

DEPARTMENT OF BOTANY

TEACHING PLAN - UG

23-24 EVEN

TEACHING PLAN

Department : Botany

Class : I B.Sc., Botany

Title of the Course: Core III: PLANT DIVERSITY – II:FUNGI, BACTERIA, VIRUSES, PLANT PATHOLOGY AND LICHENS

Semester : II

Course Code :BU232CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
BU232CC1	3	2	-	4	5	75	25	75	100

Objectives

1. To describe the biology of fungi, bacteria, virus and to discuss the importance of fungi in various ecological roles.
2. To identify the main groups of plant pathogens, their symptoms.

Course outcomes

On the successful completion of the course, student will be able to:		
1.	recognize the general characteristics of microbes, fungi and lichens and disease symptoms.	K1
2.	develop an understanding of microbes, fungi and lichens and appreciate their adaptive strategies based on structural organization.	K2 &K1
3.	identify the common plant diseases, according to geographical locations and devise control measures.	K3 & K4
4.	analyze the emerging trends in fungal biotechnology with special reference to agricultural and pharmaceutical applications.	K4
5.	determine the economic importance of microbes, fungi and lichens.	K2

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Teaching plan

Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
FUNGI						
I	1.	Classification of fungi - (Alexopoulos and Mims, 1979), criteria for classification.	4	K2(U)	Lecture using Chalk & talk, Flow chart, PPT and videos, Introductory session, Group Discussion, Review	MCQ, True/False, Simple definitions, Short essays, Recall Concept, Short summary or overview, Graphical representation, Recall steps, Suggest idea, explanations, Formative assessment, Summative assessment, Group Discussion, Oral Test,
	2.	Characteristic features, thallus organization, mode of nutrition, structure, reproduction and life-history of Zygomycotina (<i>Pilobolus</i> , <i>Mucor</i> , <i>Rhizopus</i>)	4	K2(U)	Lecture using Chalk & talk, Live specimen, Permanent slides, Charts, PPT	
	3.	Structure, reproduction and	3	K2(U)	Lecture using Chalk & talk, Live	

		life-history of Ascomycotina (<i>Aspergillus</i> , <i>Saccharomyces</i> <i>Peziza</i>),			specimen, Sectional review, Permanent slides, PPT and Group Discussion	
	4.	Structure, reproduction and life-history of Basidiomycotina (<i>Agaricus</i> , <i>Pleurotus</i> , <i>Puccinia</i>)	2	K2(U)	Lecture using Chalk & talk, Live specimen, Permanent slides, Charts, PPT and Group Discussion,	
	5.	Structure, reproduction and life-history of Deuteromycotina (<i>Cercospora</i> , <i>Alternaria</i>). Importance of mycorrhizal association.	2	K2(U)	Lecture using Chalk & talk, Live specimen, PPT and Group Discussion	

II ECONOMIC IMPORTANCE OF FUNGI:

II	1	Cultivation of mushroom – <i>Pleurotus</i> (food).	3	K3(Ap)	Lecture using Chalk & talk, PPT and videos, Hands on Training, Group Discussion	Simple definitions, Surprise Test, MCQ, True/False, Short essays, Recall, Graphical representation Simple definitions,
	2	Fungi in agriculture application	4	K4(An)	Lecture using Chalk & talk, PPT and videos,	Class test, Suggest idea/concept with examples,

		(biofertilizers): Mycotoxins (biopesticides),			Group Discussion	Formative assessment, Summative assessment, open book test
	3	Production of industrially important products from fungi- alcohol (ethanol), organic acids (citric acid), enzymes (protease). Vitamins (Vitamin B- complex and Vitamin B-12),	4	K4(An)	Lecture using Chalk & talk, Flow chart, Charts, PPT and Group Discussion,	
	4	Applications of fungi in pharmaceutical products (Penicillin). Importance of VAM fungi. Harmful effects of Fungi. Agriculture (Biofertilizers); Mycotoxins	4	K3(Ap)	Lecture using Chalk & talk, Charts, E- content, Flipped classroom, PPT and Group Discussion,	
BACTERIA, VIRUS						
III	1	Classification (Bergey's, 1994)	3	K2(U)	Lecture using Chalk & talk, Flow chart,	Simple definitions, MCQ, True/False, Essays, Short essays,

					Introductory session, Group Discussion, Review	Recall summary, Graphical representation, MCQ, Class Test, Formative assessment,
	2	Structure and reproduction of bacteria, Mycoplasma	5	K2(U)	Lecture using Chalk & talk, Permanent slides, PPT and Group Discussion,	Summative assessment, slip test, preparation of question bank
	3	Virology - Viruses general characters, structure and reproduction.	6	K2(U)	Lecture using Chalk & talk, Flipped classroom, Permanent slides, Charts, PPT and Group Discussion,	

PLANT PATHOLOGY

IV	1	General symptoms of plant diseases	2	K1(R)	PPT, Illustration, Live specimen, Lecture	Group discussion, Formative assessment, Quiz, Short test, Open book test, MCQ, Herbarium preparation, Slip test, class test, Debate
	2	Geographical distribution of diseases; Etiology	2	K2(U)	Lecture, video clippings, you – tube videos,	
	3	General characters of Bacteria and Viruses.	3	K1(R)	Lecture, Permanent slides, charts,	
	4	Bacterial diseases – Citrus canker and Bacterial wilt of	3	K3(An)	Live specimen, Lecture, Illustration, Interactive PPT	

		Banana				
5	Viral diseases – Tobacco Mosaic and Vein clearing of Papaya	2	K3(An)	Live specimen, Lecture, Illustration, Interactive PPT		
6	Fungal diseases – Blast disease in rice and Tikka disease	3	K3(An)	Live specimen, Lecture, Illustration, Interactive PPT		

V LICHEN

1	Classification (Hale, 1969). Habitat, nature of association, Structure	2	K1(R)	Lecture, PPT, Illustration	Group discussion, Formative assessment, Quiz, Short test, Open book test, MCQ, Herbarium
2	Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose)	3	K2(U)	Lecture, PPT, Illustration, Live specimen	preparation, Slip test, class test, Debate, Model making, Summative assessment
3	Types, distribution, thallus organization, reproduction and ecological significance of lichens with special reference to Usnea.	3	K2(U)	Lecture, PPT, Illustration, Live specimen	

	4	Economic importance of Lichens: food, fodder and nutrition, flavor, tanning and dyeing, cosmetics and perfumes, Brewing and distillation, minerals	3	K3(Ap)	Lecture, Interactive PPT, Illustration, Demonstration	
	5	Natural products, medicine (Ayurvedic, Siddha), pharmaceutical products, biodegradation agent, air pollution and biomonitoring, soil formation. nitrogen fixation	2	K3(Ap)	Lecture, Interactive PPT, Illustration, Display	
	6	Harmful aspects, poison from lichens.	2	K3(Ap)		

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Em/ En/SD): Role play (Classification of fungi), Model making (Micro- organisms)

Preparation of question Bank (Plant Diversity -II)

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues: Group Discussion on “ Economic Importance of Fungi”

Assignment: Plant Diseases, Production of ethanol, citric acid, protease and Vitamins

Seminar Topic: General characters of Fungi and Virus

Part A

1. The thallus organization of Zygomycotina is characterized by _____.
2. Citric acid is an example of an enzyme produced by fungi. True or False:
3. What is the primary classification reference for bacteria according to Bergey's, 1994?
 - a. Linnaeus b. Whittaker c. Bergey's d. Mims
4. The term bacteria was coined by the French microbiologist _____
5. *Usnea* is a fruticose lichen - True or False

Part B

1. Elaborate on the mode of nutrition in *Aspergillus*, a representative of Ascomycotina.
2. Explain the primary use of *Pleurotus* fungi in cultivation and its significance.
3. How does the structure of *Mycoplasma* relate to its pathogenicity in humans?
4. General characters of bacteria
5. Elucidate the nature of association of lichen.

Part C

1. Explain the life history of a representative fungus from Zygomycotina.
2. Explore the harmful effects of mycotoxins in agriculture, providing examples and discussing their impact.
3. Discuss the general characters of viruses and their structural components, emphasizing their role in the infection process.
4. Write in detail of causative organism, etiology, host-pathogen relationships, disease cycle, prevention and control measures of bacterial wilt of banana.
5. Draw and describe the internal structure of fruit body of *Usnea*

Head of the Department

A. Anami Augustus Arul

A. R. Florence

Course Instructor

A. Anami Augustus Arul

Department : Botany

Class : I B.Sc. Chemistry

Title of the Course : ELECTIVE ALLIED BOTANY-II

Semester : II

Course Code : BU232EC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
BU232EC1	4	-	-	2	2	60	25	75	100

Objectives

- To gain a solid grasp of plant systematics, acknowledging the pivotal role of plant anatomy in production systems, and comprehending the shift from vegetative to reproductive phases.
- To acquire knowledge in the physiological processes governing plant metabolism, energy production, and utilization.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	understand the fundamental concepts of plant anatomy and embryology.	PSO – 1	K2 (U)
CO - 2	analyze and recognize the different organs of plants and secondary growth.	PSO – 10	K4 (An)
CO - 3	understand water relation of plants with respect to various physiological processes.	PSO – 4	K2 (U)
CO - 4	to know about the fundamental concepts of aerobic and anaerobic respiration.	PSO – 4	K1 (R)
CO - 5	classify plant systematics and recognize the importance of herbarium and virtual herbarium.	PSO – 1	K3 (Ap)

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
Morphology of Flowering Plants:						
I	1.	Plant and its parts. Structure and function of root and stem.	4	K2 (U)	Lecture, Interactive PPT, diagrams, videos, live specimen	Short-Answer Tests, Assignments, MCQ, True/False. Evaluation through class test, quizzes, assignments, Recall steps, class test, formative assessment, open book test
	2.	Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types.	4	K2 (U)	Lecture using chalk and board, live specimens diagrams, interactive discussions	
	3.	Inflorescence - Racemose, Cymose and Special types.	2	K1 (R)	Lecture, PPT, Videos, brainstorming,	
	4.	Terminology with reference to flower description.	2	K3 (Ap)	Lecture, group discussion, PPT, debates	
Taxonomy:						
II	1.	Study of the range of characters and plants of economic importance in the following family: Rutaceae	2	K1 (R)	Lecture, diagrams, PPT, live specimen, brainstorming	Class tests, diagram labelling, online quizzes, MCQs, formative assessments, true/false statements, or fill-in-the-blank questions, group discussion summative assessments, Short Answer Questions, Essay Questions
	2.	Study of the range of characters and plants of economic importance in the following family: Caesalpiniaceae	2	K2 (U)	Lecture, PPT, diagrams, live specimen, chalk and board, videos, interaction in the classroom	
	3.	Study of the range of characters and plants of economic importance in the following family: Asclepiadaceae	3	K1 (Ap)	Lecture, PPT, live specimen, interactive discussion, reflective thinking	
	4.	Study of the range of characters and plants of economic importance in the following family: Euphorbiaceae.	3	K2 (U)	Lecture, PPT, diagrams, guided discussion, live specimen, flowcharts	
	5.	Study of the range of characters and plants of economic	2	K2 (U)	Lecture, PPT, diagrams, interactive	

		importance in the following family: Cannaceae			discussions,	
		Anatomy:				
III	1.	Tissue and tissue systems: Simple and complex tissues.	3	K2 (U)	Lecture, PPT, illustrations, microscope slide, Group discussions	Short Answer Questions, Labeling diagrams, Formative and Summative Assessments, Class test, essay question, MCQs
	2.	Anatomy of monocot and dicot roots -	6	K1 (R)	Lecture, PPT, Charts, permanent slide, sectioning, diagrams, brain storming	
	3.	anatomy of monocot and dicot stems -	3	K2 (U)	Lecture, PPT, permanent slide, interactive discussion	
	4.	anatomy of dicot and monocot leaves.	3	K1 (R)	Lecture, PPT, flowcharts, diagram, reflective thinking	
		Embryology:				
IV	1.	Structure of mature anther and ovule -	3	K2 (U)	Lecture, Chalk and board, PPT	Diagram labelling, quizzes, class test, essay test. Formative assessment, MCQs, Short answer test, peer review, Just a Minute,
	2.	Types of ovules, structure of embryo sac,	3	K2 (U)	Reflective thinking, photos,	
	3.	Pollination -double fertilization,	3	K1 (R)	Brainstorming. photos	
	4.	Structure of dicotyledonous and monocotyledonous seeds.	3	K2 (U)	Reflective thinking, photos	
		Plant Physiology:				
V	1.	Absorption of water,	2	K2 (U)	Lecture using chalk and board, group discussions, reflective thinking	formative assesment, MCQs, Class tests,online quiz, essay questions, Fill in the blanks, True or False, Summative
	2.	photosynthesis - light reaction - Calvin cycle;	3	K2 (U)	Brainstorming, diagram, videos,	

					intractive e-content	assessment, oral test, surprise test, homework
3.	respiration - Glycolysis - Krebs cycle - electron transport system.	4		K3 (Ap)	Lecture, group discussion, PPT, Videos	
4.	Growth hormones - auxins and cytokinin and their applications.	3		K2 (U)	Lecture, PPT, reflective thinking	

Course Focussing on Employability

Activities: Seminar, Assignment

Course Focussing on Cross Cutting Issues: Professional Ethics

Activities related to Cross Cutting Issues: Assignment and Seminar

Assignment Topic : Vegetative and Floral characters of the family Asclepiadaceae

Seminar Topic: Economic importance of any one family.

Sample questions

Part A

- What type of phyllotaxy has a group of three leaves occurring as a whorl at each node?
 - Ternate phyllotaxy
 - Opposite phyllotaxy
 - Whorled phyllotaxy
 - Mosaic phyllotaxy
- The fruit belongs to the family Rutaceae is _____.
 - Orange
 - Apple
 - Banana
 - Grapes.
- Which tissues are considered complex tissues?
 - Xylem and phloem
 - Parenchyma and sclerenchyma
 - Epidermis and cortex
 - Meristem and cambium
- The purpose of the microsporangia in the anther is _____.
 - To produce microspores
 - To attract pollinators
 - To protect the anther
 - To release pollen grains
- What is the role of mycorrhizal associations in water absorption?
 - They generate root pressure
 - They facilitate osmosis
 - They increase the effective root surface area
 - They aid in capillary action

Part B

- What are the types of compound leaves?

2. Describe the vegetative characters of the family Rutaceae.
3. Write short notes about the simple tissues.
4. Briefly explain the structure of an embryo sac.
5. Discuss the applications of auxin.

Part C

1. Explain the special types of inflorescence.
2. Outline the floral variations of the family Euphorbiaceae and its economic importance.
3. Discuss the anatomy of monocot and dicot stems.
4. Categorise the types of ovules.
5. Explain the stages of the Krebs cycle.

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr. Sr. P. Leema Rose

2. Dr.Bojaxa A. Rosy

Department : Botany

Class : I B.Sc. Chemistry

Title of the Course : NON-MAJOR ELECTIVE NME II: MUSHROOM CULTIVATION

Semester : II

Course Code : BU232EC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
BU232EC1	2	-	-	2	2	30	25	75	100

Pre-requisites:

Basic knowledge on structure and function of various groups of mushrooms.

Learning Objectives

1. To learn and develop skills in mushroom cultivation and harvest technology.
2. To understand and appreciate the role of mushrooms in nutrition, medicine and health.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	recall various types and categories of mushroom.	K1
2.	explain about various types of food technologies associated with mushroom industry.	K2
3.	apply techniques studied for cultivation of various types of mushrooms.	K3
4.	analyze and decipher the environmental factors and economic value associated with mushroom cultivation	K4
5.	develop new methods and strategies to contribute to mushroom production.	K3

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1	Introduction to Morphology of Mushrooms	1	K1(R)	Lecture, visual aids (slides/models)	Short-answer questions Class participation, group quiz Identification test, case study analysis Quiz, group presentation Diagram labeling, sequencing exercise
	2	Types of Mushrooms	1	K2(U)	Discussion, classification exercises	
	3	Identification of Edible/Poisonous Mushrooms	1	K3(An)	Case studies, real-life examples	
	4	Nutritive Values of Mushrooms	1	K2(U)	Lecture, nutritional charts	
	5	Life Cycle of Common Edible Mushrooms	2	K1(R)	Diagrams, life cycle models	
II	1	Mushroom Cultivation	3	K1(R)	Guest speakers, case studies	Research project, presentation
	2	Prospects and Scope in small scale industry	3	K3(An)		
III	1.	Life Cycle of Pleurotus spp	3	K2(U)	Videos, diagrams, step-by-step analysis	Comparison test, diagram labeling, Flow chart, Mind map
	2.	Life Cycle of Agaricus spp	3	K2(U)	Flow Chart, Lecture	
IV	1	Spawn Production and Growth Media	3	K2(U)	Practical demonstrations, lab sessions	Practical exam, report on spawn production Harvesting simulation, marketing plan presentation
	2	Spawn Running, Harvesting, and Marketing	3	K2(U)	Role-playing, field visits	
V	5.	Diseases and Post-Harvest Technology	3	K3(An)	Case studies, problem-solving scenarios	Diagnosis test, case study evaluation Pest identification test, field report analysis
	6.	Insect Pests, Nematodes, and Other Diseases	3	K3(An)	Guest lectures, field observations	

Course Focussing on Employability

Activities: Seminar, Assignment

Course Focussing on Cross Cutting Issues: Entrepreneurial skill

Activities related to Cross Cutting Issues: Demonstration, Field report

Demonstration-Mushroom cultivation

Field report – Report of a mushroom cultivation unit

Part-A

1. What is the life cycle of a mushroom?

- A) Spore release → Mycelium growth → Primordia formation → Fruiting body development → Spore formation
- B) Mycelium growth → Spore release → Primordia formation → Fruiting body development → Spore formation
- C) Spore release → Primordia formation → Mycelium growth → Fruiting body development → Spore formation
- D) Spore release → Mycelium growth → Fruiting body development → Primordia formation → Spore formation

2. Identify one key historical event that significantly influenced the cultivation or use of mushrooms.

- A) Invention of the microscope
- B) Discovery of penicillin
- C) Introduction of mushroom cultivation in ancient China
- D) Development of modern agricultural practices

3. Which mushroom species typically grows on agricultural waste like wheat or rice straw?

- A) Oyster mushroom (*Pleurotus* sp.)
- B) Button mushroom (*Agaricus bisporus*)
- C) Paddy Straw mushroom (*Volvariella* sp.)
- D) Shiitake mushroom (*Lentinula edodes*)

4. Which phase of mushroom cultivation involves the growth of mycelium throughout the substrate?

- A) Isolation
- B) Spawn Production
- C) Spawn running
- D) Harvesting

5. How can mushrooms be protected from various threats post-harvest?

- A) Spraying pesticides directly on harvested mushrooms
- B) Storing mushrooms in a humid environment

- C) Utilizing controlled temperature and humidity during storage
- D) Exposing mushrooms to direct sunlight for extended periods

6. Which method is effective in preventing viruses, fungal competitors, and diseases in mushroom cultivation?

- A) Using contaminated substrates for cultivation
- B) Maintaining high humidity levels in the growing environment
- C) Regularly sterilizing equipment and growing areas
- D) Exposing mushrooms to direct sunlight

7. Which technique involves the propagation of mushroom mycelium in laboratory conditions for spawn production?

- A) Mother spawn technique
- B) Commercial spawn technique
- C) Microbiological technique
- D) Traditional cultivation technique

8. What type of spawn is used as the initial inoculum in large-scale mushroom cultivation?

- A) Mother spawn
- B) Microbiological spawn
- C) Commercial spawn
- D) Traditional spawn

9. Which aspect is crucial for successful marketing of mushroom products in both domestic and international markets?

- A) Packaging techniques
- B) Government regulations
- C) Banking facilities
- D) Commercial production techniques

10. What resource is essential for mushroom cultivators seeking guidance on commercial production and government support?

- A) Banking services
- B) Help-line assistance
- C) Marketing strategies
- D) Value-added product knowledge

- 1 Explain the life cycle of mushrooms, and add notes How does this cycle differ from that of plants? (Understanding)
2. Develop a guide on how to identify commonly found edible mushrooms in a specific geographical region. Include key identifying features. (Application)
3. Describe the cultivation of Oyster mushroom
4. Analyze the process of spawn running in Paddy Straw mushrooms (*Volvariella* sp.), highlighting the critical environmental factors influencing mycelial growth. (Analysis).
5. Design a post-harvest technology plan for preserving harvested mushrooms. Address the challenges encountered during post-harvest handling. (Application)
6. Analyze the methods used to protect mushrooms from insect pests, nematodes, mites, and viruses. (Analysis)
7. Explain the commercial spawn mushroom production. (Comprehension)
8. Design a simplified step-by-step procedure for producing mother spawn for mushroom cultivation. (Application)
9. Define two value-added products derived from mushroom cultivation. Provide an example for each product. (Knowledge)
10. Summarize how packaging techniques vary for marketing mushroom products in India and abroad. Provide two distinct differences in packaging approaches for each market. (Understanding)

Part-C

1. Compare and contrast the nutritional, medicinal and therapeutic benefits value of two different edible mushroom species. {Analysis}
2. Evaluate the historical significance of mushrooms in various cultures. (Evaluation)
3. Develop a step-by-step guide for the isolation and spawn production of Oyster mushrooms (*Pleurotus* sp.). (Application).
4. Evaluate the economic viability of cultivating Paddy Straw mushrooms (*Volvariella* sp.) compared to Button mushrooms (*Agaricus bisporus*). (Evaluation)
5. Apply the strategy to safeguard mushrooms from fungal competitors and diseases. (Application)
6. Evaluate the impact of various post-harvest technology approaches on the shelf life and commercial value of mushrooms. (Evaluation)
7. Compare and contrast the microbiological technique and the mother spawn technique in spawn production. (Analysis)
8. Assess the economic viability of utilizing commercial spawn production compared to microbiological and mother spawn techniques. (Evaluation)

9. Compare and contrast the commercial production model units in India and a developed country concerning mushroom cultivation.

10. Design a comprehensive plan outlining the necessary banking and government support systems essential for encouraging mushroom cultivation as an entrepreneurial venture. (Create)

Head of the Department:

Course Instructors:

Dr. A. Anami Augustus Arul

1. Dr. Sr. P. Leema Rose

SEMESTER -II

SKILL ENHANCEMENT COURSE SEC I:

BOTANICAL GARDEN AND LANDSCAPING

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU232SE1	2	-	-	-	2	2	30	25	75	100

Pre-requisites: Students should know about the fundamental concepts of gardening and landscaping.

Learning Objectives

1. To know about the fundamental concepts of gardening and landscaping.
2. To inculcate entrepreneurial skills in students for creative landscaping design using CAD software.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	to know about the fundamental concepts of gardening and landscaping	K1
2.	to provide an overview of various gardening styles and its scope in recreation and bio-aesthetic planning.	K2
3.	to illustrate the significance of garden adornments and propagation structures.	K3 & K6
4.	to create the design outdoor and indoor gardens and inculcate entrepreneurial skills for landscaping.	K4
5.	to inculcate entrepreneurial skills in students for creative landscaping design using cad software.	K5 & K6

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6** - Create

Unit	Contents	No. of Hours

I	Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, Vertical gardens, roof gardens, art of making bonsai. Greenhouse.	6
II	Bioaesthetic planning, definition, need, round country planning, urban planning and planting at avenues, railway stations, dam sites, hydroelectric stations, colonies, river banks, planting material for play grounds.	6
III	Landscape designs, Styles of garden, formal, informal and free style gardens, Urban landscaping, Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate.	6
IV	Establishment and maintenance - indoor gardening, therapeutic gardening, non-plant components, water scaping, xeriscaping, hardscaping.	6
V	Computer Aided Designing (CAD) for outdoor and indoor landscaping Exposure to CAD (Computer Aided Designing).	6

Self-Study Portion: Establishment and maintenance of gardens.

Recommended Texts:

1. Acquaah, J. 2019. Horticulture – principles and practices, (Fourth edition), PHI learning Pvt. Ltd., New Delhi.
2. Rao Manibhushan K. 2005. Textbook of horticulture. Mac Millan India Ltd., Kolkata.
3. Gangulee H. C. and Kar A. K. 2011. College Botany (Volume – II), New Central Book Agency, Kolkata
4. Sharma V. K. 2011. Encyclopedia of Practical Horticulture, (Volume - IV), Deep and Deep Publ. Pvt. Ltd., New Delhi
5. Singh, J. 2018. Fundamentals of Horticulture. Kalyani Publishers, Chennai.

References Books:

1. Berry, F. and Kress, J. 1991. Heliconia: An Identification Guide. Smithsonian Books, Washington DC.
2. Butts, E. and Stensson, K. 2012. Sheridan Nurseries: One hundred years of People, Plans, and Plants. Dundurn Group Ltd., Canada.
3. Russell, T. 2012. Nature Guide: Trees: The world in your hands (Nature Guides).
4. Acquaah, J. 2009. Horticulture – principles and practices, (Fourth Edition), PHI learning Pvt. Ltd., New Delhi.
5. EdmentSenn Andrews. 1994. Fundamentals of Horticulture. Tata. McGraw Hill Publishing Co., Ltd., New Delhi.

Web Resources:

1. https://www.amazon.in/Gardening-Landscape-Design-and-Botanical-Garden/s?rh=n%3A1318122031%2Cp_27%3Aand+Botanical+Garden
2. <https://www.overdrive.com/subjects/gardening>
3. <https://www.scribd.com/book/530538456/Opportunities-in-Landscape-Architecture-Botanical->

Gardens-and-Arboreta-Careers

4. <https://www.scribd.com/book/305542619/Botanic-Gardens>
5. <https://www.overdrive.com/subjects/gardening>

MappingwithProgrammeOutcomes:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	3	2	2	1	2
CO2	3	3	3	2	3	3	2
CO3	3	3	3	1	2	2	1
CO4	3	3	3	2	3	2	3
CO5	3	3	3	2	2	3	3
Total	15	15	15	11	12	11	11
Average	3	3	3	2.2	2.4	2.2	2.2

MappingwithProgramme Specific Outcomes

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1	3	3	3	3	3	3	3	2	3	3
CO2	3	3	2	3	3	3	3	2	3	3
CO3	2	3	3	3	3	3	3	2	3	3
CO4	3	3	3	3	3	3	3	2	3	3
CO5	3	3	3	3	3	3	3	2	3	3
Total	15	15	14	15	15	15	15	10	15	11
Average	3	3	2.8	3	3	3	3	2	3	2.2

S-Strong (3)

M-Medium (2)

L-Low (1)

Teaching plan

Total Contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy/student centric method	Assessment/Evaluation
I	Unit-I: 6 hrs					
	1.	Principles of gardening, garden components, adornments, lawn making	3	K1, K2, K3, K4	Introductory session, Lecture using videos, Demonstration, PPT	Mind map of garden components
	2	methods of designing rockery, water garden, Vertical gardens, roof gardens	2	K2, K3, K4	Lecture using videos, Demonstration, PPT	Prepare a design for any one garden
	3	Art of making bonsai. Greenhouse.	1	K1, K2	Experiential learning	Analyze a bonsai plant and write few sentences.
II	Unit-II: 6 hrs					
	1.	Bioaesthetic planning, definition, need, round country planning, urban planning	2	K1, K2	Lecture, PPT Videos	Collect images of country and urban planning and planting in different sites – album.
	2.	Planting at avenues, railway stations, dam sites, hydroelectric stations, colonies, river banks,	3	K2, K3	Lecture using videos, PPT	
	3.	Planting material for play grounds.	1	K2, K3	PPT-discussion	Seminar
III	Unit-III: 6 hrs					
	1	Landscape designs, Styles of garden, formal, informal and free style gardens, Urban landscaping,	3	K2, K3, K5, K6	Discussion with videos	Observation of a garden
	2	Landscaping for specific situations, institutions, industries, residents, hospitals, roadsides, traffic islands, damsites, IT parks, corporate.	3	K2, K3, K5, K6	Discussion with videos	Oral test
IV	Unit-IV: 6 hrs					
	1	Establishment and maintenance - indoor gardening, therapeutic gardening, non-plant components	3	K1, K2, K3, K6	Brainstorming on gardening, observe herbal garden in the campus	Analyze the medicinal plants in the garden and write a report
	2	Water scaping,	3	K2, K3	Group discussion	Slip test

		xeriscaping, hardscaping.			Lecture	
V	Unit-V: 6 hrs					
	1	Computer Aided Designing (CAD) for outdoor and indoor landscaping	3	K2, K3, K5, K6	Group discussion Lecture -videos	Assignment
	2	Exposure to CAD (Computer Aided Designing).	3	K2, K3	Debate Lecture-videos	

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (Skill Development): Create a design for a garden

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment

Sustainability/ Gender Equity): Environmental sustainability

Activities related to Cross Cutting Issues: Importance of gardens in public places.

Assignment: Video /photography of garden-types/landscape

Seminar Topic: Establishment and maintenance of gardens

Sample questions (minimum one question from each unit)

Part A

Define Adornment

Part B

Comment on the art of Bonsai.

Part C

Explain the importance of Computer Aided Designing (CAD) for outdoor and indoor landscaping.

Head of the Department

Dr.A.Anami Augustus Arul

Course Instructor

Dr.S.MaryMettilda Bai and Dr.J.Vinoliya

Major Core – IV Plant Ecology and Phytogeography

Sub. Code: BC2041

Modules

Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Ecosystem						
	1	Fresh water (pond	3	To understand the	Lecture with	Short test,

I		ecosystem) and marine ecosystem		producers, consumers and decomposers of these ecosystems.	blackboard, field visit	Group discussion Formative assessment, Quiz
	2	Trophic organization, energy flow, autotrophy and heterotrophy	3	Know the behavior of organisms in each trophic level of an ecosystem.	Lecture with blackboard, PPT, You tube videos	Short test, Role play, Quizizz, Assignment
	3	Food chains and food webs, ecological pyramids	3	Learn the predators and preys and their interconnections in an ecosystem.	Lecture with charts, Models	
	4	Plant interactions- symbiosis, commensalism and parasitism	3	Understand the relationship between plant and other organisms.	Lecture with PPT, Illustration	
Soil						
II	1	Importance, Origin, Types Formation of soil	4	To understand the importance, origin, types and formation of soil	Lecture	Formative assessment Group discussion Short test Quiz, Assessing their creative knowledge, Open book test, Online quiz
	2	Composition of soil, Physical, chemical and biological components of soil	4	To be familiarize with the Composition and components of soil	Lecture	
	3	Soil Profile, Role of climate in soil development.	4	To know the profile of soil and role of climate in soil development.	Lecture Video clippings	
Water						
III	1	Importance of water, States of	4	To realize the importance and	Lecture	Formative

		water in the environment		States of water		assessment Class test
	2	Atmospheric moisture; Precipitation types (rain, fog, snow, hail, dew)	4	To categorize the Precipitation types	Lecture Video clippings	Quiz Group discussion Short test
	3	Water bodies: Water in soil; Water table, Aquifers, Water shed management.	4	To know the Water bodies and Water shed management	Lecture, group discussion	Summative assessment, online assignment

Ecological groups

IV	1	Morphological, anatomical and physiological adaptations of hydrophytes	3	To understand the special structures produced by plants to adapt water habitats.	Lecture Classroom Discussion	Diagrammatic assessment Assessing their Practical knowledge
	2	Morphological, anatomical and physiological adaptations of xerophytes	3	To identify the xerophytes and study their anatomical and physiological adaptations	Lecture with blackboard	Formative assessment Class test Quiz Group discussion
	3	Morphological, anatomical and physiological adaptations of halophytes	3	To learn the modifications made by plants to adapt high salinity.	Lecture Classroom Discussion	Short test
	4	Study of vegetation by quadrat and transect method.	3	To analyse the vegetation by quadrat and transect method.	Field study	

Phytogeography

V	1	Principles of phytogeography	2	Know the pattern and process in plant distribution.	Lecture with blackboard	Short test Choose the correct answer
	2	Types of plant distribution – continuous,	3	Understand the different types of distribution of	Lecture PPT	Formative

		discontinuous and endemic.		plants.		assessment Assignment Quiz Summative assessment, Model making
3		Plate tectonics, continental drift, theory of land bridges, age and area hypothesis.	4	Learn about the movements of continents.	Lecture PPT	
4		Centers of origin of cultivated crops.	3	Know about the origin of crops	Lecture PPT	

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr.A.R. Florence

2. Dr. J. Albino Wins

Elective – II (c) Biodiversity and Human Welfare

Sub. Code: BC2044

Modules

Total contact hours: 60 (Including lectures, assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
Biodiversity						
I	1	Scope and types of Genetic diversity	3	To understand the different types of genetic diversity	Lecture, Group discussion,	Short test Quiz Formative assessment Assignment, Orla test, Flow chart, Mind map
	2	Species diversity and ecosystem biodiversity.	3	To know the types of species and ecosystem biodiversity	Brain storming, Cooperative learning	
	3	Agro biodiversity and cultivated plant taxa, wild taxa.	3	To learn about the agrobiodiversity and cultivated and wild taxa	Lecture PPT, Peer tutoring	
	4	Values of biodiversity; Ethical and aesthetic values of biodiversity	3	To understand the ethical and aesthetic values of biodiversity	Lecture, YOU tube video, PPT	
Biodiversity Hot spots						
II	1	History and origin of hotspots.	3	To learn the history and origin	Lecture Group	Group discussion

				of hotspots	discussion	Formative assessment
	2	Critical role of hotspots in species richness and endemism.	3	To understand the role of hotspots	Lecture PPT	Short test Assignment, model making, slip test,
	3	Biodiversity in tropics, National biodiversity hotspots, hottest biospots of Western Ghats,	3	To be familiarize with the biodiversity hotspots and hottest biospots	Flipped classroom	Quizizz, Summative assessment
	4	Biodiversity of Tamilnadu.	3	To realize the biodiversity of Tamilnadu	Lecture Video, group discussion	

Economical values of biodiversity

III	1	Economical values of biodiversity-plants, animals and microbes.	3	To study the values of biodiversity	Lecture, group discussion	Class test Formative assessment Quiz
	2	Loss of genetic diversity, loss of species diversity, loss of ecosystem diversity, loss of agro biodiversity,	3	To realize the loss of different biodiversity.	Lecture, PPT, Peer tutoring	Short test, Edmodo, open book test
	3	Consequences and implications	3	To learn the consequences and implications of biodiversity	Lecture using videos	
	4	Projected scenario for biodiversity loss.	3	To understand the projected scenario for biodiversity loss.	Lecture, field visit	

Organizations associated with Biodiversity management

IV	1	IUCN, UNEP, UNESCO, WWF, NBPGR, CITES and CBD;	4	To study about the various organizations associated with biodiversity management	Flipped classroom	Quiz Class test Assignment Formative Assessment, MCQ, Oral presentation,
	2	National Biodiversity Authority,	4	To understand about the National Biodiversity Authority	Mind map, Inquiry based	Nearpod collaboration
	3	Nature Conservation Foundation. Rio de	4	To know about the Nature	Lecture, PPT, Socratic	

		Janeiro, 2012		Conservation Foundation	method	
Conservation of Biodiversity						
V	1	Role of NGOs in biodiversity conservation,	3	To understand the Role of NGOs	Lecture, KWL	Quiz Assignment Group discussion Class test, Mind map, Summarizing, Quizizz
	2	Conservation of genetic diversity, species diversity and ecosystem diversity,	3	To study the conservation of diversity	Lecture, PPT, seminar	
	3	In situ and ex situ conservation, social approaches for conservation,	3	To learn about the conservation of biodiversity	Lecture, PPT Video, seminar	
	4	Biodiversity awareness programmes, sustainable development.	3	To realize the importance of awareness programmes	Lecture, Group discussion	

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr.A.R. Florence

2. Dr.A. Anami Augustus Arul

Allied II- Theory

Plant Diversity – II (Gymnosperms, Angiosperms) and Plant Physiology

Subject Code: BA2041

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment / Evaluation
Gymnosperms						
I	1	General characteristics of Gymnosperms.	2	To analyse the General characteristics of Gymnosperms	Lecture, Illustration	Formative assessment Assignment Short test Open ended question, Mind map, Online quiz, Quizizz,
	2	Distribution, Systematic Position,	3	To understand the morphology	Lecture Video clippings,	

		Morphology, Anatomy of <i>Pinus</i> .		and anatomy of <i>Pinus</i>	Live specimen, Permanent Slide	
	3	Reproduction and Life History of <i>Pinus</i> .	3	To be familiar with reproduction and life history of <i>Pinus</i>	Lecture Illustrations, Demonstration	
	4	Economic importance of Gymnosperms.	4	To be familiarize with the importance of gymnosperms	Lecture PPT presentation	
Morphology						
II	1	Morphology of root, stem,	4	To compare the different types of root and stem and its modification	Lecture with PPT	Formative assessment Assignment Mind map, Oral test, Nearpod collaborative
	2	Morphology of leaf, inflorescence,	4	To realize the morphology of leaf and inflorescence	Lecture with Video clippings	
	3	Morphology of flower and fruit – their modifications.	4	To understand the morphology of flower and fruit	Lecture with live specimen	
Taxonomy						
III	1	Study of the following families and their economic importance- Brassicaceae, Rutaceae	4	To compare the difference between Brassicaceae and Rutaceae	Lecture, PPT, demonstration, Live specimen	Formative assessment Assignment Short test Assessing their creative knowledge Quiz, MCQ, Quizizz, Summarization
	2	Study of the following families and their economic importance - Lamiaceae, and Areaceae	4	To recall the importance of Lamiaceae and Areaceae	Lecture, PPT, demonstration, Live specimen	
	3	Study of the following families	4	To know the family details	Lecture, PPT,	

		and their economic importance– Euphorbiaceae		of Euphorbiaceae	demonstration	
Photosynthesis						
IV	1	Pigment systems	3	To understand the structure and uses of pigment systems	Lecture, Model	Formative assessment Group discussion Short test Quiz Short test, Oral test, Edmodo
	2	Light dependent (cyclic and non-cyclic photophosphorylation)	3	To understand the light dependent photosynthesis	Lecture with PPT, Illustration you tube videos	
	3	Light independent (C ₃ cycle).	3	To correlate light independent photosynthesis	Lecture with Video clippings	
	4	Factors affecting photosynthesis.	3	To know the factors affecting photosynthesis	Flipped classroom	
Respiration and Phyto hormones						
V	1	Anaerobic (Fermentation), Glycolysis	2	To understand the different types of anaerobic respiration	Lecture PPT, KWL	Group discussion Formative assessment, Quiz Short test, Nearpod Collaborative, Oral presentation, summative assessment
	2	Aerobic (Kreb's cycle)	3	To realize the importance of Kerb's cycle	Lecture, video, Group discussion	
	3	Electron Transport System and Oxidative phosphorylation.	3	To analyze electron Transport System and Oxidative phosphorylation.	Flipped classroom,	
	4	Factors affecting respiration.	2	To understand the factors affecting respiration	Peer tutoring	

	5	Physiological role of auxins, gibberellins and ethylene.	2	To learn about the physiological role of auxins, gibberellins and ethylene.	Lecture PPT	
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Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr.A.R. Florence

2. Dr.A. Anami Augustus Arul

Semester - VI
Major Core VIII - Genetics, Biostatistics and Bioinformatics
Sub. Code: BC2061

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

- Objectives:**
1. To have knowledge of Mendelian and non-Mendelian inheritance.
 2. Develop skills in data tabulation, its treatment, analysis and interpretation of data.
 3. Introduce the vast repositories of biological data knowledge.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO – 1	understand Mendelian principle and predict genetic inheritance patterns.	PSO - 1	U
CO – 2	analyze the facts of non-Mendelian inheritance and have conceptual knowledge on alleles and their linkage.	PSO - 3	Ap

CO – 3	examine the various stages of cell division and also a clear knowledge on DNA structure.	PSO - 3	U
CO – 4	generate biological interpretations and conclusions from data of scientific research.	PSO -3	C
CO – 5	develop skills to become employable as professionals in biochemical industries.	PSO - 5	C

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I GENETICS AS A SCIENCE						
	1	History, Experiments of Mendel with <i>Pisum sativum</i> , Principles of inheritance, Mendelian laws-monoybrid and dihybrid cross, test cross and back cross (Assignment)	5	To differentiate monohybrid and dihybrid crosses and solving the related problems	Lecture, Problem based learning	Class test, Group Discussion ,Quiz, Slido - MCQ, mind mapping, Edmodo
	2	Modification of Mendelian ratio: Incomplete dominance – <i>Mirabilis jalapa</i> , Co-dominance – MN blood group in man	5	Able to solve the problems in incomplete dominance and co-dominance	Lecture, Problem based learning	
	3	Lethal genes: Dominant lethality - Coat colour in Mice, Recessive lethality – Chlorophyll content in Maize. (Seminar)	4	To distinguish dominant and lethal genes	Flipped classroom	

	4	Genetic interaction: Dominant Epistasis – fruit colour in summer squashes, Recessive epistasis – coat colour in mice; Complementary genes – flower colour in sweet pea. Non-epistasis - comb pattern in Fowls	4	To learn about interaction of genes and solve the problems	Lecture, PPT, Problem based learning	
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II LINKAGE AND CROSSING OVER

	1	Sex Linked inheritance (eye colour in <i>Drosophila</i>) Polygenic inheritance with reference to (ear length in maize)	5	To understand the basics of inheritance and solve the problems	Lecture, Charts, problem solving	Diagrammatic representation, Short test, Formative assessment
	2	Multiple alleles - ABO blood group in man, Rh factor. Non-Mendelian inheritance	4	To distinguish mendelian and non-mendelian inheritance	Lecture, Models	, Summative assessment, Problem solving, Model making
	3	Extra-chromosomal inheritance: chloroplast mutation – variegation in 4 O'clock plant; mitochondrial mutations in yeast. Maternal effects – shell coiling in snail	4	To evaluate the mutation patterns in chloroplast and mitochondria	Lecture, PPT	
	4	Linkage: Morgan's views	5	To	Lecture,	

		on linkage, crossing over – types, mechanism of crossing over and its significance		understand and differentiate linkage and crossing over	Video Clippings, Problem solving	
	5	Holliday model for genetic recombination.	2	To analyse the recombination patterns	Lecture, Video clippings	

CELL CYCLE AND NUCLEIC ACIDS

	1	Cell division (mitosis and meiosis), Significance of mitosis and meiosis.	3	To understand and differentiate the mechanisms of mitosis and meiosis	Lecture, PPT, Chart, Interactive PPT	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment I (CIA - I).
	2	Chromosomes: Chromosome morphology – (metacentric, submetacentric, acrocentric and telocentric) and Chromosome. Structure, Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lampbrush chromosomes), supernumerary chromosomes (B chromosome).	5	To analyse the different patterns of chromosome with special reference to giant chromosomes	Lecture, Models, Socratic method	

	3	Brief account on Nucleic acids; DNA as the genetic material: Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment, RNA as the carrier of genetic information (Fraenkel-Conrat). DNA Structure (Watson and Crick) Salient features of double helix	6	To understand the basics of nucleic acids with experiments	Lecture, PPT, Seminar, Inquiry based learning	
	4	Types of RNA: structure and functions of mRNA, rRNA and tRNA.	4	To differentiate the different forms of RNA	Lecture, Charts, PPT, Mind map, MCQ	
IV BIostatISTICS						
	1	Importance of statistics in Biology, sampling - random sampling, collection and interpretation of data, tabulation	5	To know and practice the basics of biostatistics	Lecture, Problem solving	Quiz, Group discussions, Oral
	2	Presentation of data - frequency distribution, frequency curve, frequency polygon, histogram and bar diagrams	4	To understand the data presentation with graphical representation	Lecture, PPT, Problem solving	test, short test with open ended, summarization

	3	Measures of central tendencies -mean, median and mode. Measures of dispersion – standard deviation, standard error (Seminar)	5	To acquire skills to solve problems based on measures of central tendencies and dispersion	Lecture, Problem solving	
	4	Null hypothesis - Chi - square test.	4	To evaluate the test of significance in various data	Lecture, PPT, Problem solving	

VBIOINFORMATICS

	1	Aims and scope and applications- Virtual library, e-books and e- journals	4	To understand the concepts of bioinformatics	Lecture, PPT, problem solving	Multiple Choice Questions, Group
	2	Major areas of biological data bases- classification; primary, secondary, specialized	5	To differentiate the different forms of biological data bases	Flipped classroom	discussions, Computer analysis, Continuous Internal Assessment
	3	Importance data bases- NCBI, SWISS-PROT, DDBJ	4	To construct the databases in computers	Online tool assessment and demonstration	Seminar, Summative assessment
	4	Tools and softwares in Bioinformatics – similarity	5	To evaluate and practice	Lecture, Video	

		search – BLAST – FASTA sequence alignment tools. Application of Bioinformatics.		the softwares of bioinformatics	clipping, software analysis	
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Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr. A. Anami Augustus Arul

2. Dr.Sr. Leema Rose

Major Core IX - Biotechnology and Molecular Biology

Sub. Code: BC2062

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	6	90	100

Objectives: 1. To learn and apply the general principles of biotechnology and ensure adequate training in modern biotechnology.

2. To understand the various steps in DNA replication, protein synthesis and gene regulation in prokaryotes.

3. To gain knowledge on different types of IPR.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	acquaint the core concepts and fundamentals of plant biotechnology.	PSO – 1	U
CO – 2	develop competency on different types of plant tissue culture.	PSO – 3	Ap
CO – 3	understand the mechanisms of genetic information.	PSO –1	U
CO – 4	get an insight of chromosome abnormalities and related human syndromes.	PSO –7	An
CO – 5	develop skills to become employable as professionals in Biotechnology Industries.	PSO –7	C

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/Evaluation
Unit I						
	1	Definition and scope of biotechnology, Principles of recombinant DNA technology, Steps and Applications of rDNA technology;	5	To understand the importance of recombinant molecules	Lecture with PPT, model	Group discussion Assignment Quizizz Continuous Internal Assessment Class test, Collaborative, Mind mapping
	2	Restriction Enzymes – Nomenclature and Classification; Cloning Vectors - Plasmids, Cosmids, Phagemids and shuttle vectors;	5	To learn and categorize different types of restriction enzymes and cloning vectors	Lecture with PPT, Inquiry based learning, Jigsaw	
	3	DNA cloning - Steps and Applications;	3	To understand the steps and importance of DNA cloning	Lecture with PPT, you tube video	
	4	Basic techniques – Agarose gel	5	To know the different separation	Lecture with PPT,	

		electrophoresis, Northern blotting, Southern blotting and RFLP.		techniques	Hand on training	
Unit II						
	1	Scope and importance of plant tissue culture, Totipotency of cells, Tissue culture laboratory-organization and requirements	5	To practice the plant tissue culture, Sterilization techniques and Culture media preparation in laboratory	Lecture Demonstration and Hands on training	Group discussion Assignment Quiz Continuous Internal Assessment Class test Slip test, Slido - MCQ, Oral presentation
	2	MS medium composition and preparation;	4	To know the preparation of MS medium.	Lecture, demonstration and Hands-on training	
	3	Sterilization techniques; Types of tissue culture - Callus culture, apical meristem culture, Micropropagation and Protoplast culture;	4	To provide students with the knowledge and skills of sterilization and propagation of explants.	Lecture Demonstration and Hands-on training	
	4	Artificial seed: production, applications and limitations; Cryopreservation techniques.	5	To understand artificial seed production and cryopreservation techniques	Lecture PPT	
Unit III						
	1	General Features of DNA Replication: General principles –semi-conservative and semi discontinuous replication; Semi conservative model of replication – Watson and Crick,	6	To learn different methods of DNA replication.	Flipped classroom	Group discussion Assignment Quiz Continuous Internal Assessment Class test Short test Online quiz Slido Mind mapping
	2	DNA damage; DNA repair	6	To learn DNA damage and	Lecture PPT, you	

		mechanism. Photoreactivation, Mismatch repair;		different repair mechanisms.	tube video	
	3	Mutations – Gene mutation and Chromosomal mutation; Mutagens; Chromosomal abnormalities- Down Syndrome and Klinefelter Syndrome.	6	To know about mutations and its effects.	Lecture, PPT, Model	
Unit IV						
	1	Genetic code and wobble hypothesis;	4	To learn the characteristics of genetic code and wobble hypothesis.	Lecture, PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test Short test MCQ, mind mapping Oral presentation
	2	Transcription in prokaryotes and eukaryotes;	4	To understand the transcription in prokaryotes and eukaryotes	Lecture and video clippings	
	3	Assembly of ribosomes; Protein synthesis - initiation, elongation, and termination	5	To acquire knowledge on Protein Synthesis	Lecture and video clippings	
	4	Gene regulation in Prokaryotes- Operon concept, Lac Operon; Transposons in Prokaryotes and Eukaryotes.	5	To understand gene regulation and transposons.	Lecture, PPT and video	
Unit V						
	1	DNA transfer techniques: Physical method (Microinjection), Chemical method (Calcium phosphate method), Electrical method (Electroporation);	5	To understand the Gene regulation, mutation and characteristics of codons	Lecturing Interactive PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test Multiple Choice Question Orla test
	2	Gene transfer in plants – Agrobacterium	4	To understand the Gene transfer methods	Lecturing, Illustration	

		transformation;				Slip test
3	GM plants –Bt Brinjal, BtCotton,; Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice).	6	To learn about GM plants.	Lecture, PPT, and video		
4	IPR – Scope and different kinds of IPR.	3	To get a brief knowledge of IPR.	Debate		

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr. A.R. Florence

2. Dr.Bojaxa A. Rosy

Major Core X - Plant Physiology and Metabolism

Sub. Code: BC2063

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
6	5	90	100

- Objectives:**
1. Comprehend the fundamental concepts of plant physiology.
 2. Describe the physiological mechanisms of plant growth, function, and development.
 3. Recognize and describe how plants respond to their environment.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	understand water relation of plants with respect to various physiological processes.	PSO - 1	U
CO – 2	explain deficiency symptoms of macro and micro nutrients in plants.	PSO –2	U
CO – 3	relate complementary metabolic pathways such as photosynthesis and respiration in energy acquisition.	PSO –1	An
CO – 4	analyse nitrogen metabolism and its significance.	PSO –1	An
CO – 5	assess dormancy and germination in plants.	PSO –1	An

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I Plant and cell architecture						
	1	Importance of water to plant life.	3	To know about the basics and importance of water to plant life	Lecture PPT, Chart	Class test, Group Discussion, Slip test Quiz, Internal Assessment , Slido - MCQ
	2	Physical properties of water; Imbibition, diffusion, osmosis and plasmolysis.	5	To understand the physical properties of water	Lecture Problem based learning	
	3	Concepts of water potential and its components. The Concept of the Soil Plant Atmosphere Continuum (SPAC).	5	To evaluate the concepts of water potential and the concept of SPAC	Lecture PPT, Video clippings	

	4	Transpiration –Definition, types of transpiration, structure and opening and closing mechanism of stomata; guttation and anti-transpirants. Factors affecting transpiration.	5	To analyze the process of transpiration and the factors influencing it.	Lecture, PPT	
II Mineral nutrition						
	1	Essential elements, micro and macronutrients; Criteria of essentiality of elements;	4	To understand the essentiality of elements to plants	Lecture Demos- tration	Quiz,Class test, Short test, Internal Assessment Group
	2	General functions, specific role and deficiency symptoms of macronutrients (Nitrogen, Phosphorus, and Potassium) and micronutrients (Iron, Magnesium, Molybdenum and zinc)	5	To learn about the specific role and deficiency symptoms of micro and macronutrients	Lecture, PPT, Video clipping, Live specime n	Discussion Slip test Mind mapping Collaborative assessment
	3	Absorption and translocation of solutes (organic and inorganic) – active & passive uptake.	5	To analyze the absorption and translocatio n of solutes	PPT, Lecture, Video clipping	
	4	Hydroponics, types, aquaponics and significance.	4	To evaluate the mechanism and significance of hydroponics	Lecture, PPT, Demos- tration	
III Photosynthesis						
	1	Photosynthesis: Importance of photosynthesis for food security and environment	5	To understand the importanc e of photosynt hesis	Lecture PPT, Inquiry based learning	Short test, Question – Answer session, Group discussion, Continuous

2	Ultrastructure of chloroplast	2	To know the ultrastructure of chloroplast	Flipped classroom	Internal Assessment Quiz using Mentimeter Flow chart
3	Light reaction: Radiant energy, photosynthetic apparatus, light harvesting complex; light absorption, composition and characteristics of pigment systems, photosynthetic electron transport,	6	To know about the light reaction in photosynthesis	Lecture PPT Seminar	
4	Dark reaction: Carbon dioxide fixation in C3, C4 and CAM plants,	5	To understand the different types of dark reaction and its significance	Lecture Charts, Seminar	
	Photorespiration and its significance, factors affecting photosynthesis.	2	To learn about photorespiration and the factors affecting respiration	Mind mapping , Debate	

IV Respiration

1	Ultrastructure of mitochondria, Aerobic and anaerobic respiration, cyanide independent respiration, Fermentation	5	To differentiate the different forms of respiration	Brain storming, Cooperative learning	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment Quiz Oral test, Flow chart
2	Glycolysis, Krebs cycle and generation of ATP synthesis through oxidative electron transfer chain (cytochrome system)	4	To learn the generation of ATP through different process	Peer tutoring	
3	Chemiosmotic regeneration of ATP, Gluconeogenesis, Factors affecting respiration	5	To know about chemiosmotic processes with examples	Lecture, PPT, Video clippings	

	4	Nitrogen nutrition, organic nitrogen, nitrogen fixation in microbes / legumes, nif genes and NOD factors, nitrate and ammonia assimilation, nitrogenase	4	To analyze the mechanism of biological nitrogen fixation	Lecture, PPT, Video clips	
V Plant Growth Regulators						
	1	Growth, Growth curve, Growth and development, phytochrome and light control, role of phytochrome in tropism, flowering and fruiting	5	To know the growth pattern of plants and the role of phytochromes	Flipped classroom	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment Quiz Slip test Short test MCQ
	2	Physiological role of auxins, gibberellins, abscisic acid and ethylene	4	To understand the role of plant hormones with suitable examples	Inquiry based learning	
	3	Vernalization – dormancy of seeds, methods of breaking dormancy, mechanism of seed germination	5	To evaluate seed dormancy and seed germination process	Project based, Demonstration	
	4	Plant response to environmental stresses – Polyamines, brassinosteroids and their functions	4	To analyse the response of plants to environmental stresses	Peer tutoring	

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr.J. Albino Wins

Semester - VI**Elective –IV (a) Marine Botany****Sub. Code: BC2064**

Number of Hours Per week	Number of Credits	Total Number of Hours	Marks
4	3	60	100

- Objectives:**
1. Understand the diversity of marine organisms.
 2. Learn about the marine plants and their medicinal property.
 3. Acquire knowledge on marine pollution and conservation methods.

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	describe the types of marine habitat and their relationship with environment	PSO - 1	R
CO – 2	compare the threats and conservation of seaweeds and sea grasses	PSO –4	An
CO – 3	evaluate how natural events and human activities affect coastal habitats	PSO – 4	Ev
CO – 4	create a broad knowledge about themarine products and their economic value	PSO – 5	C
CO – 5	describe the role of mangroves in conservation of marine flora and fauna.	PSO –4	U

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I. Classification of Marine habitat						
	1	Classification of marine habitat – pelagic, neritic and oceanic province, benthic – zonation	3	To classify the types of marine habitats	Lecture Video, field visit	Group discussion, Assignment Quiz Continuous
	2	– shore environment –	3	To understand	Lecture, field	

		muddy, rocky and sandy, waves and tides deep sea bottom – pelagic deposits.		the shore environment	visit	Internal Assessment Class test Field report
3		Physical and chemical properties of sea water.	3	To learn the properties of sea water	Lecture PPT, Flow chart	
4		Salt marshes and sand dune vegetation.	3	To be able to understand the salt marshes and sand dunes.	Lecturing with PPT Debate	

II. Marine biodiversity

1		phytoplankton- Nekton, Benthos. Marine Phytoplankton- Dino - flagellates, Nano-plankton, Ultra-plankton, marine bacteria, marine fungi, marine Lichens.	6	To study the marine organisms	Lecture PPT, Live specimen	Assignment Quiz Continuous Internal Assessment Class test Quizizz, Debate
2		Threats and conservation of seaweeds and sea grasses.	6	To realize the importance of seaweeds and sea grasses	Lecture PPT Video	

III. Marine products

1		Traditional uses - human food and agriculture.	4	To learn about the traditional uses of marine products	Lecture PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test, Demonstration,
2		Isolation of agar-agar. Scope of the seaweed industry: Brown seaweeds as food, Red seaweeds as food.	4	To study the marine products	Lecture Demonstration Video	
3		Medicinal uses of marine seaweeds and sea grasses.	4	To assess the medicinal importance of seaweeds and sea grasses	Lecture Demonstration	

IV. Marine pollution:

1		Pollution due to heavy metals - radioactive wastes, thermal, sewage, algal blooms and oil spills –	6	To analyse the impact of marine pollution	Flipped classroom	Group discussion Assignment Quiz Continuous
2		Possible remedies – oil eating bacteria – GMO and	6	To understand	Lecture, PPT,	

		pollution abatement		the remedies for marine pollution	Debate	Internal Assessment Class test Debate
V. Mangroves						
	1	Salient features of Rhizophora and Avicennia.	4	To know the salient features of selected mangroves	Inquiry based	Assignment Quiz Continuous Internal Assessment
	2	Definition, distribution, stresses on mangroves, regeneration of mangroves,	4	To study the stress and regeneration of mangroves	Lecture, PPT, field visit	Class test, mind map, MCQ, Slip test
	3	coral reefs – ecology, species interaction, economic importance and conservations.	4	To learn about the coral reefs	Lecture, PPT Video, field visit	

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr.J. Albino Wins

2. Dr.Bojaxa A. Rosy

