Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A^+ by NAAC - IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF BOTANY

TEACHING PLAN (PG)
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 M. Sc. Botany Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve social and ecological issues and pursue research.	**M1, M2**
PEO2	continue to learn and advance their career in industry both in private and public sectors.	**M4 & M5**
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized personand to tackle the challenges in serving the country.	**M2, M5 & M6**

Programme Outcomes (POs)

POs	Upon completion of M.Sc. Botany Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	**PEO1 & PEO2**
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	**PEO1, PEO2 &PEO3**
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	**PEO2**
PO4	develop innovative initiatives to sustain ecofriendly environment	**PEO1, PEO2**
PO5	through active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	**PEO2**
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	**PEO1, PEO2 &PEO3**
PO7	learn independently for lifelong executing professional, social and ethical responsibilities leading to sustainable development.	**PEO3**

Programme Specific Outcomes (PSOs)

Program Specific Outcomes (PSO)	
On successful completion of the M.Sc. Botany programme, the students are expected to	
PSO1	familiarize with the fundamental, advanced and emerging concepts in Botany.
PSO2	understand the role of plants and their interactions with other organisms in variousecosystems.
PSO3	identify the potency of plant resources in contemporary research and visualize futurethrust areas in Botany.
PSO4	design scientific experiments independently and to generate useful information toaddress various issues in Botany.

PSO5	acquire basic knowledge on principles and applications of laboratory instruments andadequate skills to handle them.
PSO6	choose and apply appropriate tools, techniques, resources, etc. to perform variousexperiments in Botany.
PSO7	carryout scientific experiments independently or in collaboration with inter-disciplinary or multidisciplinary approaches.
PSO8	disseminate knowledge on conservation of biodiversity and protection of environment.
PSO9	awareness on the sustainable utilization of plant/microbial resources following thebioethical norms.
PSO10	demonstrate proficiency in communicating with various stakeholders like students,teachers, scientists and society.

Department : Botany
Class : I M.Sc. Botany
Title of the Course : Core I: PLANT DIVERSITY – I: ALGAE, FUNGI, LICHENS AND BRYOPHYTES
Semester : I
Course Code : BP231CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
BP231CC1	5	2	-	5	7	105	25	75	100

Objectives

1. To learn about the classification, distinguishing traits, geographic distribution, and reproductive cycle of algae, fungi, lichens, and bryophytes.
2. To gain knowledge about the ecological and economic importance of algae, fungi, lichens and bryophytes.

Course outcomes

On completion of this course, the students will be able to:		Cognitive level
1	Relate to the structural organizations of algae, fungi, lichens and Bryophytes.	K1(R)
2	Demonstrate both the theoretical and practical knowledge in understanding the diversity of basic life forms and their importance.	K2(U)
3	Explain life cycle patterns in algae, fungi, lichens and Bryophytes.	K3(Ap)
4	Compare and contrast the mode of reproduction in diverse groups of basic plant forms.	K4(An)
5	Discuss and develop skills for effective conservation and utilization of lower plant forms.	K5 & K6(Ev&Cr)

Teaching plan
Total Contact hours: 105 (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 account of algology, Contributions of Indian Phycologist (T.V.Desikachary, V.Krishnamurthy and V.S. Sundaralingam), Classification of algae by F.E. Fritsch (1935-	4	1	K2(U)	Introductory lecture, Lecture using Chalk and talk, Brain Storming	Participative Learning-Brain storming	E-content – MS Word	MCQ, homework

		45) & Silva (1982).							
	2	Salient features of major classes: Cyanophyceae, Chlorophyceae, Xanthophyceae, Chrysophyceae, Cryptophyceae, Dinophyceae, Chloromonadineae, Euglenophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae..	4	1	K1(R)	Context based	Participative Role Play, using visual images	Interactive PPT	Album preparation, Class test
	3	Range of thallus organization, algae of diverse habitats, reproduction (vegetative, asexual and sexual) and life cycles	4	1	K1(R)	Blended Learning, Demonstrative	Experiential learning-making models	Youtube videos	Online assessment and quiz questioning in the classroom
	4	Phylogeny and inter-relationships of algae, origin and evolution of sex in algae.	3		K4(An)	Reflective thinking	Participative Learning-team teaching	E-Content-MS Word	Slip Test, online Assignment
	5	Structure, reproduction and life histories of the following genera: *Oscillatoria*, *Scytonema, Ulva, Codium, Diatoms,*	3		K5(Ev)	Collaboration	Experiential Learning-PowerPoint presentation	Self directed active learning	Student presentations, oral test

		Dictyota and *Gelidium.*							
II	**1**	**FUNGI** General Characteristics, occurrence and distribution Mode of nutrition in fungi. Contributions of Indian Mycologists (C.V.Subramanian),	4	1	K2(U)	Integrative learning	Experiential Learning-Field visit	E content-MS Word, Interactive E- Book	Conceptual MCQs, Flip grid, oral rest
	2	Classification of Fungi by Alexopoulos and Mims (1979) & Recent trends inthe classification of fungi - Phylogeny and inter-relationships of major groups of fungi.	4		K1(R)	Flipped classroom, Simualtion	Participative learning-Describing visual images	Self prepared videos, E-content – external links	Preparation of question bank by students, CIA 1
	3	General characters of majorclasses: Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotinaand Deuteromycotina.	4	1	K3(Ap)	Demonstrative, lecture method, comparative charting	Group Discussion, Peer Teaching, Mind Mapping, Specimen Observation	Interactive PPT, E-Content-external links	Edpuzzle, Online assignment, CIA I
	4	Heterothallism in fungi, sexuality in fungi, Para sexuality, sex	3	1	K4(An)	Lecture Method,Chalk and Talk, Diagrammatic Explanation	Participative Learning-Group Discussion, Peer Teaching, Concept Mapping	PowerPoint Presentation, YouTube Lecture Clips, Virtual	Multiple Choice Questions (MCQs), Short Answer Questions, Matching

		hormones in fungi.						Microscopy	Exercises, Diagram Labeling Test,
	5	Structure, reproduction and life histories of the following genera: *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporus* and *Colletotrichum*	3		K5(E)	Lecture method, comparative analysis, demonstration, model-based teaching, experiential learning	Participative Learning-Group discussion, chart preparation, peer explanation, specimen observation, group presentation, case study	PowerPoint presentations, life cycle animations, microscopic images, virtual lab simulations, educational videos	MCQ quiz, short answers, diagram labeling
III	III	**LICHENS** Introduction and Classification (Hale, 1969).	4	1	K1 (U)	lecture method, comparative study approach, concept mapping, visual-based teaching	Participative learning-group discussion, collaborative chart preparation, classification tree making, student presentations.	PowerPoint presentations, classification videos, interactive quizzes, smartboard diagrams.	Multiple choice questions, short answers, diagram labeling, I CIA
	2	Occurrence and inter-relationship of phycobionts and mycobionts	4		K2(R)	Lecture method, interactive discussion, concept explanation using analogies, comparative approach	Participative learning-Group discussion, peer teaching, collaborative chart making, case study analysis	Animated videos, PowerPoint presentations, YouTube documentaries, virtual lab simulations	MCQs, short answer test, oral questioning, worksheet activity, google forms
	3	Structure and reproduction in Ascolichens, Basiodiolichens and Deuteroliche ns.	4	1	K4(An)	demonstration, comparative analysis, chalk and talk, specimen-based teaching	Experiential Learning-Group discussion, concept mapping, model making, chart preparation	Animated videos, PowerPoint presentations, virtual microscopy	MCQs, diagram labeling, short notes

	4	Structure and reproduction in Basiodiolichens	3	1	K4(An)	Integrative Teaching, Lecture Method	Experiential Learning-Mind map	E-content, MS Power point	Slip test, Group discussions
	5	Structure and reproduction in Deuteroliche ns.	3		K4(An)	Simulation based approach	Experiential learning-Sales day	E-content MS Word, Google classroom	MCQ, Oral test, II CIA
IV	IV	**BRYOPH YTES:** General characters and Classificat ion of Bryophyte s by Watson (1971).	4	1	K2(U)	Lecture method, comparative taxonomy approach, concept mapping, classification tree drawing	Participative Learning-Group discussion, peer teaching, chart preparation, herbarium-based learning	PowerPoin t presentatio ns, classificati on videos, online herbarium resources, virtual field tours	MCQ test, short answer writing, oral quiz, diagram labelling
	2	Distributio n, Stru ctural variations and evolution of gam etophytes and sporophyt es in Bryopsida, Anthocero psida and Mosses.	4		K1(R)	Lecture method, comparative teaching, Inquiry based learning	Participative Learning-Group discussion, peer presentations , collaborative charts, self-learning modules, problem-based learning.	Animated videos, digital herbarium, PowerPoin t presentatio ns, virtual microscop e tools	Short answer questions, comparative tables, diagram labeling, group assignments, formative MCQs
	3	General characters of major groups - Marchanti ales, Jungerman iales, Anthocero tales, Sphagnales, Funariales and Polytrichales .	4	1	K3(Ap)	Lecture method, comparative analysis, demonstration method, concept mapping.	Experiential Learning-Group discussion, chart preparation, herbarium observation, role play.	PowerPoin t presentatio n, animated videos, virtual microscop y tools, digital herbarium	Quiz, short answer test, diagram labeling, Google forms

	4	Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in bryophytes.	3		K4(An)	Lecture method, demonstration, inquiry-based learning,	Participative learning-Group discussion, concept mapping, model making,field observation	PowerPoint presentations, animation videos on reproduction and spore dispersal, YouTube videos on bryophyte life cycle	Quiz, diagram labeling, short answer questions, group, CIA II. Online assignment
	5	Structure, reproduction and life histories of the following genera: *Targionia, Porella*and*Polytrichum*	3	1	K5(Ev)	Lecture method, demonstration method, comparative analysis, microscopic observation, model-based teaching	Participative learning-Group discussion, peer teaching, specimen sketching, concept mapping, collaborative learning	PowerPoint presentations, animated videos of life cycles, digital herbarium	Quiz, short answers, drawing and description tests, II CIA
V	1.	Economic Importance: Algae -Economic importance in Food and feed - Single cell protein,	4	1	K3(Ap)	Lecture method, demonstration method, inquiry-based learning, concept explanation using examples.	Participative Learning-Group discussion, pair-share activity, concept mapping, poster making, student seminar.	PowerPoint presentations, animated videos on algal products, YouTube educational clips, virtual lab resources	MCQ test, short answer writing, oral questioning, concept map evaluation, poster display assessment.
	2.	Industrial products (Agar-Agar, Carrageenan, Alginic acid,	4		K4(An)	Lecture method, demonstration method	Participative Learning-Group discussion, peer learning, collaborative projects, case study analysis, hands-on experiments	PowerPoint presentations, educational videos, virtual lab simulations, animated videos, e-resources	MCQs, short answer tests

		Iodine, biofertilizers, Vitamins and biofuel), Medicinal value and Diatomaceous earth.						and online articles	
	3.	Fungi – Economic importance in food, industries and medicine. Culturing and cultivation of mushrooms *Pleurotus.*	4	1	K4(An)	Lecture method, demonstration method, activity-based teaching	Experiential Learning-Group discussion, hands-on mushroom cultivation, peer teaching, poster presentation	PowerPoint presentations, video tutorials on mushroom cultivation, virtual lab simulations,	MCQ tests, short answers, practical exam on culturing
	4.	Lichen –economic importance and as indicator pollution.	3	1	K5(Ev)	Lecture method, inquiry-based learning, concept explanation	Participative Learning-Group discussion, model making	PowerPoint presentation, YouTube videos on lichen types and pollution indicators	Quiz, concept map submission, oral questioning
	5.	Bryophytes – Ecological and economic importance – industry, horticulture and medicine.	3		K5(Ev)	Lecture method, comparative teaching, interactive teaching.	Participative Learning-Group discussion, peer presentation	PowerPoint presentations, Youtube videos, virtual herbarium	MCQs, short and long answer tests.

Course Focussing on Employability/ Entrepreneurship/ Skill Development : **Employability**, **Skill Development**
Activities (Em/ En/SD): Model making

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):
Environment Sustainability
Activities related to Cross Cutting Issues : **Algae field visit**
Assignment : Mode of nutrition in fungi./ online
Seminar Topic: Heterothallism in fungi.

Sample questions

Part A

1. Who is the father of Algology?**(K2 -U, CO 1)**
2. Which of the following fungi division includes 'Club fungi'?**(K 1-R, CO- 1)**
   a. Zygomycotina b. Deuteromycotina
   b. Basidiomycotina d, Ascomycotina
3. What is dolipore septum? **(K 1-R, CO- 1)**
4. What is the algal component of Lichen?(**K 1-R, CO- 1)**
5. Cite the lichen used as food. ?**(K2 -U, CO 1)**

Part B

1. Write short note on the thallus organisation of Algae.**(K2 -U, CO 1)**
2. List out the general characters of Fungi **(K2-R, CO-2)**
3. Categorize lichen based on habitat.**(K5- Ev, CO-4)**
4. Explain the morphological and anatomical structures of *Marchantia*.**(K4-An, C0-5)**
5. Compile the economic importance of Bryophytes. (**K5-An, CO-5)**

Part C

1. Classify Algae based on Fritsch.**(K2-U, CO-1)**
2. Summarize Parasexuality in Fungi with neat labelled sketches.**(K3-Ap, CO-3)**
3. Discuss the structure and reproduction in Lichen. **(K3-Ap, CO-4)**
4. Explain the evolution of sporophytes in Bryophytes **(K5-Ev, CO-4).**
5. Critique on the economic importance of Algae. **(K5-An, CO-5)**

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

Course Instructor
Dr. J. Celin Pappa Rani

Department : **Botany**

Class : **I M.Sc. Botany**
Title of the Course : **Core Course II: Plant Diversity II: Pteridophytes, Gymnosperms and Paleobotany**
Semester : **I**
Course Code : **BP231CC2**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP231CC2	4	3	–	–	**5**	7	**105**	**25**	**75**	**100**

Learning Objectives:

1. To investigate the classification, distinctive traits, distribution and reproduction and life history of the various classes and major types of Pteridophytes and Gymnosperms.
2. To identify and characterize diversity of lower vascular plants in order to comprehend the dynamics of diversity to realize the importance of diversity.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Recall on classification, recent trends in phylogenetic relationship, General characters of Pteridophytes and Gymnosperms.	PSO-2	K1 &K3
CO-2	Learn the morphological/anatomical organization, life history of major types of Pteridophytes and Gymnosperms.	PSO-4	K3 & K4
CO-3	Comprehend the economic importance of Pteridophytes, Gymnosperms, and fossils.	PSO-3	K3 & K5
CO-4	Understanding the evolutionary relationship of Pteridophytes and Gymnosperms.	PSO-1	K2
CO-5	Awareness on fossil types, fossilization and fossil records of Pteridophytes and Gymnosperms.	PSO-9	K1 & K3

Teaching plan

Total Contact hours: 105 (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 characteristics and	4	1	K2(U)	Lecture using Chalk and	Participative Learning- Team Teaching	Interactive PPT, E-content	MCQ, Quizzes

		classification (Reimer, 1954).Stellar evolution.				talk, Brain Storming		MS Power point	
	2	Range of structure, reproduction and evolution of the gametophytes	4		K1(R)	Cooperative learning- Group Discussion	Participative Learning- Demonstration, Role Play	You tube videos, GAMMA PPT	Online Quiz- Google Forms, Just a Minute
	3	Gametophyte types – sex organs. Apogamy and Apospory. Life cycles.	4	1	K3(Ap)	Reflective Thinking, Blended Learning	Collaborative learning- Mind mapping,	E-content- MS Word	Open book Test, MCQ
	4	Heterospory and seed habit, Telome theory.	3		K4(An)	Lecture using videos, Brain Storming	Participative Learning- Flow Chart Analysis	Interactive PPT	Slip Test, Unnounced Test
	5	Morphogenesis, Economic importance of Pteridophytes.	3	1	K5(E)	Embodied Learning, Lecture Method	Experiential Learning- Exhibit on Economic important product	You tube Videos, GAMMA PPT	Oral Test, Memory game
II	1	Structure, anatomy, reproduction and life histories of *Isoetes*	4	1	K2(U)	Inquiry based approach, Brain Storming	Experiential Learning- Role play, Mind map	You tube videos, Econtent- MS Word	Class test, Open book test
	2	Structure, anatomy, reproduction and life histories of *Equisetum*	4	1	K1(R)	Simulation based approach, Lecture Method	Experiential Learning- Making models	E-Content- External links, PPT	Creative drawing, Online Quiz- Google form
	3	Structure, anatomy, reproduction and life histories of *Angiopteris*	4		K3(Ap)	Integrative Teaching, Demonstrative	Experiential Learning- Demonstration of experiments	Discussion Forum- Google classroom, PPT	Online Assignment, Observation Notes
	4	Structure, anatomy, reproduction and life histories of *Osmunda*	3	1	K4(An)	Embodied Learning, Brain Storming	Participative Learning- Practical	Interactive E-book, Interactive PPT	Oral Presentation, Oral Test
	5	Structure, anatomy, reproduction and life histories of *Pteris* And *Azolla.*	3		K5(E)	Blended Learning, Gamification	Participative Learning- Assignments	E-content- MS Word, Google classroom	Group discussion, Slip Test
III	1	General characters - A general	3	1	K2(U)	Brain Storming,	Participative learning- Group discussion	Discussion forum- Mentimete	Quiz questioning in the classroom,

		account of distribution of Gymnosperms.				Lecture Method		r, E-content MS Word	Observation notes
	2	Morphology, anatomy of Gymnosperms.	3		K1(R)	Reflective Thinking, Demonstrative	Participative learning- Describing visual image	YouTube videos, Interactive PPT	Album preparation, Oral presentation
	3	Reproduction, phylogeny of Gymnosperms.	3	1	K3(Ap)	Blended Learning, Collaboration	Experiential Learning- Arranging exhibition	Interactive E-book, PPT	Open book test, Just a Minute
	4	Classification of Gymnosperms. (K.R.Sporne, 1965).	3	1	K4(An)	Integrative Teaching, Lecture Method	Experiential Learning- Mind map	E-content, MS Power point	Slip test, Group discussions
	5	Economic importance of Gymnosperms.	3		K5(E)	Simulation based approach	Experiential learning- Sales day	E-content MS Word, Google classroom	MCQ, Student presentations
IV	1	Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of *Thuja*	4	1	K2(U)	Co-operative Learning, Lecture Method	Participative Learning- Using visual images and models	E- content MS word, Whats app poll	Homework, CIA, Assignment
	2	Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of *Cupressus*	4		K1(R)	Reflective Thinking, Brain Storming	Participative Learning- Interaction in the classrooms	Discussion forum- Mentimeter, E-content MS Word	Quiz- Quizzes and google forms
	3	Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of *Araucaria*	4	1	K3(Ap)	Simulation based approach, Lecture Method	Experiential Learning- Demonstration	YouTube videos, Interactive PPT	Online Assignment, open book test
	4	Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of *Podocarpus*	2		K4(An)	Integrative Thinking, Gamification	Participative learning- Memory game	Interactive E-book, PPT	Oral Presentation, Just a minute
	5	Structure (Exomorphic and	2	1	K5(E)	Inquiry based approach,	Participative learning- group discussions	E-content, MS Power point	Observation notes, Creative writing

		endomorphic), anatomy, reproduction and life histories of *Gnetum*				Flipped Classrooms			
	6	Structure (Exomorphic and endomorphic), anatomy, reproduction and life histories of the following genera: *Ephedra*.	2		K5(E)	Blended Learning, Lecture Method	Experiential learning-making models	E-content MS Word, Google classroom	Preparation of quiz questions by the students
V	1.	**PALEOBOTANY:** Geological Scale; Radiocarbon dating;. Fossilization and fossil types.	4	1	K2(U)	Brain Storming, Lecture Method	Participative Learning- Role play, Mind map	Interactive PPT, E-content MS Power point	Class test, Open book test
	2.	Contribution of BirbalSahni to Paleobotany, Gondwana flora of India.	4		K1(R)	Reflective Thinking, Demonstrative	Participative Learning-Making models	You tube videos, GAMMA PPT	Creative drawing, Online Quiz-Google form
	3.	Study of fossils in understanding evolution, Economic importance of fossils. fossil fuels and industrial raw materials and uses	4	1	K3(Ap)	Blended Learning, Collaboration	Experiential Learning-Demonstrative	E-content-MS Word	Online Assignment, Observation Notes
	4.	Study of organ genera: *Rhynia, Lepidocarpon*	2		K4(An)	Integrative Teaching, Lecture Method	Participative Learning-Practical	Interactive PPT	Oral Presentation, Oral Test
	5.	Study of organ genera: *Calamites,Cordaites*	2	1	K5(E)	Simulation based approach	Participative Learning-Assignments	You tube Videos, GAMMA PPT	Group discussion, Slip Test
	6.	Study of organ genera:*Lygin opteris.*	2		K5(E)	Lecture method, blended learning	Participative learning- Role play	Interactive PPT	Student presentations, MCQ

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

Activities (Em / En /SD): **Visual images and Models**

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

Activities related to Cross Cutting Issues:- **Field Visit**

Assignment: **Economic importance of Pteridophytes, Economic importance of fossils. fossil fuels and industrial raw materials**
Seminar Topics: **Classification of Gymnosperms. (K.R.Sporne, 1965).**

Part A (1 mark)

1. Spores of Pteridophytes are **(K1-R, CO-1)**
   a. Haploid b. Diploid c. Triploid d.Tetraploid
2. In Pteridophytes, the dominant generation is **(K2-U, CO-2)**
   a. Gametophytic (b) haploid (c) diploid (d) triploid
3. Reduction division in pteridophytes occurs in **(K1-R, CO-1)**
   (a) Prothallus is formed (b) Gametes are formed
   (c) spores are formed (d) sex organs are formed

4. In pteridophytes, the gametophyte is dominant, while sporophyte is a dependent generation-State True or False. **(K1-R, CO-1)**
5. The phloem of pteridophytes does not possess _____cells. **(K4-An, CO-3)**

Part B (6 marks)

1. Describe the structure and reproduction in Coniferales (**K2-U, CO-1)**
2. Write an essay on evolution of Gymnosperms (**K2-U, CO-2)**
3. Discuss the variation in the structure of female gametophyte in Gymnosperms (**K3-Ap, CO-2)**
4. Write short notes on Cordaitales (**K1-R, CO-4)**
5. Comment on Lyginopteris (**K3-Ap, CO-5)**

Part C (12 marks)

1. Write a classification of pteridophytes in detail. (**K1-R, CO-1)**
2. Explain the life history of Osmunda in detail. (**K2-U, CO-2)**
3. Write a detail account on "Telome theory". (**K2-U, CO-1)**
4. Explain the lifecycle of Isoetes. (**K2-U, CO-3)**
5. Give a details about of fossil formation. . (**K2-U, CO-5)**

Head of the Department **Course Instructor**
Dr.W.Vincy

Dr. Sr. P. Leema Rose

Department : Botany

Class : I M.Sc. Botany

Title of the Course : CORE LAB COURSE–I: LABORATORY COURSE COVERING CORE PAPERS- I AND II

Semester : I
Course Code : BP231CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP231CP1	-	-	6	–	4	6	**90**	**25**	**75**	**100**

Learning Objectives:

1. To learn how to employ the use of instruments, technologies and methodologies related to thallophytes and non-flowering plant groups.
2. To comprehend the fundamental concepts and methods used to identify Bryophytes, Pteridophytes and Gymnosperms through morphological changes and evolution, anatomy and reproduction.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	recall and applying the basic keys to distinguish at species level identification of important algae and fungi through its structural organizations.	PSO-1	K1
CO-2	demonstrate practical skills in thallophytes, Pteridophytes and Gymnosperms.	PSO-2	K2 & K6
CO-3	describe the structure of algae, fungi, lichens, Bryophytes, Pteridophytes and Gymnosperms.	PSO-3	K3
CO-4	determine the importance of structural diversity in the evolution of plant forms	PSO-3	K4
CO-5	formulate techniques to isolate and culture of alga and fungi as well as to understand the diversity of plant forms.	PSO-3	K5

Teaching plan

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

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
I								
	ALGAE External morphology and internal anatomy	20	2	K3(Ap)	Live demonstration of culture	Experiential Learning-Group	Videos & Animations-YouTube	Lab Performance - assessment on culture

	of the vegetative and reproductive structures of the following living forms: *Oscillatoria*, *Ulva, Diatoms and Dictyota Padina and Gelidum.* Preparation of culture media and culture of green algae and blue green algae in the laboratory (Demonstration)				media preparation and algal culture. Microscopic demonstration of vegetative and reproductive structures	Work & Peer Learning Microscopy Hands-On Students rotate through lab stations to observe and sketch structures of each alga.	channels: CrashCourse Biology, Bozeman Science, MIT OpenCourseWare	preparation, slide making, and microscopic identification Sketch and Label Exercises-Drawing observed algae with properly labeled vegetative and reproductive parts
II	Study of morphological and reproductive structures of the following living forms: *Plasmodiophora, Phytophthora, Rhizopus, Taphrina, Polyporus* and *Colletotrichum.* Isolation and identification of fungi from soil, air, and Baiting method. Preparation of culture media. Cultivation of mushroom in the laboratory (Demonstration). **LICHENS** Study of morphological and reproductive structures of the genera *Usnea*	20	2	K4(Ap)	**Microscopy Integration-**Show vegetative and reproductive structures using temporary and permanent slides.	Experiential Learning-**Hands-On Practical Work, Virtual Labs & Simulations**	OLabs (India), and Virtual Microscopy tools for fungal spore observation	**Diagram and Label Tests-** Sketch and label reproductive structures
III	External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Riccia, Targionia , Anthoceros, Polytrichum*	20	2	K4(An)	Microscopic Demonstration, Comparative Morphology Charts	Lab-Based Learning, Field Collection Activity	YouTube Educational Channels, Virtual Lab Platforms	Practical Slide Identification,Viva,Lab Record Evaluation

IV	External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Isoetes, Pteris, Equisetum* and *Azolla.* Fossil slides observation: *Rhynia, Lepidocarpon, Calamites*	20	2	K3(Ap)	Storytelling Approach (Paleobotany), Specimen Walkthrough-Hands-on explanation of preserved plant parts	Role-Play as Paleo-Botanists, Field Analogies	Virtual Labs, Mobile Apps	Observation Records & Sketches,Slide Identification
V	External morphology and internal anatomy of the vegetative and reproductive organs of the following living forms: *Cupressus, Araucaria, Podocarpus,* Fossil slides observation*: Cordaites Lyginopteris*	10	2	K4(An)	Fossil-Based Historical Approach, Theory-Practical Integration	Microscopy and Slide Analysis, Specimen Study & Identification	Digital Microscopy Slides, Virtual Labs & Databases	Practical Exam, Record Evaluation

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Skill Development**
Activities (Em / En /SD): Microscopic Demonstration, Comparative Morphology Charts
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Environment Sustainability**
Activities related to Cross Cutting Issues:- **Hands on training- Entrepreneurial activity**

Assignment: Observation Records & Sketches

Sample Questions

1. Make suitable micro preparation of **A** and **B**. Identify giving reasons, draw labelled diagrams and submit the slide for valuation**. (2X6= 12 marks)**
2. Make suitable micro preparation of **C.** Identify the importance, draw labelled diagrams and submit the preparation for valuation**. (1X 6 = 6 marks)**
3. Dissection and observation of embryos (globular and cordate embryos) **D.** Show the slide for valuation. **(1x 2=2 marks)**
4. Calculate dominance / abundance, density, frequency and species diversity in the study area by quadrat / line transect method with application of Raunkiaer's life-form method /Shannon-Wiener species index**. (1x10=10 marks)**
5. Identify, draw diagram and write notes on **E, F** and **G** **(4 X 3= 12marks)**
6. Write the botanical name of given plant specimen **H** by using flora (J.S.Gamble) **(1X2=2marks)**
7. Describe the given plant specimen **I** with technical terms, draw sketches of floral importance and write floral formula. Dissect out the floral parts and submit the slide for valuation. **(1 X 9 = 9 marks)**
8. Construct a dichotomous key using the given specimens **J, K, L,M** and **N (1 X 5 = 5marks)**
9. Write Botanical name, family, useful part and uses of **O,P** and **Q** **(3 X 4 = 12 marks)**

Submission: Herbarium

Head of the Department **Course Instructor**
Dr. Sr. P. Leema Rose **Dr.J.Celin Pappa Rani**

Department : Botany
Class : I M.Sc. Botany
Title of the Course : Elective I MICROBIOLOGY, IMMUNOLOGY AND PLANT PATHOLOGY
Semester : I
Course Code : BP231EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP231EC1	4	1	–	–	3	5	**75**	**25**	**75**	**100**

Learning Objectives:

1. To provide comprehensive knowledge about microbes and its effect on man and environment.
2. To provide comparative analysis of major groups of microbes.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Recognize the general characteristics of microbes, plant defense and immune cells.	PSO-1	K1 (K)
CO-2	Explain about the stages in disease development and various defense mechanisms in plants and humans.	PSO-1	K2 (U)
CO-3	Elucidate concepts of microbial interactions with plant and humans	PSO-3	K3 (AP)
CO-4	Analyze the importance of harmful and beneficial microbes and immune system	PSO-9	K4 (AN)
CO-5	Determine and interpret the detection of pathogens and appreciate their adaptive strategies.	PSO-4	K5 & K6(C & 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.	Types of microorganisms. General characteristic of bacteria – Outline classification of Bergey's manual of 9th edition.	2	1	K2(U)	Lecture using Chalk and talk, Brain Storming	Participative Learning- Team Teaching, Assignment	Interactive PPT, E-content MS Power point	MCQ, Quiz, Open book test

	2.	Classification of bacteria based on Morphological, cultural, physiological and molecular characteristics.	2		K 3(Ap)	Cooperative learning- Group Discussion, Reflective Thinking	Participative Learning- Demonstration, Role Play	You tube videos, GAMMA PPT	Online Quiz- Google Forms, Just a Minute
	3.	Bacterial growth – batch culture and continuous culture. Growth Curve. Factors affecting growth	2	1	K1(K)	Reflective Thinking, Blended Learning	Collaborative learning- Mind mapping,	E-content- MS Word, Interactive PPT	Open book Test, MCQ, Online Asingment
	4.	Determination of bacterial growth – Direct method: Haemocytometer, Viable plate count; Indirect method: Turbidity. Nutritional types.	2		K4(An)	Lecture using videos, Brain Storming, Integrative Teaching	Participative Learning- Flow Chart Analysis,	Interactive PPT, Discussion Forum- Google Classroom	Slip Test, Unnounced Test, Oral presentation
	5.	Reproduction - Fission and sporulation. Genetic recombination- Transformation, Transduction and Conjugation	2	1	K5(E)	Embodied Learning, Lecture Method	Experiential Learning- Describing visual images	You tube Videos, GAMMA PPT	Oral Test, Memory game, MCQ
	6.	Isolation and cultivation of bacteria. Maintenance of	2		K2(U)	Reflective Thinking, Simulation based approach	Experiential Learning- Hands on training	Interactive E-book, Whats app poll	Oral Test, Oral presentation, Quiz

		bacterial culture.							
II	1.	General characters, Classification, Structure, Multiplication of virus	2	1	K2(U)	Inquiry based approach, Brain Storming	Experiential Learning- Role play, Mind map	You tube videos, Econtent-MS Word	Class test, Open book test
	2.	Overview of Phycoviruses and Mycoviruses. Viruses of Eukaryotes – Animal & Plant viruses.	2		K 3(Ap)	Simulation based approach, Lecture Method	Experiential Learning- Making models	E-Content-External links, PPT	Creative drawing, Online Quiz- Google form
	3	Cultivation of viruses – in embryonated egg and in plants. Control of viral infections.	2	1	K1(K)	Integrative Teaching, Demonstrative	Experiential Learning-Demonstration of experiments	Discussion Forum-Google classroom, PPT	Online Assignment, Observation Notes
	4	Bacteriophages-classification, replication of DNA and RNA phages-Lytic and Lysogenic cycle	2		K4(An)	Embodied Learning, Brain Storming	Participative Learning-Practical	Interactive E-book, Interactive PPT	Oral Presentation, Oral Test
	5	Viroids and prions. Mycoplasma: Structure and classification.	2		K5(E)	Blended Learning, Gamification	Participative Learning-Assignments	E-content-MS Word, Google classroom	Group discussion, Slip Test, MCQ
III	1	Beneficial role of microbes – yoghurt, Olives, Cheese, Bread, Wine, Tempeh, Miso & Fermented green tea.	2	1	K 3(Ap)	Brain Storming, Lecture Method	Participative learning- Group discussion	Discussion forum-Mentimeter, E-content MS Word	Quiz questioning in the classroom, Observation notes
	2	Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products,	2		K1(R)	Reflective Thinking, Demonstrative	Participative learning-Demonstration of Experiments	YouTube videos, Interactive PPT	Album preparation, Oral presentation

		dairy products and canned foods.							
	3	Microbial toxins - Exotoxin, Endotoxin & Mycotoxin. Action of Enterotoxin, Cytotoxin& Neurotoxin. Food Preservation – temperature, drying, radiation and chemicals.	2	1	K4(An)	Blended Learning, Collaboration	Experiential Learning- Individual project	Interactive E-book, PPT	Open book test, Just a Minute
	4	Soil Microbiology: Importance of Microbial flora of soil and factors affecting the microbial community in soil. Interaction among soil microbes (positive and negative interactions) & with higher plants (rhizosphere &phyllosphere).	2		K5(E)	Integrative Teaching, Lecture Method	Experiential Learning- Mind map	E-content, MS Power point	Slip test, Group discussions
	5	Microorganisms in organic matter decomposition. Environmental Microbiology: Microbiology of water and air. Water borne diseases - diphtheria, chicken pox	2	1	K2(U)	Simulation based approach	Experiential learning- Industrial visit	E-content MS Word, Google classroom	MCQ, Student presentations

	6	Air borne diseases - Swine flu and Measles. Microbial degradation of chemical pesticides and hydrocarbon.	2		K3(Ap)	Emboided Learning, Lecture Method	Participative learning- Case Study	E-content-External link	Seminar presentation, Open book test
IV	1	Introduction; Immune System; Types of Immunity - Innate and Acquired.Immune Cells - Hematopoiesis, B and T lymphocytes - Maturation, NK cells	3	1	K4(An)	Co-operative Learning, Lecture Method	Participative Learning- Using visual images and models	E- content MS word, Whats app poll	Homework, CIA, Assignment
	2	Introduction to inflammation, Adaptive immune system, Innate Immune system. Antigen: Definition, Properties and types. Antibody – Structure, types and function.	3		K5(E)	Reflective Thinking, Brain Storming, Lecture Method	Participative Learning- Interaction in the classrooms	Discussion forum-Mentimeter, E-content MS Word	Quiz- Quizzes and google forms
	3	Generation of antibody diversity.Antigen - Antibody interactions: definition, types- Precipitation, Agglutinati	3	1	K2(U)	Simulation based approach, Lecture Method, Reflective Thinking	Experiential Learning- Demonstration	YouTube videos, Interactive PPT	Online Assignment, open book test

		on, Complement fixation.							
	4	Immune Response – Humoral and Cell Mediated. Vaccines – history, types and recombinant vaccines	3		K 3(Ap)	Integrative Thinking, Gamification	Participative learning- Memory game, Role play	Interactive E-book, PPT	Oral Presentation, Just a minute, Memory games
	5	Immunodiagnosis – Blood Grouping, Widal test, Enzyme-Linked Immunosorbent Assay (ELISA).	3		K1(K)	Inquiry based approach, Flipped Classrooms	Participative learning- group discussions	E-content, MS Power point	Observation notes, Creative writing
	6	Immunoelectrophoresis and Immunodiffusion.	2		K4(An)	Blended Learning, Lecture Method	Experiential learning- Demonstration of Experiments	E-content MS Word, Google classroom	Preparation of quiz questions by the students
V	1.	History and significance of plant pathology. Classification of plant diseases, Symptomology (important symptoms of plant pathogens).	2	1	K2(U)	Brain Storming, Lecture Method	Participative Learning- Role play, Mind map	Interactive PPT, E-content MS Power point	Class test, Open book test
	2.	Causal agents of plant diseases - biotic causes (fungi, bacteria virus, mycoplasma, nematodes, parasitic algae	2		K 3(Ap)	Reflective Thinking, Simulation based approach	Participative Learning- Describing visual images	You tube videos, GAMMA PPT	Creative drawing, Online Quiz- Google form
	3.	Angiospermic parasites - Abiotic causes (Physiological, deficiency of nutrients	2		K1(K)	Blended Learning, Collaboration	Experiential Learning- Video making	E-content- MS Word	Online Assignment, Observation Notes

		& minerals and pollution). Mechanism of penetration-Disease development of pathogen (colonization) and dissemination of pathogens.							
	4.	Role of enzymes and toxins in disease development. Important diseases of crop plants in India - Sheath blight of rice, Late blight of potato, Little leaf of Brinjal and Red rust of tea	2	1	K4(An)	Integrative Teaching, Lecture Method	Participative Learning- Preparing and demonstrative exhibits	Interactive PPT, E-content MS word	Oral Presentation, Oral Test
	5.	Principles of disease management – Cultural practices, physical, chemical and biological methods, disease controlled by immunization	2		K4(An)	Simulation based approach	Participative Learning- online Assignments	You tube Videos, GAMMA PPT	Group discussion, Slip Test
	6.	Biocontrol - merits and demerits; Diagnostic technique to detect pest/pathogen infection -	2		K5(E)	Lecture method, Blended learning	Participative learning- Seminar	Interactive PPT, Mentimeter	Student presentations, MCQ, Online quiz, google form

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

Activities (Em / En /SD): **Preparing and demonstrating pathogen exhibits**

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

Activities related to Cross Cutting Issues:- **Industrial Visit- Microbiology**

Assignment: **Classification, Structure, Multiplication of virus ,** Genetic recombination- **Transformation, Transduction and Conjugation**

Seminar Topics: **Spoilage of fruits, vegetables, meats, poultry, eggs, bakery products, dairy products and canned foods.**

Part A (1 mark)

1. Which of the following immunity is obtained during a lifetime? **(K2-U, CO-2)**
a. Acquired immunity b. Active immunity c. Passive immunity d. None of the above.

2. Which of these bacterial components is least likely to contain useful antigens? **(K2-U, CO-2)**

a. Cell wall b. Flagella c. Ribosomes d. Capsule

3. Which of the following contains structures composed of N-acetylmuramic acid and N-acetylglucosamine? **(K1-R, CO-1)**

a. Mycoplasmas b. Amoeba c. E.coli d. Spheroplast

4. The association of endotoxin in gram-negative bacteria is due to the presence of **(K3-Ap, CO-3)**
a. Steroids b. Peptidoglycan c. Lipopolysaccharides d. Polypeptide

5. Which of the following is a gram-positive eubacterium? **(K1-R, CO-1)**
a. *Actinomyces* b. *Clostridium* c. *Rhizobium* d. *Clostridium*

Part B (6 marks)

1. Determine the bacterial count methods **(K1-R, CO-1)**
2. Discuss viriods. **(K2-U, CO-2)**
3. Spoilage of microbes in fruits- Justify **(K4-An, CO-2)**
4. Differentiate Acquired Immunity & Innate Immunity. **(K3-Ap, CO-4)**
5. Recall Citrus Canker. **(K5-Ev, CO-5)**

Part C (12 marks)

1. Explain the Bacterial growth culture and its methods. (**K2-U, CO-1)**
2. Formulate the nomenclature and classification of virus. (**K3-Ap, CO-2)**
3. Criticize the beneficial role of microbes with a relevant example. (**K6-Cr, CO-3)**
4. Analyze, how cytokines act as a signalling molecules to mediate and regulate immunity? (**K4-An, CO-4)**
5. Recall Late Blight of Potato with respect to its casual organism, disease cycle, symptoms and control measures. **(K5-Ev, CO-5)**

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

Course Instructor
Dr. S.Kala Vetha Kumari

Department : Botany

Class : I M.Sc. Botany

Title of the Course : Elective I ETHNOBOTANY, NATUROPATHY AND TRADITIONAL HEALTH CARE

Semester : I

Course Code : BP231EC4

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP231EC4	4	1	–	–	3	5	**75**	**25**	**75**	**100**

Learning Objectives:

1. Understand the concept of ethnobotany and the life style and traditional practices of plants by Indian tribals.
2. Emphasize the importance of non-timber forest products for Indian tribal people livelihoods.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Recall or remember concept of ethnobotany.	PSO-1	K1
CO-2	Understand the life style and traditional practices of plants by Indian tribals.	PSO-2	K2 & K6
CO-3	Highlight the role of Non- Timber Forest products for livelihood of tribal people of India	PSO-3	K3
CO-4	Assess the methods to transform ethnobotanical knowledge into value added products.	PSO-3	K4
CO-5	Build idea to make digitization of ethnobotanical knowledge.	PSO-3	K5

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
I							
	1	Concept, important landmarks in the development, scope, sub disciplines of ethno botany.	3	1	K2(U)	Lecture using Chalk and talk, Brain Storming	Participative Learning- Team Teaching
	2	Interdisciplinary approaches.	3		K1(R)	Cooperative learning- Group Discussion	Participative Learning- Assignment

		Knowledge of following sociological and anthropological terms					
	3	Culture, values and norms, institutions, culture diffusion and ethnocentrism.	3	1	K3(Ap)	Reflective Thinking, Blended Learning	Collaborative learning- Rural camp
	4	History of ethnobotany: A brief history of ethno botanical studies in the world and in India.	4		K4(An)	Lecture using videos, Brain Storming	Participative Learning- Flow Chart Analysis
II	1	Distribution of tribes in India.	3	1	K2(U)	Inquiry based approach, Brain Storming	Participative Learning- Describing visual images
	2	Basic knowledge of following tribes of Tamil Nadu: Irulas, Kanis,	4		K 3(Ap)	Simulation based approach, Lecture Method	Participative Learning- Role play
	3	PaliyarsBadagas, Kurumbres,	3	1	K1(K)	Integrative Teaching, Demonstrative	ParticipativeLearning- Skit
	4	Thodas and Malayalis. Plants used by tribals of Tamil Nadu.	3		K4(An)	Embodied Learning, Brain Storming	Participative Learning- Album making
III	1	Primary - archeological sources and inventories, Secondary - travelogues, folklore and literary sources.	3	1	K2(U)	Brain Storming, Lecture Method	Participative learning- Group discussion
	2	Herbaria, medicinal texts and official records. Methods in ethnobotanical research	3		K 3(Ap)	Reflective Thinking, Demonstrative	Participative learning- Preparing herbaria exhibit
	3	Prior Informed Consent, PRA techniques, interviews and questionnaire methods, choice of resource persons	3	1	K1(K)	Blended Learning, Collaboration	Participative Learning- case study
	4	Folk taxonomy – plants associated with culture and socio- religious activities	2		K4(An)	Integrative Teaching, Lecture Method	Participative Learning- Panel discussion
	5	Non – timber forest products (NTFP) and livelihood – Sustainable harvest and value addition.	2	1	K5(E)	Simulation based approach	Experiential learning- Arranging exhibition
IV	1	Role of plants in naturopathy- Importance and relevance of medicinal drugs in India.	2	1	K2(U)	Co-operative Learning, Lecture Method	Participative Learning- Memory game
	2	Indian Systems of Medicine (Ayurveda, Siddha, Allopathy, Homeopathy, Unani, Tibetan, Yoga and Naturopathy)	2		K 3(Ap)	Reflective Thinking, Brain Storming	Participative Learning- Interaction in the classrooms

	3	Disease diagnosis, treatment, and cure using natural therapies including dietetics, botanical medicine, homeopathy, fasting, exercise, lifestyle counseling, detoxification, and chelation	2	1	K1(K)	Simulation based approach, Lecture Method	Experiential Learning- Demonstration
	4	clinical nutrition, hydrotherapy, naturopathic manipulation, spiritual healing, environmental assessment,	2		K2(U)	Integrative Thinking, Lecture method	Participative learning- Assignment
	5	Health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies.	2	1	K 3(Ap)	Inquiry based approach, Flipped Classrooms	Participative learning- panel discussions
	6	manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses or maintain	2		K1(K)	Blended Learning, Lecture Method	Experiential learning- Field viit
V	1.	Bioprospecting of drug molecules derived from Indian traditional plants.	3	1	K2(U)	Brain Storming, Lecture Method	Participative Learning- Role play, Mind map
	2.	Methods for bioprospecting of natural resources	3		K 3(Ap)	Reflective Thinking, Demonstrative	Participative Learning- Chart
	3.	From folk Taxonomy to species confirmation - evidences based on phylogenetic and metabolomic analyses	3	1	K1(K)	Blended Learning, Collaboration	Experiential Learning- Poster presentation
	4.	Ethno botanical databases and Traditional knowledge Digital Library (TKDL).	3		K4(An)	Integrative Teaching, Lecture Method	Participative Learning- Online Assingment

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability, Skill Development**
Activities (Em / En /SD): **Field visit, Poster presentation**
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Environment Sustainability**
Activities related to Cross Cutting Issues: **Collection of Medicinal herbs from Tribal Areas**

Assignment: **Herbaria, medicinal texts and official records. Methods in ethnobotanical research**

Seminar Topics: **Bioprospecting of drug molecules derived from Indian traditional plants**

Part A (1 mark)

1. The word ”ethno” in ethnobotany refers to ? **(K1-R, CO-1)**

   a. region- locality- people b. culture c. civilization d. all of above

2. The concept and idea of greeks that walnut could be used to heal ailments of the human brain is known as? **(K1-R, CO-2)**

   a. doctrine of signatures b. doctrine of homeopathy c. doctrine of Allelopathy d. None of these

3. The cereals belong to the family ? **(K2-U, CO-2)**

   a. Fabaceae b. Poaceae c. Solanaceae d. Rosaceae

4. The search for previously unknown compounds in organisms that have been never used in traditional medicines is **(K2-U, CO-4)**

a. Molecular farming b. Bioremediation c. Biopiracy d. Bioprospecting

5. The Siddha science is a traditional treatment system generated from **(K1-R, CO-5)**

a. Indian b. Tamil c. Kerala d. Maharastra

Part B (6 marks)

1. Write the botanical name, family, important plant part and traditional uses of 'Ashwagandha'. (**K2-U, CO-1)**
2. Differentiate between Ethnobotany and Economic botany. (**K3-Ap, CO-2)**
3. Explain the ethnomedicinal uses of *Janakiaarayalpatra.* (**K2-U, CO-2)**
4. Differentiate Ayurvedic pharmacopoeia from pharmacology. (**K3-Ap, CO-3)**
5. Explain the importance of phyto-pharmacological screening in herbal drug development. (**K2-U, CO-5**

Part C (12 marks)

1. Analyze the history of ethnobotany. (**K4-An, CO-1)**
2. Discuss about the tribes of Tamilnadu**.** (**K1-R, CO-2)**
3. Evaluate the importance of folk taxonomy. (**K5-Ev, CO-3)**
4. List out the traditional healthcare practices**.** (**K3-Ap, CO-4)**
5. Summarize hydrotherapy. (**K4-An, CO-5)**

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

Course Instructor
Dr.W.Vincy

Department : Botany

Class : I M.Sc. Botany

Title of the Course : CORE COURSE VI: CELL AND MOLECULAR BIOLOGY

Semester : III

Course Code : BP233CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP233CC1	4	2	-	-	5	6	90	25	75	100

Objectives:

1. To understand the cell division and its molecular mechanism so as to appreciate and manipulate normal and abnormal cell and tissue growth.

2. A thorough examination of DNA structure, replication process, transcription process and translation processes.

Course outcomes

CO	On completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO -1	understand the scope and importance of population ecology, plant communities and ecosystem ecology.	PSO- 1	K1& K2
CO -2	understand the applied aspect of environmental botany.	PSO-2	K1&K4
CO -3	students will spot the sources and pollution and seek remedies to mitigate and rectify them.	PSO-3	K2& K6
CO -3	identify different plant communities, categorize plant biomes and identify threatened, endangered plant species and create awareness program in protection of biodiversity.	PSO-4	K3& K6
CO -4	analyze insight into the vegetation types, species interaction and their importance and the factors influencing the environmental conditions.	PSO-5	K5

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
1	1	Concept of prokaryote and Eukaryote.	3	1		Introductory lecture, Lecture using Chalk and talk, Brain Storming	Participative Learning-Brainstorming	E-content – MS Word	Album preparation, slip test

					K1(R)				
	2	Structural organization of plant cell, specialized plant cell types chemical foundation.	**3**		K1(R)	Context based, lecture method	Participative Role Play, using visual images	Interactive PPT	MCQ, homework
	3	Cell wall- Structure and functions	**3**	**1**	K1(R)	Blended Learning, Demonstrative	Experiential learning-making models	Youtube videos	Formative assessment, Class test
	4	Plasma membrane; structure, models and functions, site for ATPase, ion carriers channels and pumps, receptors.	**3**		K2(U)	Reflective thinking, Simulation	Participative Learning-team teaching	E-Content-MS Word	Online assessment and quiz questioning in the classroom
	5	Plasmodesmata and its role in movement of molecule.	**3**	**1**	K2(U)	Simulation	Experiential Learning-PowerPoint presentation	Self directed active learning	Slip Test, online Assignment, oral test, Ed puzzle
II	1	Chloroplast-structure and function,	**3**	**1**	K1(R)	Reflective thinking, braistorming	Experiential Learning-model making	E content-MS Word, Interactive E-Book	Conceptual MCQs, Flip grid, oral rest
	2	genome orga nization, gene expression,	**3**	**1**	K2(U)	Flipped classroom, Simualtion	Participative learning-Describing visual images	Self prepared videos, E-content – external links	Preparation of question bank by students, CIA 1
	3	Mitochondria; structure, g enome organization, biogenesis.	**3**		K3(Ap)	Demonstrative, lecture method, comparative charting	Group Discussion, Peer Teaching, Mind Mapping, Specimen Observation	Interactive PPT, E-Content-external links	Multiple Choice Questions (MCQs), Short Answer Questions,

									Matching Exercises
	4	Plant Vacuole - Tonoplast membrane, ATPases transporters as a storage organelle.	**3**	**1**	K3(Ap)	Lecture Method,Chalk and Talk, Diagrammatic Explanation	Participative Learning- Group Discussion, Peer Teaching, Concept Mapping	PowerPoint Presentation, YouTube Lecture Clips, Virtual Microscopy	MCQ quiz, short answers, diagram labeling
	5	Structure and function of other cell organelles- Golgi apparatus, lysosomes, endoplasmic reticulum and microbodies.	**3**		K4(An)	Lecture method, comparative analysis, demonstration, model-based teaching, experiential learning	Participative Learning- Group discussion, chart preparation, peer explanation, specimen observation, group presentation, case study	PowerPoint presentations, life cycle animations, microscopic images, virtual lab simulations,	MCQs, short answer test, oral questioning, worksheet activity, google forms
III	1	Nucleus: Structure and function, nuclear pore, Nucleosome organization, euchromatin and heterochromatin.	4	**1**	K1 (R)		Participative learning- group discussion, collaborative chart preparation.	PowerPoint presentations, classification videos, smartboard diagrams.	Quiziz, open book test, online assignment, MCQ test, short answer writing, oral quiz, diagram labelling
	2	Ribosome- Structure and functional significance. RNA and DNA Structure. A, B and Z Forms.	2		K4 (An)		Participative learning- Group discussion, peer teaching, collaborative chart making, case study analysis	PowerPoint presentations, YouTube videos	Evaluation through short test, Seminar

	3	DNA damage and repair (Thymine dimer, photoreactivation, excision repair).	**3**	**1**	K4 (An)		Experiential Learning-Group discussion, concept mapping, model making, chart preparation	Animated videos, PowerPoint presentations	Definitions, MCQ, Recall steps, Google forms
	4	Cell cycle and Apoptosis; Control mechanisms.	3		K4(An)	Integrative Teaching, Lecture Method	Experiential Learning-Mind map	E-content, MS Power point	Essay questions, Concept definitions
	5	Cytokinesis and cell plate formation, mechanisms of programmed cell death.	3	**1**	K3(Ap)	Simulation based approach	Experiential learning-Sales day	E-content MS Word, Google classroom	MCQs, short answer test, oral questioning, worksheet activity, google forms
IV	1	DNA replication (prokaryotes and eukaryotes), enzymes involved in replication, DNA repair. DNA sequencing.	**3**	**1**	K1(R)	Lecture method, comparative study approach, concept mapping, visual-based teaching	Participative learning-group discussion, collaborative chart preparation	E-content, MS Power point	MCQ test, short answer writing, oral quiz, diagram labelling
	2	Transcription, enzymes involved in transcription,	**3**		K2(U)	Lecture method, interactive discussion, concept explanation using analogies, comparative approach	Participative learning-Group discussion, peer teaching	E-content-MS Word, Google classroom	Short answer questions, comparative tables, diagram labeling, group assignments, formative MCQs
	3	post transcription changes, reverse	**4**	**2**	K3(Ap)	demonstration, comparative analysis, specimen-based teaching	Experiential Learning-Group discussion, model making,	PowerPoint presentations, classification videos	Quiz, short answer test, diagram labeling, Google forms

		transcription,					chart preparation		
	4	Translation. overlapping genes.	**4**		K4(An)	Inquiry based teaching, simulation	Experiential Learning-Mind map	Animated videos, PowerPoint presentations, virtual microscope tools	Quiz, diagram labeling, short answer questions, group, CIA II. Online assignment
V	**1**	DNA/gene manipulating enzymes: endonuclease, ligase, po lymerase, phosphatase, transcriptase, transferase, topoisomerase.	**3**	**1**	K3(Ap)	Lecture method, demonstration method, inquiry-based learning, concept explanation using examples.	Participative Learning-Group discussion, pair-share activity, concept mapping, poster making, student seminar.	PowerPoint presentations, YouTube educational clips, virtual lab resources	MCQ test, oral questioning, concept map evaluation, poster display assessment.
	2	Gene cloning: cloning vectors, molecular cloning and DNA libraries, transposons.	**3**	**1**	K4(Ap)	Lecture method, demonstration method	Participative Learning-Group discussion, peer learning, collaborative projects, case study analysis, hands-on experiments	PowerPoint presentations, educational videos, virtual lab simulations, interactive animations, e-resources and online articles	MCQs, short answer tests
	3	Recombinant DNA. Direct and indirect gene transfer.	**3**		K5(Ev)	Lecture method, demonstration method, activity-based teaching	Experiential Learning-Group discussion, poster presentation	PowerPoint presentations, virtual lab simulations	MCQ tests, short answers
	4	Detection of recombinant molecule, production of gene products from cloned genes.	**3**	**1**	K4(Ap)	Lecture method, inquiry-based learning, concept explanation	Participative Learning-Group discussion, model making	PowerPoint presentation, YouTube videos	Quiz, concept map submission

	5	Genome library, cDNA library.	**3**		K5(Ev)	Lecture method, comparative teaching, interactive teaching.	Participative Learning- Group discussion, peer presentation	PowerPoint presentations, Youtube videos, virtual herbarium	MCQs, short and long answer tests.

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

Activities (Em/ En/SD): **Model making – cell organelles**

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

Activities related to Cross Cutting Issues : **Field visit**

Assignment : **Genome library, cDNA library.**/online

Seminar Topic: **DNA replication.**

Sample questions (minimum one question from each unit) Part A

1. What is a cell? **(K1-R,CO-1)**
   a) smallest and advanced unit of life b) smallest and basic unit of life
   b) largest and basic unit of life d) largest and advanced unit of life
2. Which of the following is a functional unit of a body?(**K1-R, CO-1)**
   a) Mitochondria b) Cytoplasm c) Spleen d) Cell
3. Which of the following is known as the powerhouse of a cell?**(K2-U, CO-2)**
   a) Mitochondria b) Cytoplasm c) Lysosome d) Nuclei
4. DNA is stored in which of the following cell organelle?(**K4-An. CO-3)**
   a) Cell wall b) Cell Membrane c) Nucleus d) Cytoplasm
5. Protein synthesis takes place in which of the following cell organelle?**(K4-An, CO5)**
   a) Cell wall b) Ribosome c) Nucleus d) Cytoplasm

Part B

1. Write short note on Plasmodesmata and its role in movement of molecule.(**K2-U, CO-1)**
2. Enlist the characters of ATPases transporters**.(K4-An, CO-4)**
3. Differentiate euchromatin and heterochromatin.**(K3-Ap, CO-3)**
4. Criticize on DNA sequencing.**(K4-An, CO-3)**
5. Enlist the cloning vectors used in recombinant DNA Technology .**(K4-An, CO-4)**

Part C

1. Evaluate the structure, models and functions Plasma membrane. **(K4-An, CO-4).**
2. Illustrate the Chloroplast-structure and function.**(K3-Ap, CO-3)**
3. Discuss the structure and function of Ribosome. .**(K4-An, CO-4)**
4. Illustrate the process of DNA replication. **(K3-Ap, CO-3)**
5. Explain direct and indirect gene transfer methods in prokaryotic cell.(**K1-U, CO-2)**

Head of the Department

Course Instructor

Dr. Sr. P. Leema Rose **Dr. J.Celin Pappa Rani**

Department :Botany

Class : II M.Sc. Botany

Title of the Course : GENETICS, PLANT BREEDING AND BIOSTATISTICS

Semester : III
Course Code : BP233CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP233CC2	4	2	–	–	5	6	**90**	**25**	**75**	**100**

Learning Objectives:

1. The students will be able to have conceptual understanding of laws of inheritance, genetic basis of loci and alleles and their linkage.
2. Develop critical understanding of chemical basis of genes and their interactions at population and evolutionary levels.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Understand the Mendal's Law of inheritance and gene interactions	PSO-1	K1 (K)
CO-2	Analyse the various factors determining the heredity from one generation to another.	PSO-2	K2 (U)
CO-3	Explain Gene mapping methods**:** Linkage maps.	PSO-3	K3 (AP)
CO-4	Compare and contrast the genetic basis of breeding self and cross – pollinated crops.	PSO-3	K4 (AN)
CO-5	Discuss and develop skills for statistical analysis of biological problems	PSO-3	K5 & K6(C & E)

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	Stu Cer Met
I							
	1.	Mendal's Law of inheritance. Gene interactions and modified dihybrid ratios.	3	1	K2(U)	Lecture using Chalk and talk, Brain Storming	Participa Learning Teachin Checker

	2.	Quantitative inheritance. Sex determination in plants and theories of sex determination.	3		K 3(Ap)	Cooperative learning- Group Discussion, Reflective Thinking	Participa Learning Demons Role Pla
	3.	Sex linked characters. Structure of Gene, Operon, inducible operon, Operator site, Promoter, Polycistronic m RNA, Regulator, regulator constitutive.	3	1	K1(K)	Reflective Thinking, Blended Learning	Collabor learning Assignm
	4.	Gene function and regulation in prokaryotes with reference to Lac operon and trp operon.	2		K4(An)	Lecture using videos, Brain Storming, Integrative Teaching	Participa Learning Chart A
	5.	Producergene , structural gene and integrator gene. Gene Regulation eukaryotes –Britten and Davidson model.	2	1	K5(E)	Embodied Learning, Lecture Method	Experien Learning Making
	6.	Arabidopsis- gene regulation in flowering.	2		K2(U)	Reflective Thinking, Simulation based approach	Participa Learning discussi
II	1.	Recombination: Homologous and non-homologous recombination, site-specific recombination.	3	1	K2(U)	Inquiry based approach, Brain Storming	Participa Learning Creating solving
	2.	Holiday model of recombination. Transposable genetic elements: transposase, transposon, simple transposon, composite transposon.	3		K 3(Ap)	Simulation based approach, Lecture Method	Experien Learning Making
	3	Transposons in *Zea mays*. Transposable elements in prokaryotes.	3	1	K1(K)	Integrative Teaching, Demonstrative	Experien Learning making
	4	UV induced mutation and its repair mechanism. Mismatch DNA repair mechanism.	3	1	K4(An)	Embodied Learning, Brain Storming	Participa Learning presenta
	5	Mutation types- frame shift mutation, addition, deletion, substitution, transition and transversion.	3		K5(E)	Blended Learning, Gamification	Participa Learning presenta
III	1	ABO blood group in humans.	4	1	K 3(Ap)	Brain Storming, Lecture Method	Participa learning Demons of Exper

	2	QTL mapping, Gene mapping methods**:** Linkage maps, tetrad analysis	4		K1(K)	Reflective Thinking, Demonstrative	Participa learning making
	3	mapping with molecular markers ,mapping by using somatic cell hybrids.	4	1	K3(Ap)	Simulation based approach, Lecture Method	Experien Learning Making
	4	Extra chromosomal inheritance, maternal inheritance.	3	1	K4(An)	Blended Learning, Collaboration	Experien Learning presenta
IV	1	Objectives of plant breeding, characteristics improved by plant breeding.	3	1	K4(An)	Co-operative Learning, Lecture Method	Participa Learning Demons of exper
	2	Genetic basis of breeding self and cross – pollinated crops.	3	1	K5(E)	Reflective Thinking, Brain Storming, Lecture Method	Participa Learning Interacti the class
	3	Pure line theory, pure line selection and mass selection,	3		K2(U)	Simulation based approach, Lecture Method, Reflective Thinking	Experien Learning Presenta
	4	clonal selection methods. Hybridization.	3	1	K 3(Ap)	Integrative Thinking, Gamification	Participa learning Demons of exper
	5	Genetics and physiological basis of heterosis.	3		K1(K)	Inquiry based approach, Flipped Classrooms	Participa learning map
V	1.	Measures of central tendency (Mean , Median , Mode)	3	1	K2(U)	Brain Storming, Lecture Method	Problem methodo
	2.	Dispersal (Mean deviation , standard deviation) , standard errors ANOVA (One way).	3		K 3(Ap)	Reflective Thinking, Simulation based approach	Problem methodo solving problem
	3.	Sampling distribution; levels of significance;	3	1	K1(K)	Blended Learning, Collaboration	Problem methodo Researcl
	4.	Regression and correlation;	3		K4(An)	Integrative Teaching, Lecture Method	Problem methodo solving problem
	5.	t-test; analysis of variance; X2 test.	3	1	K4(An)	Simulation based approach	Problem methodo Researcl

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

Activities (Em / En /SD): **Chart Presentation, Problem solving**
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - **Environment Sustainability**

Activities related to Cross Cutting Issues:- Poster Presentation, Field Survey- Biostatistics

Assignment: Producer gene , structural gene and integrator gene. Gene Regulation eukaryotes –Britten and Davidson model.

Seminar Topics: Measures of central tendency (Mean , Median , Mode)

Part A (1 mark)

1. What is the structural unit of a gene? **(K1-R, CO-1)**

   a.Exon b. Intron c. both a&b d. None of these

2. In a dihybrid cross, the phenotypic ratio of 9:3:3:1 represents ___inheritance. **(K1-R, CO-1)**

3. According to the Britten and Davidson model, what are gene batteries? **(K2-R, CO-3)**
   a. Genes regulating metabolism b. Genes regulating development
   c. Sets of coordinately regulated gene d. Genes involved in energy production
4. QTL mapping is used to identify _____associated with quantitative traits. **(K1-R, CO-4)**
5. Maternal inheritance is often associated with which type of genetic material? **(K1-R, CO-1)**

   a. Nuclear DNAb. Chloroplast DNA c. Mitochondrial DNA d. Both B and C
6. Transposable elements in Zea mays are also known as __genes. **(K2-U, CO-4)**
7. Heterosis is also known as ----------**(K1-R, CO-4)**
8. The mean is a measure of central _____, while standard deviation is a measure of ___. **(K1-R, CO-5)**

Part B (6 marks)

1. Describe Mendel's Law of Segregation with an example **(K1-R, CO-1)**
2. Interpret the basic structure of a gene and its components **(K3-Ap, CO-2)**
3. Predicting the role of transposase in the mobility of transposable elements.? **(K3-Ap, CO-2)**
4. Describe the principle of QTL mapping and its applications in plant breeding? **(K1-R, CO-4)**
5. Highlight the ABO blood group system in human health and medical practice. **(K5-An, CO-1)**
6. Role of pure line selection in breeding – justify **(K1-R, CO-4)**
7. Illustrate the genetic basis of breeding in self-pollinated crops. **(K5-E, CO-4)**
8. Categorize the measures of central tendency and their significance in statistical analysis **(K3-Ap, CO-5)**
9. Analyze the types of correlation & its advantages **(K4-An, CO-5)**

Part C (12 marks)

1. Summarize sex determination in plants and discuss various theories of sex determination. **(K1-R, CO-1)**
2. Compare and contrast homologous recombination and non-homologous recombination. **(K3-Ap, CO-2)**
3. Classify the methods of gene mapping with molecular markers. Include examples of markers used. **(K1-R, CO-1)**
4. Determine the genetic and physiological basis of heterosis, including its application in plant breeding.? **(K1-R, CO-4)**
5. Calculate and interpret the mean, median, mode, standard deviation, and mean deviation for the following data set: [5, 8, 12, 15, 18, 22, 26) **(K1-R, CO-5)**
6. Illustrate the use of one-way ANOVA in comparing means with a detailed example and interpretation of results. **(K1-R, CO-4)**

Head of the Department **Course Instructor**
Dr. Sr. P. Leema Rose **Dr. S.Kala Vetha Kumari**

Department : Botany

Class: II M.Sc. Botany

Title of the course: CORE LAB COURSE III: CORE COURSE VI and VII

Semester: III

Course code: BP233CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP233CP1		-	6	-	5	6	90	25	75	100

Learning Objectives:

1. Observe the different stages of mitosis and chromosome behaviour and organization during various stages and to learn staining techniques of various plant tissues.
2. Understand the principles of rDNA techniques.

Course outcomes

On completion of this course, the students will be able to:		
1.	recall or remember the various aspects of cell biology, genetics, molecular biology, plant breeding and tissue culture.	**K1**
2.	understand various concepts of cell biology, genetics, plant breeding and tissue culture.	**K2**
3.	apply the theory knowledge gained into practical mode in order to acquire applied knowledge by day-to-day hands-on experiences.	**K3**
4.	analyze or interpret the results achieved in practical session in the context of existing theory and knowledge.	**K4**
5.	evaluate the theory and practical skills gained during the course.	**K5 &K**

Teaching plan

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

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Asses Eval Me
1	**CELL AND MOLECULAR BIOLOGY** 1.Identification of different stages of mitosis from suitable plant material. (Onion root tips/ garlic root tips). 2.Identification of meiosis from suitable plant material. (Onion /*Tradeschantia* floral buds).	15	3	K3(Ap)	Experiential learning, Demonstration method, Practical-based teaching	Experiential learning- Hands-on laboratory sessions, Group experiments, Observation and reporting	Virtual lab simulations, Microscopy video tutorials, Animation of mitosis and meiosis, PPTs and e-modules, Recorded demonstration videos	Lab re evalua Practi exam, Obser sheet submi

	3.Isolation of cell organelles: Mitochondria, Chloroplast, Nucleus, Lysosomes (Demo 4.Study of mitotic index from suitable plant material.							
II	1.To study plant vacuole in cells of onion leaf peel. 2.Restriction digestion of DNA samples using restriction endonucleases 3.To study the structure and organization of plant cell in various tissues of various plants (incl. leaf, stem and roots).	15	3	K4(An)	Experiential learning-demonstration method, collaborative learning	Hands-on experiments, microscopic observations, peer discussions, group projects, model preparation	Virtual lab simulations, animation videos of cell structure and DNA digestion, interactive diagrams.	Lab re rubric evalua practic skills
III	1.Problem solving on dihybrid phenotypic, genotypic and test cross ratios. 2.Incomplete dominance in plants. 3.Interactions of factors and modified dihybrid ratios. 4.Multiple alleles in plants, blood group inheritance in human. 4.Sex linked inheritance in Drosophila and plants. Quantitative inheritance in plants.	15	3	K3(Ap)	Lecture method, concept mapping, comparative analysis, interactive, problem-based approach	Group discussions, collaborative worksheet solving, inquiry-based learning, flipped classroom	Animations on Mendelian genetics, virtual genetics lab simulations, PPT with Punnett square illustrations, interactive quizzes-Kahoot	MCQs proble solvin works concep applic questi group presen peer evalua short a tests, c quizze
IV	1.Chromosome mapping from three-point test cross data. Calculation of chiasmatic interference. 2. Calculate gene and genotypic frequency by Hardy- Weinberg equation.	15	3	K4(An)	Problem-based learning, Inquiry based learning	Group activity using sample genetic data, Hands-on numerical solving in pairs-human genetics	Animation videos, interactive simulation tools for crossing over, PPTs, online calculators, gamified	Works solvin MCQ Online concep creatio

							genetic models	
V	**PLANT BREEDING** 1. Techniques in plant hybridization.	15	3	K3(Ap)	Demonstration method, experimental learning	Group discussion, field visits, hands-on training	PPTs, Youtube videos, animations, virtual lab simulations, e-modules	MCQs Practi record evalua Forma assess

Total Teaching hours include 15 hours allotted for Formative and Summative Assessments

Course Focussing on Employability/ Entrepreneurship/ Skill Development : **Employability**, **Skill Development**
Activities (Em/ En/SD): **Model making**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): **Environment Sustainability**
Activities related to Cross Cutting Issues : **Field visit**

Assignment : **Genetics problems**

Sample questions

1. 1. Carry out the cytological preparation and staining of the given material **A** and report any one stage of cell division (Meiosis/Mitosis). (1X 10 =10 marks).
2. Conduct the experiment B allotted to you and write the procedure. (1X 7 =7 marks)
3. Make suitable micro preparation of C. Identify giving reasons, draw labelled diagrams and submit the slide for valuation. (1X7= 7 marks)
4. Solving genetic problems D related dihybrid ratio / interaction of genes. (1X 10 =10 marks)
5. Identify the Blood group E and interpret your results, draw labelled diagrams and submit the slide for valuation. (1X 10 =10 marks)
6. Calculation of chromosome mapping from three-point test cross data F (1X 10 =10 marks)
7. Calculate gene and genotypic frequency by Hardy-Weinberg Equilibrium. G (1X 10=10 marks)
8. Spotters H, I (2X 3 =6 marks)
9. Submission: Record note book 5

Head of the Department **Course Instructor**
Dr. Sr. P. Leema Rose **Dr. S.Kala Vetha Kumari**

Department : Botany

Class : II M.Sc. Botany

Title of the Course : ENTREPRENEURIAL OPPORTUNITIES IN BOTANY
Semester : III

Course Code : BP233EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP233EC1	4	-	–	–	3	4	**60**	**25**	**75**	**100**

Learning Objectives:

1. Understand the different classifications of horticultural crops, nursery management, and use of technology in horticulture.
2. Evaluate the importance of floriculture and contribution spices and condiments on economy.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Students can acquire knowledge about organic farming and their advantages	PSO-1	K1
CO-2	Understand both the theoretical and practical knowledge in understanding various horticultural techniques.	PSO-2	K2 & K6
CO-3	To develop kitchen garden or terrace garden in their living area.	PSO-3	K3
CO-4	Evaluate the horticultural techniques to students can develop self-employment and economical improvement.	PSO-3	K4
CO-5	Create and develop skills for mushroom cultivation.	PSO-3	K5

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.	Organic manures and fertilizers. Composition of fertilizer, NPK content of various fertilizers.	3	1	K2(U)	Lecture using Chalk and talk, Brain Storming	Participative Learning-Team Teaching, Sales day	Interactive PPT, E-content MS Power point	MCQ, Qui Open book test

	2.	Common organic manures bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost.	3		K1(R)	Cooperative learning-Group Discussion, Reflective Thinking	Participative Learning-Demonstrating exhibit	You tube videos, GAMMA PPT	Online Quiz-Google Forms, Just a Minute
	3.	Preparation of compost, aerobic and anaerobic – advantages.	2	1	K3(Ap)	Reflective Thinking, Blended Learning	Collaborative learning-Mind mapping,	E-content-MS Word, Interactive PPT	Open book Tes MCQ, Online Asingment
	4.	Vermicompost preparation, Panchakaviyam.	2		K4(An)	Lecture using videos, Brain Storming, Integrative Teaching	Participative Learning-Demonstration of Experiments	Interactive PPT, Discussion Forum-Google Classroom	Slip Test, Unnounced Test, Oral presentation
II	1.	Common garden tools.	2	1	K2(U)	Inquiry based approach, Brain Storming	Experiential Learning-Interaction in the classroom	You tube videos, Econtent-MS Word	Class test, Ope book test
	2.	Methods of plant propagation by seeds.	2		K 3(Ap)	Simulation based approach, Lecture Method	Experiential Learning-Making models	E-Content-External links, PPT	Creative drawing, Onlin Quiz- Google form
	3	Vegetative propagation, cutting, grafting, budding and layering.	3	1	K1(K)	Integrative Teaching, Demonstrative	Experiential Learning-Demonstration of experiments	Discussion Forum-Google classroom, PPT	Online Assignment, Observation Notes
	4	Use of growth regulators for rooting.	3		K4(An)	Embodied Learning, Brain Storming	Participative Learning-Practical	Interactive E-book, Interactive PPT	Oral Presentation, Oral Test
III	1	Gardening – types of gardens, ornamental, indoor garden, kitchen garden, terrace garden, vegetable garden for marketing.	3	1	K2(U)	Brain Storming, Lecture Method	Participative learning-Using visual images and models	Discussion forum-Mentimeter, E-content MS Word	Quiz questioning in the classroom, Observation notes
	2	Rockery and artificial ponds.	2		K 3(Ap)	Reflective Thinking, Demonstrative	Participative learning-Models	YouTube videos, Interactive PPT	Album preparation, Oral presentation
	3	Ornamental garden designing.	2	1	K1(K)	Blended Learning, Collaboration	Experiential Learning-Visual images	Interactive E-book, PPT	Open book test Just a Minute

	4	Garden components flower beds, borders, hedges, edges, drives, paths, garden adornments.	3		K4(An)	Integrative Teaching, Lecture Method	Experiential Learning-Mind map	E-content, MS Power point	Slip test, Group discussions
IV	1	Packaging of fruits, vegetables.	3	1	K2(U)	Co-operative Learning, Lecture Method	Participative Learning-Using visual images and models	E-content MS word, Whats app poll	Homework, CIA, Assignment
	2	Preservation techniques drying, heat treatment, low temperature storage and by chemicals.	3	1	K 3(Ap)	Reflective Thinking, Brain Storming, Lecture Method	Participative Learning-Interaction in the classrooms	Discussion forum-Mentimeter, E-content MS Word	Quiz- Quizzes and google forms
	3	Preparation of wine, vinegar and dairy products.	4		K1(K)	Simulation based approach, Lecture Method, Reflective Thinking	Experiential Learning-Demonstration	YouTube videos, Interactive PPT	Online Assignment, open book test
V	1.	Significance of mushrooms. Cultivation.	3	1	K2(U)	Brain Storming, Lecture Method	Participative Learning-Panel discussion	Interactive PPT, E-content MS Power point	Class test, Open book test
	2.	Types of mushrooms (button mushroom, oyster mushroom).	3		K 3(Ap)	Reflective Thinking, Simulation based approach	Participative Learning-Recipes	You tube videos, GAMMA PPT	Creative drawing, Online Quiz- Google form
	3.	Spawn isolation and preparation.	2	1	K1(K)	Blended Learning, Collaboration	Experiential Learning-Preparing and demonstration	E-content-MS Word	Online Assignment, Observation Notes
	4.	Value added products from mushroom – pickles, candies and dried mushrooms.	2		K4(An)	Integrative Teaching, Lecture Method	Participative Learning-Preparing and demonstrative exhibits	Interactive PPT, E-content MS word	Oral Presentation, Oral Test

*Total Teaching hours include 15 hours allotted for Formative and Summative Assessments

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

Activities (Em / En /SD): **Preparing and demonstrating mushroom, value added products exhibits**

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

Activities related to Cross Cutting Issues:- **Hands on training- Entrepreneurial activity**

Assignment: types of gardens, ornamental, indoor garden, kitchen garden, terrace garden, vegetable garden for marketing.

Seminar Topics: Types of mushrooms (button mushroom, oyster mushroom). Spawn isolation and preparation.

Part A (1 mark)

1. Which organic manure is known for its high nitrogen content? **(K2-U, CO-2)**
   a. Bone meal b. Cow dung c. oil cakes d. Poultry waste
2. Panchakaviyam includes which of the following components? **(K2-U, CO-2)**
   a. Milk, curd, ghee, cow urine, and cow dung b. Milk, ghee, honey, water, and compost
   c. Milk, oil, leaves, water, and compost d. Milk, water, cow urine, leaves, and ghee
3. The tool commonly used for digging and turning soil in the garden is called a _____. **(K2-U, CO-3)**
4. The hormone commonly used to stimulate root formation in cuttings is _____. **(K2-U, CO-4)**
5. Rockeries are gardens that primarily feature rocks and alpine plants, whether the statement is True/ False **(K2-U, CO-2)**
6. A kitchen garden is specifically designed to grow herbs, vegetables, and fruits for household use, whether the statement is True/ False **(K2-U, CO-4)**
7. What is the primary purpose of drying fruits and vegetables?. **(K2-U, CO-4)**

   a. To enhance their flavor b. To improve their color c. To reduce their moisture content d. To increase their weight
8. Which chemical is commonly used for the preservation of fruits and vegetables? **(K2-U, CO-5)**

   a. Sodium chloride b. Sodium benzoate c. Calcium carbonate d. Potassium chloride

Part B (6 marks)

1. Compare and contrast cow dung and poultry waste as organic manures in terms of their nutrient content and application **(K1-R, CO-1)**
2. Interpret the composition and NPK content of bone meal and its use in agriculture. **(K3-Ap, CO-1)**
3. Assessing five common garden tools and their primary uses in gardening. **(K4-An, CO-2)**
4. Describe the concept of a terrace garden and its advantages? **(K1-R, CO-3)**
5. Role of acetic acid bacteria in the production of vinegar.– justify **(K4-An, CO-4)**
6. Explain the characteristics and uses of button mushrooms. **(K1-R, CO-5)**
7. Analyze the spawn preparation for mushroom cultivation. **(K4-An, CO-5)**

Part C (12 marks)

1. Summarize the steps involved in the preparation of Panchakaviyam and its benefits in organic farming. **(K3-Ap, CO-1)**
2. Discuss the process of vermicompost preparation and the benefits of vermicomposting over traditional composting methods. **(K1-R, CO-1)**
3. Compare and contrast the different methods of vegetative propagation, including cuttings, grafting, budding, and layering. **(K3-Ap, CO-2)**
4. Analyze the economic and environmental impacts of vegetable gardens for marketing purposes. **(K4-An, CO-3)**
5. Determine the process of making wine from grapes and the biochemical changes that occur during fermentation. **(K2-U, CO-4)**
6. Distinguish the different packaging materials used for fruits and vegetables and their impact on shelf life and quality? **(K3-Ap, CO-4)**
7. Compare and contrast button mushrooms and oyster mushrooms in terms of their cultivation requirements and market potential. **(K3-Ap, CO-5)**

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

Course Instructor
Dr. S.Kala Vetha Kumari

Department : Botany

Class : II M.Sc. Botany

Title of the Course :SKILL ENHANCEMENT COURSE II: AGRICULTURE AND FOOD MICROBIOLOGY

Semester : III

Course Code : BP233SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
BP233SE1	3	-	–	–		3	**45**	**25**	**75**	**100**

Learning Objectives:

1. To provide comprehensive knowledge about plant – microbe interactions.
2. To provide basic understanding about factors affecting growth of microbes

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	Recognize the general characteristics of microbes and factors affecting its growth	PSO-1	K1 &K3
CO-2	Explain the significance of microbes in increasing soil fertility	PSO-2	K3 & K4
CO-3	Elucidate concepts of microbial interactions with plant and food.	PSO-3	K3 & K5
CO-4	Analyze the impact of harmful microbes in agriculture and food Industry.	PSO-3	K2
CO-5	Determine and appreciate the role of microbes in food preservation and as biocontrol.	PSO-3	K1 & K3

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.	Role of symbiotic and free-living bacteria and cyanobacteria in agriculture.	3	1	K2(U)	Brain Storming, Simulation based approach	Participative Learning - Team Teaching, Demonst	Interactive PPT, E-content MS Power point	MCQ, Quiz, Open book test

							ration of experiments		
	2.	Mycorrhiza, Plant Growth Promoting Micro-organism (PGPM) and	2		K1(R)	Cooperative learning-Group Discussion, Reflective Thinking	Participative Learning - Demonstration, Panel discussion	You tube videos, GAMMA PPT	Online Quiz-Google Forms, Just a Minute
	3.	Phosphate Solubilizing Micro-organism (PSM).	2		K3(Ap)	Reflective Thinking, Blended Learning	Collaborative learning-Mind mapping,	E-content-MS Word, Interactive PPT	Open book Test, MCQ, Online Asingment
II	1.	Biocontrol of plant pathogens, pests and weeds.	2	1	K2(U)	Inquiry based approach, Brain Storming	Experiential Learning - Role play, Mind map	You tube videos, E-content-MS Word	Class test, Open book test
	2.	Restoration of waste and degraded lands.	2		K1(R)	Simulation based approach, Lecture Method	Experiential Learning - Making models	E-Content-External links, PPT	Creative drawing, Online Quiz-Google form
	3	Biofertilizers: Types, technology for their production and application.	2	1	K3(Ap)	Integrative Teaching, Demonstrative	Experiential Learning - Demonstration of experiments	Discussion Forum-Google classroom, PPT	Online Assignment, Observation Notes
	4	Vermi-compost.	1		K4(An)	Embodied Learning, Brain Storming	Participative Learning - Practical	Interactive E-book, Interactive PPT	Oral Presentation, Oral Test
III	1	Intrinsic and extrinsic factors influencing growth of microorganisms in food.	3	1	K2(U)	Brain Storming, Lecture Method	Participative learning-Group discussion	Discussion forum-Mentimeter, E-content MS Word	Quiz questioning in the classroom, Observation notes
	2	Microbes as source of food: Mushrooms	2		K1(R)	Reflective Thinking, Demonstrative	Participative learning-Demonstration of	YouTube videos, Interactive PPT	Album preparation, Oral

							Experiments		presentation
	3	Single cell protein.	2		K3(Ap)	Blended Learning, Collaboration	Experiential Learning - Individual project	Interactive E-book, PPT	Open book test, Just a Minute
IV	1	Microbial spoilage of food and food products: Cereals.	3	1	K2(U)	Co-operative Learning, Lecture Method	Participative Learning - Using visual images and models	E- content MS word, Whats app poll	Home work, CIA, Assignment
	2	Vegetables, prickles, fish and dairy products. Food poisoning and food intoxication.	2		K1(R)	Reflective Thinking, Brain Storming, Lecture Method	Participative Learning - Interaction in the classrooms	Discussion forum-Mentimeter, E-content MS Word	Quiz-Quizzes and google forms
	3	Food preservation processes. Microbes and fermented foods: Butter.Cheese and bakery products.	2		K3(Ap)	Simulation based approach, Lecture Method, Reflective Thinking	Experiential Learning - Demonstration	YouTube videos, Interactive PPT	Online Assignment, open book test
V	1.	PREDICTIVE METHODS: Food quality control Act and Regulations ,	2	1	K2(U)	Brain Storming, Lecture Method	Participative Learning - Role play, Mind map	Interactive PPT, E-content MS Power point	Class test, Open book test
	2.	Food safety, trade regulation of Food materials.	2	1	K1(R)	Reflective Thinking, Simulation based approach	Participative Learning - Describing visual images	You tube videos, GAMMA PPT	Creative drawing, Online Quiz-Google form
	3.	Instrumentation in food analysis.	3		K3(Ap)	Blended Learning, Collaboration	Experiential Learning - Video making	E-content-MS Word	Online Assignment, Observation Notes

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

Activities (Em / En /SD): **Preparing and demonstrating food exhibits**

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

Activities related to Cross Cutting Issues:- Field **Visit**

Assignment: Microbial spoilage of food and food products: Cereals.

Seminar Topics: Food poisoning and food intoxication.

Part A (1 mark)

1. What is the role of symbiotic bacteria in agriculture? **(K1-R, CO-1)**

a) Fixation of atmospheric nitrogen b) Decomposition of organic matter

c) Pest control d) Soil aeration

2. Which of the following is not a benefit of mycorrhizal associations in agriculture?**(K1-R, CO-2)**

b) Improved nutrient uptake b) Enhanced tolerance to drought

c) Prevention of soil erosion d) Increased resistance to pathogens

3. Plant Growth Promoting Microorganisms (PGPM) primarily enhance plant growth by: **(K2-U, CO-2)**

c) Providing mechanical support to roots b) Suppressing weed growth

c) Enhancing nutrient availability d) Increasing water content in soil

4. Phosphate Solubilizing Microorganisms (PSM) play a crucial role in agriculture by: **(K1-R, CO-3)**

d) Increasing soil pH b) Converting organic matter into inorganic phosphorus

c) Facilitating the uptake of phosphorus by plants d) Inhibiting plant growth

5. Cyanobacteria contribute to agriculture by: **(K1-R, CO-4)**

e) Producing antibiotics for plant protection b) Fixing atmospheric carbon dioxide

c) Enhancing soil fertility through nitrogen fixation d) Providing natural colors for crop protection

Part B (6 marks)

1. Discuss the role of mycorrhiza in agriculture and how it enhances plant growth. **(K1-R, CO-1)**
2. Explain the technology used for the production and application of biofertilizers.**(K1-R, CO-2)**
3. Describe the intrinsic and extrinsic factors influencing the growth of microorganisms in food.**(K2-U, CO-2)**
4. How do microbes contribute to the spoilage of dairy products?**(K3-Ap, CO-3)**
5. What are the different trade regulations of food materials?**(K2-U, CO-4)**

Part C (12 marks) Discuss the significance of plant growth-promoting microorganisms (PGPM) in agriculture, highlighting their mechanisms of action and potential benefits for crop production.(**K3-Ap, CO-1)**

1. Explain the concept of biocontrol in agriculture, focusing on its role in managing plant pathogens, pests, and weeds. Provide examples of biocontrol agents and their modes of action.(**K2-U, CO-2)**
2. Evaluate the importance of vermicompost in sustainable agriculture, detailing its production process, benefits for soil health, and potential challenges.(**K5-E, CO-3)**
3. Compare and contrast the microbial spoilage of cereals, vegetables, fruits, fish, and dairy products, discussing common spoilage microorganisms and their effects on food quality.(**K3-Ap, CO-3)**
4. Analyze the Instrumentation in food analysis.(**K4-An, CO-4)**

Head of the Department **Course Instructor**

Dr.W.Vincy

Dr. Sr. P. Leema Rose