

Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.

Accredited with A⁺ by NAAC - IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli



DEPARTMENT OF BOTANY

SYLLABUS FOR UNDERGRADUATE PROGRAMME



TEACHING PLAN

EVEN SEMESTER 2024-2025

Vision

To impart knowledge with professional zeal and devotion for plant science

Mission

Providing student – centered and profession- oriented higher education that bestows academic environment to create intellectuals with scientific temperament, in the context of global issues and environmental challenges.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to:	Mapping with Mission
PEO 1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1& M2
PEO 2	use practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5
PEO 3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	M3, M4, M5 & M6

PROGRAMME OUTCOMES (POs)

POs	Upon completion of B.Sc. Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	PEO1
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	PEO2
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	PEO2
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	PEO1 &PEO3
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	PEO2&PEO3

PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	PEO2 & PEO3
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.	PEO1&PEO3

PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the B.Sc. Botany program, the students are expected to:		Mapping with POs
PSO1	implement the concept of science and technology to foster the traditional and modern techniques for solving the complex problems in Plant Biology.	PO4
PSO2	ensure the use of contemporary tools and techniques in understanding the scope and significance of Botany	PO1& PO3
PSO3	develop the scientific problem solving skills during experimentation, research projects, analysis and interpretation of data	PO4 & PO7
PSO4	design scientific experiments independently and to generate useful information to address various issues in Botany.	PO6 & PO7
PSO5	enhanced capacity to think critically; ability to design and execute experiments independently and/or team under multidisciplinary settings	PO2 & PO5
PSO6	design and standardize protocols for public health and safety, and cultural, societal, and environmental considerations	PO6 & PO3
PSO7	apply appropriate techniques, resources, and modern ICT tools for understanding plant resources.	PO2 & PO7
PSO8	demonstrate the contextual knowledge in sustainable exploitation of medicinal, economically important and endangered plants as per the National Biodiversity Act.	PO6
PSO9	follow the concept of professional ethics and bioethics norms for practicing the value of plant kingdom.	PO6
PSO10	communicate proficiently with various stakeholders and society, to comprehend and to write and present reports effectively	PO4 & PO6

TEACHING PLAN

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, Mind mapping, Peer review	MCQ, True/False, Simple definitions, Short essays, Recall Concept, Short summary or overview, Graphical representation
	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, Microscopic observation of Permanent slides, Animated videos, Use of diagrams and charts	Suggest idea, explanations, Formative assessment, Summative assessment, Group Discussion, Oral Test, Short-answer questions based on structure and reproduction,
	3.	Structure, reproduction and life-history of Ascomycotina (<i>Aspergillus</i> , <i>Saccharomyces</i> <i>Peziza</i>),	3	K2(U)	Lecture using Chalk & talk, Live specimen, Microscopic analysis, Sectional reviews, PPT, Small group discussions	Concept-based oral quizzes.

	4.	Structure, reproduction and life-history of Basidiomycotina (<i>Agaricus</i> , <i>Pleurotus</i> , <i>Puccinia</i>)	2	K2(U)	Lecture using Chalk & talk, Field observations of Live specimens, Microscopic studies of Permanent slides, Group discussions, Flowcharts and PPTs	
	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, Demonstration with Live specimens, Use of PPTs and diagrams, Collaborative group discussions	

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, field visit, video tutorials	Surprise Test, MCQ, True/False, Short essays, Recall, Graphical representation Simple definitions, Class test, Suggest idea/concept with examples,
	2	Fungi in agriculture application (biofertilizers):	4	K4(An)	Lecture using Chalk & talk, Interactive	Formative assessment, Summative assessment,

		Mycotoxins (biopesticides),			lecture, PPT and videos, Brain storming session, group discussion	open book test, group presentation, peer-reviewed discussions
	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, flipped classroom,	
	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, Animation explaining, Storytelling session, Group Discussion,	

BACTERIA, VIRUS

III	1	Classification (Bergey's, 1994)	3	K2(U)	Lecture using Chalk & talk, Flow chart, Introductory session,	Simple definitions, MCQ, True/False, Essays, Short essays,
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					Group Discussion, Review	Recall summary, Graphical representation, MCQ, Class Test, Formative assessment, Summative assessment, slip test, preparation of question bank
2	Structure and reproduction of bacteria, Mycoplasma	5		K2(U)	Lecture using Chalk & talk, Permanent slides, PPT and Group Discussion,	
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 preparation, Slip test,
2	Nature of Mycobionts and Phycobionts, Study of growth forms of lichens (crustose, foliose and fruticose)	3	K2(U)	Lecture, PPT, Illustration, Live specimen	class test, Debate, Model making, Summative assessment
3	Types, distribution, thallus organization, reproduction and ecological significance of lichens with special	3	K2(U)	Lecture, PPT, Illustration, Live specimen	

		reference to Usnea.				
	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

Course Instructor

A. Anami Augustus Arul

A. R. Florence

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,
	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	3	K1 (Ap)	Lecture, PPT, live specimen, interactive	

		economic importance in the following family: Asclepiadaceae			discussion, reflective thinking	group discussion summative assessments, Short Answer Questions, Essay Questions	
	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 importance in the following family: Cannaceae	2	K2 (U)	Lecture, PPT, diagrams, interactive 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.	
	2.	Types of ovules, structure of embryo sac,	3	K2 (U)	Reflective thinking, photos,		

	3.	Pollination -double fertilization,	3	K1 (R)	Brainstorming, photos	Formative assessment, MCQs, Short answer test, peer review, Just a Minute,
	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 assessment, oral test, surprise test, homework
	2.	photosynthesis - light reaction - Calvin cycle;	3	K2 (U)	Brainstorming, diagram, videos, intractive e-content	
	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

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

Part B

1. 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

Class : Non-Major Elective

Title of the Course : NME II: MUSHROOM CULTIVATION

Semester : II

Course Code : BU232NM1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU232NM1	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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I						
	1	Introduction to mushroom	1	K2 (U)	Lecture, visual aids, historical references	Quiz, short-answer questions
	2	Morphology, Types of Mushrooms	2	K2 (U)	Presentation	Practical identification test, case study analysis
	3	Identification of edible and poisonous mushroom	1	K2 (U)	Visual samples, hands-on exercises	
	4	Nutritive values	1	K2 (U)	Lecture, case studies, research exploration	
	5	Life cycle of common edible mushrooms.	1	K1 (R)	Lecture, PPT	
II						
	1	Mushroom cultivation	3	K3 (AP)	Demonstration, step-by-step procedures, practice	Hands-on evaluation, practical exam
	2	Prospects and scope of Mushroom cultivation in small scale Industry.	3	K3 (AP)	Interactive Lecture, Field Trip or Virtual Tour	Discussing labeling, branding, compliance
III						
	1	Life cycle of <i>Pleurotus</i> spp	3	K3 (AP)	Demonstration, field practice	Hands-on evaluation, practical exam
	2	Life cycle of <i>Agaricus</i> spp.	3	K3 (AP)	Lecture, PPT	
IV						

	1	Spawn production	2	K3 (AP)	Presentation, hands-on practice	Laboratory test, quiz spawn production test Interactive Q&A
	2	Growth media	1	K3 (AP)	Lecture, fungal laboratory visit	
	3	Spawn running and harvesting of mushrooms	2	K3 (AP)	Demonstration, field practice	
	4	Marketing of product	1	K4 (AN)	Laboratory visit, Panel Discussion	
V						
	1	Diseases and post harvest technology	3	K4 (AN)	Lecture, case studies	Case study analysis Pest identification test
	2	Insect pests, nematodes, mites, viruses, fungal competitors and other important diseases.	3	K4 (AN)	Lecture, pest identification, preventive measures	

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability

Activities (Em/ En/SD): Case study (Visit to small scale mushroom culture unit) Hand on training (Cultivation of mushroom)

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human

Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross Cutting Issues: Panel Discussion on “ Market opportunity in mushroom cultivation”

Assignment:

Life cycle of Pleurotus spp

Life cycle of Agaricus spp.

Seminar Topic : Identification of edible and poisonous mushroom

Part-A

1. What is the life cycle of a mushroom?
2. Which mushroom species typically grows on agricultural waste like wheat or rice straw?
3. What is spawn running?
4. How can mushrooms be protected from various threats post-harvest?
5. What is help-line assistance in mushroom cultivation ?

Part B

6. Describe the cultivation of Oyster mushrooms (*Pleurotus* sp.)
7. Analyze the process of spawn running in mushrooms
8. Address the challenges encountered during post-harvest handling.
9. Analyze the methods used to protect mushrooms from insect pests, nematodes, mites, and viruses.
10. Design a simplified step-by-step procedure for producing mother spawn for mushroom cultivation.
11. Summarize the packaging techniques for marketing mushroom products.
12. How to identify commonly found edible mushrooms in a specific geographical region
13. Explain the life cycle of mushrooms.

Part C

14. Compare and contrast the nutritional, medicinal and therapeutic benefits value of two different edible mushroom species.
15. Develop a step-by-step guide for the isolation and spawn production of Oyster mushrooms (*Pleurotus* sp.).
16. Evaluate the economic viability of cultivating Oyster mushrooms (*Pleurotus* sp.) compared to Button mushrooms (*Agaricus bisporus*).
17. Apply the strategy to safeguard mushrooms from fungal competitors and diseases. (Application)

18. Evaluate the impact of various post-harvest technology approaches on the shelf life and commercial value of mushrooms.

19. Describe spawn production technique

20. Bring out the nutritional value of mushrooms.

21. Summarize the growth media necessary for spawn production.

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

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 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
	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

IV	2	Water scaping, xeriscaping, hardscaping.	3	K2, K3	Group discussion Lecture	Slip test
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: 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, Planting trees in villages**

Assignment: **Video /photography of garden types**

Seminar Topic: **Planting at avenues, railway stations, dam sites, hydroelectric stations, colonies, river banks**

Sample questions

Part A

1. Define adornment.
2. A lawn is a grassy area of land that is usually kept mowed and is often found around a house, in a garden, or in a park - State True or False.

Part B

1. Comment on the art of Bonsai.
2. List out the methods for designing rockery.
3. Difference between water garden and vertical garden.
4. Write short notes on CAD.
5. Why Urban landscaping is important?

Part C

1. Analyze the importance of Computer Aided Designing (CAD) in outdoor landscaping.
2. Explain in detail about the different styles of garden with examples.
3. Summarize the importance of green house with suitable example.

Head of the Department

Course Instructor

Dr.A.Anami Augustus Arul

Dr. J. Albino Wins

Class : II B.Sc Botany
Title of the Course : Core Course III: Plant Diversity – IV – Gymnosperms, Palaeobotany and Evolution
Semester : III
Course Code : BU234CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU234CC1	3	2	-	-	4	5	75	25	75	100

Pre-requisite: Fundamentals of Gymnosperms, fossil records and evolution.

Learning Objectives:

1. To enable the students to understand internal and the reproductive structures of Gymnosperms and the importance of evolution.
2. To acquaint students with evidences of the past history of plant groups and significance of the fossilization.

Course Outcomes

On the successful completion of the course, student will be able to:		
1.	relate the general characteristics of Gymnosperms	K1
2.	explain about the morphology and anatomy of Gymnosperms.	K2
3.	understand the various fossilization methods and their significance in paleo botany.	K2
4.	compare and contrast the reproductive structures of Gymnosperms & fossil forms	K4
5.	analyze the anatomy and reproduction of Gymnosperms along with their ecological and economical importance.	K4

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	1.	Classification of Gymnosperms (Sporne, 1954) (up to family).	6	K1(R)	Lecture using Chalk and Talk, Power point Presentation, Mind mapping,	MCQ, Short essays, Concept explanations, Short summary, field work report, peer assessment, Assignment
	2.	General characteristics of Gymnosperms.	4	K2(U)	Lecture using Chalk and Talk, Peer tutoring, Group Discussion, PPT, Field Trips	Oral presentation, PPT, videos,
	3.	Economic importance of Gymnosperms with special reference to oil, resin, timber, etc.	5	K2(An)	Field Study, Lecture with live specimen	Group Discussion, summary overview, oral presentation, CIA, field work report
II	1.	Morphology, anatomy and reproduction of Cycadales (<i>Cycas</i>)	7	K2(An)	Chart, Group Discussion, Visual aids, Peer tutoring and multimedia.	Seminar, True/False, Short essays, MCQ, Longer essay
	2.	Morphology, anatomy and reproduction of Coniferales (<i>Pinus</i>).	8	K2(An)	Demonstration Chart, Mind mapping, Peer tutoring, Visual aids and Lecture using videos	Seminar, CIA, True/False, Short essays, MCQ, Longer essay
III	1	Morphology, anatomy and reproduction of the taxa belonging to the following order:	7	K4 (U)	Lecture using Chalk and talk, PPT, Flow Chart	Chart Evaluation, Field visit, Summary overview, CIA, True/False, Short essays,

	Gnetales (<i>Gnetum</i>).				MCQ, Longer essay, Flow
2	Introduction to fossils, Contribution of Birbal Sahni	3	K4 (An)	Lecture, Group Discussion, Peer tutoring, Lecture using videos, PPT, Field Visit	Summary overview, Assignment, Group Discussion, Concept explanations
3	Fossilization processes such as compression, casts, molds, petrification, impressions and coal balls. Geological time scale.	5	K2(U)	Lecture, Group Discussion, Peer tutoring, Lecture using videos, PPT, Field Visit	Seminar, Assignment Short essays, Longer essay, Peer Review, Assessment, Field Report, Chart, Recall steps, PPT
IV	1. Study of the fossils: <i>Rhynia</i>	5	K2(U)	Lecture using Chalk and talk, Lecture using videos & images, PPT	Evaluation through short test, MCQ, True/False, Seminar, PPT ,
	2. Study of the fossils: <i>Lyginopteris</i>	5	K1(U)	Lecture using Chalk and talk, Lecture using videos, PPT, permanent slide specimen	Simple definitions, MCQ, Slip test, Seminar with PPT
	3. Study of the fossils: <i>Lepidodendron</i>	5	K4(An)	Lecture using Chalk and talk, Lecture using videos, PPT	Definitions, Suggest idea, Short essay
V	1 Evolution - origin of life, chemosynthetic theory - evidences (any five).	5	K2(U)	Lecture using Chalk and talk, Group Discussion, Peer tutoring, Lecture using videos, PPT	Short test, MCQ, True/False, Seminar with PPT
	2 Theories of evolution - Darwin, Lamark and De Veries,	6	K2(U)	Lecture using Chalk and talk, Lecture using videos, PPT	Short test, MCQ, True/False, Short essays, Assignment
	3 Modern synthetic theory.	4	K2(U)	Lecture using Chalk and	Suggest idea, Summary

	Concept of species - Allopatric and sympatric.			talk, Lecture using videos, PPT, Group Discussion,	overview, Concept explanations
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Course Focussing on: Employability

Activities (Skill Development): **Practical training on fossil identification and preparation of paleobotanical slides.**

Hands-on training in herbarium preparation, field collection, and preservation techniques.

Course Focussing on Cross Cutting Issues: **Environmental sustainability**

Activities related to Cross Cutting Issues: **Study the ecological roles of gymnosperms and pteridophytes in preventing soil erosion and maintaining ecological balance.**

Assignment: **Prepare a report on the economic importance of gymnosperms and pteridophytes in pharmaceuticals, horticulture, and industry.**

Seminar Topic: **The Evolutionary Significance of Gymnosperms in the Plant Kingdom**

Role of Pteridophytes in Ecosystem Stability and Biodiversity

SAMPLE QUESTIONS

Part A

1. Which scientist classified gymnosperms up to the family level in 1954?

- A) Birbal Sahni B) Sporne C) Darwin D) Lamarck

2. The fossilization process where organisms leave an impression in rock is known as _____.

3. Assertion and Reasoning: Assertion (A): Cycas has a well-defined reproductive structure with cones. **Reason (R):** All gymnosperms reproduce through cones.

- A) Both A and R are true, and R is the correct explanation of A.
 B) Both A and R are true, but R is not the correct explanation of A.
 C) A is true, but R is false.
 D) A is false, but R is true.

4. The modern synthetic theory combines Darwin's and Lamarck's theories of evolution. True or False

5. Out of the four fossil one is not fit to fossil gymnosperms gymnosperms.

- a. *Archaeopteris* b. *Cycadeoidea* c. *Cordaites* d. *Lyginopteris*

Part B

1. Describe the general characteristics of gymnosperms.
2. Explain the economic importance of gymnosperms with reference to oil and timber.
3. Discuss the morphology and reproduction in *Cycas* (Cycadales).
4. Explain the process of fossilization by petrification.
5. Describe Darwin's theory of evolution.

Part C

1. Discuss the classification of gymnosperms according to Sporne (1954) up to the family level.
2. Explain the anatomy and reproduction of *Pinus* (Coniferales) in detail.
3. Describe the morphology, anatomy, and reproduction of *Gnetum* (Gnetales).
4. Discuss Birbal Sahni's contribution to paleobotany and explain the geological time scale.
5. Compare and contrast the theories of evolution proposed by Darwin, Lamarck, and De Vries, including the modern synthetic theory.

Head of the Department**Course Instructor****Dr. A.R. Florence****Dr. J. Albino Wins**

Teaching Plan

Department : Botany
Class : II B.Sc., Zoology
Title of the Course : ALLIED BOTANY-III
Semester : III
Course Code : BU234EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU234EC1	3	1	-	-	3	4	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)	Interactive Lecture with Visual Aids, Live specimen, Hands on Training	Written Test, Group presentation, Field study Report, Concept map Assessment, Specimen Identification, Oral Quiz, Diagram Labelling
	2.	Leaf and its parts. Leaf types- simple and compound. Phyllotaxy and types.	4	K2 (U)	Group discussion and Presentation, Live specimens, Field Study	
	3.	Inflorescence - Racemose, Cymose and Special types.	2	K1 (R)	Field Study, Interactive Lecture with Visual Aids, Concept Mapping	
	4.	Terminology with reference to flower description.	2	K3 (Ap)	Quiz and Flashcards, Hands on Training	
Taxonomy:						
II	6.	Study of the range of characters and plants of economic importance in the following family: Rutaceae	2	K1 (R)	Field study and Plant Collection, Herbarium and Specimen preparation, Visual Aids and Illustrated Lectures	Specimen Identification, Herbarium Sheet Assessment, Field trip report, Quiz, Comparison Chart Creation, Essay Writing
	7.	Study of the range of characters and plants of economic importance in the following family:	2	K2 (U)	PPT, Live specimen, Group discussion and debates, Quiz and Flash cards for	

		Caesalpiniaceae			terminology		
	8.	Study of the range of characters and plants of economic importance in the following family: Asclepiadaceae	3	K1 (Ap)	Lecture, PPT, Live specimen, Herbarium and Specimen preparation, Visual Aids and Illustrated Lectures		
	9.	Study of the range of characters and plants of economic importance in the following family: Euphorbiaceae.	3	K2 (U)	Live specimen, Group discussion and debates, Quiz and Flash cards for terminology		
	10.	Study of the range of characters and plants of economic importance in the following family: Cannaceae	2	K2 (U)	Lecture, PPT, Live specimen, Herbarium and Specimen preparation, Visual Aids and Illustrated Lectures		
		Anatomy:					
III	5.	Tissue and tissue systems: Simple and complex tissues.	3	K2 (U)	Microscopic Observation, Interactive PPT, Lecture with chart, Interactive Visual Aids	Microscopic Identification of tissues, Diagram labelling test, Short answers, Quiz, Assignment	
	6.	Anatomy of monocot and dicot roots -	6	K1 (R)	Microscopic Observation, Interactive PPT, Lecture with chart, Interactive Visual Aids		
	7.	anatomy of monocot	3	K2 (U)	Microscopic Observation,		

		and dicot stems -			Interactive PPT, Lecture with chart, Interactive Visual Aids	
	8.	anatomy of dicot and monocot leaves.	3	K1 (R)	Microscopic Observation, Interactive PPT, Lecture with chart, Interactive Visual Aids	
Embryology:						
IV	5.	Structure of mature anther and ovule -	3	K2 (U)	Lecture, Chalk and board, PPT, Illustrated Lecture and Visual Aids	Diagram labelling, quizziz, class test, essay test. Formative assessment, MCQs, Short answer test, Seed dissection report
	6.	Types of ovules, structure of embryo sac,	3	K2 (U)	Reflective thinking, photos, field collection of ovules	
	7.	Pollination -double fertilization,	3	K1 (R)	Brainstorming, Plant reproductive map, Lecture	
	8.	Structure of dicotyledonous and monocotyledonous seeds.	3	K2 (U)	Field collection and seed dissection, Lecture, Interactive PPT	
Plant Physiology:						
V	5.	Absorption of water	2	K2 (U)	Animated Video demonstration, Group discussion	Formative assessment, MCQs, Summative assessment, Flow Chart Creation and
	6.	Photosynthesis - light reaction - Calvin cycle;	3	K2 (U)	Brainstorming, Role play, Diagrammatic	

					mapping	Explanation, Written test on pathways and Hormones, Concept map assessment, Interactive Quiz
7.	Respiration - Glycolysis - Krebs cycle - electron transport system.	4		K3 (Ap)	Lecture, group discussion, Concept mapping of energy pathways	
8.	Growth hormones - auxins and cytokinin and their applications.	3		K2 (U)	Interactive PPT, Hormone application experiment	

Course Focussing on **Employability**

Activities: Flow Chart Creation, Herbarium Sheet Assessment, Identifying the plants

Course Focussing on Cross Cutting Issues: **Professional Ethics**

Activities related to Cross Cutting Issues: **Assignment and Seminar**

Assignment Topic: Role and Applications of Plant Growth Hormones (Auxins and Cytokinins) in Agriculture and Horticulture

Comparative Study of Photosynthesis and Respiration Pathways in Plants

Seminar Topic: Water Absorption Mechanisms in Plants and Their Physiological Significance

Structure and Function of Dicot and Monocot Seeds with Emphasis on Germination and Seedling Growth

Sample questions

Part -A

1. Phyllotaxy is defined as:

- A) The arrangement of flowers on the stem
- B) The arrangement of leaves on the stem
- C) The arrangement of seeds within the fruit
- D) The arrangement of roots in the soil

2. In dicotyledonous plants, the vascular bundles are:

- A) Scattered
- B) Arranged in a ring
- C) Diffuse
- D) Closed

3. Xylem and phloem together form:

- A) Simple tissues
- B) Vascular tissues
- C) Ground tissues
- D) Meristematic tissues

4. In monocot stems, vascular bundles are:

- A) Arranged in a ring
- B) Scattered throughout the stem
- C) In pairs
- D) Absent

5. Double fertilization results in the formation of:

- A) Two embryos
- B) An embryo and endosperm
- C) A seed and fruit
- D) A fruit and embryo

6. Pollination involving pollen transfer from the anther to the stigma of the same flower is called:

- A) Cross-pollination
- B) Self-pollination
- C) Wind pollination
- D) Water pollination

7. The site of the light reaction in photosynthesis is the:

- A) Stroma
- B) Mitochondria
- C) Thylakoid membrane
- D) Cytoplasm

8. The first stable product of the Calvin cycle is:

- A) ATP
- B) RuBP
- C) 3-PGA
- D) Glucose

9. Which hormone is primarily responsible for cell elongation in plants?

- A) Cytokinin
- B) Auxin
- C) Gibberellin
- D) Ethylene

10. Cytokinins are naturally found in high concentrations in:

- A) Root tips
- B) Shoot tips
- C) Leaves
- D) Flowers

Part B

1. Describe the different types of phyllotaxy with suitable examples.
2. Compare and contrast the anatomy of monocot and dicot stems.
3. Describe the process of double fertilization in flowering plants.
4. Outline the main steps in the Calvin cycle.
5. Compare the roles of auxin and cytokinin in plant growth.

Part C

1. Explain the structure and functions of the root in plants, including their modifications and roles in support, storage, and conduction.
2. Describe the structure and function of complex tissues in plants, highlighting their roles in support, storage, and conduction.
3. Explain the structure of the mature ovule, types of ovules, and the structure of the embryo sac.
4. Describe the process of cellular respiration, detailing the energy transformations at each stage.
5. Describe the functions of auxins and cytokinins in plants and discuss their applications in agriculture and horticulture.

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr. A. Anami Augustus Arul

2. Dr. J. Albino Wins

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

Teaching Plan

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- monohybrid and dihybrid cross, test cross and back cross (Assignment)	3	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	3	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)	3	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	2	To learn about interaction of genes and solve the problems	Lecture, PPT, Problem based learning	
II LINKAGE AND CROSSING OVER						

	1	Sex Linked inheritance (eye colour in <i>Drosophila</i>) Polygenic inheritance with reference to (ear length in maize)		To understand the basics of inheritance and solve the problems	Lecture, Charts, problem solving	Diagrammatic representation, Short test, Formative assessment, Summative assessment, Problem solving, Model making
	2	Multiple alleles -ABO blood group in man, Rh factor. Non-Mendelian inheritance		To distinguish mendelian and non-mendelian inheritance	Lecture, Models	
	3	Extra-chromosomal inheritance: chloroplast mutation –variegation in 4 O'clock plant; mitochondrial mutations in yeast. Maternal effects – shell coiling in snail		To evaluate the mutation patterns in chloroplast and mitochondria	Lecture, PPT	
	4	Linkage: Morgan's views on linkage, crossing over – types, mechanism of crossing over and its significance		To understand and differentiate linkage and crossing over	Lecture, Video Clippings, Problem solving	
	5	Holliday model for genetic recombination.		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,
	2	Chromosomes: Chromosome morphology – (metacentric, submetacentric, acrocentric and telocentric) and Chromosome.	3	To analyse the different patterns of chromosome with special	Lecture, Models, Socratic method	Group discussion, Continuous Internal

		Structure, Special type of chromosomes: giant chromosomes (salivary gland chromosomes, Lamp brush chromosomes), supernumerary chromosomes (B chromosome).		reference to giant chromosomes		Assessment I (CIA -I).
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	3	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.	3	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	3	To know and practice the basics of biostatistics	Lecture, Problem solving	Quiz, Group discussions, Oral test, short test with open ended, summarization
2		Presentation of data - frequency distribution, frequency curve, frequency polygon, histogram and bar diagrams	3	To understand the data presentation with graphical representation	Lecture, PPT, Problem solving	

	3	Measures of central tendencies -mean, median and mode. Measures of dispersion – standard deviation, standard error (Seminar)	3	To acquire skills to solve problems based on measures of central tendencies and dispersion	Lecture, Problem solving	
	4	Null hypothesis - Chi - square test.	3	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	3	To understand the concepts of bioinformatics	Lecture, PPT, problem solving	Multiple Choice Questions, Group discussions,
	2	Major areas of biological data bases- classification; primary, secondary, specialized	3	To differentiate the different forms of biological data bases	Flipped classroom	Computer analysis,
	3	Importance data bases- NCBI, SWISS-PROT, DDBJ	3	To construct the databases in computers	Online tool assessment and demonstration	Continuous Internal Assessment
	4	Tools and softwares in Bioinformatics – similarity search – BLAST – FASTA sequence alignment tools. Application of Bioinformatics.	3	To evaluate and practice the softwares of bioinformatics	Lecture, Video clipping, software analysis	Seminar, Summative assessment

Head of the Department:

Dr. A. Anami Augustus Arul
Arul

Course Instructors:

1. Dr. A. Anami Augustus
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

Teaching Plan

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;	3	To understand the importance of recombinant molecules	Lecture with PPT, model	Group discussion Assignment Quiz Continuous Internal Assessment Class test, Collaborative, Mind mapping
	2	Restriction Enzymes – Nomenclature and Classification; Cloning Vectors - Plasmids, Cosmids, Phagemids and shuttle vectors;	3	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 electrophoresis, Northern blotting, Southern blotting and RFLP.	3	To know the different separation techniques	Lecture with PPT, Hand on training	
Unit II						
	1	Scope and importance of plant tissue culture, Totipotency of cells, Tissue culture laboratory-organization and requirements	3	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;	3	To know the preparation of MS medium.	Lecture, demonstration Demonstration and Hands-on training	
	3	Sterilization	3	To provide students	Lecture	

		techniques; Types of tissue culture - Callus culture, apical meristem culture, Micropropagation and Protoplast culture;		with the knowledge and skills of sterilization and propagation of explants.	Demonstration and Hands-on training	
	4	Artificial seed: production, applications and limitations; Cryopreservation techniques.	3	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,	4	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 mechanism. Photoreactivation, Mismatch repair;	3	To learn DNA damage and different repair mechanisms.	Lecture PPT, you tube video	
	3	Mutations – Gene mutation and Chromosomal mutation; Mutagens; Chromosomal abnormalities- Down Syndrome and Klinefelter Syndrome.	5	To know about mutations and its effects.	Lecture, PPT, Model	
Unit IV						
	1	Genetic code and wobble hypothesis;	2	To learn the characteristics of genetic code and wobble hypothesis.	Lecture, PPT	Group discussion Assignment Quiz Continuous Internal Assessment
	2	Transcription in prokaryotes and eukaryotes;	3	To understand the transcription in prokaryotes and eukaryotes	Lecture and video clippings	

	3	Assembly of ribosomes; Protein synthesis - initiation, elongation, and termination	3	To acquire knowledge on Protein Synthesis	Lecture and video clippings	Class test Short test MCQ, mind mapping Oral presentation
	4	Gene regulation in Prokaryotes- Operon concept, Lac Operon; Transposons in Prokaryotes and Eukaryotes.	4	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);	4	To understand the Gene regulation, mutation and characteristics of codons	Lecturing InteractivePPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test Multiple Choice Question Orla test Slip test
	2	Gene transfer in plants –Agrobacterium transformation;	2	To understand the Gene transfer methods	Lecturing, Illustration	
	3	GM plants –Bt Brinjal, Bt Cotton,; Transgenic crops with improved quality traits in major crops (FlavrSavr tomato, Golden rice).	4	To learn about GM plants.	Lecture, PPT, and video	
	4	IPR – Scope and different kinds of IPR.	2	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.Bojasa 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

	2	Physical properties of water; Imbibition, diffusion, osmosis and plasmolysis.	3	To understand the physical properties of water	Lecture Problem based learning	Quiz, Internal Assessment, Slido - MCQ
	3	Concepts of water potential and its components. The Concept of the Soil Plant Atmosphere Continuum (SPAC).	3	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.	3	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;	3	To understand the essentiality of elements to plants	Lecture Demonstration	Quiz, Class test, Short test, Internal Assessment Group Discussion Slip test Mind mapping Collaborative assessment
	2	General functions, specific role and deficiency symptoms of macronutrients (Nitrogen, Phosphorus, and Potassium) and micronutrients (Iron, Magnesium, Molybdenum and zinc)	3	To learn about the specific role and deficiency symptoms of micro and macronutrients	Lecture, PPT, Video clipping, Live specimen	
	3	Absorption and translocation of solutes (organic and inorganic) – active & passive uptake.	3	To analyze the absorption and translocation of solutes	PPT, Lecture, Video clipping	
	4	Hydroponics, types, aquaponics and significance.	3	To evaluate the mechanism and significance of hydroponics	Lecture, PPT, Demonstration	

III Photosynthesis

1	Photosynthesis: Importance of photosynthesis for food security and environment	2	To understand the importance of photosynthesis	Lecture PPT, Inquiry based learning	Short test, Question – Answer session, Group discussion, Continuous Internal Assessment Quiz using Mentimeter Flow chart
2	Ultrastructure of chloroplast	1	To know the ultrastructure of chloroplast	Flipped classroom	
3	Light reaction: Radiant energy, photosynthetic apparatus, light harvesting complex; light absorption, composition and characteristics of pigment systems, photosynthetic electron transport,	3	To know about the light reaction in photosynthesis	Lecture PPT Seminar	
4	Dark reaction: Carbon dioxide fixation in C ₃ , C ₄ and CAM plants,	4	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	3	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)	3	To learn the generation of ATP through different process	Peer tutoring	
3	Chemiosmotic regeneration of ATP, Gluconeogenesis, Factors affecting respiration	3	To know about chemiosmotic processes with examples	Lecture, PPT, Video clippings	
4	Nitrogen nutrition, organic nitrogen, nitrogen fixation in microbes / legumes, nif	3	To analyze the mechanism of biological	Lecture, PPT, Video clippings	

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

Head of the Department:

Dr. A. Anami Augustus Arul

Course Instructors:

1. Dr. J. Albino Wins

2. Dr.Bojaxa A. Rosy

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	2	To classify the types of marine habitats	Lecture Video, field visit	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	shore environment – muddy, rocky and sandy, waves and tides deep sea bottom – pelagic deposits.	3	To understand the shore environment	Lecture, field visit	
	3	Physical and chemical properties of sea water.	2	To learn the	Lecture PPT,	

				properties of sea water	Flow chart	
	4	Salt marshes and sand dune vegetation.	2	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.	5	To study the marine organisms	Lecture PPT	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	2	Threats and conservation of seaweeds and sea grasses.	4	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	Group discussion Assignment Quiz Continuous Internal Assessment Class test
	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 PPT Video	
	3	Medicinal uses of marine seaweeds and sea grasses.	1	To assess the medicinal importance of seaweeds and sea grasses	Lecture with PPT	
IV. Marine pollution:						
	1	Pollution due to heavy metals - radioactive wastes, thermal, sewage, algal blooms and oil spills –	5	To analyse the impact of marine pollution	Lecture, PPT	Group discussion Assignment Quiz Continuous

	2	possible remedies – oil eating bacteria – GMO and pollution abatement	4	To understand the remedies for marine pollution	Lecture. PPT	Internal Assessment Class test
V. Mangroves						
	1	Salient features of Rhizophora and Avicennia.	3	To know the salient features of selected mangroves	Lecture	Group discussion Assignment Quiz
	2	Definition, distribution, stresses on mangroves, regeneration of mangroves,	3	To study the stress and regeneration of mangroves	Lecture, PPT	Continuous Internal Assessment
	3	coral reefs – ecology, species interaction, economic importance and conservations.	3	To learn about the coral reefs	Lecture, PPT Video	Class test

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Course Instructor: Dr. Bojaxa A. Rosy