture, Media preparation- pH, Temperature, Solidifying agents, Slant Preparations etc. Maintenance of cultures, Environmental Conditions, explants characteristics. (5 L)

Unit 4 : Explants selection, sterilization and inoculation; Various media preparations; MS, B5, SH PC L-2; Callus and cell suspension culture (5 L)

Unit 5 : In vitro culture: approaches & methodologies - preparation steps for tissue culture, surface sterilization of plant tissue material, basic procedure for aseptic tissue transfer, incubation of culture. Culture initiation, Callus culture., Micropropagation through various explants (Leaf, Stem, Axillary bud, Tuber, Corms and Bulbils). (5 L)

Unit 6 : Tissue nutrition: Growth Hormones - Plant cells (Composition of culture media, Growth hormones, Vitamins, Unidentified supplements, selection of media) (5 L)

Unit 7 : Tissue culture methodologies - Plant cells (Types of cultures -Callus Culture, Cell Suspension Culture, Organ Micro-culture, plant micro-propagation, Somatic Embryogenesis) (5 L)

Unit-8 (In-vitro Fertilization) Role of Ovary and ovule in In-vitro Fertilization in production of agricultural and horticultural crops. Techniques and significance of Androgenesis and Gynogenesis (ovary, ovule, egg, synergids culture). (5 L)

Suggested Books

1. M.K. Rajdan , Introduction To Plant Tissue Culture , Oxford & IBH
2. Henk Hobbelink , Biotechnology and the Future of World Agriculture , Zed Books Ltd
3. G. Rangaswami, D.J. Bagyaraj , Agricultural Microbiology , PHI Learning
4. Ahindra Nag , Text Book Of Agricultural Biotechnology , PHI Learning

5. H.S Chawla,. Introduction to Plant Biotechnology. Oxford & IBH Publishing Co. Pvt. Ltd.
6. Dixon, R.A. and Gonzales, R. A. (Eds.) Plant Cell Culture - A Practical Approach. Oxford University Press
7. Gamborg, O.L and Phillips, G.C. Plant Cell, Tissue Organ Culture. Narosa Publishing House, NewDelhi.

**Paper Name : Lab On Plant Tissue Culture (Practical) Paper Type :
Discipline Specific Elective Paper Group – A Code : DGBT- 593B Credit : 02
L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the practical knowledge on various techniques of plant tissue culture and plant genetic transformation and their application in crop improvement , laboratory organization for plant tissue culture. , knowledge of callus, organ, anther and pollen culture Technique. , suspension, protoplast culture and micropropagation Technique

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an practical understanding of the technique of preparation of plant tissue culture media.

CO 2 : gain practical knowledge of basics with an insight to laboratory practices along with exposure to “lab- to-land” transfer by necessary industry integration.

CO 3 : understand about various practical techniques for plant tissue culture and application of plant tissue culture..

CO 4 : evaluate callus culture and various micropropagation culture Techniques.

CO 5 : understand how to carry out large scale plant propagation, disease elimination, plant improvement (e.g., grain quality, fiber quality, disease resistance, insect resistance, herbicide resistance etc) etc

CO 6 : carry out/ execute/ accomplish micro propagation through budculture, organogenesis and somatic embryogenesis.

CO 7 : evaluate and analyse the role of plant growth regulators in PTC technique , how to regenerate plants using the different techniques of PTC , recognize the possible reasons for failure of a specific plant tissue or organ culture and find out solution, analyse and interpret the in vitro data and draw sensible conclusions from such data

CO 8 : start or work in commercial plant tissue culture laboratory.

Content :

1. In vitro Culture - Washing & Sterilization, Preparatory steps for tissue culture, surface sterilization of plant material, basic procedures for Aseptic tissue transfer, incubation of culture. (8 P)
2. Preparation of Culture media & Reagents - Media composition, Nutrition, Hormones. (8 P)
3. Basics of Tissue Culture – (Requirement for) Callus culture, Cell suspension. (8 P)

4. Organ Micro-culture – (Requirement and Overall procedure for) Shoot tip, excised root, Leaf culture. (8 P)
5. Plant micro-propagation – micro-culture of plants (8 P)

**Paper Name : Agrobiodiversity Management (Theory) Paper Type :
Discipline Specific Elective Paper Group – B Code : DGBT- 504B
Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the knowledge on broad spectrum of Biodiversity with specific knowledge and input on various concepts , importance , methods of measurement , threats and conservation strategies of Agrobiodiversity , address the issues of Agrobiodiversity and food security , impact of climate change on agrobiodiversity , different processes shaping agrobiodiversity , role of ITK , sustainable management of Agrobiodiversity and participatory breeding

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of the principles , concepts , processes and importance of biodiversity in agriculture, with particular focus on biodiversity's role in enhancing cropping and farming systems' resilience and adaptability to climate change.

CO 2 : gain knowledge of principles and practices for gathering agrobiodiversity data through either participatory diagnostic or empirical approaches, and for their utilization to develop management approaches that improve resilience and adaptability.

CO 3 : analyse the economic value of agrobiodiversity in food systems as an incentive for conservation. It will investigate the most critical management aspects along the agricultural value chain, ranging from production to marketing and consumption..

CO 4 : equip participants with the necessary tools, knowledge and understanding to enhance productivity and improve marketing strategies in sustainable and resilient agricultural systems.

Content :

Unit 1 : Biodiversity , Levels & Types of Biodiversity, Values of Biodiversity , Threats to Biodiversity , Measurement of Biodiversity (Different index and methods) , Conservation of Biodiversity (In situ and Ex situ Biodiversity) (8 L)

Unit 2 : Fundamental concepts of Agrobiodiversity , Importance of agrobiodiversity , Methods of Measurement of Agrobiodiversity , Threats to agrobiodiversity , Conservation of agrobiodiversity (8 L)

Unit 3 : Agrobiodiversity and food security , Key processes influencing agrobiodiversity , Global change and agrobiodiversity , Impact of climate change on agrobiodiversity , Policies for agrobiodiversity conservation and use (8 L)

Unit 4 : Processes shaping agrobiodiversity , Status and trends of agrobiodiversity in India , Agrobiodiversity and livelihoods , ITK (Indegenous Traditional Knowledge) and Agrobiodiversity (8 L)

Unit 5: Sustainable management of Agrobiodiversity , Farmers' seed systems and participatory breeding , On- farm conservation and management of agrobiodiversity , Value chains of neglected and underutilized species , Biological Diversity and Associated Human Capacity in Agri-food Systems . Application of Biotechnology in Agrobiodiversity management . (8 L)

Suggested Readings

1. Prithi Palsingh , An Introduction To Biodiversity , Ane Books
2. S.C.Santra , 2001, Environmental Science, New Central Book Agency pvt.Ltd
3. Arnesha Guha, Aniruddha Ray, Kamal Lochan Barik , Environmental Pollution,Biodiversity Conservation And Climate Change: Issues & Challenges , Sparrow Publisher
4. Mohan P Arora ,2004, Ecology , Himalaya Publishing House
5. Y Anjaneyulu , 2004, Introduction To Environmental Science , B S Publications
6. P.D.Sharma , 2003, Ecology and Environment, Rastogi Publications
7. Pankaj Sharma, Narayan Singh , Pawan Kumar Bharati , Agro-Biodiversity: Conservation & Sustainable Development , Discovery Publishing House
8. Jillian Lenné (Author), David Wood (Author), Ken Giller (Contributor) , Agrobiodiversity Management for Food Security: a Critical Review , Cabi Publishing
9. Biju Kumar , Agrobiodiversity : Status, Trends and Prospects , Narendra Publishing House
10. S. Kannaiyan , Agrobiodiversity Hotspots: Access and Benefit Sharing , Narosa Publication

**Paper Name : Lab On Agrobiodiversity Management (Practical) Paper Type : Discipline Specific Elective Paper Group – A
Code : DGBT- 594B Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the practical knowledge on broad spectrum of Biodiversity with specific knowledge and input on various concepts , importance , methods of measurement , threats and conservation strategies of Agrobiodiversity , address the issues of Agrobiodiversity and food security , impact of climate change on agrobiodiversity , different processes shaping agrobiodiversity , role of ITK , sustainable management of Agrobiodiversity and participatory breeding

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of the principles , concepts , processes and importance of biodiversity in agriculture, with particular focus on biodiversity's role in enhancing cropping and farming systems' resilience and adaptability to climate change.

CO 2 : gain knowledge of principles and practices for gathering agrobiodiversity data through either participatory diagnostic or empirical approaches, and for their utilization to develop management approaches that improve resilience and adaptability.

CO 3 : analyse the Measurement of biodiversity & agrobiodiversity of an ecosystem by different methods

CO 4 : equip participants with the necessary tools, experimental design and statistical analysis for measuring agrobiodiversity health

CO 5 : understand and carry out estimation of Dissolved Oxygen , BOD , primary production , chlorophyll content , population and community ecology

CO 6 : Compare and interpret given sonograms of bird calls (any two e.g. Courtship calls, Alarm calls)

Content :

1. Layout of experimental design and statistical analysis (**3 P**)
2. Measurement of biodiversity of an ecosystem by different methods (**3 P**)
3. Measurement of Dissolved Oxygen (**3 P**)
4. Measurement of BOD (**3 P**)
5. Estimate primary production using water samples from different aquatic habitats (**3 P**)
6. Estimate chlorophyll content in leaves of different plants (**3 P**)
7. Measurement of agrobiodiversity of an ecosystem by different methods (**3 P**)
8. Study of population and community ecology of aquatic and terrestrial ecosystem (**3 P**)
9. Biodiversity documentation (**3 P**)
10. Agrobiodiversity documentation , reporting on visiting Agriculture farm (**3 P**)
11. Visits to nearby Zoo, Botanical Garden and Forest and submission of report (**3 P**)
12. Determination of LC_{50} of a suitable toxicant (e.g. $CuSO_4$, Neem leaf extract) using a suitable model e.g. Daphnia, Cyclops, Mosquito larvae, Chironomous larvae, rice weevil) (**3 P**)
13. Compare and interpret given sonograms of bird calls (any two e.g. Courtship calls, Alarm calls). (**2 P**)
14. Preparation of herbarium (**2 P**)

Year – III
Semester – VI

CORE COURSE(4+2 credits)		DISCIPLINE SPECIFIC ELECTIVE(4+2 credits) [Any One (T+P) from A group, Project / Dissertation is compulsory]	
Paper Name	Paper Code	Paper Name	Paper Code
Recent Trends in Agriculture	CAGBT-601	Agriculture Extension Management	DGBT-603A
Lab on Recent Trends in Agriculture	CAGBT -691	Lab on Agriculture Extension Management	DGBT-693A
Disease Management in Crops	CAGBT -602	Business Scope in Agriculture Biotechnology & allied field	DGBT-604A
Lab on Disease Management in Crops	CAGBT -692	Lab Business Scope in Agriculture Biotechnology & allied field	DGBT-694A
		Project/ Dissertation	DGBT-681

Year – III
Semester- VI

Paper Name : Recent Trends in Agriculture (Theory)

**Paper Type : Core Paper Code : CAGBT- 601 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the indepth knowledge and understanding on recent and emerging developments in the field of agriculture like Hi-tech Farming including Hydroponic & Aeroponics , Crop Management Scheduling , Fertilizer Designing and fertigation; new policies and platform like e NAM , FBY , SHC , NMSA , NCU , PMKSY , PKVY , MIF , ACP , RADP , NWDPR, LIS , NSWF , GBY etc . The course aims to address the e agriculture and application of ICT in Agriculture . The course also aims to provide details understanding to the learners on Concepts , types , techniques development & and management of Precision agriculture , application of Nanotechnology (nano-pesticides , nano-fertilizers, nano-sensors etc) in agriculture , Concept ,methods and ways to carry out CSA (Climate Smart Agriculture) and application of Remote Sensing & GIS in agriculture . The course aims to address the international and national policy issues on impact and role played by GATT, WTO, TRIPs and WIPO , UPOV and PPV&FR Act of India , ITPGRFA . The course also aims to provide holistic learning opportunity to the learners on Principles, Methods , Types , processes and management strategies employed to carry out Protected Cultivation (Green house , Shade Net , Poly House etc)

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of the principles , concepts , processes and importance of recent and emerging developments in the field of agriculture.

CO 2 : gain knowledge of principles and practices , methods and management of Hi-tech Farming including Hydroponic & Aeroponics.

CO 3 : analyse the system and process of Crop Management Scheduling , Fertilizer Designing and fertigation

CO 4 : equip participants with the necessary knowledge on new policies and platform like e NAM , FBY , SHC , NMSA , NCU , PMKSY , PKVY , MIF , ACP , RADP , NWDPR, LIS , NSW, GBY etc

CO 5 : understand the concept of e agriculture and application of ICT in Agriculture

CO 6 : understand and apply Concepts , types , techniques development & and management of Precision agriculture

CO 7 : Evaluate the concept of application of nanotechnology in Agriculture (nano-pesticides , nano-fertilizers, nano-sensors etc)

CO 8 : understand & comprehend the Concept ,methods and ways to carry out CSA (Climate Smart Agriculture)

CO 9 : carry out application of Remote Sensing & GIS in agriculture .

CO 10 : address the international and national policy issues and impact and role played by GATT, WTO, TRIPS and WIPO , UPOV and PPV&FR Act of India , ITPGRFA .

CO 11 : have holistic understanding of the Principles, Methods , Types , processes and management strategies employed to carry out Protected Cultivation (Green house , Shade Net , Poly House etc)

Content :

Unit 1 : Hi-tech Farming – Introduction, requirement, types Systems , components , management procedures , crop established & their management under Hydroponic Farm and Aeroponics Farm systems (**5 L**)

Unit 2 : Crop Management Scheduling , Automation System , Fertilizer Designing and fertigation , Calibration of micro & macro climate of growing media and crop canopy (**5 L**)

Unit 3 : Emerging concepts like i. National Agriculture Market (e NAM) , ii) Fasal Beema Yojana , iii) Soil Health program , iv) Agri Commodity exchange ,v) NMSA vi) NCU vii) DBT viii) PMKSY viii) PKVY ix) MIF x) Agriculture Contingency Plan xi) RADP xii) NWDPR xiii) Livestock Insurance Scheme xiv) National Scheme on Welfare of Fishermen Xiv)Gramin Bhandaran yojona xv) e agriculture and application of ICT in Agriculture (**5 L**)

Unit 4 : Precision agriculture: concepts and techniques; their issues and concerns for Indian agriculture; Geoinformatics- definition, concepts, tool and techniques; their use in Precision Agriculture. Crop discrimination and Yield monitoring, soil mapping; fertilizer recommendation using geospatial technologies; Spatial data and their management in GIS; Geodesy and its basic principles, Remote sensing concepts and application in agriculture , Introduction to crop Simulation Models and their uses for optimization of Agricultural Inputs; STCR approach for precision agriculture (**7 L**)

Unit 5 : Nanotechnology, definition, concepts and techniques, brief introduction about nanoscale effects, nano- particles, nano-pesticides, nano-fertilizers, nano-sensors, Use of nanotechnology in

tillage, seed, water, fertilizer, plant protection for scaling-up farm productivity (5 L)

Unit 6 : Concept and Principles of Climate Smart Agriculture , Concept of Agriculture Journalism , Introduction and meaning of intellectual property, brief introduction to GATT, WTO, TRIPs and WIPO, Treaties for IPR protection: Madrid protocol, Berne Convention, Budapest treaty, etc. Types of Intellectual Property and legislations covering IPR in India:- Patents, Copyrights, Origin and history including a brief introduction to UPOV for protection of plant varieties, Protection of plant varieties under UPOV and PPV&FR Act of India, Plant breeders rights, Registration of plant varieties under PPV&FR Act 2001, breeders, researcher and farmers rights. Traditional knowledge meaning and rights of TK holders. Convention on Biological Diversity, International treaty on plant genetic resources for food and agriculture (ITPGRFA). Indian Biological Diversity Act, 2002 and its salient features, access and benefit sharing (8 L)

Unit 7 : Principles and practices in protected cultivation of plants , Construction & maintenance of poly house, Package of practices for cultivation of important commercial plants in polyhouse (5 L)

Suggested Readings

1. Pradeep, T. 2007. NANO: The Essentials: Understanding Nanosciences and Nanotechnology. Tata McGraw-Hill Publishing Company Ltd
2. Lillesand, T.M. and Keifer, R.W. 1994. Remote Sensing and image interpretation (3rd edition), John Willey and Sons.
3. Anji Reddy, M. 2006. Text Book of Remote Sensing and Geographical Information Systems, (3rd edition), B.S.Publications, Hyderabad
4. Prasad,S. And Kumar, U. 2012. Greenhouse Management of Horticultural Crops. 2nd edition, Agribios Publishers,
5. Singh,H.P. , Singh, G., Samuel, J.c., and Pathak,R.K.,2003.
6. Precision Farming in Horticulture. NCPAH,MOA,PFDC,CISH
7. Sahu, K.C. 2008. Text Book of Remote Sensing and geographical Information Systems. Atlantic Publishers & Distributors.
8. RadhaManohar, K. and Igathinathene.C , 2012, Greenhouse Technology and Management, 2nd edition, BS publications
9. Tiwary G.N, 2013, Greenhouse Technology for Controlled Environment.Narosa Publishing House. Pvt Ltd.
10. Singh Brrahma and Balraj Singh. 2014. Advances in Protected Cultivation, New India Publishing Company

Paper Name : Lab On Recent Trends in Agriculture (Practical)

Paper Type : Core Paper Code : CAGBT- 691 Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide students with the indepth Practical knowledge and understanding on recent and emerging developments in the field of agriculture like Hi-tech Farming including Hydroponic & Aeroponics , Crop Management Scheduling , Fertilizer Designing and fertigation; e agriculture and application of ICT in

Agriculture , Concepts , types , techniques development & and management of Precision agriculture , application of Nanotechnology (nano-pesticides , nano-fertilizers, nano-sensors etc) in agriculture , Concept ,methods and ways to carry out CSA (Climate Smart Agriculture) and application of Remote Sensing & GIS in agriculture and Principles, Methods , Types , processes and management strategies employed to carry out Protected Cultivation (Green house , Shade Net , Poly House etc)

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough practical understanding of the principles , concepts , processes and importance of recent and emerging developments in the field of agriculture.

CO 2 : gain practical knowledge of principles and practices , methods and management of Hi-tech Farming including Hydroponic & Aeroponics by hands on training & industry Interaction .

CO 3 : analyse the practical system and process of Crop Management Scheduling , Fertilizer Designing and fertigation

CO 4 : understand the concept of e agriculture and application of ICT in Agriculture

CO 5 : understand and apply Concepts , types , techniques development & and management of Precision agriculture

CO 6 : Evaluate the concept of application of nanotechnology in Agriculture (nano-pesticides , nano-fertilizers, nano-sensors etc)

CO 7 : understand & comprehend the Concept ,methods and ways to carry out CSA (Climate Smart Agriculture)

CO 8 : carry out application of Remote Sensing & GIS in agriculture

CO 9 : have holistic understanding of the Principles, Methods , Types , processes and management strategies employed to carry out Protected Cultivation (Green house , Shade Net , Poly House etc)

CO 10 : recommend fertilizer based on VRT and STCR techniques

CO 11 : carry out Spot Test for Food adulteration (Milk , Ghee , Butter , Edible Oil , Sweetmeats, Ice-cream and beverages , Maida Rice , Besan)

CO 12 : carry out cultivation of vegetables including Process management , Uprooting and transplanting , Application of manure, fertilizers and growth hormones

Content :

1. With consultation & interaction with local existing agro e commerce or e service provider in agriculture(**2 P**)
2. prepare a project on application of ICT in Agriculture (**2 P**)
3. Introductory hands on of Geospatial Technology for generating valuable information for Agriculture
4. Visit , study and hands on practices to understand and know different Systems , components , management procedures of Hi –Tech farm (**3 P**)
5. Visit , study and hands on practices to understand and know different Systems , components , management procedures , crop established & their management under Hydroponic Farm and Aeroponics Farm systems and submission of report on the same (**3 P**)
6. Fertilizers recommendations based of VRT and STCR techniques.. (**2 P**)
7. Use of GPS for agricultural survey. (**2 P**)
8. Project submission on Formulation, characterization and applications of nanoparticles in agriculture. (**2 P**)
9. Projects formulation and execution related to precision farming (**2 P**)
10. Submission of Project on Climate Smart Agriculture (**2 P**)

11. Making Chart/ Collage on any two of the emerging concepts of agriculture as stated in the curriculum (2 P)
12. Visit to controlled cultivation facility i.e. poly-house, Hydroponics etc (3 P)
13. Visit a Commercial manufacturer of protected cultivation and learn by hands on or by observation on method of Construction of polyhouse and shade net (3 P)
14. Visit a Commercial manufacturer of protected cultivation and learn by hands on Maintenance of polyhouse and shade net (3 P)
15. Visit a farm where poly house and shade net are placed and are in operation and carry out hands on on cultivation of vegetables including Process management , Uprooting and transplanting , Application of manure, fertilizers and growth hormones (3 P)
16. Make collage , Chart on various types of poly house , Green house and mist-chamber (2 P)
17. Spot Test for Food adulteration (Milk , Ghee , Butter , Edible Oil , Sweetmeats, Ice-cream and beverages , Maida Rice , Besan) (2 P)

Paper Name : Disease Management in Crops (Theory)

**Paper Type : Core Paper Code : CAGBT- 602 Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The objectives of this course are to provide students with the indepth knowledge and understanding on plant pathology , plant pathogen , plant disease , Symptoms, etiology, disease cycle, epidemiology and management of major diseases of different fiels and horticulture crops

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of concepts of plant pathogens, major disease causing organisms and their etiology.

CO 2 : gain specific knowledge about host pathogen interactions.

CO 3 : carry out recognition of plant disease , environment and disease development , importance of sign and symptoms for detection of pathogens and disease

CO 4 : acquire the knowledge of Integrated methods of disease management and IDM including biological and chemical methods application in disease management

CO 5 : identify & know the common pathogens of different diseases

CO 6 : acquire knowledge about etiology, and symptoms of these diseases which helps in diagnosis of the diseases of field and horticultural crops

CO 7 : know means of dispersal of diseases & suitable management methods for controlling them including Eco-friendly and economically suitable management practices

CO 8 : obtain specific knowledge about host pathogen interactions

CO 9 : gain comprehensive knowledge about plant diseases , Plant Pathology , disease triangle and tetrahedron and classification of plant diseases , Causes / factors affecting disease development

CO 10 : understand Symptoms, etiology, disease cycle, epidemiology and management of major diseases of different fiels and horticulture crops

CO 11: Know biotechnological application in Plant Disease Management

Content :

Unit 1 : Importance of plant diseases, scope and objectives of Plant Pathology..Terms and concepts in Plant Pathology.Causes / factors affecting disease development: disease triangle and tetrahedron and classification of plant diseases. Important plant pathogenic organisms Growth and reproduction of plant pathogens. Liberation / dispersal and survival of plant pathogens. (5 L)

Unit 2 : Epidemiology: Factors affecting disease development. Principles and methods of plant disease management. Resistance, Exclusion, Eradication, Protection, Avoidance, Therapy. Nature, chemical combination, classification, mode of action and formulations of fungicides and antibiotics. (5 L)

Unit 3 : Symptoms, etiology, disease cycle, epidemiology and management of major diseases of following crops: Field Crops: (13 L)

- i. Rice: blast, brown spot, bacterial blight, sheath blight, false smut, khaira and tungro;
- ii. Wheat: rusts, loose smut, karnal bunt, alternaria blight, spot blotch, blast and ear cockle;
- iii. Sugarcane: red rot, smut, wilt, grassy shoot, ratoon stunting and PokkahBoeng;
- iv. Sunflower: Sclerotinia stem rot and Alternaria blight;
- v. Gram: wilt, grey mould and Ascochyta blight;
- vi. Jute: Macrophomina disease complex,
- vii. Pea: downy mildew, powdery mildew and rust.
- viii. Maize: stalk rots, downy mildew, leaf spots, blights; Sorghum: smuts, grain mold,
- ix. Soybean: bacterial spot, seed and seedling rot and mosaic;
- x. Tobacco: black shank, black root rot and mosaic.

Unit 4 : Symptoms, etiology, disease cycle, epidemiology and management of major diseases of following crops: (14 L)

- i. Mango: anthracnose, malformation, bacterial blight and powdery mildew;
- ii. Citrus: canker and gummosis, tristeza, citrus decline;
- iii. Guava: wilt and anthracnose;
- iv. Banana: Panama wilt, bacterial wilt, Sigatoka and bunchy top;
- v. Papaya: foot rot, leaf curl and mosaic;
- vi. Cruciferous vegetables: Damping off, Club root, Alternaria leaf spot and black rot; downy mildew, powdery mildew
- vii. Potato: early and late blight, bacterial wilt, black scurf, scab, mosaic, leaf roll;
- viii. Brinjal: Damping off, bacterial wilt, Phomopsis blight and fruit rot and Sclerotinia

- blight, little leaf;
- ix. Tomato: damping off, bacterial wilt, early and late blight, buck eye rot and leaf curl;
 - x. Okra: Yellow Vein Mosaic; Cercospora leaf spot;
 - xi. Beans: anthracnose and bacterial blight;

Unit V : Biotechnological application in Plant Disease Management (3 L)

Suggested Readings

1. R S Mehrotra, Ashok Aggarwal , Plant Pathology
2. Dasgupta, M.K.1987. Principles of Plant Pathology, Allied Publ.Pvt.Ltd.
3. Agrios, G.N. 2006, Plant Pathology, Elsevier Publishers
4. Rangaswami, Gand K.Mahadevan.2001. Diseases of crop plants in India. Prentice Hall of India Pvt. Ltd
5. Singh, R.S.2005. Plant Diseases. Oxford &IBH Publication
6. Pathak, V.n.2001. Diseases of Fruit crops.Oxford & IBH Publications
7. Singh, R.S.1999. Diseases of vegetable crops. Oxford & IBH Publications
8. Chaube, H.S and V.S. Pundhir,2012. Crop Diseases & Their Management. PHI Pvt. Ltd.
9. Manoj Kumar Kalita , 2017 , Diseases Of Field Crops & Their Management, Kalyani Publisher

Paper Name : Lab On Disease Management in Crops (Practical) Paper Type : Core Paper Code : CAGBT- 692 Credit : 02 L: -, T: - , P: 2 CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The objectives of this course are to provide students with the indepth Practical knowledge and understanding on plant pathology , plant pathogen , plant disease , Symptoms, etiology, disease cycle, epidemiology and management of major diseases of different fiels and horticulture crops

Course Outcomes: On Completion of the Course, Students will be able to:

- CO 1 : develop an thorough practical understanding of concepts of plant pathogens, major disease causing organisms and their etiology.
- CO 2 : gain specific knowledge about host pathogen interactions.
- CO 3 : carry out recognition of plant disease , environment and disease development , importance of sign and symptoms for detection of pathogens and disease
- CO 4 : acquire the knowledge of Integrated methods of disease management and IDM including biological and chemical methods application in disease management
- CO 5 : identify & know the common pathogens of different diseases
- CO 6 : acquire knowledge about etiology, and symptoms of these diseases which helps in

diagnosis of the diseases of field and horticultural crops

CO 7 : know means of dispersal of diseases & suitable management methods for controlling them including Eco-friendly and economically suitable management practices

CO 8 : obtain specific knowledge about host pathogen interactions

CO 9 : gain comprehensive knowledge about Identification and histopathological studies of selected diseases of field and horticultural crops

CO 10 : understand Symptoms, etiology, disease cycle, epidemiology and management of major diseases of different fields and horticulture crops

CO 11: Know biotechnological application in Plant Disease Management

Content :

1. Study of symptoms of various plant diseases (8 P)
2. Identification and histopathological studies of selected diseases of field and horticultural crops covered in theory. (12 P)
3. Field visit for the diagnosis of field problems. (12 P)
4. Collection and preservation of plant diseased specimens for Herbarium (4 P)
5. Collection and preservation of disease specimen (4 P)

**Paper Name : Agriculture Extension Management (Theory) Paper Type :
Discipline Specific Elective Paper Group – A Code : DGBT- 603A**

Credit : 04 L: 4 , T: - , P: -

CA – 30 Marks , ESE : 70 Marks Total Marks : 100

Course Objectives: The course is intended to orient the students with the concept of extension education and its importance in Agriculture development and also to expose the students with various Rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis. Besides, the students will be learning about the new innovations being brought into the Agricultural Extension in India. The course is also intended to orient students on the genesis and evolution of extension system, various extension approaches tried worldwide. The students learn about problems, future needs and strategies of agricultural extension.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development.

CO 2 : gain specific knowledge about Extension systems in India including Extension efforts in Pre-independence and post independence era including modern New trends in agriculture extension including privatization extension.

CO 3 : carry out Monitoring and evaluation of Extension programmes and Transfer of Technology including concepts of different models

CO 4 : understand concept of rural sociology, characteristics of Indian rural society , rural development and its importance in agricultural extension,

CO 5 : understand concept of educational psychology, intelligence, personality, perceptions, emotions, frustration, motivation, teaching and learning

CO 6 : acquire knowledge about Agricultural development programmes , Community development and rural development schemes and programmes and their significance

CO 7 : know means of communication and models of communication , methods of creating Rural awareness

CO 8 : obtain specific knowledge about administration and management issues in context of rural and agricultural development

CO 9 : gain comprehensive knowledge about the bottom-up approach in planning, techniques of stakeholders' participation in developmental programmes, local institutions and their need and develop Conflict management and negotiation skill

CO 10 assess and critically analyse impact of rural and agricultural development on rural livelihood

Content :

Unit 1 : Education: Meaning, definition & Types; Extension Education- meaning, definition, scope and process; objectives and principles of Extension Education (**8 L**)

Unit 2 : 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.). (**8 L**)

Unit 3 : New trends in agriculture extension: privatization extension, cyber extension/ eextension, market-led extension, farmer-led extension, expert systems, etc. (**8 L**)

Unit 4 : Rural Development: concept, meaning, definition; various rural development programmes launched by Govt. of India. Community Dev.-meaning, definition, concept & principles, Physiology of C.D. (**8 L**)

Unit 5 : 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 (**8 L**)

Suggested Books

1. Adivi Reddy, A. 2006. Extension Education. Sree Lakshmi Press
2. Jalihal, K.A. and Veerabhadraiah, V. 2007. Fundamentals of Extension Education and Management in Extension. Concept Publishing House.
3. Sagar Mondal and G.L. Ray. 2007. Text book of Rural Development. Kalyani Publishers
4. Katar Singh , Anil Shishodia , 2016 , Rural Development: Principles, Policies, and Management , SAGE

5. Sundaram S , Rural Development , 2014 , Himalaya Publishing House
6. K.K. Singh,Rakesh Kumar Sharma,Ashutosh Ghenekar Atul Kumar Singh, 2015, Agricultural Extension Explorer , Astral
7. C. Karthikeyan, R. Sendilkumar, et al., 2018, A Textbook of Agricultural Extension Management , Atlantic Publishers and Distributors Pvt Ltd.

Paper Name : Lab On Agriculture Extension Management (Practical) Paper
Type : Discipline Specific Elective Paper Group – A
Code : DGBT- 693A Credit : 02 L: -, T: - , P: 2
CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The course is intended to orient the students with the Practical concept of extension education and its importance in Agriculture development and also to expose the students with various Rural development programmes aimed at poverty alleviation and to increase employment opportunities and their analysis.

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough practical understanding of Education; Extension Programme planning Meaning, Process, Principles and Steps in Programme Development.

CO 2 : gain specific practical knowledge about Extension systems in India including Extension efforts in Pre-independence and post independence era including modern New trends in agriculture extension including privatization extension.

CO 3 : carry out Monitoring and evaluation of Extension programmes and Transfer of Technology including concepts of different models

CO 4 : understand concept of community radio and television and carry out Script writing, writing for print and electronic media

CO 5 : understand concept of PRA techniques and their application in village development planning

CO 6 : acquire knowledge about handling and use of audio visual equipments and digital camera and LCD projector , Preparation and use of AV aids , Preparation of extension literature and carry out micro teaching exercise

CO 7 : know means of communication and models of communication , methods of creating Rural awareness

CO 8 : obtain specific knowledge about administration and management issues in context of rural and agricultural development including DRDA , Self Help Groups (SHGs) of DWCRA , NGO , Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (ZPP)

CO 9 : gain comprehensive knowledge about the bottom-up approach in planning, techniques of stakeholders' participation in developmental programmes, local institutions and their need and develop Conflict management and negotiation skill

CO 10 assess and critically analyse impact of rural and agricultural development on rural livelihood

Content :

1. Group discussion- exercise; handling and use of audio visual equipments and digital camera and LCD projector (3 P)
2. Preparation and use of AV aids (3 P)
3. Preparation of extension literature – leaflet, booklet, folder, pamphlet news stories and success stories (3 P)
4. Presentation skills exercise; micro teaching exercise (3 P)
5. A visit to village to understand the problems being encountered by the villagers/ farmers (6 P)
6. To study organization and functioning of DRDA and other development departments at district level (2 P)
7. Visit to NGO and learning from their experience in rural development (3 P)
8. Understanding PRA techniques and their application in village development planning (2 P)
9. Visit to community radio and television studio for understanding the process of programme production (3 P)
10. Script writing, writing for print and electronic media, developing script for radio and television (3 P)
11. Visits to Panchayat Raj Institutions to study the functioning of Gram Panchayat (GP) & Zilla Praja Parishad (ZPP). (3 P)
12. Visit to a village to study the Self Help Groups (SHGs) of DWCRA (3 P)
13. Identification, listing powerpoint presentation and small project on Types of service required for socio economic development of the farming community by visiting the related agro service industry (3 P)

**Paper Name : Business Scope in Agriculture Biotechnology & allied field
(Theory) Paper Type : Discipline Specific Elective Paper Group – A Code :
DGBT- 604A Credit : 04 L: 4 , T: - , P: -
CA – 30 Marks , ESE : 70 Marks Total Marks : 100**

Course Objectives: The course is intended to orient the students with the comprehensive knowledge and skills on Principles , scope, functions , importance , types , processes of business scopes in Agriculture Biotechnology sector , Agribusiness , types and characteristics of enterprise , entrepreneur , Trade license , sourcing of land , finance , machineries and raw materials for agri business set up , organizing and managing finance , , designing a business and project plan and execution of the same , steps for setting up Agro Processing Industry Agro-based industries and Techno-economic feasibility report generation

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of business scopes and processes in Agriculture Biotechnology & allied fields

CO 2 : gain knowledge on types , characters , scope , importance , distinctive features and importance of agribusiness

CO 3 : understand the concept , types and characteristic features of enterprise (Individual enterprise or Individual/sole proprietorship or individual entrepreneur/ one man business , Partnership , Joint Stock Company (capitalistic form) , Co-operative enterprise , State enterprise

or public enterprise) and entrepreneurs

CO 4 : evaluate the legal compliance to start a business .

CO 5 : carry out necessary steps and processes of sourcing of land , finance , machineries and raw materials for agri business set up , organizing and managing finance , designing a business and project plan and execution of the same

CO 6 : have a comprehensive idea about capital and its type , credits , credit planning , sourcing pathways of credit for business

CO 7 : manage the finance of the business

CO 8 : identify and evaluate Types , Role , Scope , Potentials , Importance & classification of agro based and village industries

CO 9 : carry out necessary Procedures for preparation of projects

Content :

Unit 1 : Agribusiness – Meaning - Definition , Scope of Agribusiness , The distinctive features of Agribusiness Management–Background of Agribusiness in India , Structure of Agribusiness (Input sector, Farm sector and Product sector) – Types of Agri-business Management/Specialization Areas of Agribusiness Management, Objectives of Agribusiness , Six Principles of Creating Good Working Climate for Agribusiness , Importance of Agribusiness in Indian Economy. (5 L)

Unit 2 : Meaning of Organization or Enterprise , Difference between a Capitalist and an Entrepreneur , Forms of Business Organization (Individual enterprise or Individual/sole proprietorship or individual entrepreneur/ one man business , Partnership , Joint Stock Company (capitalistic form) , Co-operative enterprise , State enterprise or public enterprise) Factors Influencing Selection of Choice of Business Organization , Factors Determining Size of Agribusiness (5 L)

Unit 3 : Trade license and registration marks; Sources of finance; Selection of land and factory sheds. Agencies for promotion of different types of industries; Source of machine and equipment for starting up a unit (5 L)

Unit 4 : Capital – Meaning – Working capital – Gross working capital – Net working capital Permanent working capital- Temporary working capital- Balance sheet working capital – Cash working capital. Importance , Classification of credit, sources, purpose for which credit is advanced by the financial institutions, source-wise and purpose-wise rates of interest charged, repayment schedule, credit planning for different forms of business organization Financial management-importance of financial statements-balance sheet-profit and loss Statement , Maintenance of Book of Accounts Analysis of financial statements-liquidity ratios-leverage ratios-Coverage ratios-turnover ratios-profitability ratios (7 L)

Unit 5: Concept and Types of Agro Based Industries , Role and Scope of Agro Industries , Future Potentials of Agro Based Industries , Importance Of Employment In Agro- Industries Concept of Village Industry , Broad classification of village Industries , Reasons for Underdevelopment of Village Industry , Steps in Agro Processing Industry Agro-based industries-importance-need-institutional arrangements for the promotion of agro-based

industries-Procedure to be followed to set up agro-based industries –Managerial or Management Problems and Constrains of Agro- Business or Agro- Industries , Measures taken by the Government or Institutional Arrangements to Solve the Problem of Agro-industries (7 L)

Unit 6 : Procedures for preparation of projects, legal need and documents required , sources, terms and conditions of loans for financing agro-service and agro processing projects, Project meaning-definition-project cycle-identification-formulation-appraisal- monitoring-evaluation , Project appraisal and evaluation techniques- undiscounted measures-pay back period- proceeds per rupee of outlay-Discounted measures-Net Present Value (NPV)-Benefit Cost Ratio (BCR)- Internal Rate of Return (IRR)-Net Nene fit Investment ratio (N/K ratio)- sensitivity analysis (6 L)

Unit 7 : Different Agricultural Policies and Schemes , Preparation of project report; Market feasibility reports; Techno-economic feasibility report on fruits and vegetable processing, bakery and confectionary, mushroom manufacture and soybean processing Subsidy & Finance Schemes available for Food Processing Units. Schemes under Ministry of Food Processing, Ministry of Agriculture and other Departments for Finance as well as Subsidy for entrepreneurs (5 L)

Suggested Readings

1. David Downey, and John Ericson. Agribusiness Management
2. Harsh, S.N. Conner, U.J. and Schwab G.D. 1981. Management of the Farm Business. Prentice Hall Inc., New Jersey
3. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall of India Pvt. Ltd.
4. M.K. Purushothama , 2012, A Text On Management Process, Vrinda Publications Pvt.Ltd
5. Kailas C. Sahu, Dr. Subas Chandra Das , 2016 , Management And Theory And Practics , Ocean Publishing House
6. L K Warder, C Murthy , 2008 , Text Book Of Agricultural Marketing & Co-Operation, ICAR
7. S.S. Chhina , 2009 , Agricultural Marketing In India , Kalyani Publishers
8. Partha Sarathi Senapati, 2009, Rural & Agricultural Marketing , Educreation Publishing

Paper Name : Lab On Business Scope in Agriculture Biotechnology & allied field (Practical) Paper Type : Discipline Specific Elective Paper Group – A

Code : DGBT- 694A Credit : 02 L: -, T: - , P: 2

CA – 40 Marks , ESE : 60 Marks Total Marks : 100

Course Objectives: The course is intended to orient the students with the comprehensive practical knowledge and skills on Principles , scope, functions , importance , types , processes of business scopes in Agriculture Biotechnology sector , Agribusiness , types and characteristics of enterprise , entrepreneur , Trade license , sourcing of land , finance , machineries and raw materials for agri business set up , organizing and managing finance , designing a business and project plan and execution of the same , steps for setting up Agro Processing Industry Agro-based industries and Techno-economic feasibility report generation

Course Outcomes: On Completion of the Course, Students will be able to:

CO 1 : develop an thorough understanding of business scopes and processes in Agriculture Biotechnology & allied fields

CO 2 : gain knowledge on types , characters , scope , importance , distinctive features and importance of agribusiness

CO 3 : understand the concept , types and characteristic features of enterprise (Individual enterprise or Individual/sole proprietorship or individual entrepreneur/ one man business , Partnership , Joint Stock Company (capitalistic form) , Co-operative enterprise , State enterprise or public enterprise) and entrepreneurs

CO 4 : Assessing Agricultural / Biotechnological / Agro biotech related entrepreneurial potential.

CO 5 : carry out necessary steps and processes of sourcing of land , finance , machineries and raw materials for agri business set up , organizing and managing finance , designing a business and project plan and execution of the same

CO 6 : prepare model business plan and proposal & prepare bankable projects

CO 7 : identify Agricultural / Biotechnological / Agro biotech marketing channel

CO 8 : identify and evaluate Agricultural / Biotechnological / Agro biotech Market Structure and also will be equipped with knowledge of calculation of price spread

CO 9 : have knowledge on Commodity and Agri Finance by special hands on training from NCDEX and NSE

Content :

1. Assessing Agricultural / Biotechnological / Agro biotech related entrepreneurial potential, problem solving ability, managerial skills and achievement motivation, exercise in creativity, time audit (4 P)
2. Preparation of model business plan and proposal writing Agricultural / Biotechnological / Agro biotech related Project (4 P)
3. Visit to business entity related to Agricultural / Biotechnological / Agro biotech (2 P)
4. Preparation of Bankable projects for various Agricultural / Biotechnological / Agro biotech products and its value added products. (3 P)
5. Identification of Agricultural / Biotechnological / Agro biotech marketing channel (2 P)
6. Calculation of Price Spread for Agricultural / Biotechnological / Agro biotech related Industry (3 P)
7. Identification of Agricultural / Biotechnological / Agro biotech Market Structure (3 P)
8. Visit to different Markets wrt Agricultural / Biotechnological / Agro biotech (3 P)
9. Study of relationship between market arrivals and prices of some selected commodities (3 P)
10. Hands on Training on Commodity and Agri Finance from NCDEX and NSE (3 P)
11. Computation of marketable and marketed surplus of important commodities (2 P)
12. Study of price behaviour over time for some selected commodities (2 P)
13. Visit to a local market to study various marketing functions performed by different agencies, identification of marketing channels for selected commodity, collection of data regarding marketing costs, margins and price spread and presentation of report in the class (3 P)

14. Visit to market institutions – NAFED, SWC, CWC, cooperative marketing society, etc. to study their organization and functioning (3 P)

Paper Name : Project/ Dissertation

Paper Type : Discipline Specific Elective Code : DGBT- 681 Credit : 6 Total Marks : 100

A project work should be done individually under the guidance of one faculty member on any topic related to the subject & can be recorded as dissertation & also be presented by the candidate in front of externals in a seminar. Students are encouraged to get associated with any industry as an intern and carry out the Dissertation work / Project in Industry .

Special Task Assigned to students Throughout all semesters in three Years

- 1. Students have to mandatorily get involved in Plantation and looking after the planted sapling for 03 years**
- 2. In each semester break student have to mandatorily work in an industry / with a farmer in the field as volunteer for minimum 07 days**
- 3. Students have to design a business project and process it through all processes to get upto a starting phase**
- 4. Student have to mandatorily get involved in mini innovation project every semester in the field of Agriculture Biotechnology and return the technology to the farmers**
- 5. Students have to make use of Agriculture Biotechnology in waste management and conversion of waste to useful agri input / other useful products project in each semester and return the technology to the farmers**