Holy Cross College (Autonomous), Nagercoil
Kanyakumari District, Tamil Nadu.
Accredited with A^{++} by NAAC - V Cycle (CGPA 3.53)

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF BOTANY

TEACHING PLAN (UG)

ODD SEMESTER

2025-2026

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.

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**

Equipping students with hands-on-training through skill-based courses and promote startup.

- **Personality development:**

Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.

- **Environmental consciousness and social understanding:**

Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service-learning programmes.

- **Communicative competence:**

Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.

- **Aesthetic skills:**

Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.

- **Research and knowledge enrichment:**

Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.

- **Professional ethics:**

Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*

- **Student engagement in the learning process:**

Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.

- **Employability:**

Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance Cell.

- **Women empowerment and leadership:**

Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. Degree Programme, the graduates will be able to:	Mapping with Mission
PEO1	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
PEO2	use practical knowledge for developing professional empowerment and entrepreneurship and societal services.	M2, M3, M4 & M5

PEO3	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**

Programme Specific Outcomes (PSOs)

PSOs	On successful completion of the B.Sc. Botany programme, 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**

Department : Botany
Class : I B.Sc. Botany
Title of the Course : Core I PLANT DIVERSITY I - ALGAE
Semester : I
Course Code : BU231CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231CC1	3	2	-	-	5	5	75	25	75	100

Learning Objectives

1. To provide a comprehensive knowledge on the biology of algae and to understand the evolution higher of plants.
2. To understand the role of algae in ecosystems as primary producers of nutrition and also the importance of algae to animals and humans.

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	relate to the structural organization, reproduction and significance of algae.	**K2 &K5**
2	demonstrate knowledge in understanding the various life cycle patterns and the fundamental concepts in algal growth	**K3 &K1**
3	explain the benefits of various algal technologies on the ecosystem.	**K1**
4	compare and contrast the thallus organization and modes of reproduction in algae.	**K4 & K5**
5	determine the emerging areas of Algal Biotechnology for identifying commercial potentials of algal products and their uses.	**K5 & K6**

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

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	General characters of Algae	4	2	K2(U)	Refllective Thinking, Live Specimen	Participative learning- Brain Storming, Group Discussion	Video Lectures, E-content- MS word	Formative Quiz using Kahoot / Google Forms Assignment.
	2	Classification of algae (Fritsch-1935-1945).	4		K1(R)	Gamification, Mind mapping,	Participative learning- Charts, Interaction in the classroom	Video Lectures, E-content- External links	Memory Game, Quizziz, MCQs.
	3	Criteria for Classification.	4	1	K2(U)	Simulation Based Approach, lecture method	Participative learning- Panel Discussion	GAMMA PPT, E-content- MS word	Slip Test, Open book test, Question-Answer Session
	4	Algal Distribution	3		K2(U)	Integrative teaching, Field Study, and outdoor activities	Experiential Learning- Describing Visual images	Interactive PPT, Youtube Videos	Quizzes, Just a Minute, student presentation

II	1	Thallus organization – unicellular - . *Chlorella, Diatoms* .	3	1	K2(U)	Inquiry Based Approach, Live Specimens	Experiential Learning- Preparing and demonstrating exhibit,	Interactive PPT, Whatsapp poll	Online Quiz-Quizzes, Creative Drawing
	2	Thallus organization - colonial *Volvox*	3		K2(U)	Blended Learning - Live Specimens	Collaborative learning- Album making	Discussion Forum - Google classroom	Surprise test, Identification of specimen, Diagram evaluation
	3	Thallus organization filamentous *Anabaena*, *Oedogonium*.	3	1	K2(U)	Flipped Classroom - Slides	Experiential Learning- Using visual images and models	E content - PPT, Mentimeter	Identification of specimen, Diagram evaluation, Slip Test.
	4	Thallus organization - siphonous *Caulerpa*.	3		K2(U)	Integrative Teaching -Live Specimen, Lecture Method	Collaborative learning- Hands-On Demonstration, Charts and Models, Field visit	Interactive E-book, Google classroom	Seminar Presentation, Identification of specimen, Diagram evaluation
	5	Thallus organization - parenchymato us-	3	1	K2(U)	Emboded Learning, KWL	Experiential Learning- Hands-On Demonstrati	E-content - MS word, Mentimeter	Identification of specimen, Diagram evaluation

		Sargassum, Gracilaria.					on, Visual images		
III	1	Reproduction Vegetative, asexual, sexual reproduction and life histories haplontic *Oedogonium* and *Chara*.	3	1	K4 (An)	Cooperative Learning - Microscopic slides, Live specimens,	Participative Learning- Skit and Role play	E - content with GAMMA PPT	Quizzes, Open book test, Identification of specimen, Diagram evaluation
	2	Reproduction Vegetative, asexual, sexual reproduction and life histories of Diatoms	3		K4 (An)	Blended Learning - Lecture using videos, Microscopic slides, Field Visit	Experiential Learning- Demonstration using microscopic slides	Video display, O lab	Unannounced test, Identification of specimen, Diagram evaluation, MCQ.
	3	Reproduction Vegetative, asexual, sexual reproduction and life histories of *Sargassum*.	3	1	K4 (An)	Reflective Thinking - Live specimen	Experiential Learning - Video Making	You tube videos, E-content - External Links	Team Work Analysis and Interpretation, Slip Test.

	4	Reproduction Vegetative, asexual, sexual reproduction and life histories of *Ulva*.	3	1	K4 (An)	Blended Learning - Live specimen, Slides	Participative learning- Demonstration with specimen, Quiz competition	E-content with MS Word	Oral test, Just a Minute
	5	Reproduction Vegetative, asexual, sexual reproduction and life histories of *Gracilaria.*	3		K4 (An)	Inquiry Based Approach - Live specimen, Slides	Participative learning- Assignment	Youtube videos, Interactive E-book	Flow Chart Analysis, MCQ. Assessing Memory game, CIA I
IV	1	Algal cultivation methods	3	1	K2(U)	Reflective Thinking, Inquiry Based Approach	Participative learning- Brain storming, Debate	Econtent with GAMMA PPT	Quiz using Kahoot / Google Forms,Oral Presentation
	2	Algal production methods	3	1	K2(U)	Integrative Teaching - Mind map, Lecture Method	Collaborative learning- Panel Discussions	O lab	Slip Test, Oral Presentation, MCQs.
	3	Indoor cultivation methods	3		K3(Ap)	Flipped classroom, Demonstrative approach	Participative learning- Interactive classroom games	E-content with MS Word, Google Classroom	Surprise test, Open book test, Question-Answer Session

	4	Large-scale cultivation of algae	3	1	K3(Ap)	Blended Learning, KWL	Experiential Learning-Demonstration of experiments	E-content with MS Powerpoint	Quizzes, Just a Minute, Flow Chart Analysis
	5	Harvesting of algae	3		K4(An)	Reflective Thinking, Lecture using videos,	Participative Learning-Exhibit of algal products	Youtube videos, Mentimeter	Quiz, Group Presentation, Open book test, Sales day
V	1	Algae as food and feed: Agar-agar, Alginic acid and Carrageenan; Diatomite.	3	1	K3(An)	Inquiry-Based Learning, Lecture with Visual Aids	Experientiall earning-Preparing and Demonstrating the products	Video Lectures, E-content- MS word	Just a minute, Exhibit on algal products
	2	Resource potential of algae: Application of algae as fuel, agriculture and pharmaceutical .	3	1	K3(Ap)	Flipped Classroom, Mind Map, Stimulation based approach	Participative Learning-Charts and models, Demonstrative approach	Youtube videos, E-content- MS word	Quiz, Group Presentation, MCQs.

	3	Phytoremediation. Role of algae in CO2 sequestration,	3		K3(Ap)	Reflective Thinking, Lecture with illustration	Experiential learning- Role play, chart	Video Lectures, E-content- MS word	Slip Test, Open book test, Oral presentation
	4	Algae as indicator of water pollution	3	1	K2(U)	Integrative Teaching, Simulation Based Approach	Experiential Learning- Hands-On Demonstration, Chart, mind map	Interactive PPT, Youtube Videos	Quizzes, Just a Minute, CIA II
	5	Algal bioinoculants, Bioluminescence.	3		K4(An)	Inquiry-Based teaching, Lecture with illustration	Participative learning- Poster Presentation	E-content with MS Powerpoint	Question-Answer Session, Flow chart analysis

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

Activities (Em / En /SD):

Employability: Algae Identification

Entrepreneurship: Algae Cultivation, Algal Cuisine

Skill Development: Algae Data Collection and Analysis, Water Quality Analysis, Laboratory algal culture

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

Activities related to Cross Cutting Issues: Exhibition : : Algal products

Sample Questions

Part A (1 mark)

1. Who is known as the "father of Indian phycology"? **(K1-R, CO-1)**

    a) Carl Linnaeus

    b) William Henry Harvey

    c) M.O.P. Iyengar

    d) Felix Eugen Fritsch

2. Which statement correctly describes the thallus organization of Oedogonium? **(K1-R, CO-2)**

    a) Oedogonium forms dense mats or filamentous growths in marine habitats.

    b) Oedogonium exhibits branched filaments composed of cells arranged end to end.

    c) Growth in Oedogonium primarily occurs at the basal regions of the filaments.

    Sd) Oedogonium has a filamentous structure consisting of long, unbranched chains of cells.

3. A stem node of *Chara* bears ----------**(K1-R, CO-3)**.

4. Write any two examples for large scale cultivation of Algae (**K1-R, CO-4)**.

5. Assertion and Reasoning: (K4-An, CO-5)

Assertion: Algal bioinoculants are environmentally sustainable alternatives to chemical fertilizers and pesticides.

Reasoning: They help plants withstand environmental stresses such as drought, salinity, and heavy metal contamination.

a) Both assertion and reasoning are true, and the reasoning is the correct explanation of the assertion.

b) Both assertion and reasoning are true, but the reasoning is not the correct explanation of the assertion.

c) Assertion is true, but the reasoning is false.

d) Assertion is false, but the reasoning is true.

Part B (3 marks)

1. Write short notes on algal distribution .**(K1-R, CO-1)**
2. Schematically represent the thallus organization *of Oedogonium*. **(K3-Ap, CO-2)**
3. How vegetative reproduction occurs in *Chara ?* **(K2-U, CO-3)**
4. Analyze the indoor cultivation methods of algae? **(K4-An, CO-4)**
5. Algae can be supplemented as food- Justify your answer. **(K4-An, CO-5)**

Part C (7 marks)

1. 1. List out the general characters of algae.**(K1-R, CO-1)**
   2. Summarize the thallus organisation of *Chlorella* with a neat sketch. **(K3-Ap, CO-2)**
   3. Schematically represent the life cycle of *Gracillaria* with detailed description. **K4-An, CO-3)**
   4. Describe the different harvesting methods of algae. **K2-U, CO-4)**
   5. Evaluate the nature of algae in bioluminescence with suitable examples. **(K5-E, CO-5)**

Head of the Department

Dr.Sr.P.Leema Rose

Course Instructor

Dr.J.Albino Wins & Dr.A.R.Florence

Department : Botany
Class : I B.Sc. Botany
Title of the Course : CORE LAB COURSE I: PLANT DIVERSITY I: ALGAE
Course Code : BU231CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231CP1	1	-	2	–	3	3	**45**	**25**	**75**	**100**

Learning Objectives:

1. To develop skills to identify micro and macroalgae based on habitat, thallus structure and the internal organization.
2. To develop skills to prepare the microslides of algae.

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	recall and identify algae using key identification characters.	**K1(R)**
2	demonstrate practical skills in preparation of fresh mount and identification of algal forms from algal mixture.	**K3(Ap) &K2(U)**
3	describe the internal structure of algae prescribed in the syllabus	**K2(U)**
4	decipher the algal diversity in fresh/marine water and their economic significance.	**K4 (An) &K6 (C)**
5	evaluate the various techniques used to culture algae for commercial purposes	**K5 (E)**

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

Teaching plan

Total Contact hours: 45 (Including lectures, assignments and tests)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1.	Micro-preparation - . *Caulerpa* - Thallus	2	1	K4(An)	Reflective Thinking, lecture method	Experiential learning - Demonstration of experiments	O Lab	Evaluation of slides, observation notes and diagrams
2.	Micro-preparation - *Sargassum* – Stipe and Leaf	2		K4(An)	Flipped Classroom, Stimulation based approach	Experiential Learning - Using live specimen	Google Classroom	Evaluation of slides, observation notes and diagrams
3.	Micro-preparation - . *Gracilaria* - Thallus	2	1	K4(An)	Reflective Thinking, Lecture with illustration	Experiential Learning - Using live specimen, Preparing slides	E content - external Links	Evaluation of slides, observation notes and diagrams

4.	Micro-preparation - *Ulva* – Thallus	2		K4(An)	Integrative Teaching, Simulation Based Approach	Experiential Learning- Hands-On Demonstration	Youtube Videos	Evaluation of slides, observation notes and diagrams
5.	Micro-preparation - *Chara* - Thallus	2		K4(An)	Inquiry based approach	Experiential Learning- Slide Preparation, Live specimen	Youtube Videos	Cobservation notes and diagrams
6.	Identifying the micro slides - *Chlorella*	2	1	K2(U)	Reflective approach	Experiential Learning- Observation of Permanent Slides	Self Prepared Videos	Homework - Diagrams, Evaluation of slides
7.	Identifying the micro slides - Identifying the micro slides - *Volvox* with daughter colony	2		K2(U)	Integrative approach	Experiential Learning- Observation of Permanent Slides	Youtube Videos	Homework - Diagrams, Evaluation of slides
8.	Identifying the micro slides - *Volvox* antheridia, *Volvox* archegonia	2	1	K2(U)	Reflective Thinking, Flipped Classroom	Experiential Learning- Observation of Permanent Slides	Interactive PPT	Evaluation of slides, Diagram Correction

9.	Identifying the micro slides - . *Anabaena*	2		K2(U)	KWL, Hands on Trainning sessions.	Experiential Learning- Observation of Permanent Slides	Youtube Videos	Evaluation of slides, Diagram Correction
10.	Identifying the micro slides - *Oedogonium*	2		K2(U)	Lectures with Illustration, Brain Storming	Experiential Learning- Observation of Permanent Slides	Econtent with GAMMA PPT	Evaluation of slides, Diagram Correction
11.	Identifying the micro slides - *Sargassum* male conceptacle, *Sargassum* female conceptacle	2	1	K2(U)	Reflective Thinking, Inquiry Based Approach	Experiential Learning- Observation of Permanent Slides	O lab	Evaluation of slides, Diagram Correction
12.	Identifying the micro slides - *Gracilaria* Cystocarp	3		K2(U)	Hands on Trainning, Flipped classrooms	Experiential Learning- Observation of Permanent Slides	O Lab	Evaluation of slides, Diagram Correction
13.	Identifying types of algal mixture	3		K4(An)	Lecture with Illustration, Simulation based approach	Collabrative learning- Demonstration	O-Lab	Evaluation of slides and diagrams
14.	Economic importance of Algae as: Food, Feed, Biofertilizers, Seaweed liquid	2	1	K1(R)	Demonstrative approach	Participative learning- Exhit of spotters	Interactive PPT	Evaluation of diagrams

	fertilizer, Hydrogen production by algae							
15.	Economic importance of Algae as: SCP, Agar Agar, Alginate, Diatomaceous earth	2		K1(R)	Reflective Thinking, Inquiry Based Approach	Participative learning- Exhit of spotters	Econtent with GAMMA PPT	Evaluation of diagrams
16.	Field visit to study fresh water/marine water algal habitats.	3	1	K4(An)	Experiential Learning	Collabrative learning- Team Discussions, Field visit	Virtual Images	Evaluation of report
17.	Visit to nearby industry actively engaged in algal technology.	3		K4(An)	Experiential Learning	Collabrative learning- Team Discussions, Field visit	Virtual Images	Evaluation of report

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

Activities (Em / En /SD): **Hands on Training on Slide Preperation, Sectioning, mounting, Microscopic Analysis**

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

Activities related to Cross Cutting Issues: **Exhibit on Algal products**

Sample Questions

1. Make suitable micro preparation of A & B. Stain and mount in glycerin. Identify giving reasons, write systematic position, draw labeled sketches, and submit the slides for evaluation. (2x10=20 marks)

2. Identify any two microalgae present in the given algae mixture C and report. Draw labeled sketches and write notes. (2x8=16 marks)

3. Identify, draw diagram and write notes on D & E. (2x7=14 marks)

4. Identify, draw labeled sketches and write notes on F & G (2x5=10 marks)

5. Write the economic importance of H, I & J (3x5=15marks)

Head of the Department **Course Instructor**

Dr.Sr.P.Leema Rose **Dr.J.Albino Wins & Dr.A.R.Florence**

Department : Botany
Class : I B.Sc Chemistry
Title of the Course : Elective Course I: Allied Botany -I
Semester : I
Course Code : BU231EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231EC1	4	–	–	–	3	4	**60**	**25**	**75**	**100**

Learning Objectives:

1. To study morphological and anatomical adaptations of plants of various habitats.
2. To demonstrate techniques and experiments in plant tissue culture, plant physiology and biochemistry.

Course Outcomes

COs	Upon completion of this course, students will be able to:	CL
CO-1	increase the awareness and appreciation of human friendly algae and their economic importance.	**K3 (Ap)**
CO-2	develop an understanding of microbes and fungi and appreciate their adaptive strategies	**K2 (U)**
CO-3	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K2 (U)**
CO-4	compare the structure and function of cells and explain the development of cells.	**K4 (An)**
CO-5	understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	**K2 (U)**

Teaching Plan

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

Unit	Module (Minimum 5 to Maximum 10 modules are permitted)	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	General characters of algae	2	1	K1 (R)	Inquiry based approach, PPT & Videos	Inquiry based approach	Video, Notes/Slides & PPT	Short-Answer Tests. Assignments
	2	Structure, reproduction and life cycle of - *Anabaena*	4	1	K2 (U)	Permanent Slides, diagrams, interactive discussions	Group discussion, Interaction in the classroom	Video, PPT, Simulation Notes	quizzes, class test, formative assessment, Recall steps, Assignments, MCQ,
	3	Structure, reproduction and life cycle of *Sargassum*	3	1	K2 (U)	Group discussion, diagrams, videos, microscope slides,	Brainstorming, Group work, PPT	PowerPoint, Notes	Diagrams and Labeling, Multiple-choice questions, short answer

									questions, and essay questions,
	4	Economic importance of algae	2		K3 (Ap)	Lecture, group discussion, PPT, debates	Assignment, Mind map	PPT. Youtube Videos	MCQ, True/False, Evaluation through class test,.
II									
	1.	General characters of fungi	2	1	K1 (R)	Chalk and board, diagrams, PPT	Brainstorming	Interactive PPT	class tests, group discussion formative assessments, summative assessments,
	2.	Structure, reproduction and life cycle of *Penicillium*	2		K2 (U)	Flipped classroom, Lecture, PPT, diagrams, chalk and board, videos	Brainstorming, interaction in the classroom	Interactive PPT, notes	formative assessments, MCQs, diagram labelling short answer questions,
	3.	Structure, reproduction and life cycle of *Agaricus*	2	1	K2 (U)	Lecture, PPT, diagrams, guided group discussion, flowcharts	Group discussion, peer review	PPT	true/false statements, or fill-in-the-blank questions, class test, formative

									assessment, quiz
	4.	economic importance of fungi	1		K1 (R)	Inquiry based approach, Lecture, PPT, interactive discussion,	Brainstorming, Quiz, Powerpoint presentation	Interactive PPT, notes	Class tests, diagram labelling, online quizzes Assignments,
	5.	Bacteria - general characters, structure and reproduction of *Escherichia coli* and economic importance of bacteria.	2	1	K2 (U)	Lecture, PPT, diagrams, interactive discussions, cooperative learning	Group discussion, Powerpoint presentation	Video, Interactive PPT, notes	Diagram Labeling, Short Answer Questions, Essay Questions
	6.	Virus - general characters, structure of TMV, structure of bacteriophage.	2		K2 (U)	Inquiry based approach, Lecture, PPT, diagrams, Interactive Discussions	Interactive PPT, Brainstorming	Interactive PPT, notes	MCQs, Diagram Labeling, Class test, Assignment, Visual Presentations Formative and Summative Assessments,
III									
	1.	General		1	K1 (R)	Lecture, PPT,	Group	Video,	Labelling

		characters of Bryophytes	2			illustrations, Group discussions	discussion, Interactive PPT	Interactive PPT, notes	diagrams, Short Answer Questions, Diagram Construction Formative and Summative Assessments,
	2.	Structure and life cycle of *Funaria*.	2		K2 (U)	Flipped classroom, Lecture, PPT, Charts, diagrams	Mind map, Assignments,	YouTube Video, Interactive PPT, notes	Class test, Labeling Diagram, formative and summative assessments
	3.	General characters of Pteridophytes	2	1	K1 (R)	Lecture, PPT, diagrams, Group discussion	Team teaching, Group discussion	Interactive PPT, notes	MCQs, Diagram labelling, essay question
	4.	Structure and life cycle of *Lycopodium*.	2		K2 (U)	Flipped classroom, Lecture, PPT, flowcharts, diagram	Brainstorming, Interaction in the classroom	YouTube Video, Interactive PPT, notes	Life Cycle Sequencing, Diagram Labeling, Class test, formative assessment,
	5.	General characters of Gymnosperms	1	1	K1 (R)	Inquiry based approach, Lecture, PPT,	Group discussion, Mind map,	Video, Interactive PPT, notes	Debate, Assignment, Class test,

						videos, comparing with other groups of plants	Interactive PPT		MCQs,
	6.	Structure and life cycle of *Cycas*.	2		K2 (U)	Cooperative learning, Lecture, charts, chalk and board, diagram, lifecycle flowcharts	Flow chart, Mind map	YouTube Video, Interactive PPT, notes	Life Cycle Sequencing, Class test, Labeling Diagram,
IV									
	1.	Prokaryotic and Eukaryotic cell- structure /organization.	2	1	K2 (U)	Flipped classroom, Lecture, Chalk and board, PPT	Brainstorming, Mind map	Interactive PPT, Video, notes	class test, quizzes Diagram labelling,
	2.	ultra structure and function of chloroplast	2		K2 (U)	Reflective thinking, lecture, PPT, photos, videos	Interactive PPT, Assignments,	Interactive PPT, notes	class test, Assignment MCQs, essay test. Formative assessment,
	3.	ultra structure and function of mitochondria	2	1	K2 (U)	Lecture, reflective thinking, PPT, videos, photos	Group discussion. Interaction in the classroom	Interactive PPT, notes, YouTube Video,	Short answer test, MCQs, Assignment Class test,
	4.	ultra structure and function	2		K2 (U)	Brainstorming, lecture, PPT,	Team teaching,	Interactive PPT,	Quizzes, formative

		of nucleus.				Chart, videos	Group discussion, ,	YouTube Video, notes	assessment, class test, Assignment
	5.	Cell division - mitosis and meiosis.	3	1	K1 (R)	Lecture, diagram, photos, chalk and board, videos.	Mind map, Assignment	Interactive PPT, notes, YouTube Video,	MCQs, open book test, Short test
V									
	1.	Mendelism - Law of dominance, Law of segregation, Incomplete dominance.	4	1	K2 (U)	Brainstorming, lecture, group discussions, diagrams	Group discussion, peer review	PPT	MCQs, formative assessement, Class tests,
	2.	Law of independent assortment.	3	1	K2 (U)	Lecture, chalk and board, diagram, videos	Quiz, Powerpoint presentation, Brainstorming	Interactive PPT, notes	Class test, MCQs, formative assessment, quizzes
	3.	Monohybrid and dihybrid cross - Test cross - Back cross.	4		K3 (Ap)	Inquiry based approach, Lecture, Chalk and board, PPT,	Powerpoint presentation, Group discussion	Video, Interactive PPT, notes	essay questions, MCQs, Fill in the blanks.
	4.	Plant tissue culture - *In vitro* culture methods. Plant tissue culture	4	1	K2 (U)	Videos, flipped classroom, Lecture, chart, flow chart,	Mind map, Brainstorming	Interactive PPT, notes	MCQs. True or False online quiz,

		and its application in biotechnology.				PPT			

Course Focussing on Employability **Employability**

Activities (Em / En /SD): **Seminar, Assignment**

Course Focusing on Cross Cutting Issues Professional Ethics

Assignment: Structure of TMV (Last date to submit –10-09-2025)

Sample questions (minimum one question from each unit)

Part A - (1 mark)

1. Which of the following is a brown alga with differentiated plant body and air bladders? **(K1-R, CO-1)**
   a) Spirogyra b) Anabaena c) Sargassum d) Chlamydomonas
2. Which of the following is known for producing antibiotics? **(K2-U, CO-2)**
   1.
   a) Agaricus b) Rhizopus c) Penicillium d) Saccharomyces
   2. The dominant phase in the life cycle of *Funaria* is_____. **(K1-R, CO-3)**
   a) Sporophyte b) Gametophyte c) Embryo d) Zygote
   3. Which cell organelle is responsible for cellular respiration? **(K2-U, CO-4)**
   a) Chloroplast b) Mitochondria c) Golgi apparatus d) Ribosome
   4. In a monohybrid cross, the phenotypic ratio in the F2 generation is _____. **(K3-Ap, CO-5)**
   a) 3:1 b) 1:2:1 c) 9:3:3:1 d) 1:1

Part B - (6 marks)

3. Describe the structure of *Anabaena*. **(K1-R, CO-1)**
4. Explain the economic importance of *Escherichia coli*. **(K2-U, CO-2)**

5. List any ten general characters of pteridophytes. **(K1-R, CO-3)**
6. Differentiate between prokaryotic and eukaryotic cells. **(K4-An, CO-4)**
7. Define test cross. Give an example. **(K3-Ap, CO-5)**

Part C – (12 marks)

1. Write an essay on the life cycle of *Sargassum*. (**K1-R, CO-1)**

2. Describe the structure and reproduction of *Escherichia coli*. **(K2-U, CO-2)**

3. Elaborate the life cycle of *Lycopodium*. **(K3-Ap, CO-3)**

4. Describe the ultrastructure and functions of chloroplast **(K2-U, CO-4)**

5. Discuss the applications of plant biotechnology **(K2-U, CO-5)**

Head of the Department

Dr. Sr. Leema Rose

Course Instructors

Dr. Bojaxa A Rosy

Dr. Sr. P. Leema Rose

Department : Botany
Class : I B. Sc Chemistry
Title of the Course : ELECTIVE LAB COURSE I: ALLIED BOTANY PRACTICAL
Semester : I
Course Code : BU231EP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231EP1	-	-	2	-	2	2	30	25	75	100

Learning Objectives:

1. To understand the role of different components in generating pulses and stable signals.
2. To observe the frequency generation and stability of the oscillator circuits.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	to study the internal organization of algae and fungi.	**K1**
2.	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K2**
3.	to study the classical taxonomy with reference to different parameters.	**K4**
4.	understand the fundamental concepts of plant anatomy and embryology	**K2**
5.	to study the effect of various physical factors on photosynthesis.	**K3**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze**, K5-** Evaluate**, K6-**Create

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Make suitable micro preparation of a. Anabaena b. Sargassum - Stipe, Leaf,	4	1	K1	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment, identification
2	c. Penicillium d. Agaricus e. Structure of Bacteria f. Structure of Bacteriophage	4	1	K2	**Demonstrative**	Brainstorming		Model Exam, record diagram
3	Funaria – Stem, Archegonial cluster, Antheridial cluster, Sporophyte L.S	4	1	K1	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment
4	Lycopodium – Stem, Cone Cycas – Leaflet, T.S Microsporophyll, T.S. of Megasporophyll, Ovule L.S	4	1	K2	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment
5	Micro photographs of the cell organelles	5		K2	**Experimental learning**	Performance based		Record diagram,

	ultra structure – Chloroplast, Mitochondria, Nucleus, Mitosis and Meiosis					learning		Stages of mitosis and meiosis assessment
6	Simple Genetic Problem Biotechnology Spotters a. Hot Air Oven b. Laminar Air Flow Chamber Autoclave	4	1		**Demonstrative**	Practicals		Record diagram, identification, genetics problem correction

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

Activities (Em / En /SD): Hands on Training on sectioning plant specimen.

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

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Make a suitable micro preparation of A and B. Identify, giving reasons, draw diagrams and submit the prepared slide for valuation.
2. Solve the monohybrid genetic problems C

3. Solve the dihybrid genetic problems D

4. Identify, draw and write notes on E, F, G, H, I and J

Head of the Department

Dr. Sr. Leema Rose

Course Instructors

Dr. Bojaxa A Rosy

Dr. Sr. P. Leema Rose

Department : Zoology
Class : I B.Sc. Botany
Title of the Course : Non-Major Elective NME I: Nursery and Landscaping
Semester : I
Course Code : BU231NM1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231NM1	2	–	–	–	2	2	30	25	75	100

Learning Objectives:

1. To recognize the importancee of growing plants and practice the knowledge gained by developing kitchen garden and ornamental garden.
2. To be able to design gardens, learn the methods of propagation and become entrepreneur in Horticulture.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recognize the basic principles and components of gardening.	**K2**
2.	explain about bio-aesthetic planning and conceptualize flower arrangement.	**K1**
3.	apply techniques for design various types of gardens according to the culture and art of bonsai.	**K3**
4.	compare and contrast different garden styles and landscaping patterns	**K4**
5.	establish and maintain special types of gardens for outdoor and indoor landscaping.	**K2**

K1 - Remember; **K2** - Understand; **K3**- Apply; **K4** - Analyse; **K5-** Evaluate

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E – Resources	Assessment/ Evaluation on Methods
	UNIT : I (6 Hrs)								
I	1	Introduction to nursery and landscaping	2	1	K1, K2	Lecture with PPT, Flipped Classroom.	Group discussion, Field visit	YouTube Videos, Notes, PPT	Conceptual questions, Peer discission
	2	Prospects of nursery and landscaping	2		K2, K3	Collaborative learning, Blended learning	Peer teaching, Discussion	YouTube Videos, Notes, PPT	Assignment, Group discussion, CIA I
	3	Scope of nursery and landscaping	1		K1, K5	Inquiry-Based Learning, Concept-based discussion	Group discussion	Online Tutorials and Notes	
	UNIT: II (6 Hrs)								
II	1	Methods of Ppropagation — cutting, layering	1	1	K2, K4	Lecture with PPT, YouTube Videos	Concept Mapping	PPT, YouTube Videos, Notes	Mind map, Open Book Test
	2	Grafting, budding	1		K2, K3	Lecture with PPT, YouTube Videos	Learning by doing	PPT, YouTube Videos, Notes	Flow chart, Oral Question, CIA I

	3	Floriculture — Rose cultivation	1		K1, K3	Lecture with YouTube video, Experiential learning, Participatory learning	Peer learning, Think-pair-share	YouTube Videos, Notes	Mind map, CIA II
	4	Chrysanthemum cultivation	1		K1, K3	Inquiry-Based Learning, Participatory learning	Peer learning, Video based learning	YouTube Videos, Notes	
	5	Jasmine cultivation	1		K1, K3	Experiential learning, Participatory learning	Peer learning learning by doing	YouTube Videos, Notes	
III	**Unit: III (6 hrs.)**								
	1	Gardening— formal garden, informal garden	2	1	K1, K2	Inquiry-Based Learning, Concept-based discussion	Field trip	YouTube Videos, Notes	Quiz - Google form
	2	Vegetable garden	1		K2, K3	Lecture with YouTube Videos, Experiential learning	Peer learning, Think-pair-share	YouTube Videos, Notes	Class test, CIA I Assignment / Quiz
	3	Landscape layout designing	1		K3, K4	Visual and Auditory Pedagogy	Model Making	E – Notes, YouTube videos	
	4	Formation and maintenance of lawn.	1		K3, K5	Lecture with Model Design and utilizing campus gardens	Model Making and Presentation	E - Content as Video and PPT	

IV	**Unit: IV (6 hrs.)**								
	1	Nursery structures — Green house	2	1	K2,K3	Lecture with diagrams & models	Group model creation	Ms-PPT, YouTube Videos	Class Test CIA I
	2	Shade house, Mist chamber	2		K2,K4	PPT	Peer discussion/ Model making	Ms-PPT, YouTube Videos	Class Test CIA II Quiz - Google form/ Quizizz, Class notes
	3	Topiary, Bonsal culture.	1		K3, K5	Guided lecture using real-life examples	Demo/ video based training	Case study and Class discussion	
V	**Unit: V (6 hrs.)**								
	1	Manures	1	1	K2, K3	Conceptual teaching and VK method	Pair work	You tube videos and animations	Class Test CIA II
	2	Coirposting	2		K3,K4, K5	Conceptual teaching and VK method	Field demo visit	You tube videos and animations	Quiz - Google form/ Quizizz, Class notes
	3	Vermicomposting	2		K3,K4, K5	Conceptual teaching and VK method	Role play	You tube videos and animations	

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

Activities (Employability / Entrepreneurship /Skill Development):

Mind map on “Rose cultivation”

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

Activities related to Cross Cutting Issues:-

Group discussion on “Ethics in nursery business”

Assignment: Scope of landscaping

Sample questions

Part A (5 x 2 = 10 marks)

1. What is a plant nursery? Mention any two types of plant nurseries. **(R; CO-1)**
2. Differentiate between sexual and asexual methods of plant propagation with one example each. **(An; CO-4)**
3. List any two distinct characteristics of a formal garden. **(U; CO-2)**
4. What is a green house? **(K, CO - 4)**
5. State any two differences between manure and compost. **(U,CO1)**

Part B (5 x 4 = 20 marks)

8. Define landscaping. Explain any two important principles of landscaping with suitable examples**. (R; CO-1)**
9. Analyze how grafting contributes to the improvement of plant varieties. Discuss its advantages and limitations**. (An; CO-4)**
10. Describe the importance of lawn formation in landscape gardening**. (U,CO5)**
11. Analyse the aesthetic importance of bonsai and topiary in landscaping. **(An,CO4)**
12. Explain the role of manures in maintaining soil fertility **(U, CO1)**

Part C (5 x 9 = 45 marks)

6. Explain the scope of plant nursery in detail. Discuss its role in agriculture, horticulture, and environmental conservation**. (U; CO-2)**

7. Explain how soil type, climate, and propagation methods influence the successful cultivation of jasmine. **(Ap; CO-3)**

8. Discuss in detail the planning, layout, and maintenance of a vegetable garden **(R; CO-1)**

9. Compare and contrast greenhouse, shade house, and mist chamber in terms of structure, function, and applications in nursery management. **(An, CO4)**

10. Evaluate the importance of composting and vermicomposting in sustainable agriculture. Provide examples from organic farming. **(Ev,CO1)**

Head of the Department
Dr. Sr. P. Leema Rose

Course Instructor
Dr. P.T. Arokya Glory, Dr. S. Bhuvaneshwari

Department : Botany
Class : I B.Sc Botany
Title of the Course : Foundation Course: Basics of Botany
Semester : I
Course Code : BU231FC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231FC1	2	–	–	–	2	2	**30**	**25**	**75**	**100**

Learning Objectives:

1. To learn about the classification and Salient features of algae, fungi, bryophytes, Pteridophytes and gymnosperms, viruses and bacteria.
2. To learn about cell biology, Plant Morphology, Genetics, and plant physiology.

Course Outcomes

COs	Upon completion of this course, students will be able to:	CL
CO-1	increase the awareness and appreciation of human friendly algae and their economic importance.	**K3 (Ap)**
CO-2	develop an understanding of microbes and fungi and appreciate their adaptive strategies	**K2 (U)**
CO-3	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K2 (U)**
CO-4	compare the structure and function of cells and	**K4 (An)**

	explain the development of cells.	
CO-5	understand the core concepts and fundamentals of plant biotechnology and genetic engineering.	**K2 (U)**

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

Unit	Module (Minimum 5 to Maximum 10 modules are permitted)	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	Systematics: Two Kingdom and Five Kingdom systems	1	1	K2 (U)	Inquiry based approach, PPT & Videos	Brainstorming	Notes/Slides & PPT	Class test,. Assignments
	2	Salient features of various Plant Groups: Algae, Fungi,	3		K1 (R)	PPT diagrams, interactive discussions	Group discussion, Interaction in the classroom	YouTube Video, PPT, Notes	class test, formative assessment, Oral questioning, Recall steps, Assignments, MCQ,

	3	Bryophytes, Pteridophytes	3	1	K2 (U)	Group discussion, diagrams, videos, microscope slides, interactive discussions	Brainstorming, Group work, PPT	PowerPoint, Notes,	Multiple-choice questions, short answer questions, and essay questions,
	4	Gymnosperms-	3	1	K2 (U)	Brainstorming, group discussion, PPT, debates	Assignment, Mind map	Youtube Videos, PPT.	MCQ, True/False, Short-Answer Tests, Diagrams and Labeling,
	5	Viruses - Bacteria.	2		K2 (U)	Inquiry based approach, Group discussion	Interaction in the classroom	Youtube Videos, PPT.	Recall steps, MCQ,
II									
	7.	Cell as the basic unit of life - Prokaryotic and Eukaryotic Cell (Plant Cell) -	3	1	K1 (R)	Lecture, Chalk and board, diagrams, PPT	Group discussion, Brainstorming	Interactive PPT, notes	Group discussion, class test, summative assessments,
	8.	Light Microscope and Electron	3		K2 (U)	Flipped classroom, Lecture, PPT,	Brainstorming, Interaction in the classroom	Interactive PPT, notes	MCQs, diagram labelling

		Microscope				diagrams, chalk and board, videos			short answer questions, Formative assessments,
	9.	Ultra Structure of Prokaryotic and Eukaryotic Cells	3	1	K2 (U)	Lecture, PPT, diagrams, guided group discussion, flowcharts	Group discussion, peer review	PPT, YouTube Videos	Class test, formative assessment, quiz
	10.	Cell Wall - Cell Membrane,	1		K1 (R)	Inquiry based approach, Lecture, PPT, interactive discussion,	Brainstorming, Quiz, Powerpoint presentation	Interactive PPT, notes	Class tests, diagram labelling, online quizzes Assignments, True/false statements,
	11.	Plastids, Ribosomes.	2	1	K2 (U)	Lecture, PPT, diagrams, interactive discussions, cooperative learning	Powerpoint presentation, Group discussion	Video, Interactive PPT, notes	Short Answer Questions, Essay Questions, Formative assessments,
III									
	7.	Structure and Modification of Root, Stem	1	1	K1 (R)	Lecture, PPT, illustrations, Group discussions, using visual images	Team teaching, Group discussion	YouTube Video, Interactive PPT, notes	Short Answer Questions, Diagram Construction Formative

									and Summative Assessments, Labelling diagrams,
	8.	Leaf	1	1	K2 (U)	Flipped classroom, Lecture, PPT, Charts, diagrams	Assignments, Interaction in the classroom	YouTube Video, Interactive PPT, notes	Class test, Labeling Diagram, formative and summative assessments
	9.	Structure and Types of Inflorescences	1		K1 (R)	Lecture, PPT, diagrams, Group discussion, using visual images	Interactive PPT, Group discussion,	Interactive PPT, notes	MCQs, Diagram labelling, essay question
	10.	Structure and Types of Flowers,	1	1	K2 (U)	Flipped classroom, Lecture, PPT, using visual images, diagram,	Brainstorming, Mind map,	Video, Interactive PPT, notes	Diagram Labeling, Class test, formative assessment,
	11.	Fruits and Seeds.	1		K1 (R)	Inquiry based approach, Lecture, PPT, videos, comparing with other groups of plants	Group discussion, Mind map, Interactive PPT	Video, Interactive PPT, notes	Assignment, Class test, MCQs,

IV									
	6.	Concept of Heredity and Variation -	6	1	K2 (U)	Brainstorming, lecture, group discussions, diagrams	Group discussion, peer review	PPT	MCQs, formative assessement, Class tests,
	7.	Mendel's Laws of Inheritance.	6	2	K2 (U)	Lecture, chalk and board, diagram, videos	Quiz, Powerpoint presentation, Brainstorming	Interactive PPT, notes	Class test, MCQs, formative assessment, quizzes
V									
	5.	Cell as a Physiological Unit	3	1	K2 (U)	Group discussions, PPT, Brainstorming, lecture, diagrams	Group discussion, peer review	PPT	Formative assessement, Class tests, online quiz,
	6.	Water relations - Absorption and movement : Diffusion, Osmosis,	3		K2 (U)	Lecture, chalk and board, diagram, videos	Powerpoint presentation, Group discussion	Interactive PPT, notes	Class test, MCQs, formative assessment, quizzes
	7.	Plasmolysis, Imbibition - Permeability,	3	1	K3 (Ap)	Inquiry based approach, Lecture, Chalk and board, PPT,	Powerpoint presentation, Brainstorming, Quiz	Video, Interactive PPT, notes	essay questions, MCQs, Fill in the blanks.
	8.	Water Potential - Transpiration -	3	1	K2 (U)	Videos, flipped classroom,	Mind map, Brainstorming	Interactive PPT, notes	MCQs. True or False,

		Movement - Mineral Nutrition .				Lecture, chart, flow chart, PPT			

Course Focussing on Employability **Employability**

Activities (Em / En /SD): **Seminar, Assignment**

Course Focusing on Cross Cutting Issues Professional Ethics

Assignment: Modification of Root (Last date to submit –10-09-2025)

Sample questions (minimum one question from each unit)

Part A - (2 marks)

13. In the Five Kingdom classification, fungi are placed under _____. **(K1-R, CO-2)**
    a) Monera b) Protista c) Fungi d) Plantae
14. Which organelle is present in plant cells but absent in animal cells? **(K1-R, CO-2)**
    a) Mitochondria b) Ribosomes c) Plastids d) Nucleus
15. A stem modified into a flattened, green structure for photosynthesis is called _____. **(K2-U, CO-4)**
    a) Tuber b) Cladode c) Thorn d) Bulbil
4. Which law of Mendel states that two alleles separate during gamete formation? **(K1-R, CO-3)**
    a) Law of Independent Assortment b) Law of Segregation
    c) Law of Dominance d) Law of Incomplete Dominance
5. The process by which water moves from higher to lower water potential is called _____. **(K1-R, CO-3)**
    a) Diffusion b) Active transport c) Osmosis d) Imbibition

Part B - (4 marks)

16. Write a short note on the Five Kingdom classification system. **(K1-R, CO-3)**
17. Draw and label a plant cell. **(K2-U, CO-4)**
18. Describe any four types of root modifications with examples. **(K1-R, CO-4)**
19. Explain Mendel’s Law of Dominance with a suitable example. **(K4-An, CO-5)**

20. Define osmosis. How does it differ from diffusion? Mention one example of each in plants.. **(K3-Ap, CO-4)**

Part C - (9 marks)

11. Describe the salient features of Algae and Fungi. (**K1-R, CO-1)**

12. Explain the structure and functions of Plastids. **(K2-U, CO-4)**

13. Write an account on the morphological structure and modifications of Leaf. **(K2-U, CO-4)**

14. Describe Mendel's experiments on monohybrid and dihybrid crosses**. (K2-U, CO-5)**

15. Describe the processes of plasmolysis, and imbibition with examples **(K1-R, CO-4)**

Head of the Department

Dr. Sr. Leema Rose

Course Instructors

Dr. Bojaxa A Rosy

Dr. Sr. P. Leema Rose

Department : Botany
Class : II B.Sc Botany
Title of the Course : Core course III: Plant Diversity-III Bryophytes and Pteridophytes
Semester : III
Course Code : BU233CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU233CC1	3	2	–	–	**5**	5	**75**	**25**	**75**	**100**

Learning Objectives:

1. To enable the students to have an overview of non-vascular and vascular cryptogams.

2. To know the evolution, morphological diversity, structure, reproduction and economic importance of Bryophytes and Pteridophytes.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	decipher the stages of plant evolution and their transition to land habitat.	**PSO - 10**	K1 R & K2 U
CO-2	recognize morphological variations of Bryophytes and Pteridophytes	**PSO - 1**	K2 U & K4 An
CO-3	explain and analyze the anatomy and reproduction of Bryophytes and Pteridophytes.	**PSO - 3**	K2 U & K4 An
CO-4	access and interact about the useful role of	**PSO - 6**	K3 Ap

	Bryophytes and Pteridophytes.		
CO-5	compare and contrast the variations in the internal cellular organization, gametophyte and sporophyte of Bryophytes and Pteridophytes.	**PSO - 10**	K4 An

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**BRYOPHYTES**								
	1	General characters of bryophytes	2	1	K1(R)	videos, Group discussion, Visual images	PPT, Brainstorming	PowerPoint, Notes,	Multiple-choice questions, short answer questions, and essay questions,
	2	Evolution of bryophytes	2		K2(U)	Lecture, group discussion, PPT	Mind map, Group discussion	PPT. Youtube Videos	True/False, class test, MCQ,
	3	Classification (Watson, 1971, up to family level).	3	2	K2(U)	Lecture, PPT, Inquiry based approach	Interaction in the classroom	Notes & PPT	Short-Answer Tests. Assignments
	4	Economic importance of Bryophytes –	3		K2(U)	Permanent Slides,	Group discussion,	Video, PPT, Notes	quizzes, class test, formative

		Ecological importance (Pollution indicators and monitoring),				diagrams, interactive discussions	Interaction in the classroom		assessment, Recall steps, Assignments, MCQ,
	5	Medicinal uses, horticulture, and industrial uses.	2		K1(R)	Group discussion, videos,	Brainstorming, Group work, PPT	PowerPoint, Notes	Diagrams and Labeling, Multiple-choice questions, short answer questions, and essay questions,
II	1	Structure of the following class Hepaticopsida (*Marchantia*)	2	1	K2(U)	Flipped classroom, Lecture, PPT, diagrams, chalk and board, videos	Brainstorming, interaction in the classroom	Interactive PPT, notes	MCQ, diagram labelling, short answer questions
	2	Reproduction and life histories of the following class Hepaticopsida (*Marchantia*);	2		K2(U)	Lecture, PPT, diagrams, group discussion	Group discussion, peer review	PPT	true/false statements, or fill-in-the-blank questions, class test, formative assessment
	3	Structure of the following class Anthocerotopsida	2		K1(R)	Lecture, Flipped classroom, PPT, diagrams, chalk	Interaction in the classroom,	Interactive PPT	Quiz, Class Test

		(*Anthoceros*)		1		and board	Brainstormin g		
	4	Reproduction and life histories of the following class Anthocerotopsida (*Anthoceros*)	2		K2(U)	Interactive discussion, Inquiry based approach, Lecture and PPT	Brainstormin g, Quiz, Powerpoint presentation	Interactive PPT, notes	Class tests, diagram labelling, online quizzes Assignments,
	5	Structure of the following class Bryopsida (*Polytrichum*)	2	1	K1(R)	Lecture, Brainstorming, Permanent Slides	Brainstormin g, Describing permanent slide, diagram	Interactive PPT, notes	Oral questioning, online quiz
	6	Reproduction and life histories of the following class Bryopsida (*Polytrichum*)	2		K2(U)	Inquiryl based approach, flow chart	Explaining flow chart, Brainstormin g,	Brainstorming,	Flow Chart, Oral questioning, Diagram
III	1	General Characters of Pteridophytes	1	2	K2(U)	Inquiry-Based Learning	Participative Learning - Formulating questions	Live specimen	Understanding check- Exit test
	2	Classification of Pteridophytes (Reimer, 1954)	2		K1(R)	Collaborative Learning	Participative Learning - Group discussions, peer feedback	Interactive PPT, You Tibe videos, Live specimens	Flow chart, Concept Mapping
	3	Origin and evolution of Pteridophytes. Stelar Evolution	3		K2(U)	Active Learning	Participative Learning – Discussion,	Field visit, Microscopic slides	Herbarium Preparation, Pteridophyte

							Brain storming		Identification, Slide Identification
	4	Types of steles	2		K2(U)	Gamification	Experimental Learning - Game-based experiments	Chart, Microscopic slides	Slide identification Test, Class test
	5	Economic and Ecological importance of Pteridophytes	4	1	K3 (Ap)	Experiential Learning, KWL	Experimental Learning - Debate	PPT, Live specimen	Assignment, Flow chart
IV	1	Morphology, anatomy of the following classes: Psilotopsida (*Psilotum*)	3	1	K2(U)	Brain storming, Lecture	Collaborative learning- Team Discussions, Charts and Models	Live Specimen, Microscopic slide	Slip test, Quizzes, Open Book Test
	2	Reproduction of the following classes: Psilotopsida (*Psilotum*)	3		K2(U)	Collaborative Learning	Integrative Teaching - Charts and Visual Images	Interactive PPT, E-content with MS Word	Flow chart analysis, Essay test
	3	Morphology, anatomy of the following classes: Lycopsida (*Selaginella*),	2	1	K2(U)	Brain storming, Lecture	Inquiry-Based Learning, Lecture with Visual Aids	Live Specimen, Microscopic slide	Slip test, Quizzes, Open Book Test
	4	Reproduction of the following classes: Lycopsida (*Selaginella*),	2		K2(U)	Collaborative Learning	Stimulation based approach, Mind Map	Interactive PPT, E-content with MS Word	Flow chart analysis, Essay test
	5	Heterospory and Seed habit.	2	1	K4(An)	Experiential Learning	Reflective Thinking	You tube Video	Concept mapping, Student led

									presentation
V	1	Morphology, anatomy of the following classes: Sphenopsida (*Equisetum*),	3	1	K2(U)	Brain storming, Lecture	Inquiry-Based Learning, Lecture with Visual Aids	Live Specimen, Microscopic slide	Slip test, Quizzes, Open Book Test
	2	Reproduction of the following classes: Sphenopsida (*Equisetum*),	3		K2(U)	Lecture, PPT, videos, using visual images, brain storming	Group discussion. Interaction in the classroom,	Interactive PPT, E-content with MS Word YouTube Video	Flow chart analysis, Essay test
	3	Pteropsida (*Marsilea*).	4	1	K2(U)	Brainstorming, lecture, PPT, videos, describing visual images	Peer teaching, Group discussion,	Interactive PPT, YouTube Video, notes	Class test, Quizzes, formative assessment, Assignment
	4	Apogamy and apospory and homospory	2	1	K1(R)	Lecture, diagram, photos, chalk and board, videos.	Assignment, Mind map	Interactive PPT, notes, YouTube Video	Open book test, Short test, MCQs,

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

Activities (Em / En /SD): **Hands on Training on Pteridophyte identification and sectioning**

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

Activities related to Cross Cutting Issues: Exhibit of economically important belonging to Pteridophyte and Gymnosperms

Assignment: Classification of Pteridophyte and Gymnosperms, Life cycle of type specimens - Chart preparation (Last date to submit – 20-07-2025)

Sample questions

Part A (1 mark)

1. Which of the following bryophytes is commonly used as a pollution indicator? **(K1-R, CO-5)**

   A) *Marchantia* B) *Polytrichum* C) *Riccia* D) *Sphagnum*

2. In *Anthoceros,* the sporophyte is distinguished by the presence of_____. **(K1-R, CO-5)**

   A) Foot and seta only B) Capsule with stomata and chloroplasts

   C) Elaters D) Operculum

3. Assertion (A): Pteridophytes are considered the first true land plants to possess vascular tissues. **(K4-An, CO- 5)**

   Reason (R): Pteridophytes have specialized tissues, xylem and phloem, which facilitate the transport of water, minerals, and nutrients throughout the plant.

   Options:

   1. Both A and R are true, and R is the correct explanation of A.
   2. Both A and R are true, but R is not the correct explanation of A.
   3. A is true, but R is false.
   4. A is false, but R is true.

4. Out of the four vegetative reproduction methods one doesn't fit into the *Selaginella* **(K4-An, CO-3)**

   A) Protonema B) Resting buds C) Fragmentation D) Tubers

5. Which of the following is homosporous? **(K2-U, CO-3)**

   A) *Selaginella* B) *Marsilea* C) *Equisetum* D) *Isoetes*

Part B (6 marks)

1. Write a brief note on the economic importance of bryophytes. **(K1-R, CO-4)**
2. Compare the sporophytes of Marchantia and Anthoceros with suitable diagrams. **(K3-Ap, CO-5)**
3. Define stelar theory. Illustrate the types of siphonostele and solenostele. **(K4-An, CO-1)**
4. Draw the cross section of a mature sporangim of *Psilotum* and explain. **(K4-An, CO-5)**
5. Write a note on apogamy and apospory in pteridophytes with one example each. **(K2-U, CO-2)**

Part C (12 marks)

16. Classify bryophytes based on Watson, 1971. **(K1-R, CO-2)**

17. Describe the structure, reproduction, and life cycle of *Polytrichum*. **(K2-U, CO-3)**

18. Classify Pteridophytes according to Reimer (1954), with flowchart and examples. **(K2-U, CO-2)**

19. Describe the asexual reproduction of *Selaginella* with sketches. **(K2-U, CO-3)**

5. Describe the mode of reproduction in *Marsilea.* **(K2-U, CO-3)**

Head of the Department

Dr. Sr. Leema Rose

Course Instructor

Dr. A. Anami Augustus Arul

Dr. Bojaxa A Rosy

Department : Botany
Class : II B. Sc Botany
Title of the Course : Core Lab Course I: Plant Diversity-III Bryophytes and Pteridophytes
Semester : III
Course Code : BU233CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU233CP1	-	-	3	-	2	3	45	25	75	100

Learning Objectives:

1. To enable the students gain expertise in hand sectioning technique.
2. To study diversity of Bryophytes and Pteridophytes and the structure of fossil forms.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	recognize the major groups of non-vascular and vascular cryptogams	**K1**
2.	describe the structure of bryophytes and pteridophytes forms prescribed in the syllabus	**K2**
3.	identify and illustrate the morphological and anatomical features of bryophytes and pteridophytes	**K3**
4.	develop comprehensive skills in sectioning and micro preparation	**K4**
5.	interpret the significance of reproductive structures in bryophytes and pteridophytes	**K4**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze**, K5-** Evaluate**, K6-**Create

Total Contact hours: 45 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Marchantia –Dorsal view, Ventral view, T.S. of Thallus Slides – Marchantia Antheridiophore, Archegoniophore, Sporophyte, Gemma cup V.S.	6	1	K1& K2	Simulation Based Approach	Experiential Learning: Sectioning and identification	https://www.amazon.in/Manual-Practical-Bryophyta-Suresh-Kumar/dp/B0072GNFX4	Sectioning, Identification, Drawing the specimens
2	Anthoceros: Slides – Thallus V.S., AntheridiaV.S., sporophyte	6	2	K3	Simulation Based Approach	Experiential Learning: Sectioning and identification		Sectioning, Identification, Drawing the specimens
3	Polytrichum- habit, Slides - Leaf T.S., Antheridia V.S., Sporophyte V.S.	6		K3	Simulation Based Approach	Experiential Learning: Sectioning and identification		Sectioning, Identification, Drawing the specimens
4	Psilotum Habit, T.S. of stem Slide- Psilotum T.S. of synangium	4		K3	Simulation Based Approach	Experiential Learning: Sectioning and identification	https://www.amazon.in/Practical-Manual-Pteridophyta-Rajan-Sundara/dp/81	Sectioning, Identification, Drawing the specimens
5	Selaginella – Habit, T.S. of stem,	6	2	K5&K6	Simulation Based Approach	Experiential Learning:		Sectioning, Identification

	rhizophore Slide- Selaginella L.S. of Cone					Sectioning and identification	26106883	, Drawing the specimens
6	Equisetum – habit, Slide –T.S. of stem, rhizome root., L.S. of cone.	6		K5&K6	Simulation Based Approach	Experiential Learning: Sectioning and identification		Sectioning, Identification , Drawing the specimens
7	Marsilea – Habit, T.S. of Petiole, rhizome Slide- Sporocarp V.S.	6			Simulation Based Approach	Experiential Learning: Sectioning and identification		Sectioning, Identification , Drawing the specimens
8	Botanical excursion.	-		K5&K6	Experiential Learning	Experiential Learning: Field visit	-	Submission of field visit

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

Activities (Em / En /SD): **Hands on Training on sectioning plant specimen and identification**

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

Environment Sustainability activities related to Cross Cutting Issues: **Botanical Excursion**

Sample questions

1. Make suitable micro preparations of the given specimen. Stain and mount in glycerine. Draw labelled sketches and identify giving reasons. Submit the slides for valuation.

2. Identify, draw sketches and write notes on the given habit

3. Identify draw sketches and write notes on the given slides

Head of the Department

Dr. Sr. Leema Rose

Course Instructor

Dr. A. Anami Augustus Arul

Dr. Bojaxa A Rosy

Department : Botany
Class : II B.Sc. Zoology
Title of the Course : ELECTIVE COURSE I: ALLIED BOTANY -I
Semester : III
Course Code : BU233EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU231EC1	3	1	–	–	3	4	**60**	**25**	**75**	**100**

Learning Objectives:

1. To study morphological and anatomical adaptations of plants of various habitats.
2. To demonstrate techniques and experiments in plant tissue culture, plant physiology and biochemistry

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	increase the awareness and appreciation of human friendlyalgae and their economic importance.	**K3**
2	develop an understanding of microbes and fungi andappreciate their adaptive strategies	**K2**
3	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K2**
4	compare the structure and function of cells and explain thedevelopment of cells.	**K4**
5	understand the core concepts and fundamentals of plantbiotechnology and genetic engineering.	**K2**

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

Unit	Module	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	1	General characters of algae	1	2	K2(U)	Inquiry based Approach - Lecture with visual aid PPT, **C**onceptual demonstration	Participative Learning - Quiz, Concept Mapping.	Self prepared videos.	Formative Quiz using Google Forms, Written Assignment
	2	Structure, reproduction and life cycle of *Anabaena*	2		K1(R)	Integrative teaching - Lecture with chalk and talk, photographs	Collaborative Learning – Group Discussion	Interactive photographs and E-content – MS Word	Formative Assessment and Group discussion,
	3	Structure and reproduction of *Sargassum*	2		K1(R)	Blended Teaching - Lecture with visualization of specimen, Concept-based discussion	Experimental Learning - Hands-On demonstration on sectioning of reproductive organs	Power Point with YouTube videos	Slip test, Group discussion, Diagram evaluation
	4	Life cycle of *Sargassum*	2		K1(R)	Constructivist Learning – L:ive	Collaborative Learning -	YouTube Videos–	Class test, preparation of

				1		specimen, Visual images, Gamification	Flow chart, assignment	Animation-based concepts,	questions, Memory games
	5	Economic importance of algae.	2		K3 (Ap)	Flipped classroom	Participative Learning - Peer Learning	Interactive PPT	Open Book test, Exhibit the algal products
II	1	General characters of fungi, structure, reproduction and life cycle of *Penicillium*	2	1	K2 (U)	Integrative teaching - Lecture using Chalk & board	Participative learning- Interactive classroom games	E- content (MS word)	Simple definitions with Diagrammatic representation
	2	Structure, reproduction and life cycle of *Agaricus* and economic importance of fungi.	2		K1 (R)	Blended Learning - Lecture using Videos.	Collaborative learning- Hands-On Demonstration , Charts and Models, Field visit	Interactive E-book, PPT	Seminar Presentation, Identification of specimen, Diagram evaluation
	3	Bacteria - general characters,	1		K1 (R)	Integrative teaching - Lecture with chalk and black board	Collaborative Learning, Concept	E- content (MS word)	Simple definitions, MCQ, Recall steps
	4	Structure and reproduction of	2		K3 (Ap)	Brainstorming, Lecture using	Participative learning-	Lecture, Google	Flow chart, Open book test

		Escherichia coli and economic importance of bacteria.		2		Chalk and board	Interactive classroom games	slides, notes	
	5	Virus – general characters, structure of TMV, structure of bacteriophage	2		K3 (Ap)	Inquiry Based Approach, PPT, Animated Videos	Peer Learning	PPT, YouTube videos, notes	Chart preparation, CIA
III	1	General characters of Bryophytes,	1		K1 (R)	Integrative teaching - Lecture using Chalk & Board,	Collaborative Learning	Discussion forums Notes/photographs.	Slip test and presentation
	2	Structure and life cycle of *Funaria*.	2	1	K2 (U)	Blended Learning, KWL	Experiential Learning- Demonstration of sectioning	Video lecture, simulation tool, interactive notes,	Conceptual quiz, Group presentation,
	3	General characters of Pteridophytes,	1		K1 (R)	Flipped Classroom, Mind Map,	ParticipativeLearning- Charts and models,	Power Point with graphical representations of general characters.	Written Assignment, open book test
	4	Structure and life cycle of *Lycopodium*.	2	1	K2 (U)	Integrative teaching- Lecture with	Learning, Peer Teaching.	You tube Videos– Animation-	Preparation of question bank

						Visual Aids such as PPT		based concepts,	by students
	5	General characters of Gymnosperms, Structure and life cycle of *Cycas*.	3	1	K1 (R)	Lecture using charts, posters and photographs	Using visual images and models.	Online Tutorials and Notes	Open Book Exam
IV	1	Prokaryotic and Eukaryotic cell- structure and organization	1	1	K4 (An)	Integrative teaching- Lecture, PPT, Permanent Slides	Collaboratite learning- Panel Discussions	Self prepared videos, interactive PPT.	Slip test
	2	Ultra structure and function of chloroplast,	2		K4 (An)	Inquiry based approach Lecture with illustration	Participative learning- Interactive classroom games	Video Lecture, Interactive Notes,	Assignments and seminar presentation
	3	Ultra structure and function of mitochondria	2	1	K4 (An)	Inquiry based approach- Lecture with illustration	Concept mapping	Iinteractive E book	Assignments and seminar presentation
	4	Ultra structure and function of nucleus	2		K4 (An)	Flipped classroom- chalk and talk Lecture method,	Participative Learning- Charts and models,	Self prepared videos, interactive	Assignments and seminar presentation

						models.	Demonstrative approach	PPT.	
	5	Cell division - mitosis and meiosis	2	1	K4 (An)	Reflective Thinking- Lecture, PPT, permanent slide, plant specimen	Experimental Learning- Demonstration of mitosis meiosis	Self prepared videos, interactive PPT.	Assignments and seminar presentation
V	1	Mendelism - Law of dominance, Law of segregation, Incompletedominance. Law of independent assortment.	2	1	K4 (An)	Integrative teaching- Lecture using Chalk & Board	Collaborative Learning, Concept Mapping	Online Tutorials and Notes:	Open book test
	2	Monohybrid and dihybrid	2		K4 (An)	Reflective Thinking - Lecture using Chalk and board, posters.	Experimental Learning- Analyze problem solution	Interactive E content	Album preparation
	3	Cross - Test cross - Back cross.	1	2	K4 (An)	Integrative teaching- Lecture with Concept-based discussion.	Collaborative Learning, - Memory game	PowerPoint and You tube videos, *Video Lectures,* Simulations, Notes/Slides.	Written Assignment
	4	Plant tissue culture - In vitro culture methods.	2		K3 (Ap)	Lecture with Visual Aids such as PPT, photographs	Experiential Learning- Demonstration of plant tissue	You tube Videos– Animation-based concepts	Formative Quiz using Google Forms,

							culture		
	5	Plant tissue culture and its application in biotechnology.	2		K3 (Ap)	Integrative teaching- Lecture using chalk and board	Experiential Learning- Exposure to lecture by experts	Online Tutorials and Notes	Slip test and CIA

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

Activities (Em / En /SD): S**eminar presentation and assignments**

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/**Environment Sustainability**/ Gender Equity): - Environment Sustainability activities related to Cross Cutting Issues:- **Preparation of herbarium (algae).**

Sample questions

Part A (1 mark)

21. Anabaena is often found in symbiotic association with: **(K3-Ap, CO-1)**

a) Fungi b) Ferns c) Azolla d) Algae

2. Assertion (A): Penicillin production by Penicillium illustrates amensalism **(K2-U, CO-2)**
Reason (R): The fungus remains unaffected by penicillin, which kills nearby bacteria.

a) A & R are true, and R explains A
b) A & R are true, but R does not explain A
c) A is true, R is false
d) A & R are false

3, Which plant has the largest sperm cells in the plant kingdom **(K2-U, CO-3)**

a) Pinus
b) Mango
c) Sunflower
d) Cycas.

4. Meiosis converts a diploid germ cell (2n) into four genetically unique haploid gamete True or False **(K4-An, CO-4)**
5. Who is the father of genetics _____ **(K1-R, CO-5)**

Part B (6 marks)

1. Construct the general characters of algae. **(K3-Ap, CO-1)**

22. Discuss the structure of bacteriophage **(K2-U, CO-2)**
23. Describe the general characters of bryophytes. **(K2-U, CO-3)**
24. Compare Prokaryotic and Eukaryotic cell. **(K4-An, CO-4)**
25. Tabulate monohybrid cross. **(K1-R, CO-5)**

Part C (9 marks)

1. interpret the structure and reproduction in Sargassum, highlighting its life cycle. **(K3-Ap, CO-1)**
2.Describe the structure and general characters, structure of TMV **(K2-U, CO-2)**
3.Summarize lifecycle of lycopodium. **(K2-U, CO-3)**
4.Categorize the functions of mitochondria **(K4-An, CO-4)**
5.Demonstrate Plant tissue culture. **(K1-R, CO-5)**

Head of the Department **Course Instructor**

Dr. Sr. Leema Rose **Dr. A.R. Florance**
Dr. J. Albino Wins

Department : Botany
Class : II B.Sc. Zoology
Title of the Course : ELECTIVE LAB COURSE III: ALLIED BOTANY PRACTICAL

Course Code : BU233EP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU233EP1	-	-	2	–	2	2	**30**	**25**	**75**	**100**

Learning Outcomes:

1. To enhance information on the identification of each taxonomical group by developing the skill-based detection of the morphology and microstructure of microorganisms, algae, fungi, bryophytes, pteridophytes, gymnosperms and angiosperms.

2. To understand the laws of inheritance, genetic basis of loci and alleles.

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	to study the internal organization of algae and fungi.	**K1 (R)**
2	develop critical understanding on morphology, anatomy and reproduction of Bryophytes, Pteridophytes and Gymnosperms.	**K2(U)**
3	understand the fundamental concepts of plant anatomy and embryology	**K2(U)**
4	to analyze the classical taxonomy with reference to different parameters.	**K3(Ap)**
5	to compare the effect of various physical factors on photosynthesis.	**K4(An)**

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

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1.	Make suitable micro preparation of *Anabaena*	2	1	K4(An)	Reflective Thinking, lecture method	Experimental learning - Demonstration of experiments	O Lab	Evaluation of slides, observation notes and diagrams
2.	Make suitable micro preparation of *Sargassum* - Stipe, Leaf	1		K4(An)	Flipped Classroom, Stimulation based approach	Experiential Learning - Using live specimen	Google Classroom	Evaluation of slides, observation notes and diagrams
3.	Make suitable micro preparation of *Penicillium*	1	1	K4(An)	Reflective Thinking, Lecture with illustration	Experiential Learning - Using live specimen, Preparing slides	E content - external Links	Evaluation of slides, observation notes and diagrams
4.	Make suitable micro preparation of Agaricus	2		K4(An)	Integrative Teaching, Simulation Based Approach	Experiential Learning- Hands-On Demonstration	Youtube Videos	Evaluation of slides, observation notes and diagrams

5.	Structure of Bacteria	1		K4(An)	Inquiry based approach	Experiential Learning- Slide Preparation, Live specimen	Youtube Videos	Evaluation of slides, Observation notes and diagrams
6.	Make suitable micro preparation of *Funaria* – Stem	2	1	K2(U)	Reflective approach	Experiential Learning- Observation of Permanent Slides	Self Prepared Videos	Homework - Diagrams, Evaluation of slides
7.	Make suitable micro preparation of *Funaria* – Archegonial cluster, Antheridial cluster, Sporophyte L.S	2		K2(U)	Integrative approach	Experiential Learning- Observation of Permanent Slides	Youtube Videos	Homework - Diagrams, Evaluation of slides
8.	Make suitable micro preparation of *Lycopodium* – Stem, Cone	2		K2(U)	Integrative approach	Experiential Learning- Observation of Permanent Slides	Youtube Videos	Homework - Diagrams, Evaluation of slides
9.	Make suitable micro preparation of	2	1	K2(U)	Reflective Thinking,	Experiential Learning-	Interactive PPT	Evaluation of slides,

	Cycas – Leaflet, T.S Microsporophyll, T.S. of Megasporophyll, Ovule L.S				Flipped Classroom	Observation of Permanent Slides		Diagram Correction
10.	Micro photographs of the cell organelles ultra structure – Chloroplast, Mitochondria, Nucleus,	2		K2(U)	KWL, Hands on Training sessions.	Experiential Learning- Observation of Permanent Slides	Youtube Videos	Evaluation of slides, Diagram Correction
11.	Micro photographs of the cell organelles ultra structure – Mitosis and Meiosis	2		K2(U)	Lectures with Illustration, Brain Storming	Experiential Learning- Observation of Permanent Slides	Econtent with GAMMA PPT	Evaluation of slides, Diagram Correction
12.	Simple Genetics Problem - Monohybrid Cross	2	1	K2(U)	Problem Solving - Lecture with illustrations	Experiential Learning- Solving genetics problem, Puzzles	O lab	Evaluation of genetics problem

13.	Simple Genetics Problem - Dihybrid Cross	2		K2(U)	Problem Solving - Lecture with illustrations	Experiential Learning- Solving genetics problem, Puzzles	O Lab	Evaluation of genetics problem
14.	Simple Genetics Problem - Gene Interaction	1		K4(An)	Problem Solving - Lecture with illustrations	Experiential Learning- Solving genetics problem, Puzzles	O-Lab	Evaluation of genetics problem
15.	Biotechnology Spotters - Hot Air Oven and Laminar Air	1		K1(R)	Demonstrative approach	Participative learning- Exhit of spotters	Interactive PPT	Evaluation of diagrams
16.	Biotechnology Spotters - Flow Chamber and Autoclave	2		K1(R)	Reflective Thinking, Inquiry Based Approach	Participative learning- Exhit of spotters	Econtent with GAMMA PPT	Evaluation of diagrams

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

Activities (Em / En /SD): **Hands on Training on Slide Preparation, Sectioning, mounting, Microscopic Analysis**

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

Activities related to Cross Cutting Issues: **Exhibit of Algae**

Sample Questions

1. Make a suitable micro preparation of given specimen.. Identify, giving reasons, draw diagrams and submit the prepared slide for valuation. (2 X 12 = 24)
2. Solve the monohybrid genetic problems (1 X 5 =5)
3. Solve the dihybrid genetic problems (1 X 10 = 10)
4. Identify, draw and write notes of the specimen. (6 X 6 = 36)

Head of the Department **Course Instructor**

Dr.Sr.P.Leema Rose **Dr.J.Albino Wins & Dr.A.R.Florence**

Department : **Botany**

Class : **II B.Sc. Botany**

Title of the Course : **SKILL ENHANCEMENT COURSE – SEC II ENTREPRENEURIAL OPPORTUNITIES IN BOTANY**

Semester : **III**

Course Code : **BU233SE1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU233SE1	2	-	-	-	2	2	30	25	75	100

Learning Objectives:

1. To foster student's comprehension of entrepreneurial opportunities within Botany, including ventures utilizing medicinal plants, biotechniques, and marketing bioproducts.
2. To cultivate a mindset among students to initiate their own ventures as a means of income generation and professional empowerment.

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	explain the concept of entrepreneurial opportunities in Botany.	K1
2	relate to how various fields of botany could be understood with an entrepreneurial approach.	K2
3	make use of the knowledge gained to start new venture with the help of government agencies	K3
4	decipher effective ways of making vale added products from coconut, banana, and jack fruit	K4
5	develop strategies to cultivate algae and ornamental plants	K5

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	Module (Minimum 5 to Maximum 10 modules are permitted)	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	1	Introduction to entrepreneurship- scope	1	1	K3 (Ap)	Inquiry-Based Learning, Lecture with Visual Aids	Quiz, Concept Mapping.	Video Lectures, Simulations, Notes/Slides.	Formative Quiz using Google Forms
	2	Identification of new ventures using plant resources	1		K3 (Ap)	Flipped Classroom, Mind Map, Stimulation based approach	Problem solving methodologies- group discussion	Interactive E content - Word	Written Assignment
	3	General concept about the Govt. formalities, rules & regulation	1		K3(Ap)	Reflective Thinking, Lecture with illustration	Participative Learning- Debate, Role play	E content (word and ppt)	group discussion
	4	Role of funding agencies – NABARD,	1		K3(Ap)	Integrative Teaching,	Collaborative Learning -	Conceptual clarity in	Evaluate by short notes,

						Simulation Based Approach	Case Study Analysis of NABARD	funding agencies	slip test
	5	Rural Banking and DIC	1		K3 (Ap)	Reflective Thinking, Lecture using PPT, Chalk and board	Participative learning- Brain Storming, Assignment	Online Tutorials and Notes	Home work
II	1	Value Addition of Coconut: Production and value addition in Coconut; Coconut honey	1	1	K4 (An)	Cooperative learning - Lecture with Power point preparation	Experimental learning- preparation of products from coconut	Video Lecture, Interactive E content	Problem-Solving Assignments, Open Book Exam
	2	White meat	1		K4 (An)	Conceptual Demonstration	Experimental learning - Collaborative Learning	Self prepared videos, interactive ppt.	Album preparation
	3	Desiccated coconut, Coconut flour	1		K4 (An)	Brainstorming- Lecture with board and chalk	Experimental learning - Preparation of coconut products	You tube videos	Team Work Analysis and Interpretation, Slip Test.
	4	Coconut milk, Coconut chips	1		K4 (An)	Blended learning- Performance based learning	Experimental learning - Hand on demonstration (coconut chips)	Video Lecture, Interactive Notes.	Panel discussion

	5	Value added products from Coconut Shell	1		K4 (An)	Lecture method- Lecture with board and chalk	Experimental learning - Hands on training on Products from coconut shell preparation	Self prepared videos, interactive ppt.	Formative Quiz using Google Forms, CIA
III	1	Value Addition of Banana: Production and value addition in Banana; Banana flour	1	1	K4 (An)	Integrative Teaching, - Lecture, PPT,	Collaborative Learning- Panel Discussions	Self prepared videos, interactive ppt.	Flow chart analysis, Quizes
	2	Banana puree	1		K4 (An)	Constructivist Learning – Board and chalk method	Experimental learning - Demonstrating for the preparation of Banana puree	Video Lecture, Interactive E content	Seminar presentation and assignments.
	3	Banana RTS Juice	1		K4 (An)	Integrative Teaching,- Lecture with board and chalk	Experimental learning - Banana RTS Juice preparation	You tube videos of preparation based concepts	Team Work Analysis and Interpretation, Slip Test.
	4	Banana Wine	1		K4 (An)	Performance based learning	Experimental learning -	E-content with MS	Slip Test, Oral Presentation,

						using PPT	Hand on demonstration (Banana Wine)	Powerpoint	MCQs.
	5	Banana biscuits, and Banana fibre	1		K4 (An)	Integrative Teaching, - Lecture with board and chalk	Experimental learning - Product preparation from banana	Self prepared videos, interactive ppt.	Open book test, Question-Answer Session
IV	1	Value Addition of Jackfruit: Production and value addition of Jack fruit; Dried jack	1	1	K4 (An)	Inquiry-Based Learning, Lecture with Visual Aids and PPT	Collaborative Learning	Self prepared videos, interactive ppt.	Quizzes, Just a Minute, Flow Chart Analysis
	2	Jack rind pickle	1		K4 (An)	Flipped Classroom, Stimulation based approach	Experimental learning - Demonstrating of jack rind pickle preparation	Video Lecture, Interactive Notes	Slip Test, Oral Presentation, MCQs.
	3	Jack fruit halwa	1		K4 (An)	Reflective Thinking, Lecture with PPT	Experimental learning - Jack fruit halwa preparation	E-content with MS Word, Google Classroom	Formative Quiz using Google Forms,
	4	Jack fruit toffee	1		K4 (An)	Integrative Teaching,	Experimental learning -	Video Lecture, Interactive	Team Work Analysis and

						Simulation Based Approach	Hand on demonstration (Jack fruit toffee)	Notes.	Interpretation, Slip Test.
	5	Jack chips	1		K4 (An)	Inquiry-Based teaching, Lecture with Board and clalk	Experimental learning - Presentation of jack chips	Lecture, Interactive E content (MS Word).	Slip test
V	1	*Spirulina* cultivation	1	1	K5(E)	**c**onceptual Demonstration Lecture with visual Aids such as PPT,	Experimental learning - Concept Mapping.	Self prepared videos.	Formative Quiz using Google Forms, Written Assignment
	2	*Azolla* cultivation	1		K5(E)	Lecture with chalk and talk, photographs	Experimental learning - Hands-On demonstration on Azolla cultivation	Interactive photographs and Notes	Formative Assessment and Group discussion,
	3	Elite and ornamental plants in vitro propagation	1		K5(E)	Concept-based discussion	Experimental learning - Hands-On demonstration of invitro propogation	Power Point with YouTube videos	Slip test, Group discussion
	4	Selection of superior biotypes of orchids	1		K5(E)	Constructivist Learning-	Collaborative Learning, -	PowerPoint and You tube	Class test, preparation of

						Lecture with chalk and talk	Memory game	videos, Video Lectures, Simulations, Notes/Slides.	question bank
	5	Selection of superior biotypes of Syngonium.	1		K5(E)	Lecture using PPT, Chalk and board	Peer Learning, DIY Activity,	Interactive ppt	Open Book Test, CIA

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

Activities (Em / En /SD): **preparation of value addition products from banana**

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

Sample questions

Part A (2 marks)

1. What does NABARD stand for? **(K3-Ap, CO-1)**
2. Name one edible value-added product made from coconut meat **(K4-An, CO-2)**
3. Name the liquid banana product used in beverages. **(K4-An, CO-3)**
4. What part of jackfruit is used to prepare pickle? **(K4-An, CO-4)**
5. Name one aquatic fern used as green manure **(K5-E, CO-5)**

Part B (4 marks)

26. Discuss the scope of entrepreneurship in rural areas with examples of ventures using plant resources. **(K1-R, CO-1)**
27. Describe the process of making desiccated coconut. **(K4-An, CO-2)**
28. Describe the process of making Ready-To-Serve (RTS) banana juice.. **(K4-An, CO-3)**
29. What is dried jack and how is it prepared? **(K4-An, CO-4)**
30. Explain the in vitro propagation method for orchids. **(K5-E, CO-5)**

Part C (9 marks)

20. Explain in detail the government formalities, rules, and regulations to be followed before starting a new enterprise.. (**K3-Ap, CO-1)**
21. Analyze the economic and nutritional advantages of value-added coconut products in rural entrepreneurship. **(K4-An, CO-2)**
22. Describe the value addition process of banana and its importance in rural entrepreneurship.. **(K4-An, CO-3)**
23. Explain the methods of preparation, preservation, and market potential of jackfruit halwa, toffee, and chips. **(K4-An, CO-4)**
24. Explain in detail the cultivation techniques, nutritional value, and commercial importance of Azolla. **(K5-E, CO-5)**

Head of the Department

Dr. Sr. Leema Rose

Course Instructor

Dr. A.R. Florance

Department : Botany
Class : III B.Sc., Botany
Title of the Course : Core Course V: Plant Morphology, Taxonomy and Economic Botany
Semester : V
Course Code : BU235CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU233CC2	4	1	–	–	4	5	**75**	**25**	**75**	**100**

Learning Objectives:

1. To impart knowledge on the vegetative and floral morphology of flowering plants and familiarize students with plant classification systems.
2. To enable students to identify key floral characteristics of selected plant families and understand their economic significance.

Course Outcomes

COs	Upon completion of this course, students will be able to:	
1	recall the morphological features of vegetative and floral structures in flowering plants, including modifications of roots, stems, leaves, inflorescences, and fruits.	**K1(R)**
2	explain the principles of different angiosperm classification systems, botanical nomenclature, and herbarium techniques for plant identification and preservation.	**K2(U)**
3	identify and differentiate selected plant families based on the different system of classification and recognize their key morphological characteristics.	**K3(Ap)**
4	analyze the distinguishing floral features of selected plant families and their taxonomic significance in classification.	**K4(An)**
5	assess the economic importance of plants from the prescribed families concerning their role in food, medicine, timber, dyes, and other commercial uses.	**K5(E)**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	Introduction to systematic: Botanical nomenclature	1	1	K2(U)	Inquiry-Based Learning	Experimental Learning - simulations		Slip test
	2	Principles and rules of International Code of Nomenclature (ICN); Ranks and names; Typification, author citation, valid publication, rejection of names, principle of priority and its limitations. formula.	2		K2(U)	Lecturing	Participative Learning - Think-pair-share	Interactive PPT	Conceptual Quiz, Group Presentation
	3	Morphology of root, stem and leaves.	3	1	K1(R)	Active Learning	Experiential Learning – Teaching with live specimens	Live specimen	Identification of specimens, Quizzes, Open book test, MCQ
	4	Inflorescences— racemose, cymose, and special types.	3		K1(R)	Active Learning	Experiential Learning – Teaching	Live specimen	Identification of specimens, Quizzes, Open

							with live specimens		book test, MCQ
	5	Fruit – types, floral diagram and floral	3	1	K1(R)	Active Learning	Experiential Learning – Teaching with live specimens	Live specimen	Identification of specimens, Quizzes, Open book test, MCQ
II	1	Systems of Angiosperm classification – Detailed study on Sexual system-Carolus Linnaeus,	3	1	K3(Ap)	Gamification	Experiential Learning – Game-based scenarios, simulations	E-content with MS Word, Video display	Flow Chart Analysis, Group Discussion, Memory game
	2	Natural System – Bentham and Hooker, Phylogenetic System - APG Classification (2016).	3		K3(Ap)	Gamification	Experiential Learning – Game-based scenarios, simulations	E-content with MS Word, Video display	Flow Chart Analysis, Group Discussion, Memory game
	3	Herbarium technique– collection, pressing, drying, mounting and preservation of plant specimens	2	1	K2(U)	Experiential Learning	Experimental Learning – Field visit, Hand on training	E-content with MS Word, Video display	Flow Chart Analysis, Group Discussion, Memory game
	4	Virtual herbarium	2	1	K2(U)	Lecture	Participative Learning – Concept explanation	E-content with MS Word, Video display	Flow Chart Analysis, Group Discussion, Memory game

	5	Taxonomic literature: Floras, monographs, revisions, journals and Hortus malabarica	2		K2(U)	Flipped Classroom	Experimental Learning – Q&A with instructor	E-content with MS Word, Video display	Flow Chart Analysis, Group Discussion, Memory game
III	1	Study of the following families based on the natural system and their economic importance: Annonaceae	2	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y	Peer review, Learning circles assessment
	2	Study of the following families based on the natural system and their economic importance: Nymphaeaceae	2		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	3	Study of the following families based on the natural system and their economic importance:	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback,	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment

		Rutaceae					activities involving pairs and small groups		
	4	Study of the following families based on the natural system and their economic importance: Caesalpinaceae,	1	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	5	Study of the following families based on the natural system and their economic importance: Anacardiaceae	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	6	Study of the following families based on the natural system and their economic importance: Cucurbitaceae.	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment

							involving pairs and small groups		
	7	Study of the following families based on the natural system and their economic importance: Apocynaceae.	2	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	8	Study of the following families based on the natural system and their economic importance: Asclepiadaceae.	2		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
IV	1	Study of the following families based on the natural system and their economic importance: Convolvulaceae.	2	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving	https://books.google.co.in/books/about/PLANT_TAXONOMY_2E.html?id=Roi0lwSXFnUC&redir_esc=y	Peer review, Learning circles assessment

							pairs and small groups		
	2	Study of the following families based on the natural system and their economic importance: Acanthaceae.	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	3	Study of the following families based on the natural system and their economic importance: Lamiaceae.	2		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	4	Study of the following families based on the natural system and their economic importance: Euphorbiaceae.	2	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment

							small groups		
	5	Study of the following families based on the natural system and their economic importance: Amaranthaceae	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	6	Study of the following families based on the natural system and their economic importance: Liliaceae.	1		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
	7	Study of the following families based on the natural system and their economic importance Arecaceae	1	1	K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment

	8	Study of the following families based on the natural system and their economic importance: Poaceae	2		K4(An)	Collaborative Learning	Participative Learning – Group discussions, peer feedback, activities involving pairs and small groups	PPT, Live specimen, Exhibition	Peer review, Learning circles assessment
V	1	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Cereals - Paddy, Wheat.	2	1	K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	. https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y 5.	Field report, Report of discussion
	2	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Pulses - Green gram and Bengal gram	2		K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y 5.	Field report, Report of discussion

	3	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Tuber crops -Tapioca and Potato.	2		K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	https://books.google.co.in/books/about/Economic_Botany.html?id=2ahsDQAAQBAJ&redir_esc=y 5.	Field report, Report of discussion
	4	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Spices – Pepper and Cardamom.	1	1	K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	Interactive PPT, Live specimen	Field report, Report of discussion
	5	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Beverages – Tea and Coffee.	1		K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	Interactive PPT, Live specimen	Field report, Report of discussion
	6	Study of the following groups of plants with special reference to	1		K5(E)	Experiential Learning	Experimental Learning - Field trips,	Interactive PPT, Live specimen	Field report, Report of discussion

		their botanical name, family, morphology of useful part, economic products and uses: Oil yielding plants – Coconut and Groundnut.					simulations Participative Learning – discussion of experiences		
	7	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Fibre yielding plants - Cotton, Coir; Timber yielding plants - Teak, Rose wood;	1	1	K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	Interactive PPT, Live specimen	Field report, Report of discussion
	8	Study of the following groups of plants with special reference to their botanical name, family, morphology of useful part, economic products and uses: Latex yielding plants - Para rubber and Sapota;	1		K5(E)	Experiential Learning	Experimental Learning - Field trips, simulations Participative Learning – discussion of experiences	Interactive PPT, Live specimen	Field report, Report of discussion
	9	Study of the following groups of plants with special reference to	1		K5(E)	Experiential Learning	Experimental Learning - Field trips,	Interactive PPT, Live specimen	Field report, Report of discussion

		their botanical name, family, morphology of useful part, economic products and uses: Ornamental plants - Rose, Orchids.					simulations Participative Learning – discussion of experiences		

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

Activities (Em / En /SD):Herbarium Preparation

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

Activities related to Cross Cutting Issues: **Exhibition of economic important plants/Herbarium preparation**

Assignment: **Morphological and floral characters of families prescribed in the syllabus**

Sample Questions

Part A (1 mark)

1. The flat, expanded part of a leaf is known as the: **(K2-U, CO-1)**

a. Petiole b. Blade c. Midrib d. Vein

2. Which of the following is a commonly used method for drying plant specimens in a herbarium? **(K4-An, CO-2)**

a. Pressing between heavy books
b. Hanging the specimen upside down
c. Placing in a microwave oven
d. Immersing in water

3. Which of the following plants belongs to the Anacardiaceae family? **(K1-R, CO-4)**

a. Sunflower b. Rose c. Mango d. Lavender

4. The Amaranthaceae family is characterized by the presence of edible seeds known as: **(K4-An, CO-4)**

a. Nuts b. Grains c. Legumes d. Drupes

5. What is the morphologically useful part of cardamom **(K1-R, CO-5)**

Part B (6 marks)

1. What is the correct format for writing scientific plant names according to the ICN? (**K1-R, CO-2)**
2. What is the purpose of e-flora? (**K2-U, CO-2)**
3. Analyse the distinctive characteristic of the leaves in the Rutaceae family? (**K4-An, CO-4)**
4. Analyse the distinctive feature of the flowers in the Lamiaceae family? (**K4-An, CO-4)**
5. Write short notes on cotton and coir based on its economic importance? (**K1-R, CO-5)**

Part C (12 marks)

1. Explain the characteristics and examples of racemose inflorescence. (**K1-R, CO-1)**
2. Explain the functions of herbarium specimens in documenting plant diversity and distribution. (**K2-U, CO-2)**
3. Provide an overview of the Cucurbitaceae family, including its botanical characteristics, distribution, and economic importance. (**K4-An, CO-4)**
4. Compare and contrast the floral characters of Amaranthaceae and Euphorbiaceae (**K3-Ap, CO-4)**
5. Describe the botanical name, family, morphology of useful part, economic products of timber yielding and latex yielding plant studied by you (**K2-U, CO-5)**

Head of the Department

Dr.Sr.P.Leema Rose

Course Instructor

Dr.A. Anami Augustus Arul

Dr. Sr. P. Leema Rose

Department : Botany
Class : III B.Sc Botany
Title of the Course : Core Course VI: Cell Biology, Plant Anatomy and Embryology
Semester : V
Course Code : BU235CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU235CC2	4	1	–	–	4	5	**75**	**25**	**75**	**100**

Learning Objectives:

1. To understand the ultrastructure of prokaryotic and eukaryotic cells, including their organelles, cell cycle, and modes of cell division.
2. To explain the organization of plant tissues, primary and secondary growth, and reproductive structures, including embryological processes like megasporogenesis, double fertilization, and endosperm formation.

Course Outcomes

COs	Upon completion of this course, students will be able to:	CL
CO-1	explain the ultrastructure of prokaryotic and eukaryotic cells, including the structure and function of the cell wall, plasma membrane, and cell organelles.	**K1 (R)**
CO-2	illustrate the process of cell cycle, mitosis, and meiosis, and analyze their significance in growth and reproduction.	**K2 (U)**
CO-3	differentiate between various plant tissues and	**K3 (Ap)**

	interpret apical organization theories, including the Tunica-Corpus and Histogen theories.	
CO-4	compare the primary and secondary structures of dicot and monocot roots and stems, leaves and examine anomalous secondary growth in plants	**K4 (An)**
CO-5	assess the process of megasporogenesis and megagametogenesis, and evaluate the role of double fertilization, triple fusion, and types of endosperm in seed development.	**K5 (E)**

Teaching plan

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

Unit	Module (Minimum 5 to Maximum 10 modules are permitted)	Topic	Teaching Hours	Assessment hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	Ultra structure of Prokaryotic cell and Eukaryotic cell	2	1	K2 (U)	Lecture using Chalk & talk, PPT and videos, Introductory session, Mind mapping, Peer review	Mind mapping, Peer review	*Video Lectures, PPT,* Notes, Slides,	Simple definitions, Diagrammatic representation, MCQ
	2	Cell wall- Structure, and functions of cell wall	2		K1 (R)	Lecture using Chalk & talk, PPT, Videos	Group Discussion, Describing visual images	PPT, Videos Notes,	Assignment, Short summary, short test
	3	Plasma membrane - structure (fluid mosaic model) and function.	2	1	K2 (U)	Lecture with PPT, Animated Videos, diagrams	Brainstorming, Interaction in the classroom	PowerPoint, Videos	Simple definitions, MCQ, Recall steps
	4	Cell cycle,	2		K2 (U)	Brainstorming, Lecture using PPT, Chalk	Assignments, Using visual images	Lecture, Google slides, notes	Flow chart, Open book test

						and board			
	5	Cell division, Mitosis and Meiosis- their significance	4	1	K2 (U)	Inquiry Based Approach, PPT, Animated Videos, Permanent slides	Peer Learning, Group discussion	PPT, YouTube videos, notes	Chart preparation, MCQ,
II	1	Structure and function of Endoplasmic reticulum,	3	1	K2 (U)	Lecture using videos, PPT, Inquiry based approach.	Describing visual images **Mind mapping, Peer review**	PPT, YouTube videos, notes	MCQ, Oral questioning, Class test
	2	Ribosomes, Mitochondria,	3		K2 (U)	Lecture, PPT, Mind map Flipped classroom	Group Discussion, Describing visual images	YouTube videos , PPT, Notes, Slides,	Assignment, MCQ, short test, Recall steps
	3	Chloroplast, Nucleus	2	1	K2 (U)	Lecture, PPT, Chart,Animated Videos	Brainstorming, Peer Learning,	YouTube videos, PPT, Notes, Slides,	Simple definitions, MCQ,
	4	Chromosomes.	2	1	K2 (U)	Brainstorming, PPT, Videos	Assignments, Using visual images	PPT, Notes, Slides, YouTube videos	MCQ, Flow chart, Open book test
	5	Cell inclusions– starch grains, crystals-cystolyth and raphide.	2		K1 (R)	Lecture method, Permanent Slides, PPT	Group discussion, Mind mapping	YouTube videos, PPT, Notes, Slides,	Chart preparation, MCQ,
III	1	Tissues - Definition, types - Simple tissue	2	1	K1 (R)	Lecture using Chalk & Board	Collaborative Learning, Concept	*Video Lectures,* Simulations	Formative Quiz using Google Forms,

		system - parenchyma, collenchyma and sclerenchyma (fibers and sclereids).					Mapping	, Notes/Slides.	
	2	Complex tissue system - xylem and phloem.	3		K1 (R)	Lecture using PPT, Chalk and board	Learning, mindmap	Video Lecture, Simulation Tool, Interactive Notes,	Conceptual Quiz, Group Presentation,
	3	Meristem: definition, structure, function,. Apical organization and theories:Tunica-Corpus theory. Root apex: Histogen theory.	2	1	K1 (U)	Lecture with PPT, Concept-based discussion.	Concept mapping	PowerPoint with graphical representations of theory.	Written Assignment
	4	Epidermal tissue system, cuticle, epicuticular waxes, trichomes (uni-and multicellular, glandular and nonglandular, two examples of each)	2		K1 (R)	Lecture with Visual Aids such as PPT	Learning, Peer Teaching,	Youtube Videos– Animation-based concepts,	Evaluation through MCQs
	5	stomata and its types; Nodal anatomy types -	3	1	K1 (U)	Lecture using charts, posters and	Hands-On Demonstration in types of	Online Tutorials and Notes	Open Book Exam Questions

		unilacunar (*Justicia*), trilacunar (*Azadirachta*) and multilacunar (*Aralia*), Hydathodes and laticifers.				photographs	stomata.		
IV	1	Primary growth; Primary structure of dicot and monocot stem,	2	1	K2 (U)	Lecture, PPT, Permanent Slides , Chart, Drawing, Plant specimen	Mind mapping, Using visual images	PPT, YouTube videos, notes	MCQ, Oral questioning, Class test
	2	root and leaf.	3		K2 (U)	Inquiry based approach, PPT, Permanent slide, Plant specimen	Peer review, Group Discussion, Describing visual images	YouTube videos , PPT, Notes, Slides,	Assignment, MCQ, short test, Recall steps
	3	Secondary growth in stem and root – Formation of cambial ring, activity of cambial ring, secondary vascular tissue, formation of periderm, lenticels, dendrochronology, annual ring, Wood (heartwood and sapwood).	3	1	K2 (U)	Inquiry based approach, PPT, Permanent slide, Plant specimen	Brainstorming, Describing visual images	YouTube videos, PPT, Notes, Slides,	Simple definitions, MCQ,

	4	Anomalous secondary growth of stem- Boerhaavia	2	1	K1 (R)	Flipped classroom, Lecture method, Plant specimen, Permanent slide, PPT	Assignments, Using visual images, Peer Learning,	PPT, Notes, Slides, YouTube videos	MCQ, Flow chart, Open book test
	5	Dracaena	2		K2 (U)	Lecture, PPT, Permanent slide, Plant specimen	Group discussion, Mind Mapping, Describing visual images	YouTube videos, PPT, Notes, Slides,	Chart preparation, MCQ,
V	1	Structure of mature anther and ovule**,** types of ovules.	3	1	K2 (E)	Lecture using Chalk & Board, permanent slide	Collaborative Learning, Concept Mapping	Online Tutorials and Notes:	Formative Quiz using Google Forms
	2	Female gametophyte– megasporogenesis (monosporic, bisporic and tetrasporic) and megagametogenesis (*Polygonum* type in detail);	4		K2 (E)	Lecture using Chalk and board, posters.	Learning, mindmap	Interactive Notes,	Conceptual Quiz, Group Presentation,
	3	Double fertilization and triple fusion.	3	1	K2 (E)	Lecture with PPT, youtube videos, Concept-based discussion.	Concept mapping	PowerPoint and Youtube videos, *Video*	Written Assignment

								Lectures, Simulations, Notes/Slides.	
	4	Endosperm and its types-free nuclear, cellular, helobial. Endosperm haustoria.	3	1	K2 (E)	Lecture with Visual Aids such as PPT, photographs	Learning, Peer Teaching,	Online Tutorials and Notes	Evaluation through MCQs
	5	Apomixis and polyembryony	2		K2 (E)	Lecture using ppt, chalk and talk, videos	Peer Learning, DIY Activity	Youtube Videos– Animation-based concepts,	Open Book Exam Questions

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

Activities (Em / En /SD): **Hands on Training on sectioning plant specimens.**

Course Focusing on Cross Cutting Issues: Professional Ethics

Assignment: Primary structure of dicot and monocot stem, (Last date to submit – 10-09-2025)

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. The fluid mosaic model explains the structure of which cellular component? **(K1-R, CO-1)**

a) Cell wall b) Nucleus c) Plasma membrane d) Ribosome

2. Which organelle is known as the 'powerhouse of the cell'? **(K1-R, CO-1)**

a) Nucleus b) Ribosome c) Endoplasmic reticulum d) Mitochondria

3. The cambium which is found between the xylem and phloem is called fasicular or intrafasicular. State true or false **(K2- U, CO-3).**

4. Annual rings in woody plants are formed due to _____. **(K2-U, CO-4)**

a) Primary growth b) Cell elongation

c) Periodic activity of cambium d) Activity of xylem parenchyma

5. The point of attachment between ovule body and funicle is called _____. **(K2- U, CO-5).**

Part B (6 marks)

1. Describe the structure of the plasma membrane based on the fluid mosaic model. **(K1-R, CO-1)**
2. Write a short note on the functions of ribosomes. **(K2- U, CO-1)**
3. Determine the organization Tunica-Corpus theory**(K4- An, CO-3)**
4. Mention the role of cambium in the formation of annual rings. **(K2- U, CO-4)**
5. Distinguish the structure and types of ovules. **(K5- E, CO-5)**

Part C (12 marks)

1. Describe the ultrastructure of eukaryotic cells (**K1-R, CO-1)**
2. Explain the structure and functions of the following organelles: Endoplasmic reticulum, Mitochondria **(K2-U, CO-2)**
3. Describe the types of Complex tissue system - xylem and phloem with suitable diagram **(K4- An, CO-3)**
4. Explain the process of secondary growth in dicot stem. **(K2- U, CO-4)**
5. Determine the structure and organization of a typical embryo sac of angiosperm **(K2- U, CO-3)**

Head of the Department
Dr. Sr. Leema Rose

Course Instructors
Dr. Bojaxa A Rosy

Dr. A. R. Florence

Department : Botany
Class : III B. Sc Botany
Title of the Course : Core Lab Course V -Plant Morphology, Taxonomy and Economic Botany
Semester : V
Course Code : BU235CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU233CP1	1	-	2	-	2	3	45	25	75	100

Pre-requisites: Theoretical understanding of plant taxonomy as well as basic laboratory skills.

Learning Outcomes:

1. To understand the morphological modifications of plant organs, types of inflorescence, and economic importance of plants.

2. To develop practical skills in plant identification, herbarium preparation, and field-based botanical studies

Course Outcomes

On the successful completion of the course, students will able to:		
1.	explain the morphological modifications of roots, stems, and leaves, along with different types of inflorescence.	**K2**
2.	perform dissections and identify floral parts of selected plant families based on key diagnostic characteristics.	**K3**
3.	analyze and document plant specimens through herbarium preparation and maintain a field notebook	**K4**
4.	examine the economic importance of selected plants by studying their morphology, botanical names, and family classification.	**K4**
5.	assess plant diversity through field trips and critically evaluate plant specimens based on field observations.	**K5**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze**, K5-** Evaluate**, K6-**Create

Total Contact hours: 45 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Morphology of root, stem and leaf modification	3	1	K2	Experimental Learning	Experiential Learning: Identification	https://www.amazon.in/Practical-Taxonomy-Angiosperms-R-Sinha/dp/9380578210	Identification, Drawing the specimens
2	Types of inflorescence	3		K2	Experimental Learning	Experiential Learning: Identification		Identification, Drawing the specimens
3	Dissection, identification, observation of the floral parts of the plants belonging to the families included in the syllabus.	25	3	K3	Experimental Learning	Experiential Learning: Dissection and Identification		Dissection, Identification, Drawing the specimens
4	Preparation and submission of ten Herbarium sheets and field note book	3	1	K4	Experimental Learning	Experiential Learning: Hands on herbarium preparation	-	Submission of herbarium specimen
5	Study the products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family.	6		K4	Experimental Learning	Experiential Learning: Identification	https://www.kopykitab.com/Economic-Botany-By-Manoj-Kumar-Sharma-eBook.	Identification of economic important plants

6	Field trips to places for observation, study and collection of plants prescribed in the syllabus for1 to 2 days under the guidance of faculties	-		K5	Experimental Learning	Experiential Learning: Field trip	-	Submission of field note

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

Activities (Em / En /SD): **Hands on Training on herbarium preparation, dissection and identification of plant specimen to their family, identifying the economically important plant products.**

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

Environment Sustainability activities related to Cross Cutting Issues: **Field Visit, Herbarium Preparation**

Sample questions

1. Identify the given plant, describe it in technical terms. Draw labeled sketch of the twig, L.S. of flower, other floral parts including the floral diagram. Write the floral formula.
2. Identify the family of given plant, giving reasons.
3. Write the botanical name and family of the given specimen
4. Write the botanical name, family, and with neatly labeled diagram point out the economic/medicinal importance.

Head of the Department

Dr. Sr. Leema Rose

Course Instructor

Dr. A. Anami Augustus Arul, Dr. Sr. Leema Rose

Department : Botany
Class : III B.Sc. Botany
Title of the Course : CORE LAB COURSE V1 -CELL BIOLOGY, PLANT ANATOMY AND EMBRYOLOGY
Semester : V
Course Code : BU235CP2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU235CP2	-	-	2	-	2	2	30	25	75	100

Learning Objectives:

3. To understand the role of different components in generating pulses and stable signals.
4. To observe the frequency generation and stability of the oscillator circuits.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	explain the ultrastructure of cell organelles and cell inclusions by studying photomicrographs and permanent slides.	**K2**
2.	perform squash and smear techniques to identify different stages of mitosis using onion root tip cells.	**K3**
3.	examine simple and complex tissues, meristems, and secondary structures in dicot and monocot plants through sectioning and microscopic analysis.	**K4**
4.	differentiate between various types of ovules and endosperms using permanent slides and photomicrographs.	**K4**
5.	assess embryological structures by sectioning and dissecting anthers, ovules, and embryos to understand plant reproductive development.	**K5**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze**, K5-** Evaluate**, K6-**Create

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Study of photo micrographs of cell organelles mentioned in the theory. Observation of cell inclusions through permanent slides- starch grains, crystals- cystolyth and raphide. Identification of different stages of mitosis by using squash and smear techniques (acetocarmine)– onion root tip.	4	1	K2	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment, identification
2	Observation of Simple and complex (Primary and Secondary) tissues through permanent slides. Observation of Meristems–Shoot apex and Root apex through permanent slides	4	1	K2	**Demonstrative**	Brainstormin g		Model Exam, record diagram

3	Sectioning: Internal structure of young root, stem and leaf of dicot and monocot plant.	4	1	K1	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment
4	Sectioning: Secondary structure of dicot and monocot root.	4	1	K2	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment
5	Sectioning of Anomalous secondary growth in the stems of Boerhaavia and Dracaena.	5		K1	**Experimental learning**	Performance based learning		Record diagram, Plant section assessment
6	Sectioning mature anther- Datura Types of ovules- Anatropous, Orthotropous, Circinotropous, Amphitropous, Campylotropous (Permanent slides).Types of Endosperm - Nuclear, cellular and helobial(photograph) Dissection and display of any one stage of embryo in Tridax.	4	1		**Practoc**	Practicals		Record diagram, Anther section assessment, identification

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

Activities (Em / En /SD): Hands on Training on sectioning plant specimen

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

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Identify the given photo micrograph of a cell organelle. Draw and label the structure.
   (Eg: Mitochondria, Chloroplast, Golgi apparatus)

2. Identify the given permanent slide showing cell inclusion. Name the plant part and inclusion observed.
   (Eg: Raphide in Colocasia, Cystolith in Ficus)

3. Observe the slide of onion root tip stained with acetocarmine. Identify and label the stage of mitosis.
   (Eg: Prophase, Metaphase, Anaphase, Telophase)

Head of the Department

Dr. Sr. Leema Rose

Course Instructors

Dr. Bojaxa A Rosy

Dr. A. R. Florence

Department : **Botany**
Class : **III B.Sc Botany**
Title of the Course : **Bio-analytical Techniques**
Semester : **V**
Course Code : **BU235DE1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
CU233CC1	**3**	1	-	-	**3**	**4**	**75**	**25**	**75**	**100**

Learning Objectives:

1. To understand the principles, operation, and maintenance of laboratory tools and equipment.

2. To expose students to various field research methods, data analysis techniques, and modern equipment, fostering confidence to pursue research careers or entrepreneurial ventures.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	relate to the various biological techniques and its importance.	**K1**
2.	explain the principles of light microscopy, compound microscopy, fluorescence microscopy and electron microscopy.	**K2**
3.	apply suitable strategies in data collections and disseminating research findings	**K3**
4.	compare and contrast the significance of different types of chromatography techniques.	**K4**
5.	develop methodologies for extraction and analysis of biochemical compounds.	**K5**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyse; **K5** - Evaluate

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I	**Microscopy**								
	1	Principles of microscopy; light microscopy; compound microscopy.	2	3	K1(R) & K2(U)	Lecture with visual aids and models, Demonstration	Inquiry based learning, Live demonstration of concepts	Virtual lab simulations, Interactive ppt	Formative Quiz using Nearpod/ Quizizz/ Google Forms, slip test, Conceptual questions, CIA I
	2	Bright field microscope, dark field microscope, phase-contrast microscope.	2		K2(U)	Lecture with visual aids and models, Demonstration	Live demonstration of concepts	Virtual lab simulations	slip test, Conceptual questions, CIA I
	3	Fluorescence microscopy; transmission electron microscopy.	2		K4(An)	Lecture with visualization, Demonstration	Problem based learning, Concept mapping	Virtual labs, Interactive ppt	Quiz, Image labeling activity, short test, CIA I
	4	Scanning electron microscopy.	2			Lecture with visualization, Demonstration	Problem based learning, Concept mapping	Virtual labs, Interactive ppt	Quiz, Image labeling activity, Assignment, slip test, CIA I
	5	Microscopic measurements - micrometry. Microscopy drawing: Camera Lucida.	4		K3(A)	Visual learning using tools, Demonstration	Simulation based learning, Think-Pair-Share	Virtual lab simulations, Notes, Interactive ppt	Slip test, Quick quiz using Kahoot, Conceptual questions, CIA I
II	**Chromatographic Principles and Applications**								
	1	Principle; paper chromatography	2	3	K2(U) & K4(An)	Lecture with visual aids, Demonstration	Visual learning, Concept mapping, Hands-on experimentation	Interactive videos, tutorials and ppt	Formative Quiz using Quizizz, Image labeling activity, CIA I

	2	Thin Layer Chromatography (TLC).	2		K2(U) & K4(An)	Lecture with visual aids	Visual learning, Concept mapping	Interactive videos, and ppt	Short test, CIA I
	3	Column chromatography.	2		K2(U) & K3(Ap)	Lecture with visualization and demonstration	Simulation based learning, Think-Pair-Share	Virtual lab simulations, Interactive ppt	Conceptual quiz, Group activity, CIA I
	4	Gas chromatography - Mass spectrometry (GCMS).	3		K2(U) & K3(Ap)	Lecture with visual aids	Problem based learning, Visual learning	Video lectures, Interactive ppt	Slip test, Case study report, Conceptual questions, CIA I
	5	High Performance Liquid Chromatography (HPLC).	3		K2(U) & K3(Ap)	Visual learning, Flipped classroom	Blended learning	Interactive videos	Quick quiz using Kahoot, Case study analysis, CIA I
III	**Electrophoresis and pH Meter**								
	1	Basic principle and construction of pH meter.	2	3	K2(U) & K3(Ap)	Lecture with visualization and demonstration	Hands-on experimentation, Simulation based learning	Video lectures, Virtual lab simulations, Interactive ppt	Formative Quiz using Nearpod, Conceptual questions, CIA I
	2	Operation of pH meter.	2		K2(U) & K3(Ap)	Lecture with visualization and demonstration	Simulation based learning	Virtual lab simulations	Conceptual questions, CIA I
	3	Polyacrylamide gel electrophoresis (PAGE).	2		K2(U)	Lecture with visualization	Visual learning, Concept mapping		Slip test, Quick quiz using Socrative, CIA II
	4	Agarose Gel Electrophoresis.	2		K2(U)	Lecture with videos and ppt, Core conceptual approach	Visual learning, Concept mapping	Interactive videos, tutorials and ppt	Quiz, short test, Group activity, Conceptual questions, CIA II

	5	Separation of biological molecules using Polyacrylamide and Agarose Gel Electrophoresis.	4		K3(Ap)	Lecture with visual aids and models	Visual learning	Interactive videos and tutorials	Group activity, Conceptual questions, CIA II
IV	**Spectrophotometry and Centrifugation Technique**								
	1	Principle and law of absorption of colorimeter	2	3	K2(U)	Visual learning using tools, Flipped classroom	Blended learning	Video lectures, Interactive ppt	Concept explanations, Quiz, Open book test, CIA II
	2	Construction, operation and uses of colorimeter.	2		K2(U) & K3(Ap)	Visual learning using tools, Demonstration	Hands-on experimentation	Video lectures, Interactive ppt	Conceptual questions, CIA II
	3	Principle and law of absorption, construction, operation of UV-Visible spectrophotometer.	2		K2(U)	Lecture with visualization	Inquiry based learning	Virtual lab simulations, Interactive ppt	Formative Quiz using Quizizz, Conceptual questions, CIA II
	4	Uses of UV-Visible spectrophotometer.	2		K2(U) & K3(Ap)	Lecture with visualization and demonstration	Simulation based learning	Virtual lab simulations	Conceptual questions, CIA II
	5	Principles, methods of centrifugation, types of centrifuge and applications.	4		K2(U) & K3(Ap)	Lecture with visual aids Demonstration	Hands-on experimentation	Interactive videos and ppt	Quick quiz using Kahoot, Slip test, CIA II
V	**BIOSTATISTICS**								
	1	Data collection methods, population samples, parameters.	2	3	K2(U) & K4(An)	Lecture with visual aids, Case study, Data collection methodology	Problem based learning, Collaborative learning, Think-Pair-Share	Video lectures, tutorials and ppt	Formative Quiz using Quizizz, Problem solving, Group activity, CIA II

	2	Representation of Data: Tabular, Graphical - Histogram.	2		K5(E)	Constructivist activity, Core conceptual approach	Concept-based teaching using real-life examples, Problem based learning, Visual learning	Video lectures, tutorials and ppt	Rubric based evaluation, Peer Assessment, CIA II
	3	Frequency curve - Bar diagram - measures of central tendency.	3		K5(E)	Integrative Teaching - Visual learning and hands-on activities	Experimental Learning - Pair work, Game based learning	Video lectures, tutorials and ppt	Problem solving, Group activity, CIA II
	4	Mean, Median and Mode; Standard deviation, Standard error.	3		K5(E)	Flipped classroom - Use of Analogies and Simulations	Experimental Learning data collection activity, Group discussion	SWAYAM portal	Problem solving, Group activity, CIA II
	5	Chi-square test and t-test.	2		K5(E)	Inquiry based teaching - Statistical story telling	Problem based learning, Think-Pair-Share, Real-Life Application Tasks	NCRET portal	Quick quiz using Kahoot, slip test, Problem solving, Group activity, CIA II

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

Activities (SD): Hands-on training on Problem solving

Assignment: Fluorescence microscopy

Sample questions

PART A (1Mark)

1. Which of the following microscopes is most suitable for observing living, unstained cells in high contrast? **(K2-U, CO-2)**

   a) Bright field microscope b) Dark field microscope c) Phase-contrast microscope d) Transmission electron microscope
2. A researcher wants to separate and identify trace levels of pesticide residues in a fruit juice sample. Which of the following techniques would be the most suitable and efficient choice? **(K3-Ap, CO-3)**

   a) Paper Chromatography b) Thin Layer Chromatography c) Gas Chromatography-Mass Spectrometry d) Column Chromatography
3. What is the role of the glass electrode in a pH meter? **(K2-U, CO-2)**

   a) To regulate the voltage supply during measurement

   b) To detect the concentration of hydrogen ions in the solution

   c) To maintain a constant pH in the reference solution

   d) To separate ions during electrophoresis
4. Differential centrifugation separates cellular components based on the differences in their _____ and _____. **(K2-U, CO-2)**
5. Which of the following best describes the purpose of using a bar diagram in data representation? **(K2-U, CO-2)**

   a) To show the relationship between two continuous variables

   b) To display the distribution of continuous data using connected bars

   c) To represent categorical data using separate rectangular bars

   d) To calculate the mean and median of grouped data

PART B (6 Mark)

1. Discuss the principles of light microscopy and compound microscopy. **(K2-U, CO-2)**
2. Illustrate the instrumentation of Gas chromatography-Mass spectrometry with a neat diagram. **(K3-Ap, CO-3)**
3. Summarize the steps involved in performing agarose gel electrophoresis. **(K2-U, CO-2)**
4. State the sedimentation concept of centrifugation. **(K2-U, CO-2)**
5. Differentiate between mean, median, and mode with one example. **(K4-An, CO-4)**

PART C (12 Mark)

1. Compare scanning and transmission electron microscopy. **(K4-An, CO-4)**
2. Outline the principle and instrumentation of HPLC. **(K2-U, CO-2)**
3. Generalize the use of pH meters over traditional acid-base indicators. Discuss in terms of accuracy, ease of use, maintenance, and applications. **(K3-Ap, CO-3)**
4. Compare the principle and instrumentation of UV-Visible spectrophotometer. **(K4-An, CO-4)**
5. Evaluate the role of inferential statistics (Chi-square test and t-test) in biological research. **(K5-E, CO-5)**

Head of the Department **Course Instructor**

Dr.Sr.P.Leema Rose **Dr.J.Albino Wins, Dr.Sheeba Daniel & Dr.Y.Christabel Shaji**

Department : Botany
Class : III B.Sc. Botany
Title of the Course : ELECTIVE COURSE II: a) PHYTOBIORESOURCES
Semester : V
Course Code : BU235DE4

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BU235DE4	3	1	–	–	3	4	**60**	**25**	**75**	**100**

Learning Objectives:

1. To understand the scope, significance, and sustainable management of plant bioresources, including their role in agriculture, biofertilizers, and conservation.
2. To explore the applications of plant bioresources in biofuels, bioplastics, and biopesticides for environmental sustainability

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	define and explain the scope, significance, and bioprospecting of plant bioresources.	**PSO - 1**	**K1(R)**
CO-2	demonstrate knowledge of biofertilizers, single-cell proteins, and their applications in sustainable agriculture.	**PSO - 2**	**K2(U)**
CO-3	analyze the production and utilization of biofuels	**PSO - 3**	**K4(An)**

	and bioplastics from plant sources.		
CO-4	assess the applications, advantages, and limitations of biopesticides in sustainable agriculture.	**PSO - 2**	**K3(Ap)**
CO-5	evaluate biodiversity conservation strategies, plant genetic resource management, and global policies	**PSO - 8**	**K5(E)**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I									
	1	Introduction to Plant Bioresources Definition and its scope	1	1	K1(R)	Inquiry-Based Learning, Lecture with Visual Aids - GAMMA PPT, Reflective Thinking	Participative learning- Brain Storming, Group Discussion	Video Lectures, E-content- MS word	Formative Quiz using Kahoot/ Google Forms, Written Assignment-
	2	Importance of plant bioresources	2		K1(R)	Simulation Based Approach, Gamification	Participative learning- Brain Storming, Assignment	E-content- MS word	Individual task, Memory Game
	3	Sustainable agriculture and organic farming.	2	2	K2(U)	Flipped Classroom,	Experimental Learning-	Video Lectures, E-	Conceptual Quiz, Group

		Green revolution.				Mind Map, Stimulation based approach	O-Lab, Charts, Demonstrative approach	content- MS word	Presentation, MCQ.
	4	Bioprospecting: Concept; Role of traditional knowledge in bioprospecting	2		K2(U)	Reflective Thinking, Lecture with illustration	Participative learning- Brain Storming, Debate	Video Lectures, E-content- MS word	Slip Test, MCQ, Open book test, Question-Answer Session
	5	Traditional Knowledge Digital Library (TKDL).	2		K3(Ap)	Integrative Teaching, Simulation Based Approach	Experiential Learning- Hands-On Demonstration, Chart.	Interactive PPT, Youtube Videos	Quizzes, Just a Minute, Flow Chart Analysis
II	1	Biofertilizers: Scope and importance. Bacterial Fertilizer – *Rhizobium* – mass production and uses.	2	1	K4(An)	Flipped Classroom, Mind Map, Inquiry based approach	Experiential Learning- Hands-On Demonstration, Chart.	Interactive PPT, Youtube Videos	Online Quiz-Quizzes, Product Evaluation, Open book test
	2	Cyanobacterial Biofertilizer- *Nostoc* - mass production and application.	2		K4(An)	Blended based approach, Reflective approach	Collabrative learning- Hands-On Demonstration, Charts and Models	Interactive PPT, Youtube Videos	Unannounced test, Interpretation of Results
	3	*Azolla*- mass production and application.	1	1	K4(An)	Integrative approach, Mind Map	Experiential Learning- Hands-On	Interactive PPT, Youtube Videos	Team Work Analysis and Interpretation,

							Demonstration, Chart.		Slip Test.
	4	Single Cell Protein and Mycoprotein: Mass Cultivation of *Spirulina*.	2		K4(An)	Reflective Thinking, Flipped Classroom	Collabrative learning-Hands-On Demonstration, Charts and Models	Interactive PPT, Youtube Videos	Flow Chart Analysis, SCP Products Exhibit, Group Discussion.
	5	Mushroom Cultivation-*Pleurotus* and *Agaricus*.	2	1	K4(An)	KWL, Hands on Trainning sessions.	Experiential Learning-Hands-On Demonstration, Project based learning	Interactive PPT, Youtube Videos	Flow Chart Analysis, Mushroom Receipes Exhibits, MCQ.
III	1	Biofuels - Importance of biofuel	2	1	K2(U)	Lectures with Illustration, Brain Storming	Participative Learning-Debate, Role play	Econtent with GAMMA PPT	Quizzes, Open book test, MCQ
	2	Biodiesel Production *Pongamia* and *Jatropa*.	2		K3(Ap)	Reflective Thinking, Inquiry Based Approach	Experiential Learning-Hands-On Demonstration, Project based learning	Video display, O lab	Unannounced test, Interpretation of Results
	3	Alcohols – the liquid fuel- ethanol production.	2	2	K3(Ap)	Hands on Trainning, Flipped	Project based learning-O	You tube videos	Team Work Analysis and Interpretation,

						classrooms	lab		Slip Test.
	4	Gaseous fuels: Biogas production and Hydrogen fuel.	2		K3(Ap)	Lectures with Illustration, Simulation based approach	Collabrative learning- Demonstratio n	E-content with MS Word	Flow Chart Analysis, Group Discussion, Just a Minute
	5	Plant-derived bioplastics	1		K2(U)	Demonstrative approach, Gamification	Participative learning- Debate	Interactive PPT	Flow Chart Analysis, MCQ. Assesing Memory game, CIA I
IV	1	Biopesticides: Introduction, desirable qualities of biopesticides	3	1	K1(R)	Reflective Thinking, Inquiry Based Approach	Participative learning- Brain storming, Debate	Econtent with GAMMA PPT	Quiz using Kahoot / Google Forms, Oral Presentation,
	2	Microbial Pesticides – Fungi and Viruses	2		K2(U)	Flipped Classroom - Brain storming, mind map	Collabrative learning- Team Discussions, Charts and Models	Video display, O lab	Slip Test, Group Presentation, MCQ.
	3	Microbial Pesticides – Bacteria	1	1	K2(U)	Integrative Teaching - Chartts and Visual Images	Experiential Learning - Panel Discussion	E-content with MS Word	Kahoot, Flow chart analysis
	4	Advantages and disadvantages of Microbial Pesticides	1	1	K2(U)	Flipped classrooms	Participative learning- Brain storming,	E-content with MS Word	MCQ, Open book test, Question-Answer

							Debate		Session
	5	Application of Biopesticides	2		K4(An)	Blended Learning, KWL	Experiential Learning- Demonstration, Individual work	E-content with MS Powerpoint	Quizzes, Just a Minute, Flow Chart Analysis
V	1	Biodiversity conservation: Species extinction, causes of Biodiversity loss; IUCN threat categories	2	1	K1(R)	Inquiry-Based Learning, Lecture with Visual Aids - GAMMA PPT, Reflective Thinking	Participative learning- Brain Storming, Role play	Video Lectures, E-content- MS word	Just a minute, Question and Answer Session
	2	Red data book; Biodiversity surrogates	1		K1(R)	Flipped Classroom, Mind Map, Stimulation based approach	Participative Learning- Charts and models, Demonstrative approach	Youtube videos, GAMMA PPT,	Quiz, Group Presentation, MCQ.
	3	In situ conservation strategies— National parks	2	2	K2(U)	Blended Learning, KWL	Participative Learning- Charts and models	E-content- MS word	Kahoot, Exhibit
	4	Ex situ conservation strategies— Botanical gardens Role of botanical gardens, gene banks, and seed banks	2		K2(U)	Reflective Thinking, Lecture with illustration	Experiential learning- Endangered species exhibit	Video Lectures, E-content- MS word, live	Slip Test, MCQ, Open book test, Question-Answer

		in plant conservation.						specimens	Session
	5	Strategies for biodiversity conservation and plant genetic resource management.	2		K4(An)	Integrative Teaching, Simulation Based Approach	Experiential Learning-Hands-On Demonstration, Chart, mind map	Interactive PPT, Youtube Videos	Quizzes, Just a Minute, Flow Chart Analysis, CIA II

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

Activities (Em / En /SD): **Hands on Training on Mushroom Cultivation, SCP**

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

Activities related to Cross Cutting Issues: **Exhibit on Plant Derived Bioplastics**

Assignment: Red data book; Biodiversity surrogates; In situ conservation strategies— National parks

Sample Questions

Part A (1 mark)

1. **Assertion (A):** Bioprospecting helps in discovering new drugs and bioactive compounds from plants.

Reason (R): Traditional knowledge often provides clues about the medicinal properties of plants.**(K4-An, CO-1)**

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.

2. Which microorganism is commonly associated with nitrogen fixation in leguminous plants?

a) Azolla b) Nostoc c) Rhizobium d) Bacillus **(K2-U, CO-2)**

3.Spirulina is widely cultivated for its protein content- state True or False **(K1-R, CO-3**)

4. The most commonly used bacterial biopesticide is_____ **(K1-R,CO-4)**

5. The primary purpose of biodiversity conservation strategies is _____ (**K2-U, CO4)**

Part B (6 marks)

1. State the concept of bioprospecting. **(K1-R, CO-1)**
2. Outline the mass production of bacterial fertilizer. **(K3-Ap, CO-2)**
3. Elucidate the production process of biogas **(K2-U, CO-3)**
4. Justify the applications of biopesticides **(K4-An, CO-4)**
5. Evaluate the different strategies used for biodiversity conservation **(K5-E, CO-5)**

Part C (12 marks)

1. Explain the about the traditional knowledge digital library (TKDL) (**K1-R, CO-1)**
2. Discuss the mass cultivation of Spirulina and its applications **(K2-U, CO-2)**
3. Analyse the production of biodiesel from Jatropa and its benefits **(K4-An, CO-3)**
4. Outline the production of bacteiral and fungal biopesticides**(K4-An, CO-4)**
5. Describe the role of botanical garden, gene bank and seed bank in plant conservation. **(K2-U, CO-5)**

Head of the Department **Course Instructor**

Dr.Sr.P.Leema Rose **Dr.J.Albino Wins & Dr.A.R.Florence**