KANNUR UNIVERSITY

(Abstract)

FYUGP - Scheme (six Semesters) and Syllabus (First & Second Semesters only) of B.Sc. Plant Science Programme - Approved & Implemented w.e.f. 2024 Admission - Orders Issued

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FYUGP Spl.cell

ACAD/FYSC-III/21060/2024 Dated: 17.11.2024

Read:-1. U.O. No. FYUGPSC/FYSC-I/5074/2024, dated: 18/04/2024

2. E-mail of the Chairperson, Board of Studies in Botany(UG), dated 10.06.2024
3. The Minutes of the Meeting of the Scrutiny Committee held on 13.06.2024
4. The Orders of the Vice Chancellor dtd 24.06.2024
5. The Minutes of the Meeting of the Academic Council, held on 25.06.2024
6. E-mail from the Chairperson, Board of Studies in Botany (UG), dated 29.06.2024

ORDER

1.The Regulations of the Kannur University Four Year UG Programmes (KU-FYUGP Regulations 2024) for affiliated Colleges was implemented with effect from 2024 admission, vide paper read as(1) above.

2.As per paper read (2) above, the Chairperson, Board of Studies in Botany (UG) submitted the Scheme (of six Semesters) and Syllabus (First & Second Semesters only) in respect of the B.Sc. Plant Science programme, prepared in line with KU-FYUGP Regulations.

3.Subsequently, as per the paper read (3) above, a Scrutiny Committee, which included the Dean, Faculty of Science scrutinized the Scheme (Six Semesters) and Syllabus (First & Second Semesters only) of the B.Sc. Plant Science Programme and recommended certain suggestions.

4.Subsequently, as per paper read (4) above, the Vice Chancellor ordered to place the same before the Academic Council for approval.

5. XXVIIIth meeting of the Academic Council as per paper read (5) above approved the Scheme & syllabus of the FYUGP in Affiliated Colleges w. e. f 2024 admission in principle and permitted to publish the same as and when ready after making necessary modifications.

6. Afterwards, as per paper read (6) above, the Chairperson, Board of Studies in Botany (UG) forwarded the Scheme (six Semesters) and Syllabus (First & Second Semesters only) of B.Sc Plant Science Programme, after incorporating certain modifications.

7. The Vice Chancellor, in tune with the decision of the Academic Council, approved the modified Scheme (six semesters) and Syllabus (First & Second Semesters only) of the B.Sc. Plant Science Programme (FYUGP), exercising the powers of the Academic Council conferred under Section 11(1) Chapter III of Kannur University Act 1996 and accorded sanction to implement the same in the affiliated Colleges w.e.f. the academic year 2024-'25.

8. The Scheme (six semesters) and syllabus (First and Second semesters only of B.Sc.Plant

Science Programme (FYUGP) to be implemented in the affiliated colleges w.e.f. the academic year 2024-'25 is appended with this U.O and uploaded in the official website of the University.

Orders are issued accordingly.

Sd/-

ANIL CHANDRAN R

DEPUTY REGISTRAR (ACADEMIC)

For REGISTRAR

To:
1. The Principals of Arts and Science Colleges affiliated to Kannur University
2. The Chairperson, BoS in Botany (UG)

Copy To:
1. PA to CE (to circulate the same among the sections concerned under Examination Branch)
2. PS to VC/PA to R
3. JR II (Exam)
4. DR/AR (Academic)
5. Web manager (to upload in the website)
6. Computer Programmer
7. SF/DF/FC

Forwarded / By Order

SECTION OFFICER

KANNUR UNIVERSITY
കണ്ണൂർ സർവകലാശാല
Re-accredited by NAAC with 'B++' Grade

KANNUR UNIVERSITYFYUGP SYLLABUS

B.Sc. PLANT SCIENCE

Effective from 2024 admissions

2024

CONTENTS

Foreword

The Four-Year Undergraduate Programme (FYUGP) in BSc Plant Science is undergoing rigorous transformations to better align with the evolving needs of students, industries, and society at large. Recognizing education as a cornerstone of progress, it's imperative that the curriculum reflects contemporary demands. This necessitates frequent and strategic updates to keep pace with societal and economic shifts.

In the current era, it is paramount that higher education equips students with robust, practical skills that are directly applicable to their chosen fields. Despite a surge in college enrollment, doubts persist regarding the adequacy of educational preparation for the workforce, particularly in terms of the competencies sought by employers.

As globalization intensifies and the world accelerates, educational institutions must adapt,instilling in students not only technical expertise but also critical thinking, communication prowess, and adaptability. These competencies are essential for thriving in the 21st century.

Moreover, there is an escalating expectation for colleges and universities to champion social responsibility and contribute to sustainable development through innovation. The government of Kerala is taking decisive actions to enhance higher education by establishing commissions to recommend comprehensive policy reforms, regulatory updates, and evaluation system overhauls.

Integral to these initiatives is the restructuring of the undergraduate curriculum, including the FYUGP in BSc Plant Science. This restructuring aims to forge a knowledge-driven society capable of spearheading sustainable development. These changes are designed to ensure that higher education remains relevant, effective, and advantageous for both students and society as a whole.

Chairperson, Board of Studies in UG Botany

Dr. K.P. Prasanth,

Associate Professor, Department of

Botany,Sree Narayana College, Kannur

Preamble

Welcome to the Four-Year Undergraduate Programme (FYUGP) in BSc Plant Science at Kannur University. This curriculum has been meticulously engineered to impart a profound understanding of plant science, arming students with the critical skills necessary to excel in today's demanding and ever-changing environment.

Plant science, the rigorous study of plants, is a field of immense and multifaceted significance, intersecting essential domains such as agriculture, medicine, ecology, and conservation. With the relentless pace of scientific and technological advancements, plant science continually evolves, offering both unprecedented opportunities and formidable challenges. Recent breakthroughs in genome editing, sustainable agriculture, and plant-microbe interactions are revolutionizing our understanding and capabilities in plant science.

Our syllabus is designed to merge deep theoretical knowledge with practical application, providing a robust education that readies students for both advanced academic research and professional careers. Through an intensive mix of classroom lectures, laboratory experiments, fieldwork, and research projects, students will delve into the intricate realms of plant biology.

At Kannur University, we are unwavering in our commitment to fostering an intellectually stimulating environment that promotes curiosity, critical thinking, and a fervor for discovery. We champion active participation, independent thought, and collaborative learning, ensuring our graduates emerge as confident and competent leaders ready to make significant contributions to society.

This syllabus embodies our relentless pursuit of academic excellence, innovation, and continuous improvement. We are dedicated to cultivating a profound appreciation for the natural world and instilling a deep sense of environmental stewardship in our students. Our goal is to shape future leaders who can tackle the pressing challenges facing our planet.

We extend our best wishes to all students embarking on this rigorous educational journey, confident that their time studying plant science at Kannur University will be enriching, rewarding, and transformative.

Academic Competency

In the dynamic field of BSc Plant Science at Kannur University, our graduate attributes bridge academic learning with practical botanical expertise. These attributes encompass a wide range of essential skills and qualities that students develop throughout their studies, ensuring they are well-prepared for real-world applications. Key attributes include critical thinking, enabling students to analyze and evaluate information effectively; problem-solving, fostering creative and practical solutions to botanical challenges; and professionalism, maintaining high standards in work and conduct. Leadership skills guide and inspire others, while teamwork emphasizes the importance of collaboration. Clear and effective communication is crucial for sharing ideas, and a deep understanding of botanical principles underpins all scientific endeavors. Kannur University is dedicated to nurturing these attributes in BSc Plant Science students, seamlessly integrating them into the curriculum. This commitment ensures that graduates are not only knowledgeable in plant science but also resilient, compassionate, and socially conscious leaders ready to excel in their careers and make meaningful contributions to society.

KANNUR UNIVERSITY VISION AND MISSION STATEMENTS

Vision

To establish a teaching, residential and affiliating University and to provide equitable and just access to quality higher education involving the generation, dissemination and a critical application of knowledge with special focus on the development of higher education in Kasargode and Kannur Revenue Districts and the Manandavady Taluk of Wayanad Revenue District.

Mission

➢ To produce and disseminate new knowledge and to find novel avenues forapplication of such knowledge.

➢ To adopt critical pedagogic practices which uphold scientific temper, theuncompromised spirit of enquiry and the right to dissent.

➢ To uphold democratic, multicultural, secular, environmental and gender sensitivevalues as the foundational principles of higher education and to cater to the modernnotions of equity, social justice and merit in all educational endeavors.

➢ To affiliate colleges and other institutions of higher learning and to monitor academic, ethical, administrative and infrastructural standards in such institutions.

➢ To build stronger community networks based on the values and principles of higher education and to ensure the region's intellectual integration with nationalvision and international standards.

➢ To associate with the local self-governing bodies and other statutory as well asnon-governmental organizations for continuing education and also for building public awareness on important social, cultural and other policy issues.

FYUGP BSc BOTANY AD HOC COMMITTE

1. Prof. S Sudheesh Dean, Faculty of Science, Kannur University

2. Dr. Harikrishnan E, (**Convener**) Assistant Professor of Botany Payyanur College, Edat 3.

Falilullahim Aslam K V., Assistant Professor, Department of Botany, Government Brennen College, Thalassery

4. Muhammed Haneef K A, Assistant Professor, Department of Botany. GovernmentBrennen College, Thalassery

5. Suvarnika V., Assistant Professor, Department of Botany, Government Brennen College, Thalassery

6. Dr. Biju P., Associate Professor, Department of Botany. Government College Kasaragod

7. Dr Josekutty EJ, Associate Professor, Department of Botany, Government College, Kasaragod

8. Dr Tomson Mani, Assistant Professor, Department of Botany, Government Brennen College, Thalassery

9. Dr. P.S Prakash, Associate Professor, Department of Botany. Government Brennen College,Thalassery

10. Dr. Gayatri. R. Nambiar, Asst. Professor, Dept. of Botany, Sir Syed Collage, Taliparamba

11. Dr Prajith PK, Assistant Professor, Department of Botany Nehru Arts and Science College Kanhangad

12. Dr. P Aparna, Assistant Professor, Department of Botany, Sree Narayana College Kannur

13. Sruthi C.C, Assistant Professor of Plant Science PRNSS College, Mattannur

14. Resmi P Thomas, Assistant Professor, Department of Botany Nirmalagiri College, Kuthuparamba

15. Dr. Ratheesh Narayanan M.K., Assistant Professor, Department of Botany, Payyanur College,Edat

16. Dr.Tajo Abraham, Assistant Professor, Department of Botany, Sir Syed College, Taliparamba

BOARD OF STUDIES IN UG BOTANY

Chairperson

Dr. K.P. Prasanth, Associate Professor, Department of Botany, Sree Narayana College, Kannur

Members

1. Mr. Falilullahim Aslam K V, Assistant Professor, Department of Botany, Government Brennen College, Thalassery
2. Mr.Muhammed Haneef K.A, Assistant Professor, Department of Botany, GovernmentBrennen College, Thalassery,
3. Ms.Suvarnika V, Assistant Professor, Department of Botany, Government Brennen College, Thalassery
4. Ms. Deepa A V, Assistant Professor, Department of Botany, Government Brennen College, Thalassery
5. Dr. Biju P, Associate Professor, Department of Botany, Government College, Kasaragod
6. Dr. R.D. Anpin Raja, Assistant Professor, Department of Botany, Nirmalagiri College, Kuthuparamba
7. Dr. Jeeshna MV, Assistant Professor, Department of Botany, Sree Narayana College, Kannur
8. Dr. Prajith PK, Assistant Professor, Department of Botany, NAS College, Kanhangad
9. Dr. Abdussalam A.K. Assistant Professor, Department of Botany, Sir Syed College, Taliparamba
10. Dr C. Pramod, Assistant Professor, Department of Botany, University of Calicut (Chairperson, PG Board)

PROGRAMME OUTCOMES

PO 1. CRITICAL THINKING

1. Evaluate information objectively to form well-founded judgments.

2. Draw logical conclusions from data, identifying essential details and discarding irrelevant ones for effective problem-solving or decision-making.

3. Detect logical inconsistencies in others' arguments.

4. Analyze data, facts, observable events, and research findings to generate relevant andvalid conclusions specific to the field.

PO 2. COMPLEX PROBLEM SOLVING

1. Tackle various challenges in both known and new environments, applying knowledgeto practical situations.

2. Analyze problems, develop and implement solutions, and assess their effectiveness.

3. Evaluate the impact of solutions on people and the

environment.

PO 3. CREATIVITY

1. Develop innovative content, theories, and methodologies.

2. Use diverse approaches to connect different concepts or events.

3. Provide new insights or improve existing ideas and solutions.

4. Generate, refine, and express new ideas with practical value or inherent

significance.

PO 4. COMMUNICATION SKILLS

1. Clearly and effectively communicate ideas or emotions.

2. Use language precisely to convey messages.

3. Engage and captivate the audience skillfully.

4. Listen attentively, understand, and show empathy towards speakers.

5. Express opinions and thoughts with confidence and assertiveness.

PO 5. LEADERSHIP QUALITIES

1. Lead diverse teams effectively and respectfully.

2. Build team unity toward common goals.

3. Motivate and mentor individuals to achieve collective solutions.

4. Offer support and motivation during tough times, promoting resilience and bravery.

PO 6. MASTERING THE ART OF SKILL ACQUISITION

1. Acquire new knowledge and skills, like mastering the ability to learn continuously, through self-directed learning.

2. Independently find and access appropriate resources essential for ongoing learningpursuits.

3. Cultivate organizational skills and time management strategies to set personal goalsand deadlines.

4. Cultivate a positive outlook to welcome lifelong learning.

PO 7. EMERGING TECHNOLOGICAL ABILITIES

1. Apply Information and Communication Technology in diverse learning and professional settings, accessing, evaluating, and utilizing various relevant information sources.

2. Utilize appropriate software for data analysis purposes.

3. Understand the risks associated with the digital world and take precautions to ensure security.

4. Uphold constitutional, humanistic, ethical, and moral principles in life, embracing universal values such as truth, integrity, peace, compassion, nonviolence, scientific reasoning, and citizenship responsibilities.

5. Formulate a position or argument on an ethical issue by considering multiple perspectives.

6. Identify ethical dilemmas in professional contexts, adhering to ethical standards by

avoiding unethical practices like data fabrication, falsification, plagiarism, and respecting intellectual property rights.

7. Employ impartial, objective, and truthful approaches in all professional endeavors.

PROGRAMME SPECIFIC OUTCOMES

Upon completing the program, graduates will discover a multitude of opportunities, armed with the expertise to excel in their selected field.

PSO 1

The curriculum provides students with a thorough grasp of plant diversity, encompassing topics such as structure, genetics, reproduction, ecology, and economic importance across diverse plant categories. (Programme Outcome Numbers1,6)

PSO 2

Students acquire a broad understanding of plant diversity, exploring the complexities of structure, function, reproduction, and life cycles within specific plant groups, igniting a profound curiosity to delve deeper into the world of plants. (Programme Outcome Numbers 1,2)

PSO 3

In the field of Plant Science, students delve into fundamental principles of Morphology, Taxonomy, Anatomy, Ecology, Physiology, Genetics, and Molecular Biology, while also exploring advanced subjects such as Plant Biotechnology, Molecular Plant Pathogen interactions, and Developmental Botany. (Programme Outcome Numbers 2,6)

PSO 4

Students encounter a wide array of professional pathways, ranging from Landscaping, Gardening, and Floriculture to Organic farming, Herbal technology, Mushroom cultivation, Ecotourism, and Forensic Botany, empowering them to emerge as future entrepreneurs in the field of Plant Science. (Programme Outcome Numbers 3,6,7)

PSO 5

Students develop proficiency in employing diverse analytical techniques and tools for both fundamental and practical research in plant biology, while also addressing intellectual and ethical aspects inherent in biological discoveries. (Programme Outcome Numbers 6,7)

PSO 6

Students acknowledge the essential role of the plant kingdom in human survival and cultivate skills for documenting, conserving, and sustainably managing plant resources in the face of climate change challenges. (Programme Outcome Numbers 6,7,8)

PSO 7

Involvement in project work and research activities encourages students to utilize interdisciplinary concepts, nurturing critical thinking, problem-solving skills, and creativity to innovate and generate new knowledge. (Programme Outcome Numbers 3,6,7)

PSO 8

Practical training across different fields nurtures hands-on skills, mastery in equipment operation, laboratory techniques, and the collection, analysis, and interpretation of biological data. (Programme Outcome Numbers 4,5,6)

PSO 9

Participating in laboratory work and field studies nurtures teamwork and leadership skills among students. Additionally, hands-on field experience provides a practical opportunity for mastering new skills. (Programme Outcome Numbers 5,6,7)

PSO 10

Completing assignments and presentations improves students' communication and ICT skills. Furthermore, coursework in Biostatistics and Bioinformatics offers hands-on experience with software and tools relevant to these areas of biology. (Programme Outcome Number 7)

PSO 11

The flexible curriculum enables instructors to incorporate inquiry-based learning activities, prompting students to inquire, investigate, and draw conclusions independently. This method fosters curiosity, encourages self-directed learning, and enhances understanding of scientific principles. Additionally, teacher-led debates and discussions on controversial scientific topics equip students with argumentation skills, enabling them to support claims with evidence and consider various viewpoints. (Programme Outcome Numbers 5,6,8)

PSO 12

Inspire a lifelong love for learning and professional growth by motivating students to stay abreast of developments in the field of botany, engage in continuing education initiatives, and pursue further studies or certifications when necessary. (Programme Outcome Numbers 4,5,7)

PROGRAMME PATHWAYS WITH PLANT SCIENCE

Sl No	Name of the Pathway	Minimum Requirements
1.	BSc Degree with Single Major in Plant Science	For the THREE YEAR PROGRAMME A minimum of 68 credits from 17 courses and out of these 10 courses above should be above level 300. 2 credits of internship in Plant Science and 24 credits from any 6 disciplines other than the major discipline. For the FOUR YEAR PROGRAMME students should earn a further 32 credits in Plant Science from advance level courses and project and an additional 12 credits from any discipline.
2.	BSc. Degree Major in Plant Science with Minor	A minimum of 24 credits in the minor discipline by the end of Third year and 32 credits by the end of Fourth year in any discipline along with major in Plant Science
3.	BSc Degree Major in Plant Science with Multiple Disciplines	Along with the criteria 4 major discipline in Plant Science, 68 credits from 17 courses along with 12 credits from 3 courses belonging to a maximum of two other disciplines with a total of 24 credits. In the Fourth-year students need to earn an additional 12 credits from any 3 disciplines with a total of 36 credits.
4.	BSc Degree with Plant Science and any other discipline as Major	There is a minimum requirement of 50 percentage credits in Plant Science and a minimum 40 percentage credits from any other disciplines. Students should earn a minimum of 68 credits in Plant Science and 53 credits from another discipline. The double major pathway is not extended to the Fourth year. In the fourth year the required credits from Plant Science or any other major discipline.
5	BSc Degree Major in Plant Science with Vocational Minor	68 credits from 17 courses in Plant Science and in the fourth year they should earn 32 credits in Vocational Minor discipline to get a UG Honours degree with a Vocational Minor
6.	Multidisciplinary UG Programme	The overall fraction of credits should be 70 percentage in the major and minor disciplines. A minimum of 94 credits is required for the Third year programme and a minimum of 124 credits including the project for the Four Year Programme
7.	Inter disciplinary UG Programme	For a Third Year Programme 94 credits from the constituent discipline and for a Four Year Programme124 credits including Project are required.

CONSOLIDATED LIST OF COURSES AND CREDITS REQUIRED FOR BSc BOTANY AND PLANT SCIENCE

Sl. No.	Course Category	3 year UG		4 Year UG	
		Minimum no. of Courses required	Minimum No. of Credits required	Minimum no. of Courses required	Minimum No. of Credits required
1	Major	17	68	22	88
2	Minor (for those with minor pathway)	6	24	8	32
3	MDC	3	9	3	9
4	SEC	3	9	3	9
5	VAC	3	9	3	9
6	AEC	4	12	4	12
7	Internship		2		2
8* (only one type of course from these 4 divisions)	Research project of 12 credits- Mandatory for Honours with research				12
	Project of 12 credits - optional for Honours				12
	Project of 8 credits + one major course (honours)				8 + 4
	Three major Courses instead of optional project				12
9	An additional Course in major/minor/any other discipline			1	4
	TOTAL	36	133	47	177

SEMESTER WISE CREDIT DISTRIBUTION OF GENERAL FOUNDATION COURSES FOR BSc PLANT SCIENCE

SL.. No.	Name of the GFC	No. of Courses	Required credits	Distribution among Semesters and Disciplines (*Should select from the list given in the GFC courses of Plant Science)	
1	AEC	4	12	Sem 1	**AEC 1**(English) and **AEC 2** (Hindi/ Malayalam/ Sanskrit/ Kannada/ Urdu/ Arabic, etc.)
				Sem 2	**AEC 3** (English) and **AEC 4** (Hindi/ Malayalam/ Sanskrit/ Kannada/ Urdu/ Arabic, etc.)
2	MDC	3	9	Sem 1	MDC 1
				Sem 2	MDC 2
				Sem 3	MDC 3*
3	VAC	3	9	Sem 3	VAC 1 *
				Sem 4	VAC 2* and VAC 3
4	AEC	3	9	Sem 4	SEC 1*
				Sem 5	SEC 2
				Sem 6	SEC 3
Total		13	39		

*MDC, VAC and SEC should be related to Horticulture, Plantation Management, Tissue culture and Plant propogation

DETAILS OF MAJOR PATH WAY COURSES IN B.Sc. PLANT SCIENCE									
Sl. No.	Course Code	Sem	Name of the course	credit	THEORY		PRACTICAL		TOTAL
					ESE	CCA	ESE	CCA	
FIRST YEAR									
Semester 1									
1	KU1DSCPLS101	1	Cell: Structure and Reproduction	3 +1	50	25	15	10	100
Semester 2									
2	KU2DSCPLS102	2	Angiosperm Anatomy, Embryology and Palynology	3+ 1	50	25	15	10	100
SECOND YEAR									
Semester 3									
3	KU3DSCPLS201	3	Diversity of Algae and Bryophytes	3 + 1	50	25	15	10	100
4	KU3DSCPLS202	3	Angiosperm Systematics I	4	70	30	0	0	100
Semester 4									
5	KU4DSCPLS203	4	Diversity of Pteridophytes and Gymnosperms	3 + 1	50	25	15	10	100
6	KU4DSCPLS204	4	Angiosperm Systematics II	3 + 1	50	25	15	10	100
7	KU4DSCPLS205	4	Genetics	3+ 1	50	25	15	10	100

DETAILS OF MAJOR PATH WAY COURSES IN B.Sc. PLANT SCIENCE

Sl. No.	Course Code	Sem	Name of the course	Credit	THEORY		PRACTICAL		
					ESE	CCA	ESE	CCA	TOTAL
THIRD YEAR									
Semester 5									
8	KU5DSCPLS301	5	Mycology and Plant Pathology	3+ 1	50	25	15	10	100
9	KU5DSCPLS302	5	Bio-instrumentation and Computers	4	70	30	0	0	100
10	KU5DSCPLS303	5	Basics in Molecular biology and Genetics	4	70	30	0	0	100
11	KU5DSCPLS304	5	Phytochemistry	3+ 1	50	25	15	10	100
12	KU5DSEPLS305	5	*Plantation Management*	4	70	30	0	0	100
13	KU5DSEPLS306	5	*Stress Physiology*	4	70	30	0	0	100
14	KU5DSEPLS307	5	*Weed Ecology*	4	70	30	0	0	100
15	KU5DSEPLS308	5	*Seed Technology*	4	70	30	0	0	100
Semester 6									
16	KU6DSCPLS309	6	Biotechnology and Basic Bioinformatics	3 + 1	50	25	15	10	100
17	KU6DSCPLS310	6	Research Methodology and Biostatistics	4	70	30	0	0	100
18	KU6DSCPLS311	6	Phytophysiology	3+ 1	50	25	15	10	100
19	KU6DSCPLS312	6	Evolution and Plant Breeding	4	70	30	0	0	100
20	KU6DSCPLS313	6	Plant Ecology and Phytogeography	3+ 1	50	25	15	10	100
21	KU5DSEPLS314	6	*Floriculture and Olericulture*	4	70	30	0	0	100
22	KU5DSEPLS315	6	*Agroecology*	4	70	30	0	0	100
23	KU5DSEPLS316	6	*Ethnobotany*	4	70	30	0	0	100
24	KU5DSEPLS317	6	*Pharmacognosy and Phytochemistry*	4	70	30	0	0	100
25	KU6INTPLS318	6	Internship/apprenticeship/ Field trip/ Nature Camp	2	35	15	0	0	50

DETAILS OF MAJOR PATH WAY COURSES IN B.Sc. PLANT SCIENCE

Sl. No.	Course Code	Sem	Name of the course	Credit	THEORY		PRACTICAL		TOTAL
					ESE	CCA	ESE	CCA	
FOURTH YEAR									
Semester 7									
26	KU7DSCPLS401	7	Advanced course in Plant Developmental Biology	4	70	30	0	0	100
27	KU7DSCPLS402	7	Advanced course in Cryptogamic Diversity	3+ 1	50	25	15	10	100
28	KU7DSCPLS403	7	Advanced course in Diversity of Phanerogams	3+ 1	50	25	15	10	100
29	KU7DSCPLS404	7	Advanced course in Mycology, Microbiology and Plant pathology	4	70	10	0	20	100
30	KU7DSCPLS405	7	Modern tools and Techniques for Ecological Studies	4	70	10	0	20	100
Semester 8									
31	KU8DSCPLS406	8	Advanced Bioinformatics	3+ 1	50	25	15	10	100
32	KU8DSCPLS407	8	Phytogeography of North Kerala	4	70	30	0	0	100
33	KU8DSCPLS408	8	Applications of Botany in Industries - North Kerala	3+ 1	50	25	15	10	100
34	KU8DSEPLS409	8	*Advanced course in Angiosperm Systematics*	4	70	30	0	0	100
35	KU8DSEPLS410	8	*Plant Microtechnique*	4	70	30	0	0	100
36	KU8DSEPLS411	8	*Nanobiotechnology*	4	70	30	0	0	100
37	KU8DSEPLS412	8	*Climate change and Disaster Management*	4	70	30	0	0	100
38	KU8DSEPLS413	8	*Environmental Impact Assessment and Conservation Management*	4	70	30	0	0	100
39	KU8DSEPLS414	8	*Structural biology*	4	70	30	0	0	100
40	KU8PRJPLS415	8	Project (A project of 8 credits +1 Major course or 3 Major courses instead of optional project. The scheme of evaluation of the project of 8 credits will 140 +60 = 200)	12	210	90		0	300

DETAILS OF MINOR PATHWAY COURSES IN BOTANY / PLANT SCIENCE

Sl. No.	Course Code	Sem	Name of the course	credit	THEORY		PRACTICAL		
					ESE	CCA	ESE	CCA	TOTAL
Semester 1									
41	KU1DSCBOT103	1	Diversity of Plants I	3 + 1	50	25	15	10	100
42	KU1DSCBOT104	1	Plant Ecology and Phytogeography	3+ 1	50	25	15	10	100
Semester 2									
43	KU2DSCBOT105	2	Reproduction and Life Cycle of Plants	3+ 1	50	25	15	10	100
44	KU2DSCBOT106	2	Angiosperm Taxonomy and Morphology	3 + 1	50	25	15	10	100
Semester 3									
45	KU3DSCBOT206	3	Diversity of plants II	3+ 1	50	25	15	10	100
46	KU3DSCBOT207	3	Angiosperm Anatomy and Embryology	3+ 1	50	25	15	10	100
47	KU3DSCBOT208	3	Forest Botany	3+1	50	25	15	10	100
Semester 6									
46	KU6DSCBOT321	6	Mycology, Phytopathology and Applied Botany	3+ 1	50	25	15	10	100
47	KU6DSCBOT322	6	Evolution of Plants and Animals	4	70	30	0	0	100
48	KU6DSCBOT413	6	Plantation Management	3+ 1	50	25	15	10	100
49	KU6DSCBOT414	6	Forest Botany	3+ 1	50	25	15	10	100
50	KU6DSCBOT415	6	Ethnobotany	3+ 1	50	25	15	10	100
51	KU6DSCBOT416	6	Herbal Science	3+ 1	50	25	15	10	100
52	KU6DSCBOT417	6	Modern Plant Pathology	3+ 1	50	25	15	10	100
53	KU6DSCBOT418	6	Horticulture	3+ 1	50	25	15	10	100
54	KU6DSCBOT419	6	Agronomy and Agroforestry	3+ 1	50	25	15	10	100

DETAILS OF FOUNDATION COURSES IN BOTANY / PLANT SCIENCE

Sl. No.	Course Code	Sem	Name of the course	credit	THEORY		PRACTICAL		TOTAL
					ESE	CCA	ESE	CCA	
1	KU1MDCBOT101	1	Plant diversity	3	50	25	0	0	75
2	KU1MDCBOT102	1	Botany for the Beginners	3	50	25	0	0	75
3	KU2MDCBOT103	2	Beginner's exploration to the world of leaves and flowers	3	50	25	0	0	75
4	KU2MDCBOT104	2	Agrobiodiversity	3	50	25	0	0	75
5	KU3MDCBOT105	3	Botanical Art	3	50	25	0	0	75
6	KU3MDCBOT106	3	Introductory course on Applications of Botany	3	50	25	0	0	75
7	KU3MDCBOT107	3	Microscopy and visualisation tools in Biology	3	50	25	0	0	75
8	KU4SECBOT108	4	Biodiversity of Kerala and Ecotourism	3	50	25	0	0	75
9	KU4SECBOT109	4	Floral art Business	3	50	25	0	0	75
10	KU4SECBOT110	4	Entrepreneurship in Botany	3	50	25	0	0	75
11	KU4SECBOT111	4	Gardening Indoor and Outdoor	3	50	25	0	0	75
12	KU4SECBOT112	4	Medicinal Plants of Kerala	3	50	25	0	0	75
13	KU4SECBOT113	4	Mushroom Cultivation and Marketing	3	50	25	0	0	75
14	KU4SECBOT114	4	Plant Tissue culture Lab set up for commercial Production	3	50	25	0	0	75
15	KU5SECBOT115	5	Basics of Anthurium and Orchid Cultivation	3	50	25	0	0	75
16	KU5SECBOT116	5	Mangrove and Laterite Hill Ecology for Tourism	3	50	25	0	0	75
17	KU5SECBOT117	5	Plantation Crop Nursery Setup Management	3	50	25	0	0	75
18	KU5SECBOT118	5	Hydroponics and Aquaponics	3	50	25	0	0	75
19	KU5SECBOT119	5	Plant Propagation Methods	3	50	25	0	0	75
20	KU3VACBOT120	3	Gender: A Biological perspective	3	50	25	0	0	75
21	KU3VACBOT121	3	Sustainable Life style	3	50	25	0	0	75
22	KU3VACBOT122	3	Conservation Biology	3	50	25	0	0	75
23	KU4VACBOT123	4	Basics of Environmental Science	3	50	25	0	0	75
24	KU4VACBOT124	4	Climate Change and Disaster Management	3	50	25	0	0	75
25	KU4VACBOT125	4	Entrepreneurship in Compost Making	3	50	25	0	0	75
26	KU4VACBOT126	4	Biofertiliser and marketing	3	50	25	0	0	75
27	KU6VACBOT127	6	Agribased Microenterprises	3	50	25	0	0	75
28	KU6VACBOT128	6	Indigenous plants: their Identification and utility	3	50	25	0	0	75
29	KU6VACBOT129	6	Wetland and Laterite Hill Ecology	3	50	25	0	0	75
30	KU6VACBOT130	6	Apiculture	3	50	25	0	0	75

GENERAL RULES

ELIGIBILITY FOR ADMISSION AND SELECTION OF COURSES

Admission, enrollment, registration, options for changing major programs, selection of academic pathways, readmission and scheme migration, assessment and evaluation, and final grading and awarding of degrees are based on the Kannur University FYUGP Regulations and Curriculum Framework 2024, as well as the norms and rules established by the Government and the University from time to time.

Students must have completed the examination conducted by a recognized Board or University at the +2 level of schooling or its equivalent.

Departments will provide information on the courses they offer, including the eligibility criteria.

At the end of the second semester, students may be permitted to change their major program of study. Based on the availability of seats and infrastructure facilities, students may opt for any discipline they studied during the first two semesters as discipline-specific foundation courses or multidisciplinary foundation courses. If a student switches their major to a discipline in which an MDC has been completed, they will have to undertake additional DSC courses in the new discipline to acquire the required minimum credits.

One course should be offered by a faculty member whenever possible. The faculty member shall inform the students about the outcomes, course plan, and assessment methods at the beginning of the course.

Module 5 of each course is designated as 'Teach Space'—a personal, flexible, and dynamic area for teaching activities tailored to the needs of the instructor, infrastructure, course outcome, and the requirements of the students.

Students are advised to select a variety of courses from the available options instead of choosing courses with similar content. Some professional courses and jobs require a Botany/Plant Science major along with minors in Chemistry and Zoology. Therefore, students should carefully consider their selection of major and minor courses.

SWAYAM, MOOC, or other online courses can be selected from the course offerings of Indian universities and institutes. These courses must be related to the student's major and can be used to earn credits. Students can opt for SWAYAM and other online courses to earn credits, provided they complete an internal viva, give a presentation, and submit a report on the course.

SUGGESTED PEDAGOGY AND EVALUATION

Teaching-Learning

The FYUGP program is based on Outcome-Based Education (OBE). To achieve the desired outcomes in each course, various methods of teaching, learning, and evaluation are employed. Credit earning and transfer follow the guidelines of the Kannur University FYUGP regulations and curriculum framework of 2024.

Types of Teaching and Learning Activities

Types of Course	Teacher Activity	Student Activity
Theory	Lectures, demonstrations, presentations, discussions, and debates	Review of literature, assignments, presentations, e-learning, discussions, and debates with peers, teachers, and experts.
Practical	Demonstrations, experimentation, field visits, and certification	Identification, comparison, differentiation, and categorization of different plants and their parts using permanent slides and hand sectioning. Additionally, demonstration, experimentation, field visits, report writing, and record keeping
Field Study/Study Tour	For plant diversity and technological studies, experiential learning should complement theoretical learning. Faculty members guide this flexible activity, determining the field for the trip.	Students should observe the features from the field and document peculiarities and diversity in a report.

Internship

Each student must complete an internship within the six semesters to engage with practical aspects of their learning and enhance employability. A report is required by the end of the sixth semester. The internship must last a minimum of 60 working hours and can be on-campus or off-campus, potentially consisting of 1-3 accumulated activities. Off-campus internships require prior approval, and an attendance certificate must be submitted to the HoD upon rejoining. HoDs ensure completion of the internship.

Suggested Internships: Summer internships at biology institutes or local industries related to botany/ecology/agriculture, field trips to various ecosystems or nature camps, apprenticeships in NGOs or relevant industries, and social responsibility activities such as river restoration, PBR preparation, landscaping, and green auditing.

Student Responsibilities: Selecting the internship topic/activity, discussing with a mentor, planning and execution, and preparing and presenting the report.

Teacher/Supervising Guide Responsibilities: Confirming the topic/activity, providing guidance, and correcting and certifying the prepared report.

Mandatory/Optional Project

In the eighth semester, a mandatory 12-credit project (minimum 360 working hours) is required for FYUGP research or honors, or an optional 8-credit project (minimum 240 working hours) alongside a major theory course. Project guidance can be provided by a faculty member of the department. If necessary, the expertise of an external guide may be utilized. Facilities and expertise for the project can be on-campus or off-campus, with required permissions for off-campus projects. Students must maintain and submit a project log book/register along with the final report.

Student Responsibilities: Suggesting the topic, discussing with the project guide and peers, reviewing literature, planning and designing the project, experimentation, data analysis, and preparing and presenting the project report.

Teacher/Supervising Guide Responsibilities: Confirming the topic, demonstrating, planning experimentation, providing guidance, and correcting and certifying the project.

Evaluation

Each student should go through the evaluation process in an indirect grading method, as per the Kannur University FYUGP- regulations and curriculum frame work.- 2024. The evaluation for the odd semesters and the practical components will be done by the college itself and that for even semesters will be conducted at the university level.

Regarding evaluation, one-credit courses will be assessed for 25 marks, two-credit courses for 50 marks, three-credit courses for 75 marks, and four-credit courses for 100 marks. A copy of all records of evaluation shall be maintained in the department/college and should be available for verification by the university/BoS / the student.

EVALUATION	WEIGHTAGE
END SEMESTER EVALUATION- ESE	70
CONTINUOUS COMPREHENSIVE ASSESSMENT - CCA	30

The CCA component has two parts Formative Assessment (FA) and Summative Assessment (SA) with an equal weightage. The components of Evaluation will be determined by the instructor/faculty and the same will be communicated to the student at the beginning of the course.

Suggestive Methods of Formative Assessment (FA)

Formative assessment methods may include assignments (both theory and practical), viva voce, quizzes, interviews, presentations, classroom discussions, observation of practical skills, and self and peer assessments. The course coordinator or faculty member will determine the combination of these

tools and their respective weightages and will communicate this information to the students at the beginning of the course.

Suggestive Methods of Summative Assessment (SA)

SA methods may include written tests, open-book tests, laboratory records or reports, project reports, and case study reports. The coordinator can decide on the combination and relative weightage of these tools, which should be communicated to the students at the beginning of each course.

Evaluation of Theory Courses

End Semester Examinations will be held in October for odd semesters and in March for even semesters. A 3-credit theory course will be evaluated with a 50-mark question paper, with a duration of 1.5 hours. A 4-credit theory course will be evaluated with a 70-mark question paper, with a duration of 2 hours.

A copy of all records of evaluation shall be maintained by course in charge or the faculty for verification by the HoD / the student.

Evaluation of Practical Courses

Students must attend the practical classes and go through the continuous evaluation process for the course. Only those who have completed the continuous evaluation will be permitted to appear for the end-semester (practical) viva-voce. A copy of all records of evaluation shall be maintained by course in charge or the faculty for verification by the HoD / the student.

The end-semester practical examination, viva-voce, and evaluation of practical records shall be conducted by the course in-charge and an internal examiner appointed by the Department Council. The Continuous Comprehensive Assessment (CCA) of practical courses shall be conducted by the course in-charge. For courses with both theory and practical components, the CCA components: The continuous evaluation of practical courses shall be completed at least 10 days before the start of the end-semester examination.

EVALUATION	WEIGHTAGE
END SEMESTER EVALUATION- ESE	60
CONTINUOUS COMPREHENSIVE ASSESSMENT - CCA	40

Internship

The components of internship evaluation include performance evaluation, attendance and participation, the quality of the internship report, and the effectiveness of the presentation. Additional components are the viva voce examination, feedback from the internship site, self-assessment, and, if applicable, peer assessment. Continuous Comprehensive Assessment (CCA) will be conducted by the

faculty in charge, while the End Semester Examination will be evaluated by the Department Council, excluding the faculty in charge.

Components of Evaluation of Internship	Weightage Marks	Marks for Internship 2 Credit/50
Continuous Comprehensive Assessment (CCA)	30%	15 (Report 5, Viva 5 , Presentation 5)
End Semester Evaluation (ESE)	70%	35

Evaluation of Project

A student pursuing UG Honours with research must complete a mandatory research project worth 12 credits by the end of the eighth semester. For other UG Honours students, the project is optional. Since each credit corresponds to 25 marks, the 12-credit project will be evaluated for a total of 300 marks. The evaluation scheme for the project is detailed below:

Project type	Maximum Marks	CCA (30%)	ESE (70%)
Research Project of 12 Credits	300	90 Pre synopsis presentation and viva Review of literature Regularity and Participation (1:1:1)	210 Report, Methodology, Social Relevance, Scientific accuracy, innovation, data analysis, presentation skill ,viva (components and their relative weightage can be decided by the department council)
Research Project of 8 Credits	200	60 Pre synopsis presentation and viva Review of literature Regularity and Participation (1:1:1)	140 Report, Methodology, Social Relevance, Scientific accuracy, innovation, data analysis, presentation skill ,viva (components and their relative weightage can be decided by the department council)

**The question paper design and model question papers will be added later*

Grading

Marks obtained in each component or question of a course are converted into a 10-point indirect grading system. The Semester Grade Point Average (SGPA) is calculated from these grades to evaluate student performance each semester. The Cumulative Grade Point Average (CGPA) and the corresponding grading scale are outlined below.

Sl. No	Percentage of Marks (ESE and CCA put together)	Description	Letter Grade	Grade Point (P)	Range of Grade Points
1	95% and above	Outstanding	O	10	9.50 – 10
2	Above 85% and below 95 %	Excellent	A+	9	8.50 – 9.49
3	Above 75% to below 85%	Very Good	A	8	7.50 – 8.49
4	Above 65% to below 75%	Good	B+	7	6.50 – 7.49
5	Above 55% to below 65%	Above Average	B	6	5.50 – 6.49
6	Above 45% to below 55%	Average	C	5	4.50 – 5.49
7	Above 35% to below 45% (CCA and ESE put together) with a minimum of 30% in ESE.	Pass	P	4	3.50 – 4.49
8	Below an aggregate of 35% or below 30% in ESE	Fail	F	0	0 – 3.49
9	Not attending the examination	Absent	Ab	0	0

1	CELL: STRUCTURE AND REPRODUCTION	KU1DSCPLS101
Semester : I **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Knowledge in the basic structural and functional unit of life, the cell.
CO2	Understanding of the cell biology related terms used in the description of diverse forms of life.
CO3	Understanding the basic differences in cell structure and cell reproduction that exist in various plant groups.
CO4	Ability to apply the concepts gathered in the field of evolution and diversity studies.
CO5	Firsthand experience in viewing cells under microscope and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√		√							
CO3					√				√			
CO4							√		√			
CO5											√	√

Course Description
This is an introductory biology course designed for UG students in general and BSc Botany and Plant Science in particular. The aim of the course is to give basic knowledge about the structure and function of cells and cellular components with historical and evolutionary perspectives.
• *First module gives the brief history of the development of cell biology and evolution of cells.* • *Second module gives an account on the cellular envelopes and nucleus.* • *Third module is packed with endo-membrane system and other cellular organelles.* • *Fourth module will give you in-depth knowledge on cell cycle and division, different phases of Mitosis and Meiosis.*

This course will also provide you opportunities to observe diverse cells and hands-on training to identify stages of mitosis and meiosis during laboratory sessions.

Course Objectives:

1. To gather knowledge on evolution of cell biology as a discipline.
2. To understand the diversity in structure and function of cells and cell components.
3. To understand the stages of cell reproduction- mitosis and meiosis as well as the significance of these processes in sustenance and evolution of species.
4. To get hands on training in observing various types of cells under microscope.

Credit			**Teaching Hours**		**Assessment**		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. INTRODUCTION TO CYTOLOGY (5 hrs)

1.1. History - History of the progress of cell biology and development of cell theory.
1.2. Cell as a unit of structure and function. Levels of organization of cells up to organism.
1.3. Origin and Evolution of cell. Characteristics of prokaryotic and eukaryotic cells.
1.4. Modern concept on cell components- Cellular envelopes, Protoplasm, Cell organelles, Cytoplasm, Non living inclusions.

Module 2. CELLULAR ENVOLOPE AND NUCLUEUS (10 hrs)

2.1. Cellular envelopes- Types and functions
2.2. Cell wall - Chemistry, Ultra structure and function of Plant cell wall. Thickening of cell wall, Pits and pit apertures, Plasmodesmata. Cytoplasm- Physical, chemical and biological properties.
2.3. Cell membrane - Overview of fluid mosaic model; Chemical composition of membranes; membrane function.
2.4. Nucleus - Ultra structure of the interphase nucleus, The nuclear envelope; Nuclear pore complex, Nucleolus - Structure and functions.

Module 3. CELL ORGANELLES (15 hrs)

3.1. Endomembrane system - Endoplasmic Reticulum; Golgi Apparatus; Lysosomes. Vacuole. Phagocytosis and Pinocytosis and Membrane transport
3.2. Plastids – Types of plastids. Structure and function of Chloroplast and Mitochondria. Significance of Mitochondria and Chloroplast in evolutionary biology and molecular taxonomy. Endosymbiotic Theory.
3.3. Microbodies- Structure and functions of Peroxisomes, Glyoxysomes and Ribosomes.
3.4. Cytoskeleton: Role and structure of microtubules, microfilaments and intermediary

filament. Major nonliving inclusions in the plant cell.

Module 4. CELL CYCLE AND CELL REPRODUCTION (15 hrs)

4.1. Concept of cell Cycle: Phases of eukaryotic cell cycle -Interphase and Mitotic Phase.

4.2. Mitosis: Karyokinesis and Cytokinesis. Different Stages in Karyokinesis – Prophase, Metaphase, Anaphase and Telophase. Significance of mitosis. Cytokinesis – Cytoplasmic division in Plant cell. Types of mitosis.

4.3. Meiosis: Stages of Meiosis I and II- both karyokinesis and cytokinesis.Variations among plants. Significance of Meiosis.

4.4. Comparative account of Mitosis and Meiosis among different organisms- Gametic meiosis and Zygotic meiosis.

Module 5. Teach Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Compound microscope and its parts.
2. Study of plant cell structure with the help of epidermal peel mount of Onion/*Crinum*/*Rheo*.
3. Diversity of cells- prokaryotic (blue green alga), eukaryotic (*Chlorella*, *Spirogyra*, stomata of different leaves, Trichomes).
4. Demonstration of the phenomenon of protoplasmic streaming in *Hydrilla* leaf, *Vallisnaria*.
5. Mitosis using Onion root smear.
6. Demonstration of staining of organelles/ animal/ plant/ microbial cells for light microscopic observation
7. Demonstration of meiosis using flower buds or any other suitable specimen.
8. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics

1. Geological time scale
2. Theories and experiments on evolution of life- classical and modern
3. Types of models of plasma membrane
4. Significance and applications of membrane studies in immunology, medicine , drug designing etc.
5. Meiotic errors and syndromes in human beings and plants
6. Evolution of crop plants and significance of meiosis and mitosis.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. The World of	1, 2, 3,4

	the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco, 2009	
2	Cooper, G.M. and Hausman, R.E. The Cell: A Molecular Approach. 5th edition. ASM Press &Sunderland, Washington, D.C.; Sinauer Associates, MA.,2009	1, 2, 3, 4
3	De Robertis E.D. and De Robertis E.M.F. Cell and Molecular Biology 8th Edition. Lee and Fab International edition, Philadelphia.2017.	1, 4
4	Pawar, Cell Biology, Himalaya Publishing House, Mumbai. 2019.	1, 2,3, 4
5	Rastogi, S.C. Cell and Molecular Biology. New Age International Publishers, New Delhi. 2016	1, 2, 3, 4
6	Verma P.S. and Agarwal V.K. Cell Biology (Cytology, Biomolecules, Molecular biology),Paper back, S.chand and Company .Ltd. 2016.	2, 4
Core Compulsory Readings		
1	Karp, G. (2010), Cell Biology, John Wiley & Sons, U.S.A. 6th edition.	
2	Lodish, H. Berk A, Zipursky SL, et al., 2000: Molecular Cell Biology, 4th edition., W.H. Freeman, New York.	
Core Suggested Readings		
1	http://ndl.iitkgp.ac.in/document/eXF1YzdhQ2RxM3hPUm8ra0k0NHZGUT09	
2	http://ndl.iitkgp.ac.in/document/SFBhRUg0cDg3MTJyRXE0OVB5RkpLZz09	

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- What are the two main types of cells, and what distinguishes them from each other?
- Explain the fluid mosaic model of the cell membrane and its significance in cell biology.
- What are the phases of the eukaryotic cell cycle, and what happens during each phase?
- How does protoplasmic streaming contribute to cellular functions in plants?

- Define cytokinesis and describe its role in cell division.

3 Marks Questions (Applying and Analyzing):

- Using a diagram, illustrate the structure of a plant cell wall and explain its functions.
- Compare and contrast the structure and function of mitochondria and chloroplasts.
- Design an experiment to demonstrate the process of phagocytosis in cells.
- Analyze the implications of the endosymbiotic theory for our understanding of cellular evolution.
- Propose a hypothesis to explain the possible evolutionary line of three cells- A- prokaryotic cell autotrophic, B- prokaryotic heterotrophic and C- eukaryotic autotrophic.
- Give an illustrated self- explanatory diagram of prokaryotic and eukaryotic cells, indicating their primary structural differences.

5 Marks Questions (Evaluating and Creating):

- Evaluate the significance of mitosis in the growth and development of multi-cellular organisms.
- Design an educational poster illustrating the stages of meiosis and explaining their importance in sexual reproduction.
- Critically evaluate the role of the endomembrane system in protein synthesis and trafficking within cells.
- Develop a model to demonstrate the role of the cytoskeleton in maintaining cell shape and facilitating cell movement.
- Evaluate the impact of advancements in cell biology on modern scientific research and technology.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in biology as well as in daily life

2	ANGIOSPERM ANATOMY, EMBRYOLOGY AND PALYNOLOGY	KU2DSCPLS102
Semester : II **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
C01	Knowledge in the internal structure of angiosperm.
C02	Understanding of the anatomical, palynological and embryological related terms used in the description of diverse forms of life.
C03	Understanding the variations in the internal structure and reproduction that exist in various plant groups.
C04	Interpret the adaptive and protective mechanisms exhibited by plants in response to various environmental conditions.
C05	Ability to apply the concepts in the field of evolution and diversity studies.
C06	Firsthand experience in viewing cells under microscope and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/Pos

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√		√									
CO2		√			√							
CO3							√	√				
CO4											√	√
CO5				√					√			
CO6											√	√

Course Description
The course offers a thorough exploration of plant biology- angiosperm anatomy, embryology, palynology. Students get theoretical and practical knowledge about various plant tissues, tissue systems present in various plant organs; along with secondary growth of root and stem. Additionally, the course gives insights into various terms and stages in embryology, fertilization mechanisms.
• *First module brings the knowledge of tissues and tissue systems in angiosperms* • *Second module gives an account on structure of primary plant body and its secondary growth.*

• *Third module is packed with pre fertilisationsal stages relevant in the embryology of angiosperms.* • *Fourth module gives in-depth knowledge on embryo formation, structure and variations.*
This course will also provide opportunities for intense laboratory sessions to observe diverse tissues and tissue systems present in plants.

Course Objectives:

1. Understand plant tissue classification, structure, and functions.
2. Explore plant anatomy, including primary structures and tissue systems.
3. Study plant reproduction mechanisms and embryology.
4. Develop practical skills in observing and analyzing plant structures and tissues.

Credit			**Teaching Hours**		**Assessment**		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Plant Tissues and Tissue Systems (12 hours)

1.1. Introduction to plant tissues and their classification. Meristems and Permanent Tissues. Classification, distribution, structure, and function of meristems.

1.2. Theories explaining the growth and development of plant structures from meristem. Histogen theory, Tunica Corpus Theory. Developmental processes of the plant body: root apex, vegetative shoot apex, floral apex.

etc.

1. 3. Occurrence, structure and functions of simple tissues: Parenchyma, Collenchyma, Sclerenchyma. Complex tissues: Xylem and Phloem. Special tissues- Types of secretory tissues: digestive glands, glandular hairs, nectaries,

1.4. General Account of Epidermal tissue system, Ground tissue system and Vascular System.

- Types of Stomata- monocot and Dicot; different types of vascular bundles-Radial, Conjoint, Collateral- open and closed, Bicollateral.

Module 2. Structure of Plant Body (15 hours)

2.1. Anatomy of primary structures: roots, stems, and leaves in dicots and monocots with a comparative account. Nodal Anatomy- Types of nodes and Evolutionary trend. Anatomy of Abscission zone. Floral anatomy and mechanisms of flower development.

2.2. Processes and structures involved in secondary growth: distribution, structure and

function of stelar cambium and extra-stelar cambium. Secondary growth in dicot stem root. Seasonal variation in cambial activity and its implications on wood formation. Heartwood and sap wood. Spring wood and Autumn Wood.

2.3. Anomalous Secondary growth- A general account on types of anomalies. Unusual patterns of secondary growth in *Dracaena*, *Bignonia* and *Boerhaavia*.

2.4. Anatomical adaptations in xerophytes, halophytes, epiphytes, hydrophytes.

Module 3. Sporogenesis, Gametophyte formation and Pollination (10 hours)

3.1. Introduction to Angiosperm Embryology and Palynology**:** Historical overview of embryology and its significance. Various techniques in Embryology and Palynology. General account on pollen structure and morphology. Applications of Embryology and Palynology.

3.2. Structure and functions of microsporangium and its wall layers. Pollinia. Microsporogenesis- process, types and male gametophyte development.

Megasporogenesis: process and significance in female gametophyte development.

3.3. Structure and functions of megasporangium- Types of ovules. Megasporogenesis- process, types and female gametophyte development. Monosporic, Bisporic and Ttrasporic; detailed structure of Polygonum type of Embryosac.

3.4. Pollination- Types of Pollination- Self Pollination and Cross Pollination. Significance of Cross Pollination. Different Mechanisms of pollination. Basic concept of self-incompatibility. Economic and Evolutionary significance of Pollination.

Module 4. Fertilization and Embryogenesis (8 Hrs)

4.1. Pollen tube formation and fertilization: Processes and significance. Types of pollen tube entry- Porogamy, Chalazogarmy and mesogamy.

4.2. Double Fertilization and triple fusion- processes and significance. Structure, development, and types of endosperms.

4.3. Development of Embryo in Dicots and Monocots with major substages. Structure of mature dicot and monocot embryos.

4.4. Apomixis and Amphomixis. Classification and significance of polyembryony. Brief account on Experimental Embryology.

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Module 5. Teach Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Observation of apical meristems in root and stem.
2. Microphotographs of different types of tissues- Parenchyma- Aerenchyma, Chlorenchyma (Spongy, Palisade), Collenchyma, Sclerenchyma, Xylem and Phloem
3. Microphotographs of different types of tissue systems- trichomes, stomata- Anomocytic,

Paracytic, Diacytic and Anisocytic.

4. Primary structures in dicot stem (*Centella*), root (*Tinospora*), and leaf (*Ixora*) and monocot stem (Grass), root (*Colocasia*), and leaf (Grass).
5. Secondary Structures in Dicot root (*Tinospora, Ricinus*) and Stem (*Eupatorium/Vernonia* and *Tinospora*)
6. Anomalous secondary thickening in *Boerhaavia* stem.
7. Acetolysis of Pollengrains - *Hibiscus*
8. TS of Mature anther- *Datura, Ixora*
9. Observation of Pollinia- *Calotropis*/ Orchids
10. Embryos of Monocots and Dicots

Suggested Assignments – Theory

1. Different theories on meristem
2. Different types of nodes with examples
3. Root stem transition with examples
4. Biochemical changes that happen during abscission
5. Anomalous secondary thickening in various climbers and herbs and shrubs
6. Types of anthers with examples
7. Variations in Pollen morphology
8. Anatomy and taxonomy
9. Anatomy and Evolution
10. Polyembryony and Apomixis with examples and relevance
11. Production of fruits without pollination/seeds

Suggested Assignments – Practical

1. Different types of nodes with examples
2. Root stem transition with examples
3. Anomalous secondary thickening in various climbers and herbs and shrubs
4. Types of anthers with examples
5. Variations in Pollen morphology
6. Pollen calendar preparation
7. Aeropalynology- survey

Suggested readings specific to the module.		
Sl. No	Title/Author/Publishers of the Book specific to the module	Module No.
1	Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, Vikas Pub. House. Delhi. 5th edition.	3, 4
2	Dutta, A. C. (2019). Botany for Degree Students. Oxford University Press.	1, 2, 3, 4
3	Esau, K. (1953). Plant Anatomy. John Wiley & Sons.	1, 2

4	Johri, B.M. l (1984). Embryology of Angiosperms, Springer-Verlag, Netherlands	3, 4
5	Pandey, B. P. (2009). Plant Anatomy and Embryology. S. Chand & Company Ltd.	1, 2, 3, 4
6	Shivanna, K.R. (2003). Pollen Biology and Biotechnology. Oxford and IBH Pub. Co. Pvt. Ltd. Delhi.	3
7	Tripathi, R. D. (2018). Introduction to Plant Anatomy. Rastogi Publications	1, 2
Core Compulsory Readings		
1	Fahn, A. (1990). Plant Anatomy. Pergamon Press.	
2	Kaur, R., & Singh, J. (2019). Practical Plant Embryology. S. Chand Publishing.	
3	Mauseth, J. D. (2012). Plant Anatomy and Development. Jones & Bartlett Learning	
4	Singh, S., & Singh, P. K. (2015). Textbook of Embryology. CBS Publishers &Distributors Pvt. Ltd	
Core Suggested Readings		
1	O'Brien, T. P., & McCully, M. E. (1981). Introduction to Plant Anatomy. Academic Press.	
2	Mauseth, J. D. (2012). Plant Anatomy: An Applied Approach. Jones & Bartlett Learning.	
3	Irish, V. F. (2009). Plant Development and Evolution. Wiley-Blackwell.	
4	Taiz, L., & Zeiger, E. (2010). Principles of Plant Physiology. Sinauer Associates, Inc.	

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Questions:

1. Explain the structural characteristics of Parenchyma tissue and its role in plant physiology.
2. Differentiate between conjoint and collateral vascular bundles, highlighting their significance in plant structure and function.
3. Define the term "hydathodes" and discuss their role in plant water management.
4. Describe the structure of the root apex in dicot plants and its importance in root development.
5. Compare and contrast the anatomy of monocot and dicot leaves, emphasizing their structural differences.

3 Marks Questions:

1. Discuss the functions of secretory tissues in plants and provide examples of plant organs where they are found.
2. Analyze the process of microsporogenesis and its significance in plant reproduction.
3. Explain the mechanism of self-incompatibility in plants and its implications for pollen-pistil interactions.
4. Compare the structures of dicot and monocot embryos, highlighting their developmental differences.
5. Evaluate the importance of endosperm in seed development, citing examples of different types of endosperm.

5 Marks Questions:

1. Describe the process of double fertilization in angiosperms, including the events occurring during each fertilization event.
2. Discuss the structure and functions of the vascular cambium in secondary growth of roots and stems.
3. Analyze the adaptive features of xerophytes and hydrophytes, illustrating how their anatomical structures enable them to thrive in their respective habitats.
4. Explain the significance of pollen allergy in human health and its ecological implications.
5. Compare and contrast the primary and secondary structures of dicot stems, highlighting their differences in tissue composition and organization.

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Employability for the Course / Programme

It is one of the basic courses with intense practical exercises involving the observation of plant structures and tissues; thereby provides a solid foundation in plant biology essential for careers in botany, agriculture, and pharmacognosy.

3	Diversity of Algae and Bryophytes	KU3DSCPLS201
Semester : 3 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English
3. Completed the basic foundation courses in the first two semesters

Course Outcomes	
CO1	Acquisition of basic knowledge in the diversity among plants, especially algae and bryophytes.
CO2	Understanding of the life cycles in algae and bryophytes.
CO3	Understanding the basic differences that exist among different selected genera of algae and bryophytes..
CO4	Ability to apply the concepts gathered in this course to the field of evolution and ecological studies.
CO5	Firsthand experience in viewing the diversity in algae and bryophytes using laboratory procedures. .

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2	√				√							
CO3						√	√					
CO4											√	√
CO5								√	√			

Course Description
This is a major intermediate course designed for BSc Botany students. The aim of the course is to give basic knowledge about the diversity of algae and bryophytes..
• *First module gives a general idea on Algal classification.* • *Second module gives details on the structure and life cycle of model organisms from selected algal taxa.* • *Third module gives a general account on classification of bryophytes* • *Fourth module is a detailed account on selected bryophytes.*

This course will also provide you opportunities to observe diverse cells, tissues and organs of algae and bryophytes, through the practical sessions on model organisms.

Course Objectives:

1. To expertise in collection, preservation and studies in algae and bryophytes.
2. A comparative knowledge of lower plants.
3. Skill development in for proper description, identification and classification through morphological, anatomical and life cycle studies
4. Consciousness on the origin and evolution of lower groups of plants.

Credit			**Teaching Hours**		**Assessment**		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Taxonomy of Algae (10 hrs)

1.1. Salient features of algae; Features used for the identification; Classification of algae F E Fritsch.
1.2. Origin and evolution of Algae, Relationships of Algae.
1.3. Thallus organization in algae. Pigments and stored food in algae. flagella types, life cycle and alternation of generations in algae. Evolutionary trends in Algae.
1.4. Brief Account on Indian Algology and major contributors

Module 2. Diversity of Algae (15 hrs)

2.1. Study of the habitat, distribution, habit, anatomy, reproduction and life cycle of Cyanophyceae- *Nostoc* and *Oscillatoria*, Chlorophyceae –*Volvox*, *Zygnema*, *Oedogonium*, *Chara*; Xanthophyceae – *Vaucheria*; Bacillariophyceae - *Pinnularia*; Phaeophyceae – *Sargassum*; Rhodophyceae - *Polysiphonia* (Developmental details are not required). .
2.2. General methods in collection, preservation and Algal culturing. Ecological and economic importance of Algae. Algal blooms.

Module 3. Taxonmy of Bryophytes (8 hrs)

a. General characters and classification of bryophytes. Diversity-habitat, thallus structure and Sprophyte structure. Salient features for the identification. Classification.
b. Evolutionary trends and affinities with Algae. Evolution of gameto phyte and sporophyte among Bryophytes.

Module 4. Diversity of Bryophytes (12 hrs)

4.1. Distribution, morphology, anatomy, reproduction and life cycle of the following types (developmental details are not required): Hepaticopsida - *Riccia*, *Marchantia*;

Anthocerotopsida - *Anthoceros*; Bryopsida - *Funaria*.

4.2. General methods in collection and preservation of Bryophytes Ecological and Economic importance of Bryophytes

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Micropreparations and microscopic observations of vegetative and reproductive structures of model genera of algae and bryophytes.
2. Documentation of algal and bryophyte diversity in various nearby places.
3. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Employability for the Course / Programme

It is one of the intermediate major course which is very essential for understanding the diversity of plants, especially of lower plants, for the completion of BSc Botany.

4	Angiosperm systematics I	KU3DSCPLS202
Semester: 3 **Hrs/week : 4 Theory + 0 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English
3. Completed the basic foundation courses in the first two semesters

Course Outcomes	
CO1	Knowledge on basic terms and methods in Angiosperms Taxonomy
CO2	Understanding the diversity in angiosperm morphology
CO3	Classification of angiosperms, especially belonging to Polypetalae, based on evaluation of taxonomic characters
CO4	Skill in conducting taxonomic field work, collection and identification of angiosperms.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2						√						
CO3			√		√				√			
CO4							√	√		√		

Course Description
This course is tailored for student majoring in Botany, focusing on foundational aspects of Angiosperm Systematics. The course blends theoretical knowledge and practical skills, including hands-on plant identification, field visits, and herbarium techniques.
• *First module deals with the classification of angiosperms and Indian contribution in taxonomy.* • *Second module draws attention to the vegetative morphology of angiosperms.* • *Third module gives an idea on reproductive morphology of angiosperms.* • *Fourth module is related to the taxonomic characters of selected families in Polypetalae.*
This course will also provide you opportunities to observe diverse angiosperms through the practical sessions on model organisms.

Course Objectives:

1. Develop a Fundamental Understanding of Systematics and Taxonomy
2. Acquire Proficiency in Angiosperm Classification and Nomenclature
3. Explore Polypetalous Plant Families with Economic Significance
4. Integrate theoretical understanding with practical skills through hands-on activities such as plant identification, field visits to botanical gardens or natural habitats, and herbarium techniques.
5. Prepare Students for Practical Applications in Botany

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CE	ESE	Total
3	1	4	4 +0 +0 (60 +0 +0)	4 (60)	30 (30 theory including module 5)	70	100

COURSE CONTENT

Module 1. Classical Taxonomy of Angiosperms: 10 hrs

1.1 Salient features of Angiosperms; Classification by Linnaeus, Bentham and Hooker .

1.2 Origin and evolution of angiosperms, Relationship, similarities and dissimilarities with Gymnosperms.

1.3. Major Indian contributors:

1.4. Basic Features used for classical systematic of angiosperms. Basic Herbarium technique.

Module 2. Vegetative Morphologic characters: 15 hrs

2.1. Root: types of roots and modifications in angiosperms

2.2. Stem types of stem and modifications in angiosperms

2.3. Leaf types of leaves and phyllotaxy and leaf modifications in angiosperms

Module 3. Reproductive Morphologic characters: 8 hrs

a. Flower the sex organ and general features – non essential and essential whoerls. Adhesion and cohesion. Aestivation. Placentation
b. Inflorescence- types
c. Fruits – types
d. Seeds and germination- types

Module 4. Diversity of Polypetalae: 12 hrs

4.1. Study of the distribution, habit, major vegetative and reproductive features Annonaceae, Nympheaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae with sub families.

Module 5. TEACH Space 15 hrs

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Survey and documentation of vegetative modifications in angiosperms.
2. Survey and documentation of reproductive morphology of angiosperms
3. Study of Adhesion, Cohesion, Aestivation and Placentation in common plants.
4. Germination experiments.
5. Major vegetative and reproductive features Annonaceae, Nympheaceae, Malvaceae, Rutaceae, Anacardiaceae, Fabaceae with sub families.
6. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Employability for the Course / Programme

It is one of the intermediate major course which is very essential for understanding the diversity of plants, especially of Angiosperms and also for the completion of BSc Botany.

5	Diversity of Pteridophytes and Gymnosperms	KU4DSCPLS203
Semester: 4 **Hrs/week: 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English
3. Completed the basic foundation courses in the first two semesters

Course Outcomes	
CO1	Acquisition of basic knowledge in the diversity among plants, especially Pteridophytes and gymnosperms.
CO2	Understanding of the life cycles in pteridophytes and gymnosperms.
CO3	Understanding the basic differences that exist among different selected genera of Pteridophytes and gymnosperms.
CO4	Ability to apply the concepts gathered in this course to the field of evolution and ecological studies.
CO5	Firsthand experience in viewing the diversity in tracheophytes using laboratory procedures. .

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√	√		√						
CO3					√	√	√					
CO4									√	√	√	
CO5									√	√		

Course Description
This is a major intermediate course designed for BSc Botany students. The aim of the course is to give basic knowledge about the diversity of pteridophytes and gymnosperms.
• *First module deals with the taxonomy of Pteridophytes.* • *Second module is giving and idea on diversity of Pteridophytes through selected taxa.* • *Third module is focused on the classification of Gymnosperms.* • *Fourth module is a giving a detailed account on diversity of Gymnosperms.*
This course will also provide you opportunities to observe diverse cells, tissues and organs of Pteridophytes and gymnosperms through the practical sessions on model organisms.

Course Objectives:

1. To expertise in collection, preservation and studies in Pteridophytes and Gymnosperms.
2. To achieve a comparative knowledge of lower vascular plants.
3. To develop skill in proper description, identification and classification through morphological, anatomical and life cycle of ferns and gymnosperms.
4. Consciousness on the origin and evolution of lower groups of plants.

Credit			**Teaching Hours**		**Assessment**		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Taxonomy of Pteridophytes 10 hrs

1.1 Salient features of Pteridophytes; Features used for the identification; Classification of pteridopytes- Reimer

1.2 Origin and evolution of Pteridophytes, Relationships of pteridophytes , similarities and dissimilarities with bryophytes.

1.3. Stelar variation and stelar evolution in Pteridophytes; heterospory and seed habit.

1.4. Brief Account on Indian Pteridology and major contributors

Module 2. Diversity of Pteridophytes 15 hrs

2.1. Study of the habitat, distribution, habit, anatomy, reproduction and life cycle of *Psilotum*, *Selaginella, Equisetum*, *Pteris* and *Marsilea*. (Developmental details are not required). .

2.2. General methods in collection, preservation, staining techniques for spores and reproductive parts. Ecological and economic importance of Pteridophytes

Module 3. Taxonomy of Gymnosperms 8 hrs

3.1. Salient features of gymnosperms. Classification -Sporne's

3.2. Origin and evolution of Gymnosperms. Relationship with Pteridophytes and Angiosperms

3.3. Distribution of Gymnosperms in India. Gymnosperm studies in India.

Module 4. Diversity of Gymnosperms 12 hrs

Study of the habitat, distribution, habit, anatomy, reproduction and life cycle of *Cycas, Pinus* and *Gnetum* (Developmental details not required).

General methods in collection, preservation and staining techniques for the vegetative and reproductive parts of Gymnosperms Ecological and Economic importance of Gymnosperms

Module 5. TEACH Space 15 hrs

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Micropreparations and microscopic observations of vegetative and reproductive structures of model genera of Pteridophytes and gymnosperms.
2. Documentation of Pteridophyte and gymnosperm diversity in various nearby places.
3. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Employability for the Course / Programme

It is one of the intermediate major courses which is very essential for understanding the diversity of plants, especially of tracheophytes, for the completion of BSc Botany.

6	Angiosperm Systematics II	KU4DSCPLS204
Semester : 4 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English
3. Completed the basic foundation courses in the first two semesters

Course Outcomes	
CO1	Acquisition of basic knowledge in the diversity among Angiosperms, other than polypetalae.
CO2	Understanding of modern angiosperm classification.
CO3	Understanding the basic differences that exist among different selected families of angiosperms
CO4	Ability to apply the concepts gathered in this course to the field of evolution and ecological studies.
CO5	Firsthand experience in viewing the diversity of angiosperms using laboratory procedures. .

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2		√	√		√							
CO3				√				√				
CO4						√	√					
CO5									√	√		

Course Description

This course is meant for the student in Botany major, focusing on systematics and taxonomy of selected gamopetalae, monochlamydeae and monocot families. The course blends theoretical knowledge and practical skills, including hands-on training in plant description and identification, field visits, and herbarium techniques.

- *First module deals with modern systematic and typification.*
- *Second module focuses on families belonging to gamopetalae.*

- *Third module outlines the characteristics of selected angiosperm families belonging to monocotyledonae and monochlamydeae.*
- *Fourth module comapares the modern and classical systematics.*

This course will also provide you opportunities to observe diverse angiosperms through the practical sessions on model organisms.

Course Objectives:

1. Develop a fundamental understanding of modern systematics and taxonomy of angiosperms.
2. Acquire Proficiency in Angiosperm Classification and Nomenclature
3. Explore angiosperm families other than Polypetalae with Economic Significance
4. Integrate theoretical understanding with practical skills through hands-on activities such as plant identification, field visits to botanical gardens or natural habitats, and herbarium techniques.
5. Prepare Students for Practical Applications in Botany

Credit			**Teaching Hours**		**Assessment**		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Introduction to Modern systematics of Angiosperms (10 hrs)

1.1 Typification-. Holotype, Syntype, Lectotype, Paratype,
1.2 Rules of Botnaical Nomenclature. ICN. Rule of Priority.
1.3. Numerical Taxonomy, Chemotaxonomy. Molecular Taxonomy.
1.4. Brief account on Phylogentic System of Classification. Engler and Prantle, APG system of classification. Evolution of APG system.

Module 2. Diversity of Gamopetalae (15 hrs)

Study of the distribution, habit, major vegetative and reproductive features of gamopetalae.. Combretaceae, Cucurbitaceae, Apiaceae, Rubiaceae, Asteraceae, Sapotaceae, Apocynaceae, Asclepiadaceae, Solanaceae, Acanthaceae, Verbenaceae, Lamiaceae.

Module 3. Diversity of Monochlamydeae and Monocotyledonae (15 hrs)

3.1. Study of the distribution, habit, major vegetative and reproductive features of Monochlamydeae.. Euphorbiaceae, Amarantaceae,
3.2. Study of the distribution, habit, major vegetative and reproductive features of Monocotyledoneae. Orchidaceae, Zingiberaceae, Liliaceae, Arecaceae, Poaceae

Module 4. Comparative account of modern and classical systematics (12 hrs)

4.1. Comparative account on classification. Merits and demerits of Bentham and Hookers classification. Bentham and Hooker's Vs. APG system
4.2. Brief account on Phylogenetics and Cladistics in Angiosperms.

Module 5. TEACH Space (15 hrs):
This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Major vegetative and reproductive features of families given above.
2. Visit to a taxonomic research station to gather knowledge on the typification procedures.
3. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Employability for the Course / Programme

It is one of the intermediate major course which is very essential for understanding the diversity of plants, especially of angiosperms, for the completion of BSc Botany.

7	Genetics	KU4DSCPLS205
Semester : 4 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English
3. Completed the basic foundation courses in the first two semesters

Course Outcomes	
CO1	Acquisition of basic knowledge in classical genetics
CO2	Understanding the basic mechanism of phenotypic expressions.
CO3	Understanding the basis of differences that exist among different species.
CO4	Ability to apply the concepts gathered in this course to the field of evolution.
CO5	First -hand experience in solving genetic problems

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2					√	√	√					
CO3				√	√							
CO4										√	√	√
CO5							√		√			

Course Description

It is a comprehensive exploration of the fundamental principles and applications of genetics, beginning with an introduction to Mendelian genetics and Molecular Basis of genetics. The course also covers on social relevance of genetics and HGP.

- *First module is an introduction to the branch of genetics.*
- *Second module gives a detailed background and progress of Mendelian genetics.*
- *Third module gives an idea on different types of ratio in phenotypic expression.*
- *Fourth module is focused on the basic knowledge on genes, DNA and chromosomes.*

This course will also provide opportunities to practice the problems in genetics.

Course Objectives:

1. Identify the basic principles and current trends in classical genetics.
2. Recognise the historical process of the evolution of molecular genetics from classical genetics.
3. Review the relevance of the application of genetic principles in agriculture, medicine, research and industry.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1.Introduction to Genetics (5 hrs)

1.1 Definition and scope of genetics. Brief history of genetics. Early concepts on reproduction and genetics. Phases of genetics.

1.2 Major terms used in genetics - factors, genes, chromosomes, alleles, homozygous and heterozygous, hemizygous, traits, phenotypes, genotypes, locus, linkage, mutation; population, offspring, clone, Test cross, back cross, reciprocal cross.

1.3 Genetics and Epigenetics. Genetics and Society – Euthenics, Eugenics, and Euphenics with examples.

1.4 Human genome project- Mile stones- Major output and their relevance in medicine and disease management.

Module 2. Mendelian Genetics (8 hrs)

a. Brief account of Mendel's life history
b. Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance.
c. Reasons for Mendel's success. Mendelian Genetics and sexual cycle in plant.
d. Rediscovery of Mendelism. Reasons for negligence of Mendelian discoveries.

Module 3. Mendelian and Non-Mendelian ratios. (17 hrs)

3.1. *Allelic interactions*: dominant – recessive, Incomplete dominance – flower color in Mirabilis; Co-dominance – Coat colour in cattle, Lethal genes – Sickle cell anemia in Human beings.

3.2. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry 9:3:3:1. Epistasis: dominant - Fruit colour in summer squashes12:3:1; recessive - Coat color in mice 9:3:4; Complementary gene interaction- flower color in *Lathyrus* 9:7:1. Inhibitory genes – Leaf Colour in paddy 13:3; Duplicate gene interaction- Shepherd's Purse15:1, Duplicate

genes with cumulative effect-9:6:1.

3.3. Quantitative inheritance- Polygenes-General Characters-. Ear size in corn. Transgressive variation-Heritability Phenotypic expression- Penetrance and expressivity. Pleotropic genes. Examples from plants and human beings.

Module 4. DNA, Genes and Chromosomes (15 hrs)

4.1. Concept of Genes – from factors to the modern concept of gene. Role of chromosomes in inheritance and its significance.

4.2. Chromosome Morphology, Chromosomal nomenclature- Chromatid, Centromere, Telomere, Secondary constriction, Satellite and Nucleolar Organizing Regions.

4.3. Chromosomal classification based on position and number of Centormere. Heterochromatin and Euchromatin, Karyotype and Idiogram.Chromatin reticulum-Structure, Chemical organization of Chromosomes; DNA and Histones. Packaging the DNA into Chromosomes,

4.4. Special types of chromosomes: Polytene chromosomes, Lamp brush chromosomes and B chromosomes.

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Dihybrid inheritance
2. Allelic and Non allelic Gene interactions.
3. Poster preparation on HGP
4. Poster presentation competition on Chromosome structure.
5. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Employability for the Course / Programme

It is one of the intermediate major course which is very essential for understanding the classical genetics and its relevance; highly essential for the completion of any biological course.

41	Diversity of Plants I	KU1DSCBOT103
Semester : 1 **Hrs/week: 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Acquisition of basic knowledge in the cell structure and diversity among life forms, especially on lower plants and fungi.
CO2	Understanding of the terms used cell biology and also in the description of diverse forms of life.
CO3	Understanding the basic differences that exist among different groups of plants.
CO4	Ability to apply the concepts gathered in this course to the field of evolution and advanced diversity and ecological studies.
CO5	Firsthand experience in viewing the diversity using laboratory procedures and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√		√	√						
CO3						√						
CO4									√	√		
CO5											√	√

Course Description
This is an introductory biology course designed for UG students in general and BSc Zoology BSc Microbiology and BSc Forestry in particular. The aim of the course is to give basic knowledge about the diversity of plant life forms.
• *First module gives details on plant cell structure* • *Second module focuses on the diversity of cell structure* • *Third module gives a detailed account on vegetative and reproductive structures of fungi, which enables the student to understand the classification of fungi.* • *Fourth module is a brief account on the diversity of algae, bryophytes and Pteridophytes and their economic importance and their classification.*
This course will also provide you opportunities to observe diverse forms of plant life of lower groups including fungi, during laboratory sessions.

Course Objectives:

1. Understanding of the fundamental structure of cells.
2. Concept development in structure and reproduction of lower plants- algae and bryophytes and fungi.
3. Enable the student to appreciate bio diversityfor sustainable development.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/entrepreneurship.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Cells and Structure of plants (10 hrs)

1.1. History - History of the progress of cell biology and development of cell theory. Origi n and Evolution of cell. Characteristics of prokaryotic and eukaryotic cells.

1.2. Brief history of classification of organism from Aristotle's days to modern days. Si x Kingdom Classification.

1.3. Levels of organization of cells up to organism. Macroscopic forms of plant life: Brief morphological and functional account on Root, Stem, Leaf, Flower, Fruit and Seed.

1.4. Morphological Comparison of Herbs, Shrubs, Trees, Creepers, Twiners, Lianas and Epiphytes.

Module 2. Diversity of cell structure (15 hrs)

1. Cell as a unit of structure and function. Modern concept on cell. A brief account on plant cell structure.
2. Cellular envelopes- Types and functions - Cell wall - Chemistry, Ultra structure and function of Plant cell wall. Thickening of cell wall, Pits and pit apertures. Plasmodesmata.
3 Protoplasm and Cytoplasm. A brief account of cell organelles and Non living inclusions plant cell. Chloroplast – structure and function.
4. Comparative account of cell structure and cell organelles among different lower plant groups- Algae, Bryophytes and Pteridohytes.

Module 3. Fungi (8 hrs)

3.1. General characters of Fungi and classification by Ainsworth (brief account).

3.2 General account on thallus structure and fruiting bodies among different fungal groups- Ascocarps, basidiocarps, ascogonium, perithecium, ascothecium, cleistothecium,

3.3. General account of Lichens- classification based on thallus morphology; major mycobionts and phycobionts.

3.4 Economic and ecological importance of fungi and lichens. Major Fungal diseases of plants, pets and human beings.

Module 4. Diversity of plants (12 hrs)

4.1. General characters of algae and their classification up to classes (F E Fritsch); Range of thallus variation in Algae.

4.2. Salient features of Bryophytes and brief account on their classification

4.3. General account on the characteristics of Pteridophytes and brief account on their classification

4. 4 Economic and ecological importance of Algae and Bryophytes and pteridophytes: food, industry, medicine, biofertilizers; algal bloom. Importance of Algae in Fisheries and livestock management. Role of Algae and Bryophytes in ecological succession and soil formation.

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Compound microscope and its parts.
2. Study of plant cell structure with the help of epidermal peel mount of Onion/*Crinum*/*Rheo*.
3. Diversity of cells- prokaryotic (*Nostoc*), eukaryotic (*Spirogyra*, *Oedogonium*, stomata of different leaves, Trichomes).
4. Study of non-living inclusions: cystolith (*Ficus*), raphides (*Pistia*), aleurone grains(Castor) and Starch grains (Rice, Wheat and Potato)
5. Photographs of Herbs, Shrubs, Trees, Creepers, Twiners, Lianas and Epiphytes from local sites.
6. Geotaggged Photographs of algae (2), bryophytes (5) and Pteridophytes(10).
7. Geotagged photographs of any 5 fungal fruiting bodies from the premises of.house and college
8. Collection, classification and documentation of different types of plants- algae, bryophytes and Pteridophytes.
9. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Geological time scale
2. Theories and experiments on evolution of life- classical and modern
3. Comparative account on different plant groups
4. Comparative account on prokaryotes and eukaryotes

Suggested Assignment Topics- Practical

1. Microphotographs of different stomata and trichomes
2. Collection of different mushrooms and their submission
3. Preparation of Album of fungal fruiting bodies.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	De Robertis E.D. and De Robertis E.M.F. (2017). Cell and Molecular Biology 8th Edition. Lee and Fab International edition, Philadelphia.	1, 2
2	Pawar, (2019).Cell Biology, Himalaya Publishing House, Mumbai.	1, 2
3	Rastogi, S.C. (2016).Cell and Molecular Biology. New Age International Publishers, New Delhi.	1, 2
4	Verma P.S. and Agarwal V.K. (2016).Cell Biology (Cytology, Biomolecules, Molecular biology),Paper back, S.chand and Company .Ltd.	1, 2,
5	Kumar H D and H N Sharma, (1979). A textbook on Algae,	4
6	Dube, H.C. (2008). Fungi, Bacteria and Viruses. Agrobios	3
7	Sambamurty A. V. S. S., (2006). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K. International publication, New Delhi.	4
8	Arumugam N, Annie Ragland and V Kumaresan, A textbook of Botany, Saras Publication	4
9	Annie Ragland, V Kumaresan and Arumugam N, (2020). A text of Botany- algae, Fungi, Bryophytes, Microbiology and Plant Pathology,	3, 4

	Saras Publication.	
10	Pandey, S. N. & Misra, S. P. (2008). Taxonomy of Angiosperms. Ane Books India, New Delhi.	4
Core Compulsory Readings		
1	Karp, G. (2010), Cell Biology, John Wiley & Sons, U.S.A. 6th edition.	
2	Misra, A., & Agrawal, P. R., (1978). Lichens. Oxford and IBH, NewDelhi	
3	Singh, G. (2010). Plant systematics - an integrated approach (3rd Edn) Science Publishers	
4	Bell, A.D (1991). Plant form- An illustrated guide to Flowering plant morphology. Oxford University Press, New York, Tokyo.	
5	Gangulee, S.C., Das, K.S., Dutta, C.D., & Kar, A.K., (1968). College Botany Vol. I, II and III. Central Education Enterprises.	
Core Suggested Readings		
1	Starr, C., (2007). Biology: concepts and applications. VI edn. Thomson Press.	
2	Raven, P.H., Evert, R.F., & Eichhorn, S.E., (2013). Biology of plants. VIIIth Ed. W.H. Freeman Publishers.	

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- What are the two main types of cells, and what distinguishes them from each other?
- List out any four features of fluid mosaic model of the cell membrane and its significance in cell biology.
- Differentiate pit from pit fields
- What are the functions of plant roots?
- Differentiate phycobiont from mycobiont with examples

3 Marks Questions (Applying and Analyzing):

- Using a diagram, illustrate the structure of a plant cell wall and explain its functions.
- The distribution and structure of chloroplast helps in the functioning of photosysntheis. Substantiate.
- Analyze the implications of the endosymbiotic theory for our understanding of cellular evolution.

- Explain the vegetative thallus of ascomycete fungi.

5 Marks Questions (Evaluating and Creating):

- Evaluate the impact of advancements in cell biology on modern scientific research and technology.
- Knowledge in biodiversity is highly essential for the economic growth and human welfare. Substantiate the statement.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in cell biology as well as in diversity of life

42	Plant Ecology and Phytogeography	KU1DSCBOT104
Semester : 1 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Acquisition of basic knowledge in ecology and phytogeography.
CO2	Understanding the dynamic nature of ecosystems in particular and biosphere in general.
CO3	Understanding the basic relationships that exist among different species.
CO4	Ability to apply the concepts gathered in this course to the field of evolution and modern ecology
CO5	First -hand experience in observing the major ethical and legal aspects in environmental sciences.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√	√	√							
CO3			√	√								
CO4								√	√	√		
CO5											√	√

Course Description
This is an intermediate minor course designed for BSc Zoology, Forestry and Microbiolgy students. It emphasizes on the basic principles and processes that are very relevant to the vast field of environmental sciences.
• *First module is an introduction to environmental sciences.* • *Second module emphasizes on the basic structure of Ecosystem* • *Third module is related to the function and dynamics of ecosystem.* • *Fourth module is mainly focused on the basic principles of phytogeography and relationship of plant with biodiversity.*
This course will also provide opportunities to do some laboratory work to find out the adaptations of plants as well as regional differences in physicochemical parameters of various ecosystems.

Course Objectives:

1. To enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities.
2. To recognise the need for more research to create a baseline data for sustainable exploitation- Think globally and Act locally
3. To observe and analyse the interrelationship between the geography and pattern of distribution of plants.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Introduction to Environmental Science (5 hrs)

1.1. History, scope and importance of ecology and environmental science.
1.2. Difference between ecology, environmental biology and environmental science and environmental studies.
1.3. Branches of ecology- autecology, synecology.
1.4. Motto and Achievements of Major Indian Institutes and Research Centres in Ecology and Environmental Science.

Module 2. Basic Structure of Ecosystem (8 hrs)

1. Structure and hierarchy of ecological units- species, population, community, ecosystem, biome and biosphere.
2. Basic structure of ecosystem- Factors affecting the structure of ecosystem-biotic- Producers, consumers and decomposers; and abiotic- climatic, edaphic, physiographic.
3. Concept of food chain and food web, Energy flow, 10% theory. Ecological Pyramids- Pyramid of numbers, biomass and energy. Erect and inverted.
4. General structure of pond and forest ecosystem.

Module 3. Function and Dynamics of Ecosystem (20 hrs)

3.1. Concept of Productivity. Primary productivity, Secondary Productivity, GPP and NPP. Comparative account on productivity major ecosystems in the biospehere. Concept of Biogeochemical Cycles. Carbon Cycle, Nitrogen Cycle, Sulphur and Phosphorus Cycle. Water Cycle.
3.2. Concept of habitat and ecological niche, Ecotone and Edge Effect. Concepts in ecospecies- Ecads and Ecotypes.
3.3. Concept of Succession: Types, characteristic features, structure of each substages in Xeracrh, Hydrarch and Mesarch.
3.4. Adaptations -morphological, anatomical and physiological in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.

Module 4. Role of plants and Phytogeography (12 hrs)

4.1. Role of plants in structure, function and evolution of existing ecosystems. Deforestation and its ill effects on biodiversity and ecosystems.
4.2. Biodiversity. Definition and Types. India as a megadiversity centre. Endangered and endemic plants of India with special emphasis to Western Ghats.
4.3. Phytogeography- Definition, concepts --Descriptive and dynamic -Continental drift, age and area theory,
4.4. Plant migration and barriers. Topographic factors- Altitude and latitude. Vegetation types of India

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Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Study of ecological and anatomical modifications of xerophyte, hydrophyte, halophyte, parasite and epiphyte.
2. Estimation of DO and BOD and calculate the primary productivity of pond water.
3. Observation of ecads and ecotypes, if available in the college campus.
4. Estimation of biodiversity in the premises of house and college campus.
5. Collection of maps showing hotspots of biodiversity.
6. Visit to a local polluted site and/or reserve forest. for documentation of major pollutants/species
7. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Structure of Ecosystem
2. Food chain and Food Webs in Nearby locality
3. Vegetation types of India

Suggested Assignment Topics- Practical

1. Visit to pond ecosystem and estimation of physicochemical parameters
2. Estimation DO in different temperatures

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Kumaresan V and N Arumugam, 2020. *Plant Ecology & Phytogeography* – Saras Publication	1, 2, 3,4
2	Deka U and T Datta, 2023. *Plant Ecology and Phytogeography*, Asian Humanities Press	1, 2, 3, 4
3	Ambasht RS and N K Ambasht, 1988. Text book of Plant Ecology, Students Friends.	1,2, 3
4	Bhatnagar A, 2010. Ecology and Environment. Oxford	1, 2,3
5	Bharucha F R, 1983. A text book of the Plant Geography of India, Oxford University Press.	4
6	Mc Dougall, W B B, 2022. Plant Ecology, Legare Street Press.	2, 3
Core Compulsory Readings		
1	Kormondy, E. 1989. *Concepts of Ecology* (3rd Ed.). Printice Hall of India, New Delhi.	
2	Schulze E. D., Beck, E., & Klaus Mü ller-Hohenstein. (2005). Plant ecology. Springer.	
Core Suggested Readings		
1	Bock, J. H., Linhart Y B, Stebbins G L and C E Turner, 2020. The Evolutionary Ecology of plants. CRC Press.	
2	Pullaiah, T, 2024. Biodiversity Hotspot of the Western Ghats and Sri Lanka. Apple Academic Press.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- List out any two environmental science research institutes in India and their major achievements
- Define ecological niche with example.
- Differentiate GPP and NPP
- List out the similarities of Food Chain and Food web
- Enlist any four morphological adaptations of Xerophytes with example.

3 Marks Questions (Applying and Analyzing):

- Discuss the adaptive features of Halophytes and list out the similarities with xerophytes.
- How does altitude and latitude influences the plant vegetation?
- What are the similarities and dissimilarities between autecology and synecology.

5 Marks Questions (Evaluating and Creating):

- How do anthropogenic land conversion and natural succession influence ecosystem dynamics? Illustrate with specific impacts on biodiversity and ecosystem services.
- Mangrove ecosystems are found to be more productive and diverse. Substantiate and evaluate this statement based on Edge effect.

Employability for the Course / Programme

It is one of the basic minor courses which is very essential for understanding the diversity of plants and their ecosystems.

43	Reproduction and Life cycle of plants	KU2DSCBOT105
Semester : 2 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Acquisition of basic knowledge in diversity of reproduction and life cycle among life forms, especially plants.
CO2	Understanding of the terms used in the description of diverse forms of life.
CO3	Understanding the basic differences that exist among different reproductive methods of plants.
CO4	Ability to apply the concepts gathered in this course to the field of evolution and advanced diversity and ecological studies.
CO5	Firsthand experience in viewing the diversity using laboratory procedures and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√	√	√							
CO3			√				√					
CO4								√	√			
CO5											√	√

Course Description
This is an introductory biology course designed for UG students in general and BSc Zoology BSc Microbiology and BSc Forestry in particular. The aim of the course is to give basic knowledge about the diversity of plant life forms.
• *First module deals with the reproduction and life cycles of plants.* • *Second module focuses on the reproduction algae and bryophytes.* • *Third module gives an idea on the reproduction of pteridophytes and gymnosperms.* • *Fourth module delves into the reproduction in angiosperms.*
This course will also provide opportunities to observe and experience diverse forms of plant reproduction through various laboratory sessions.

Course Objectives:

1. Understanding of the fundamental concepts in reproduction and life cycle of plants.
2. Concept development in diversity of general growth and development plants.
3. Enable the student to appreciate bio diversity.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/enterpreneurship

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Reproduction and Life cycles of plants (20 hrs)

1. Definition and significance of Reproduction. Brief account on reproduction of prokaryotic and eukaryotic cells. A comparative account on reproduction among different Fungal groups.
2. Types of reproduction with examples- vegetative, asexual and sexual reproduction. Importance of reproductive methods in identification and classification of plants. General Account on Vegetative methods with examples: Buds, Bulbils, Fragmentation; Asexual reproduction with examples- Spores- Zoospores, Hypnospores, Chlamydospores.
3. Sexual reproduction- Characteristics and Substages- Gametogenesis and Fertilization. Comparative account on reproduction among different plant groups. Brief account on post fertilization changes. Types of sexual reproduction–Isogamy, Anisogamy and Oogamy with examples.
4. Different Life cycles -haplontic diplontic, haplodiplo biontic life cycles.

Module 2. Diversity of reproduction in Lower plants (8 hrs)

1. Vegetative methods of reproduction among different algal groups.
2. Sexual reproduction in Algae- General and comparative account.
3. Vegetative methods of reproduction among different groups of Bryophytes. .
4. Sexual reproduction in Bryophytes. General and comparative account

Module 3. Diversity of reproduction in Higher plants (7 hrs)

1. Vegetative methods of reproduction among different pteridophyte groups.
2. Sexual reproduction in Pteridophytes- General and comparative account.
3. Vegetative methods of reproduction among different groups of Gymnosperms.
4. Sexual reproduction in Gymnosperms. General and comparative account.

Module 4. Diversity of reproduction in Angiosperms (10 hrs)

1. Vegetative methods of propagation in angiosperms-natural- root stem and leaf as propagules and human intervention- budding, layering, grafting and micropropagation.
2. Sex organs of angiosperms- flower –parts and their function.
3. Brief account on gametogenesis in plants; Types of pollination; Pollen tube growth and fertilization. Brief account on embryo and seed development.
4. Life cycle of angiosperms. Seed- germination-sapling establishment- vegetative growth-flowering – pollination – pollen tube growth – fertilization embryo formation – fruits.

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Collection of different types of flowers, inflorescence, fruits and seeds.
2. Observation of conjugation in Spirogyra.

3. T.S of mature anther
4. Observation of Dicot embryo and Monocot embryo.
5. Dissection of Embryo from Flower buds
6. Digitalisation of any one -Flower/inflorescence/placentation/flower as a modified shoot/anthers/pollinia or any other
7. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Comparative analysis of different reproductive methods in different plant groups
2. Poster preparation on life cycles of different groups
3. Vegetative propagation methods in various crops

Suggested Assignment Topics- Practical

1. Observe diverse reproductive structure in major plant groups and classification of collected specimens
2. Finding out the mixed characters in the inflorescences of common plants.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Pandey, S. N. (2009). Plant Anatomy and Embryology. India: Vikas Publishing House Pvt Limited	4
2	Bhojwani, S. S, Bhatnagar, S. P., and Dantu, P. K. (2015). The embryology of angiosperms. Vikas Publishing House	4
3	Singh A K and Kumar A, (2023). Plant Propagation and Nursery management, AK Kataria and Sons.	1, 4
4	Kumar H D and H N Sharma, (1979). A textbook on Algae,	2
5	Vasishta, P. C. (1980). Gymnosperms, S Chand & Co., Ltd., New Delhi	3
6	Sambamurty A. V. S. S., (2006). A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K. International publication, New Delhi.	2, 3
7	Arumugam N, Annie Ragland and V Kumaresan, A textbook of Botany, Saras Publication	1,2, 3, 4
8	Annie Ragland, V Kumaresan and Arumugam N, 2020. A text of Botany-algae, Fungi, Bryophytes, Microbiology and Plant Pathology, Saras Publication.	2, 3
9	Pandey, S. N. & Misra, S. P. (2008). Taxonomy of Angiosperms. Ane Books India, New Delhi.	4
10	Vashista, B. R, (1993). Gymnosperms, S Chand & Co., New Delhi.	3
Core Compulsory Readings		
1	Maheshwari, P. (1971). An introduction to the embryology of angiosperms. Tata McGraw Hill Publishing Company Ltd., New Delhi.	
	Vashista, B. R, (1993). Bryophyta, S Chand & Co., New Delhi.	
	Vashista, B. R, (1993). Pteridophyta, S Chand & Co., New Delhi.	
2	Davis W, (2006). Plant Propagation. Read Books.	
Core Suggested Readings		
1	Kains M. G., 2010. Propagation of plants - A complete guide for professional and amateur growers of plants by Seeds, Layers, Grafting and Budding, With Chapters On	
	Nursery And Greenhouse Management, Read Books.	

2	Raven, P.H., Evert, R.F., & Eichhorn, S.E., (2013). Biology of plants. VIIIth Ed. W.H. Freeman Publishers.
3	Starr, C., (2007). Biology : concepts and applications. VI edn. Thomson Press.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- Discuss the most important two stages in an amphimictic life cycle
- Define haplontic life cycle and cite an example
- Draw a neat labeled diagram of mature anther T S

3 Marks Questions (Applying and Analyzing):

- Comment on 'Flower is a modified shoot'.
- Compare and contrast Orthotrpus and Anatropus ovules with examples.
- Distinguish different types of endosperms.
- Distinguish the lomentum fruit from the legume type.

5 Marks Questions (Evaluating and Creating):

- Describe megasporogenesis and female gametophyte formation in *Polygonum* with the help of neat labeled diagram.
- Distinguish different types of Racemose inflorescence with the help of diagrammatic sketches and brief description of salient features of each type.
- Botanists classify inflorescences into three or four types. Nature doesn't obey our classification rules. Substantiate the two statements.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in cell biology as well as in diversity of life

44	Angiosperm Taxonomy and Morphology	KU2DSCBOT106
Semester : 2 **Hrs/week: 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 200-299 level
2. Ability to write examination in Englis**h**

Course Outcomes	
CO1	Understanding of the fundamental concepts in morphological characters and classification of Angiosperms.
CO2	Concept development in diversity that exist in angiosperms through studies in vegetative and floral morphology.
CO3	Enable the student to classify different types flower, inflorescences, fruits and seeds.
CO4	Skill in comparison by observing the features, both vegetative and reproductive, and thereby classification of angiosperms.
CO5	Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/entrepreneurship

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√	√	√							
CO3			√				√					
CO4								√	√			
CO5											√	√

Course Description
This is an introductory biology course designed for UG students in general and BSc Zoology BSc Microbiology and BSc Forestry in particular. The aim of the course is to give basic knowledge about the diversity of plant life forms.
• *First module deals with the reproduction and life cycles of plants.* • *Second module focuses on the reproduction algae and bryophytes.* • *Third module gives an idea on the reproduction of pteridophytes and gymnosperms.* • *Fourth module delves into the reproduction in angiosperms.*
This course will also provide opportunities to observe and experience diverse forms of plant reproduction through various laboratory sessions.

Course Objectives:

1. Understanding of the fundamental concepts in reproduction and life cycle of plants.
2. Concept development in diversity of general growth and development plants.
3. Enable the student to appreciate bio diversity.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/enterpreneurship

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Vegetative morphology 5 Hrs

Root- Types of roots and brief account on modifications Stem- Types of stem and brief account on modifications

Leaf - simple, compound; venation and phyllotaxy and brief account on modifications

Module 2. Reproductive Morphology 8 hrs

Inflorescence: racemose, cymose and special types

Flower as a modified shoot, structure of flower - floral parts, their arrangement, relative position; cohesion and adhesion of floral parts, symmetry of flowers; types of aestivation and placentation; floral diagram and floral formula.

Module 3. Angiosperm Classification 7 Hrs

Systems of classification Artificial, Natural of Phylogenetic (Brief account only). Nomenclature-Binomial system of nomenclature, ICBN (Brief account only)

Bentham & Hooker's system of classification (Up to series) and its merits and demerits. Herbarium technique. Significance of herbaria and botanical gardens; important herbaria and botanical gardens in India.

Module 4. Representative Angiosperm Families 15 Hrs

Study the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance.

Annonaceae, Malvaceae, Fabaceae (with special emphasis to Subfamily Papilionoidiae, two others mention only), Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Euphorbiaceae, Orchidaceae. Evolutionary significance of the families studied

Primitive and advanced characters of the families mentioned above. Evolutionary significance of Angiosperms-relationship with gymnosperms

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Identify different types of inflorescences and fruits included in the syllabus by affixing photographs in the record
2. Learning family characteristics by demonstrations in the laboratory using one typical plant from each family Annonaceae, Malvaceae, Fabaceae (with special emphasis to Subfamily Papilionoidiae), Rubiaceae, Asteraceae, Apocynaceae, Solanaceae and Euphorbiaceae
3. Learning to describe plants in technical terms identifying the family to which the plant belongs.
4. Each student shall submit 10 herbarium specimens belonging to the families included in the syllabus & field book for evaluation
5. Documentation of the practical works – videos, microscopic photo, diagrams and photographs

into a record book.

Suggested Assignment Topics- Theory

1. Comparative analysis of different reproductive methods in different plant groups
2. Poster preparation on life cycles of different groups
3. Vegetative propagation methods in various crops

Suggested Assignment Topics- Practical

1. Observe diverse reproductive structure in major plant groups and classification of collected specimens
2. Finding out the mixed characters in the inflorescences of common plants.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Gangulee, S.C., Das, K.S., Dutta, C.D., & Kar, A.K., (1968). College Botany Vol. I, II and III. Central Education Enterprises	1,2, 3, 4
2	Baruah A, 2023. Angiosperm Taxonomy, Asian Humanities Press	3, 4
3	Gupta R.K. (1981). A Text Book of Systematic Botany, Atma Ram & Sons, Delhi	3, 4
4	Tewari L M and Jeewan S. Jalal (2011). Flowering Plants- Angiosperms, Jagdamba Publishing Company, New Delhi.	1, 2, 3,4
5	Harris JG and M W Harris, 2001. Plant Identification Terminology: An Illustrated Glossary, Spring Lake Publishers	1, 2, 3, 4
6	Ragland A and V Kumaresan, Angiosperms,Saras Publication	2, 3
7	Pandey, S. N. & Misra, S. P. (2008). Taxonomy of Angiosperms. Ane Books India, New Delhi.	3, 4
8	Singh V, Pande P C and D K Jain, 2019. Taxonomy of Angiosperms, Rastogi Publications.	3
Core Compulsory Readings		
1	Gifford, E.M., & Foster, A.S., (1988). Morphology and Evolution of Vascular Plants. W.H. Freeman & Company, New York	
2	Simpson M G, (2019). Plant Systematics, Academic Press.	
3	Sharma ,O.P. (2010). Plant Taxonomy, The Mc Graw Hill Companies	
Core Suggested Readings		
1	Douglas, E. & Soltis *et al*. (2005). Phylogeny and Evolution of Angiosperms. Sinauer Associates Inc.	
2	Kitching, I.J. *et al*. (1998). Cladistics – the theory and practice of Parsimony Analysis. Oxford University Press.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	**Marks**
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	

• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- What are the major features of polypetalae?
- Define aestivation
- Name any two phyllotaxy with appropriate examples.
- Expand ICBN

3 Marks Questions (Applying and Analyzing)

- Flower is a modified shoot. Substantiate with the help of any four features.
- Position of gymnosperm in Bentham and Hookers' classification is found to be less significant. Apply the concepts of primitive and advanced characters in pheanerogams to substantiate the statement.
- How does herbaria preparation helps in plant taxonomy?

5 Marks Questions (Evaluating and Creating):

- Tubers are different in its morphology. Critically evaluate this statement.
- Asteraceae is having several advanced and primitive characters. Classify the characters of asteraceae to advanced and primitive; in a tabular form.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in cell biology as well as in diversity of life

45	Diversity of Plants II	KU3DSCBOT206
Semester : 3 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 100-199 level.
2. Completed the course Diversity of Plants I
3. Ability to write examination in English

Course Outcomes	
CO1	Acquisition of basic knowledge in the diversity among life forms, especially on plants.
CO2	Understanding of the terms used in the description of diverse forms of life.
CO3	Understanding the basic differences that exist among different groups of plants.
CO4	Ability to apply the concepts gathered in this course to the field of evolution and advanced diversity and ecological studies.
CO5	First-hand experience in viewing the diversity using laboratory procedures and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1V	√	√	√									
CO2			√	√	√							
CO3				√	√	√						
CO4								√	√			
CO5										√		√

Course Description
This is an intermediate biology course designed for UG students in general and BSc Zoology BSc Microbiology and BSc Forestry in particular. The aim of the course is to give basic knowledge about the diversity of plant life forms.
• *First module gives an idea on reproduction and lifecycle of algae through type organism studies.* • *Second module focuses on the features and life history of selected fungal taxa.* • *Third module is a discussion on bryophytes and pteridophytes, with an emphasis to reproduction and life cycle.* • *Fourth module is dealing with the reproductive structure and life cycle of gymnosperms.*
This course will also provide you opportunities to observe diverse cells and hands-on training to identify stages of mitosis and meiosis during laboratory sessions.

Course Objectives:

1. Understanding of the fundamental concepts in description of plants.
2. Concept development in structure and reproduction of lower groups of plants.
3. Enable the student to appreciate biodiversity.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/entrepreneurship

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Algae (15 hrs)

Reproduction and life history of the following groups with reference to the types mentioned (Excluding the developmental stages).

a) Cyanophyceae – *Nostoc*
b) Chlorophyceae –*Volvox*, *Spirogyra* and *Chara.*
c) Phaeophyceae – *Sargassum*
d) Rhodophyceae – *Polysiphonia*

Module 2. Fungi (10 hrs)

General characters, thallus structure, reproduction and life history of the following groups with reference to the types mentioned:

a) Zygomycotina – *Rhizopus*
b) Ascomycotina – *Penicillium*
c) Basidiomycotina – *Agaricus*

Module 3. Bryophytes and Pteridophytes (12 hrs)

General characters and classification -Morphology, anatomy, reproduction and life cycle of *Riccia* and *Funaria.*

General characters - Structure and reproduction of *Selaginella* and *Nephrolepis*

Module 4. Gymnosperms (8 hrs)

General characters - Structure and reproduction of *Cycas and Pinus*

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Identification of the vegetative & reproductive structures: Cyanophyceae – *Nostoc;* Chlorophyceae –*Spirogyra* and *Chara;* Rhodophyceae – *Polysiphonia*; *Selaginella; Cycas*
2. Study of vegetative structures – *Volvox* colony, *Sargassum* lateral, *Riccia* thallus, *Cycas* Leaflet TS
3. Study of reproductive structures – *Spirogyra* lateral and scalariform conjugation; *Rhizopus* zygospore and sporangiospore; *Agaricus* Basidiocarp entire and Gill TS, *Nephrolepis* sporophyll T S, *Cycas* sporophylls (entire), *Pinus* male and female cones (entire).
4. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Thallus structure in algae
2. Cell Structure and Pigments in mentioned algal genera

3. Lifecycle in algae with examples
4. Morphological variation in bryophytes
5. Variation in Reproduction among fungi
6. Leaf structure in Pteridophytes
7. Distribution of Gymanosperms
8. Fossil gymnosperms
9. Poster presentation in Life cycle of Algae, Archegoniates and Fungi.

Suggested Assignment Topics- Practical

1. Fungal culture and collection
2. Bryophyte collection
3. Variation in Sporangium and sporophyll of ferns
4. Collection of algae from ponds

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Bilgrami K S and L C Saha, (2020). A Textbook of Algae,Athithi Books.	1
2	Sundararajan S, (2023). Introduction to Algae, V M Books	1
3	Singh, V, Pande P C and D K Jain, (2017). Archegoniate (bryophyta, pteridophyta & gymnosperms), Rastogi Publications.	2, 3, 4
4	Yadav, S.,2022. Archegoniate with practical, Mahaveer Publications.	2,3, 4
5	Singh, V, Pande P C and D K Jain, (2022). Botany Archegoniates And Plant Architecture, Rastogi Publications	2, 3, 4
6	Sirka, Y., (2021). An Introduction to Archegoniate Plants: Bryophytes, Pteridophytes and Gymnosperms, Academic Aspirations.	2, 3, 4
Core Compulsory Readings		
1	Pandey, A, Malhotra, S, Shukla, K, Husain, M, Saxena, S, (2023). Plant architecture: insights from Archegoniate, Book Saga Publications.	
2	Acharya, B C, (2020). Archegoniates, Kalyani Publishers.	
Core Suggested Readings		
1	Vanderpoorten, A and B Goffinet, (2009). Introduction to Bryophytes, Cambridge University Press.	
2	Price D and C Bealey, (2022). A field guide to Bryophytes, Species Recovery Trust.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	**Marks**
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5

• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- What is meant by stele? Give an example for polystele from Pteridophytes.
- Give a short note on heterospory with an example.
- Differentiate elaters from spores
- List out any four reserve food materials specific to algal groups.

3 Marks Questions (Applying and Analyzing):

- Amphibians are having the ability to live in two types of habitats. Comment on amphibious nature of bryophytes.
- Comment on the peculiarities of *Polysiphonia* life cycle.
- Write short note on different life cycles in algae.

5 Marks Questions (Evaluating and Creating):

- Critically analyze the characters of *Cycas* and comment on the xerophytic nature.
- Give a comparative account on reproductive structures in fungi.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in biology as well as in daily life

46	Angiosperm Anatomy and Embryology	KU3DSCBOT207
Semester : 3 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 200-299 level
2. Ability to write examination in English

Course Outcomes	
CO1	Knowledge in the internal structure of angiosperm.
CO2	Understanding of the anatomical, palynological and embryological related terms used in the description of diverse forms of life.
CO3	Understanding the variations in the internal structure and reproduction that exist in various plant groups.
CO4	Interpret the adaptive and protective mechanisms exhibited by plants in response to various environmental conditions.
CO5	Ability to apply the concepts in the field of evolution and diversity studies.
CO6	Firsthand experience in viewing cells under microscope and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1V	√	√	√									
CO2			√	√	√							
CO3				√	√	√						
CO4								√	√			
CO5										√		√

Course Objectives

1. Understand plant tissue classification, structure, and functions.
2. Explore plant anatomy, including primary structures and tissue systems.
3. Study plant reproduction mechanisms and embryology.
4. Develop practical skills in observing and analyzing plant structures and tissues.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Tissues 10 Hrs

Tissues – meristematic and permanent; classification of meristems based on position, origin; Organization of shoot apex and root apex- Histogen theory & Tunica corpus theory. Simple and complex tissues, secretory tissues (nectarines and hydathodes). Vascular bundles – types: conjoint collateral, bicollateral, concentric and radial.

Module 2. Anatomy of root, stem and Leaf 10 Hrs

Primary structure of monocots and dicots –root, stem and leaf. Secondary thickening in dicot

stem and dicot root. Anomalous secondary thickening in *Boerhaavia.* Heart wood and sap wood; tyloses; hard wood and soft wood; growth rings, dendrochronology.

Module 3. Embryology 15 Hrs

Introduction and Historical account of Embryology.

Structure and functions of Microsporangium and wall layers. Microsporogenesis and development of male gametophyte.

Megasporogenesis and development of female gametophyte (*Polygonum*, *Allium* and *Peperomia*). Types of ovules.

Pollination-mechanism. Fertilisation. Endosperm – structure, development and types (Nuclear, Cellular, Helobial, Special type – Ruminate). Embryo – Structure and development of Dicot embryo, Monocot embryo. Polyembryony- Classification and Significance, Apomixis, Agamospermy- Apospory and Parthenocarpy.

Module 4. Fruits, Seeds and Palynology 10 Hrs

Fruits-classification- simple, aggregate and multiple

Seeds – Definition, Types, Structure and germination.

Palynology - Pollen structure and Morphology, Acetolysis of pollen grain. Economic importance, Pollen allergy.

Plant animal Interaction in pollination and seed dispersal. Co-evolution of plants and insects, Role of Plant-Animal interactions in sustainability of ecosystem. Brief account of myrmecophily, chiropterophily.

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Observation of apical meristems in root and stem.
2. Microphotographs of different types of tissues- Parenchyma- Aerenchyma, Chlorenchyma (Spongy, Palisade), Collenchyma, Sclerenchyma, Xylem and Phloem
3. Microphotographs of different types of tissue systems- trichomes, stomata- Dicot and Monocot
4. Primary structures in dicot stem (*Centella*), root (*Tinospora*), and leaf (*Ixora*) and monocot stem (Grass), root (*Colocasia*), and leaf (Grass).
5. Secondary Structures in Dicot root (*Tinospora*) and Stem (*Vernonia*)
6. Anomalous secondary thickening in *Boerhaavia* stem.
7. TS of Mature anther- *Datura, Ixora*
8. Observation of Pollinia- *Calotropis*/ Orchids
9. Embryos of Monocots and Dicots
10. Documentation of the practical works – videos, microscopic photo

Suggested Assignment Topics- Theory

1. Comparative analysis of different reproductive methods in different plant groups
2. Poster preparation on life cycles of different groups
3. Vegetative propagation methods in various crops

Suggested Assignment Topics- Practical

1. Observe diverse reproductive structure in major plant groups and classification of collected specimens
2. Finding out the mixed characters in the inflorescences of common plants.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Pandey, S. N. (2009). Plant Anatomy and Embryology. India: Vikas Publishing House Pvt Limited	1, 2, 3
2	Bhojwani, S. S, Bhatnagar, S. P., and Dantu, P. K. (2015). The embryology of angiosperms. Vikas Publishing House	3
3	Pandey, B P, (2001). Plant Anatomy, S Chand Publications	1,2, 3
4	Siddiqui G A, (2012). Plant Anatomy, Pragun Publications.	2
5	Rudall, P A, (2020), Anatomy of Flowering Plants An Introduction to Plant Structure and Development, Cambridge University Press.	4
6	Spjut, R. W, (1994). A Systematic Treatment of Fruit Types, The Newyork Botanical Garden.	4
7	Dutta A C, 1964. A Class Book of Botany, Oxford University Press	1,2, 3, 4
8	Gangulee, H C and A K Kar, 2011. College Botany- Volume I, II, III New Central Book Agency (P) Ltd.	1,2, 3, 4
Core Compulsory Readings		
1	Maheshwari, P. (1971). An introduction to the embryology of angiosperms. Tata McGraw Hill Publishing Company Ltd., New Delhi.	
2	Crang, R, S L Sobaski and R, Wise, (2018). Plant Anatomy: A Concept-Based Approach to the Structure of Seed Plants, Springer.	
3	Davis W, (2006). Plant Propagation. Read Books.	
Core Suggested Readings		
1	Kains M. G., (2010). Propagation of plants - A complete guide for professional and amateur growers of plants by Seeds, Layers, Grafting and Budding, With Chapters On Nursery And Greenhouse Management, Read Books.	
2	Raven, P.H., Evert, R.F., & Eichhorn, S.E., (2013). Biology of plants. VIIIth Ed. W.H. Freeman Publishers.	
3	Starr, C., (2007). Biology: concepts and applications. VI edn. Thomson Press.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	**Marks**
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- Discuss the most important two stages in an amphimictic life cycle
- Define haplontic life cycle and cite an example
- Draw a neat labeled diagram of mature anther T S

3 Marks Questions (Applying and Analyzing):

- Comment on 'Flower is a modified shoot'.
- Compare and contrast Orthotrpus and Anatropus ovules with examples.
- Distinguish different types of endosperms.
- Distinguish the lomentum fruit from the legume type.

5 Marks Questions (Evaluating and Creating):

- Describe megasporogenesis and female gametophyte formation in *Polygonum* with the help of neat labeled diagram.
- Distinguish different types of Racemose inflorescence with the help of diagrammatic sketches and brief description of salient features of each type.
- Botanists classify inflorescences into three or four types. Nature doesn't obey our classification rules. Substantiate the two statements.

Employability for the Course / Programme

It is one of the basic courses which is very helpful in understanding the fundamental concepts in cell biology as well as in diversity of life

47	Forest Botany	KU3DSCBOT208
Semester : 3 **Hrs/week : 3 Theory + 1 Practical**		**Credits : 4**

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Completed the minor courses in the first two semesters
3. Ability to write examination in English

Course Outcomes

CO1	Knowledge in the basic concept and principles of forest botany.
CO2	Understanding the fields of application of botanical knowledge in the field of botan
CO3	Understanding the plant adaptations in forest ecosystem with an emphasis to Western Ghats.
CO4	Interpret the adaptive and protective mechanisms exhibited by plants in response to various environmental conditions.
CO5	Ability to apply the concepts in the field of evolution and diversity studies.

Mapping of Course Outcomes to PSOs/Pos

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√	√	√							
CO3				√	√	√						
CO4								√	√			
CO5										√		√

Course Description
This is a comprehensive course designed for UG students in general and BSc Zoology and BSc Forestry in particular for understanding the applications of botany in understanding forest ecosystems. It covers taxonomy and morphology of forest plants that equips students for sustainable forest management. The aim of the course is to give basic knowledge about the diversity of plant life forms.
• *First module gives glimpses of forestry and its relation with botany.* • *Second module is an account on flora of Western Ghats and their adaptations.* • *Third module emphasizes on forest trees of Western Ghats.* • *Fourth module delves into the utilitarian aspect of forests.*
This course will also provide opportunities to observe diverse forms of plant life in forests and will help in future entrepreneurship.

Course Objectives:

1. Understanding of the fundamental concepts in forest botany.
2. Concept development in basic structure and reproduction of forest plants.
3. Enable the student to appreciate bio diversity, sustainable development with the help of their core subject and subsidiary subject botany.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/enterpreneurship

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	1	4	3 +0 + 2 (45 +0 +30)	5 (75)	35 (25T+10P)	65 (50T+ 15P)	100

COURSE CONTENT

Module 1. Introduction to forestry 10 Hrs

Definition, role direct and indirect benefits. General account on forest types in the World. Classification, Status and distribution of forests, with special reference to India. Comparative primary productivity of different types of forest ecosystems in the world. Basic concepts on Forest types of India and Kerala Champion & Seth Revised system of classification

Module 2. Diversity of plants in forests in Western Ghats 10 Hrs

Types of plant forms in tropical rain forests-Trees, Herbs, Shrubs, Creepers, Lianas, Twiners, Epiphytes. Annuals, Biennials, Perennials. Major plant groups- bryophytes, Pteridophytes, gymnosperms and angiosperms. Adaptation in forest environment- Structure of leaves, stem wood , bark and roots in trees, Adaptations with special reference to shade tolerance, leaf modifications, Root systems, seed dispersal mechanisms , epiphytic adaptations and mycorrhiza associations
Types of woody plants. Comparative wood anatomy of gymnosperms and angiosperms. Soft wood and hardwood. Dendrochronology and Dendroclimatology.

Module 3. Major forest trees of Western Ghats 10 Hrs

Concept of Endemic and RET plants. Significance, Threats and consequences of loss. Red data book, An overview of major RET and Endemic trees of Western Ghats. Role of vegetative characters in identification of forest trees- the bole, buttresses, flute, leaf characters, colour of younger and older leaves, characteristic of bark, blaze and exudations. Tree identification and classification based on morphology of stem and leaves and architecture. Tree forms, shapes and architecture. Importance scope of dendrology

Module 4. Useful Forest products and plants 10 Hrs

Major Timbers, Non timber forest products- bamboo and canes, resins, tannins, honey, Forest products and their utilization in industries and entrepreneurships
An overview of Gadgil Committee Report, Oommen V Ommen report.

Module 5. TEACH Space 15 Hrs

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Collection of forest products.
2. Visit to forest area and document the diversity.
3. Collect news and photographs regarding the forest.
4. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Vegetation types of India
2. Types of products and their documentation

Suggested Assignment Topics- Practical

1. Microphotographs of all practical works
2. Collection documentation and classification of diverse forms of plant life in forestry.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Shanmughavel P, 2014. Forest Botany, Pointer Publishers	1, 2, 3,4
2	Negi S S, 2012. Forest Botany, Bishen Singh Mahendrapal Singh	1, 2, 3, 4
3	Sarmah D, 2024. Distribution of trees across the Western Ghats in Karnataka, Notion Press.	2, 3, 4
4	Pullaiah, T., 2024. Biodiversity Hot Spots of the Western Ghats and Srilanka, CRC Press.	2,3
5	Mukherjee, P, 2016. Flora of the Southern Western Ghats and Palnis, Niyogi books.	2, 3
6	Bor, N. L. (1953). Manual of Indian forest botany. Manual of Indian forest botany.	2, 4
7	Sivanna, H, 2012. Handbook on Forest Biology, Discovery Publishing House	1, 2, 3, 4
8	Raj, A J., 2013. Forestry Principles And Applications, Scientific Publishers	1,2, 3,4
Core Compulsory Readings		
1	Grebner D.L., 2024. Introduction To Forestry and Natural Resources, Elsevier.	
2	Burton, L D, 2019. Introduction To Forestry Science, Cengage India.	
Core Suggested Readings		
1	Sterck, F., & Turnbull, C. (2005). Woody tree architecture. Annual Plant Reviews, Plant Architecture and its Manipulation, 17, 210-237.	
2	FAO. (2015). *Global Forest Resources Assessment*. Rome: FAO of United Nations.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	**Marks**
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- Define Forest Botany

- Give the botanical name and peculiarities of good timber
- Expand RET. Give an example from Western Ghats
- Differentiate Woods from forests

3 Marks Questions (Applying and Analyzing):

- Analyse the major reasons to consider Western Ghats as Biodiversity hot spot?
- List out the major reasons for the deterioration of Western Ghats and explain.

5 Marks Questions (Evaluating and Creating):

- Critically comment on Gadgil Committee Report and Add a note on the strategies that can be used to manage Western Ghat's biodiversity.
- Give a detailed account on different landscapes and forest types present in Western Ghats.

Employability for the Course / Programme

It is one of the advanced courses which is very helpful in understanding the diversity of plant life

1	Plant Diversity		KU1MDCBOT101
MDC	Semester : 1	Hrs/week: 3 Theory	Credits : 3

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Acquisition of basic knowledge in botany.
CO2	Understanding of the major terms used in botany and the way of scientific description of diverse forms of life.
CO3	Understanding the basic differences that exist among diverse groups of plants.
CO4	Ability to apply the concepts gathered in this course to move forward in botanical studies.
CO5	First-hand experience in viewing the diversity using laboratory procedures and there by induction of enthusiasm in biological studies.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√		√	√						
CO3						√						
CO4									√	√		
CO5											√	√

Course Description
This is an introductory biology course designed for all UG students who are interested in botanical studies in future and presently are having a shallow knowledge in the field of biology. The aim of the course is to give basic knowledge about botany and the diversity of plant life forms.
• *First module gives details on branches of botany* • *Second module focuses on the classification of plants* • *Third module gives a detailed account on vegetative morphology of angiosperms.* • *Fourth module is a brief account on the reproductive morphology of angiosperms.*
This course will also provide opportunities to observe diverse forms of plant life of lower groups including fungi, during theory and laboratory sessions designed by the teacher.

Course Objectives:

1. Understanding of the fundamental nature of science, namely botany.
2. Concept development in identification, description and classification of plants.
3. Enable the student to appreciate bio diversity for sustainable development.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/entrepreneurship.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	0	3	3 +0 + 0 (45 +0 +0)	45	25	50	75

COURSE CONTENT

Module 1. Botany as a science 8hrs

Botanical History: Contributions of eminent botanists: Theophrastus and Carl Linnaeus. Indian contributors- Itty Achudan and Van Rheed. E K Janaki Ammal, M S Swaminathan. Plants and their value- economic-food and fibre, timber- both natural and processed; medicinal- drugs and medicines; aesthetic - in gardening and landscaping; ecological - Producer and habitat for several organisms.

Module 2. Classification of Plants 6 hrs

Herbs, shrubs, trees, climbers, creepers, twiners, epiphytes and parasites. Annuals, biennials, and perennials.
Distinguishing features of major plant groups with an emphasis to vegetative morphology and prominent reproductive features- Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

Module 3. Vegetative morphology of Angiosperms 6hrs

Roots- Morphological Structure, function and Modifications-tubers (carrot), prop root (*Ficus*), stilt root (*Rhizophora*) and pneumatophores (*Avicennia*)
Stem- Morphological Structure –node- internode; Modifications- phylloclade (*Opuntia*), cladode (*Asparagus*), tuber (potato), rhizome (ginger).
Leaves- Basic morphology- Phyllotaxy- alternate, opposite, whorled. Venation- Parallel and reticulate. Modifications.

Module 4. Reproductive morphology Angiosperms 10 hrs

Flower- parts- calyx, corolla, androecium, gynoecium. Trimerous, tetramerous and pentamerous flowers with examples. Aestivation - Valvate (in calyx- *Hibiscus*) Twisted (in corolla- *Hibiscus*), Vexillary (*Clitoria*).
Inflorescence – Racemose, Cymose, Special and Mixed types. Raceme – in *Crotalaria*, *Caesalpinia*, Sunflower, *Anthurium*, Coconut. Cymose- Jasmine and *Hamelia*. Special- *Euphorbia*, *Ficus*. Mixed- *Ocimum*, *Clerodendrum panniculatum.*
Fruits- Simple- Berry- Tomato; Drupe- Coconut; Aggregate- *Polyalthia*; Multiple fruit- Jack fruit.
Seeds- General structure. Dicot and Monocot. Germination- Hypogeal and epigeal germination.

Module 5: TEACH Space 15 hrs (Only suggested list of topics and activities; that helps to achieve the aim, objectives and outcome of the course, which can be finalized by the concerned teacher. Assessment for this module is ***strictly internal***.)

Research potentials in Botany 2 hrs

Branches in Botany- Taxonomy, Morphology, Anatomy, Physiology. Pure and Applied Branches. Interdisciplinary and Multidisciplinary branches- with major applications of these branches.

Brief Account and Research potentials in: Plant systematics, Ecology, Plant anatomy, Plant physiology, Genetics, Ethnobotany, Crop improvement & Plant genetic engineering.

Practicals 13 hrs. This module is a list of suggested activities; which will be determined by the concerned teacher.

1. Reading on *Hortus Malabaricus*, Contributions of E K Janaki Ammal, Green revolution, and Life history and achievements of MS Swaminathan.
2. Observation of diversity in vegetative characters in the premises.
3. Documentation of diversity in flowers, inflorescences, fruits and seeds; in the premises.
4. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Gangulee, S.C., Das, K.S., Dutta, C.D., & Kar, A.K., (1968). College Botany Vol. I, II and III. Central Education Enterprises.	1, 2, 3, 4
2	Manilal, K.S. (2003). *Van Rheede's Hortus Malabaricus. English Edition*, with Annotations and Modern Botanical Nomenclature. (12 Vols.) University of Kerala, Trivandrum.	1
3	Iyer R D, 2021. M S Swaminathan	1
4	Dutta A C, (2000). A class book of botany, Oxford University Press.	1, 2, 3, 4
5	Suresh Narayana P and T. Pullaiah, 2021. Eminent Indian Botanists: Past and Present Biographies and Contributions, Regency Publications.	1
Core Compulsory Readings		
1	Baker. H.G. 1970. Plant and Civilization, Wadsworth Publishing Company	
2	Hait, G., 2023. Introductory Botany Vol – II, Asian Humanities Press, Global net Publication.	
3	Hait, G., 2024. INTRODUCTORY BOTANY - II : Morphology and Reproduction of Spermatophytes, Asian Humanities Press, Global net Publication.	
Core Suggested Readings		
1	Starr, C., (2007). Biology: concepts and applications. VI edn. Thomson Press.	
2	Raven, P.H., Evert, R.F., & Eichhorn, S.E., (2013). Biology of plants. VIIIth Ed. W.H. Freeman Publishers.	

TEACHING LEARNING STRATEGIES	**MODE OF TRANSACTION**
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	**Marks**
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5

• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

- What are the two main types of cells, and what distinguishes them from each other?
- List out any four features of fluid mosaic model of the cell membrane and its significance in cell biology.
- Differentiate pit from pit fields
- What are the functions of plant roots?
- Differentiate phycobiont from mycobiont with examples

3 Marks Questions (Applying and Analyzing):

- Using a diagram, illustrate the structure of a plant cell wall and explain its functions.
- The distribution and structure of chloroplast helps in the functioning of photosysntheis. Substantiate.
- Analyze the implications of the endosymbiotic theory for our understanding of cellular evolution.
- Explain the vegetative thallus of ascomycete fungi.

5 Marks Questions (Evaluating and Creating):

- Evaluate the impact of advancements in cell biology on modern scientific research and technology.
- Knowledge in biodiversity is highly essential for the economic growth and human welfare. Substantiate the statement.

Employability for the Course / Programme

It is one of the basic courses in botany that is very helpful in understanding the fundamental concepts in botany, diverse forms of plant life and their description as well as classification. It is one of the course designed for a better start of a botanical journey in academics.

2	Botany for the Beginners		KU1MDCBOT102
MDC	Semester : 1	Hrs/week: 3 Theory	Credits : 3

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Basic knowledge in botany
CO2	Understanding of the terms, concepts and basic nature of botany and its applications in human welfare.
CO3	Understanding the Ecological relations of plants.
CO4	Application of the concepts of botany and knowledge in plant diversity in future activities and also for the profession.

Mapping of Course Outcomes to PSOs/Pos

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2			√		√	√						
CO3						√						
CO4									√	√		

Course Description
This is a foundation course in botany designed for all UG students in general with an aim to give basic knowledge about plants, their diversity and diverse applications in human welfare.
• *First module is emphasizing on the general classification of living forms.* • *Second module is dealing with the description and classification of higher plants.* • *Third module delves into the ecological roles of plants.* • *Fourth module is giving an idea on the application of plant into various aspects of human life.*
This course will also provide opportunities to observe diverse forms of plant life within the premises and will help to widen the knowledge in botany.

Course Objectives:

1. Understanding of the fundamental concepts in Botany.
2. Concept development in description and classification of plants.
3. Enable the student to appreciate bio diversity, sustainable development with the help of their core subject and subsidiary subject botany.
4. Induce to experiment on the subject in an intensive way to facilitate an interdisciplinary profession/enterprise/enterpreneurship

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	0	3	3 +0 + 0 (45 +0 +0)	45	25	50	75

CONTENT

Module 1. Living world 6 hrs

Concept of Living and Non Living: Origin of Life. Viruses, Bacteria, Fungi, Plants and Animals; Five kingdom Classification. General characters of major plant groups- Algae, Bryophytes, Pteridophytes, gymnosperms and angiospersm. Life cycle of angiosperms plants.

Module 2. Major features of Angiosperms 6 hrs

Typical angiosperm plant: Functions of each organ viz. Root, Stem, leaves, inflorescence, flowers, fruit and seed.

Flower: Basic structure - essential and non essential whorls. Trimerous, tetramerous and pentamerous flowers with examples. Aestivation - Valvate (in calyx- *Hibiscus*) Twisted (in corolla- *Hibiscus*), Vexillary (*Clitoria*).

Inflorescence – Racemose, Cymose, Special and Mixed types. Raceme – in *Crotalaria*, Sunflower, Cymose- Jasmine. Special- *Ficus*. Mixed- *Ocimum.*

Fruits- Simple- Berry- Tomato; Drupe- Coconut; Aggregate- Polyalthia; Multiple fruit- Jack fruit.Seeds- General structure. Dicot and Monocot.

Module 3. Ecological role of plants 8hrs

Ecological Significance of Plants – Solar energy fixing Producers and Nitrogen fixation, Symbiotic relationships of plants – Lichens, Azolla and Blue green alga, Parasitism.

Plants and Animals for pollination and seed/fruit dispersal- Pollination- Entomophily, Chiropterophily, Myrmecophily. Seed Dispersal: Zoochory,

Specific case studies on examples for co evolution- Dodo and Calvaria, Butterflies and plants; Wasps and Ficus, mimicking for pollinators.

Module 4. Applications of Plant biology 10Hrs

Agriculture-Crop improvement-weed control and management-Integrated pest management- plant propagation- intercropping- crop rotation- biofertilisers, biopesticides, Plant breeding- Medicine-Plant derived drugs in various systems of medicine- netraceuticals and pharmaceuticals.

Environmental management- Gardens and biodiversity conservation- Productivity and role in biogeochemical cycling. Green corridors and belts

Module 5. TEACH Space (15 hrs):

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Collection, documentation and observation of plants in the premises.
2. Collection of information on role of plants in various aspects of human life.
3. Documentation of the practical works – videos, microscopic photographs and other drawings by the student for evaluation as soft copy and/or hard copy.

Suggested Assignment Topics- Theory

1. Group wise characters of plants
2. Life cycle of plants

Suggested Assignment Topics- Practical

1. Photographs of different plants in the premises

2. Microphotographs of all practical works
3. Collection documentation and classification of diverse forms of plant life

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Hait, G., 2023. Introductory Botany Vol – I, Asian Humanities Press, Global net Publication.	1, 2, 3,4
2	Sen K and P Giri, 2024. Fundamental Botany, Santra Publication Pvt Ltd	4
3	Dutta A C, (2000). A class book of botany, Oxford University Press.	1, 2, 3, 4
4	Gangulee, S.C., Das, K.S., Dutta, C.D., & Kar, A.K., (1968). College Botany Vol. I, II and III. Central Education Enterprises.	1, 2,3, 4
Core Compulsory Readings		
1	Hait, G., 2023. Introductory Botany Vol – II, Asian Humanities Press, Global net Publication.	
2	Hait, G., 2024. INTRODUCTORY BOTANY - II : Morphology and Reproduction of Spermatophytes, Asian Humanities Press, Global net Publication.	
Core Suggested Readings		
1	Starr, C., (2007). Biology: concepts and applications. VI edn. Thomson Press.	
2	Raven, P.H., Evert, R.F., & Eichhorn, S.E., (2013). Biology of plants. VIIIth Ed. W.H. Freeman Publishers.	

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question
- ➢ What are the major features Kingdom Protista
- ➢ Define Primary Productivity

3 Marks Questions (Applying and Analyzing):
- ➢ Alga is a synthetic term to denote organisms belonging to different plant groups. Analyse.
- ➢ Basic knowledge about plants helps in improving human welfare. Give a short note.

5 Marks Questions (Evaluating and Creating):
- ➢ Plants are the dominating component of any ecosystems, that plays a key role in shaping of ecosystems. Critically evaluate.

Employability for the Course / Programme

It is one of the foundation courses which is very helpful in understanding the diversity of plant life and its application in various aspects of human life.

3	Beginner's Exploration to the world of leaves and flowers	KU2MDCBOT103
MDC	Semester : 2	Hrs/week: 3 Theory	Credits : 3

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Ability to identify and describe the external morphology of a leaf and its parts.
CO2	Appreciation of the significance of leaves in plant identification and classification.
CO3	A comprehensive understanding the structure and function of flower and floral parts.
CO4	Acquisition of basic knowledge in the stages of reproduction in flowering plants and their importance in plant life cycles.
CO5	Ability to integrate their knowledge on leaf morphology, flower structure, and reproductive biology for further understanding of biology and ecology.

Mapping of Course Outcomes to PSOs/Pos

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10	PSO11	PSO12
CO1	√	√	√									
CO2		√		√								
CO3					√	√						
CO4							√		√			
CO5											√	√

Course Description
This is a foundation course designed for UG students in general and for BSc Zoology, BSc Microbiology and BSc Forestry in particular. This course provides a foundational understanding of structure, function and diversity among leaves and flowers into various studies in botany, ecology, and related fields and also for the application in bouquet making and other interior decorations.
• *First module identifies and describes the external morphology of a leaf, including the blade (lamina), petiole, stipules, and veins.* • *The second module provides an overview of the significance of leaves in plant identification and classification.* • *The third module focuses on the structure and function of flowers.* • *The fourth module covers flower development and reproduction.*
In this course, participants have the opportunity to delve into a wide array of plant leaves and flowers.

Course Objectives:

1. To identify different types of plant leaves and flowers based on their unique characteristics.
2. To get a basic knowledge in classification of flowers and leaves based on their structures, functions, and other features.

3. To appreciate the vast diversity present in plant leaves and flowers, recognizing the range of shapes, sizes, colors, and adaptations that exist in the plant kingdom.
4. to apply their knowledge of plant leaves and flowers in real-world contexts, such as gardening, landscaping, bouquet making, interior decorations and plant conservation efforts.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	0	3	3 +0 + 0 (45 +0 +0)	45	25	50	75

COURSE CONTENT

Module 1: Basics of Leaf Structure, Function, and Diversity 8 hrs

External Structure: Blade (Lamina), Petiole, Stipules and Veins.

Leaf Arrangements: Alternate, Opposite, Whorled: Leaf Diversity: Leaf Types: Simple Leaves: Compound Leaves: Leaf Shapes: Elliptical, Lanceolate, Ovate. Leaf Margins: Entire, Serrated, Lobed. An overview of leaf apices.

Internal Structure: Epidermis, Mesophyll, Palisade Mesophyll, Spongy Mesophyll and Stomata.

Module 2: Leaf Diversity for various uses 8 Hrs

Role of Leaf in plant Life: Photosynthesis, Gas Exchange, Transpiration, Guttation, Storage, Protection. Leaf Senescence and Colour changes during development with examples. A brief account on leaf pigments. Dye yielding leaves. Modifications of leaves. Reproduction from leaves. Modern methods of propagation using leaves. Leaf spray in agriculture and horticulture. Significance of Phylloplane and Phyllosphere..

Significance of Leaf study in various fields. Adaptations and leaves. Evolution and leaves. Taxonomy and Leaves. Role in Ecosystem Dynamics- Allelopathy, Humus formation and Soil biodiversity. Medicinal and cultural uses of leaves.

Module 3. Sex organ of angiosperms – the flower: Structure and Function 6 hrs

Parts of a flower. Various types of flowers- based on symmetry, position of ovary, number of floral units, complete or incomplete, cohesion and adhesion.

Inflorescences- Racemose, Cymose and Special and Mixed. Special structures – Bracts, Bracteoles.

Fruits and seeds the end products of sexual reproduction.

Module 4. Flower Development and Reproduction- 8 Hrs

Flower/ inflorescence development stages: From bud to Anthesis, Pigments in flowers. Colour changing flowers. Adaptations for attraction of pollinators.

Fruit/Seed development and Fruit ripening and colour change. Diversity in dispersal of fruits and seeds.

Pollinators and Pollination mechanisms. Floral mimicry and deception. Fruit and seed dispersal and germination mechanisms with an emphasis to zoochory and germination with the help of animals. Case study- Rafflesia and elephant, Loranthus and Birds, Calvaria and Doddo.

Economic significance of flowers: Agriculture, horticulture, and floriculture. Medicinal and cultural uses of flowers.

Module 5. TEACH Space (15 hrs):

Theory: 5 hrs

Importance of leaves and flowers/inflorescence in various decorations- vase, wreath, garlands, stage arrangements, arch makings. Making methods. An overview of major flowers and leaves used in decorations- live and dead/preserved. Methods to increase the longevity and prevention of senescence. Wet and dry methods of preservations. Local case studies – during religious customs and ritual practices.

PRACTICALS 10 hrs

This module is a list of suggested activities that helps to achieve the aim, objectives and outcome of the course; which will be determined by the concerned teacher. Assessment for this module is ***strictly internal***.

1. Microscopic observation of internal structure of leaf.
2. Observation and collection of different types of leaves.
3. Ecological variation in leaves.
4. Dissect out diverse flowers.
5. Students observe pollination in action by observing flowers in the college campus.
6. Organize symposium and workshops on floral decoration /bouquet making.
7. Visits to local farms or floral markets.

Suggested Assignment Topics- Theory/Practical

1. Leaf Morphology Comparative Analysis
2. Leaf Function Experiment Report
3. Leaf Diversity Field Guide
4. Taxonomic Classification Project
5. Ecosystem Dynamics Case Study
6. Leaf Identification Challenge
7. Flower Dissection Lab Report
8. Pollinator Observation Field Journal
9. Flowering Plant Life Cycle Diagram
10. Flowering Plant Classification Poster
11. Economic Importance of Flowers Presentation

Suggested readings specific to the module.		
Sl. No	**Title/Author/Publishers of the Book specific to the module**	**Module No.**
1	Ollerton J, 2020. Pollinators and Pollination: Nature and Society, Pelagic Publishing	4
2	Hait, G., 2023. Introductory Botany Vol – I, Asian Humanities Press, Global net Publication.	1, 2, 3,4
3	Sen K and P Giri, 2024. Fundamental Botany, Santra Publication Pvt Ltd	1, 2, 3, 4
4	Dutta A C, (2000). A class book of botany, Oxford University Press.	1, 2, 3, 4
5	Gangulee, S.C., Das, K.S., Dutta, C.D., & Kar, A.K., (1968). College Botany Vol. I, II and III. Central Education Enterprises.	1,2, 3, 4
Core Compulsory Readings		
1	"Botany for Gardeners: An Introduction and Guide" by Brian Capon	
2	"The Botany of Desire: A Plant's-Eye View of the World" by Michael Pollan	
3	"Plant Systematics: A Phylogenetic Approach" by Walter S. Judd, Christopher S. Campbell, Elizabeth A. Kellogg, and Peter F. Stevens	

4	"Botany in a Day: The Patterns Method of Plant Identification" by Thomas J. Elpel
5	"The Hidden Life of Trees: What They Feel, How They Communicate – Discoveries from a Secret World" by Peter Wohlleben
6	"Indian Herbalogy of North America: The Definitive Guide to Native Medicinal Plants and Their Uses" by Alma R. Hutchens
7	"Flowers of India" by Dinesh Valke
8	"The Book of Indian Trees" by K. C. Sahni
9	"Indian Medicinal Plants: An Illustrated Dictionary" by C.P. Khare
10	Natália O. Leiner, André R.T. Nascimento and Céline Melo Plant Strategies For Seed Dispersal In Tropical Habitats: Patterns And Implications - Tropical Biology And Conservation Management – Vol. I - Encyclopedia of Life Support Systems (EOLSS)
Core Suggested Readings	
1	Abrol D P, 2012. Pollination Biology: Biodiversity Conservation And Agricultural Production, Springer.
2	Roberto Caballero, Elizabeth V. Reyes and Luca Invernizzi Tettoni, 2012. Decorating with Flowers: A Stunning Ideas Book for all Occasions, Tuttle Publishing.

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group Discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

1. How do the blade (lamina), petiole, stipules, and veins contribute to the external morphology of leaves?
2. What are the main components of leaf internal anatomy, and how do they facilitate leaf functions?
3. When might leaves exhibit different types of arrangements such as alternate, opposite, or whorled?
4. What are the primary functions of leaves, including photosynthesis, gas exchange, transpiration, storage, and protection?
5. How do simple and compound leaves differ, and what are some examples of each type
6. How do leaf shape and size serve as key identifying features in plant classification?
7. What are venation patterns in leaves, and when are they used for classification?
8. When are apex/base shapes of leaves important in identifying plant species

9. What is the significance of taxonomic classification in identifying plant families and genera?
10. Why are stamen, pistil, petals, and sepals essential reproductive structures in flowers?
11. When do flowers typically utilize wind, water, insects, and animals for pollination?
12. How do flowers adapt to different pollination mechanisms?
13. What are the stages of flower development from bud to fruit?
14. Why is it important to differentiate between pollination and fertilization in flower reproduction?
15. When does seed development and dispersal typically occur in the life cycle of a flowering plant?
16. How do adaptations in flowering plants contribute to their survival and reproduction

3Marks Questions (Applying and Analyzing):

1. Identify and describe the external morphology of a leaf, including the blade (lamina), petiole, stipules, and veins.
2. Explain the internal anatomy of a leaf, including the epidermis, mesophyll (palisade and spongy), and stomata.
3. Understand the functions of leaves, including photosynthesis, gas exchange, transpiration, storage, and protection.
4. Recognize different leaf types, such as simple and compound leaves.
5. Identify various leaf shapes, including elliptical, lanceolate, and ovate.
6. Describe different leaf arrangements, such as alternate, opposite, and whorled.
7. Differentiate between various leaf margins, including entire, serrated, and lobed.

5 Marks Questions (Evaluating and Creating)

1. Describe in detail the external morphology of a leaf, highlighting the significance of the blade (lamina), petiole, stipules, and veins. Explain how variations in these structures contribute to leaf diversity.
2. Discuss the internal anatomy of a leaf, including the epidermis, mesophyll (palisade and spongy), and stomata. Explain how each component facilitates leaf functions such as photosynthesis, gas exchange, and transpiration.
3. Compare and contrast simple and compound leaves, providing examples of each type and explaining their structural differences and potential advantages in various environments.
4. Analyze the diversity of leaf shapes, including elliptical, lanceolate, and ovate. Discuss the adaptive significance of different leaf shapes in relation to environmental factors and ecological niches.
5. Evaluate the importance of leaf arrangements, such as alternate, opposite, and whorled, in plant physiology and ecology. Discuss how different arrangements may reflect adaptations to specific environmental conditions.
6. Explain how leaf shape and size, leaf arrangement, and venation patterns serve as key identifying features in plant classification. Provide examples of how these features are used to classify different plant species.
7. Discuss the significance of taxonomic classification in plant biology, focusing on its role in identifying plant families and genera. Explain how taxonomic classification reflects evolutionary relationships among plants.

8. Analyze the functional adaptations of leaves to different environmental conditions, including structural modifications and physiological processes. Discuss how these adaptations enhance plant survival and reproduction.
9. Evaluate the ecological importance of leaves in ecosystem dynamics, including their role in primary productivity, nutrient cycling, and habitat provision. Provide examples of how leaves contribute to ecosystem services and biodiversity.
10. Discuss the potential impacts of environmental changes, such as climate change and habitat loss, on leaf diversity and plant communities. Evaluate strategies for conserving leaf diversity and promoting sustainable plant ecosystems.

Employability for the Course / Programme

"A Beginner's Exploration to the World of Leaves and Flowers" provides a gateway to various career paths within the realm of botany, horticulture, and environmental education. Graduates can find employment as botanical technicians, gardening assistants, floral designers, and nature educators, utilizing their knowledge of leaves and flowers to contribute to plant research, landscape design, and environmental advocacy.

4	Agrobiodiversity		KU2MDCBOT104
MDC	Semester : 2	Hrs/week: 3 Theory	Credits : 3

Course Pre-requisite:

1. Knowledge in Biology at 10th Standard
2. Ability to write examination in English

Course Outcomes	
CO1	Basic knowledge in agro-biodiversity.
CO2	Understanding the historical context of plant and animal domestication.
CO3	Appreciation of the ecological benefits provided by agro-biodiversity.
CO4	Recognition of the critical role of agro-biodiversity in ensuring food security, nutrition, and its economic and cultural significance in agricultural systems.
CO5	Understanding of the importance of agro-biodiversity in sustainable agricultural practices, fostering resilience and environmental sustainability in farming systems.

Mapping of Course Outcomes to PSOs/POs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	POS8	POS9	POS10	POS11	POS12
CO1	√	√	√									
CO2			√		√							
CO3				√	√		√					
CO4								√	√			
CO5										√	√	√

Course Description
This course explores the variety and variability of plants, animals, and microorganisms used directly or indirectly for food and agriculture. It covers the concepts, importance, and conservation strategies of agro-biodiversity, focusing on sustainable agricultural practices and the impact of modern agricultural techniques.
• *First module covers the fundamentals of Agro-biodiversity Introduction.* • *The second module focuses on assessment and Threats to Agrobiodiversity.* • *Third module deals with Sustainable Agricultural Practices* • *Fourth module covers Modern Agricultural Technologies*
In addition, this course offers practical sessions on model organisms, providing you with opportunities to explore a wide range of angiosperms and their diversity. By combining theoretical learning with hands-on experiences, the course offers a structured approach to comprehending agro-biodiversity, ensuring a holistic understanding of the subject matter.

Course Objectives:

1. Understand the concept and components of agro-biodiversity.
2. Recognize the importance of agro-biodiversity in sustainable agriculture.
3. Identify the threats to agro-biodiversity and strategies for its conservation.
4. Explore traditional and modern agricultural practices and their impact on agro-biodiversity.

Credit			Teaching Hours		Assessment		
L/T	P/I	Total	L/T/P	Total	CCA	ESE	Total
3	0	3	3 +0 + 0 (45 +0 +0)	45	25	50	75

COURSE CONTENT

Module 1: Introduction to Agro-biodiversity 8Hrs

Definition and scope of agro-biodiversity, Components of agro-biodiversity: Genetic, species, and ecosystem diversity, Historical perspective on the domestication of plants and animals, Importance of Agro-biodiversity- Role in food security and nutrition, Ecological benefits: Soil health, pollination, pest and disease control, Economic and cultural significance. Rice varieties of Kerala and contribution of Cheruvayal Raman.

Module 2: Assessment and Threats to Agrobiodiversity 12 Hrs

Methods and tools for measuring agro-biodiversity, Species Richness, Genetic Diversity, Ecosystem Diversity, Agro-Ecological Methods. On-farm conservation vs. ex-situ conservation- On-farm Conservation-definition, advantages, challenges. Ex-situ Conservation: Conservation-definition, advantages, challenges. Modern agricultural practices: Monocultures, use of pesticides and fertilizers, Climate change and its impact, Habitat loss and degradation

Module3: Sustainable Agricultural Practices- Organic farming 5 Hrs

Agroforestry and Crop rotation and polycultures. Traditional Knowledge and Agro-biodiversity- Indigenous farming practices, Role of traditional knowledge in conservation, Case studies from different regions. PPVFRA and Concept of Genomic Saviours- Shaji -the tuber saver. Praseed Kumar Thayyil and Sunil Kumar M. of Wayanad district. John Joseph of Kozhikode district and Vinod E.R of Thrissur district.

Module 4. Modern Agricultural Technologies for Agrobiodiversity Management 5 Hrs

GMOs and their impact on agro-biodiversity- Genetic erosion. Agricultural biodiversity management Strategies- Good agricultural practices to manage agricultural biodiversity- Species-based conservation- Area-based conservation- Ecosystem approaches- Creating a supportive environment- Improving the practice of conservation on the ground.

Module 5. TEACH Space (15 hrs):

Theory- 5 hrs

Successful agro-biodiversity conservation projects. Local initiatives- Kuttiattoor Geotagged Mango. Kannapuram and Kunhimangalam Mango movements. Shimjith Thillenkery and Curcuma varieties. Ezhome Rice Project.

Practical-10 hrs

Field Visits and Practical Work- Visits to local farms, botanical gardens, or research institutions. Hands-on activities: Seed saving, soil health assessment, biodiversity surveys

Sl. No	Title/Author/Publishers of the Book specific to the module
1	D. I. Jarvis, C. Padoch, and H. D. Cooper- "Agrobiodiversity: Managing Biodiversity in Agricultural Ecosystems"
2	Food and Agriculture Organization - "The Role of Biodiversity in Agriculture: Report of an FAO/UNEP Expert Consultation"
3	P. S. Teng - "Seeds of Sustainability: Lessons from the Birthplace of the Green Revolution in Agriculture"
4	S. K. Sharma, K. S. Varaprasad, P. S. S. Rao, S. A. Tarafdar, 2019. "Agrobiodiversity Hotspots: Concepts, Conservation and Management" Springer.
5	A.K.Kandya, 2015. "Agrobiodiversity and Sustainable Rural Livelihoods", Scientific Publishers.
6	P. R. Seshagiri Rao, 2004. Agrobiodiversity in India", Concept Publishing Company.
7	T. C. James, 2008. "Agricultural Biodiversity, Biotechnology and Traditional Knowledge: Biological and Legal Correlations", Academic Foundation.
8	B. S. Dhillon, B. S. Rana, R. K. Tyagi, 2002. "Managing Agrobiodiversity: Farmers' Changing Perspectives and Institutional Responses in the Hindu Kush-Himalayan Region", International Centre for Integrated Mountain Development (ICIMOD).
9	R. S. Rana, R. K. Tyagi, T. J. H. Renault, 1997. "Conserving Agricultural Biodiversity: The IPGRI Programme in Asia, the Pacific and Oceania", International Plant Genetic Resources Institute (IPGRI).
10	M.S. Swaminathan, 1996."Agrobiodiversity and Farmers' Rights", Konark Publishers Pvt. Ltd.
11	M.S. Swaminathan,2004. "Agrobiodiversity and Sustainable Agriculture", Academic Foundation.
12	M.S. Swaminathan and S. L. Kochhar, 2000. "Biodiversity and Sustainable Food Security: Exploring the Links", Macmillan India.
13	Nayar, N M (2011), "Agrobiodiversity in a biodiversity hotspot: Kerala State, India. Its origin and status", Genetic Resources and Crop Evolution, 58(1):55-82
14	Sunil Mani, S M Mohanakumar, V Santhakumar and T Abhilash, Conservation of Agrobiodiversity: Lessons from Kerala. *https://practiceconnect.azimpremjiuniversity.edu.in/conservation-of-agrobiodiversity-lessons-from-kerala*

TEACHING LEARNING STRATEGIES	MODE OF TRANSACTION
➢ Hands-on experiments ➢ Collaborative learning-Group discussion	➢ Lecturing ➢ ICT ➢ Practicals

ASSESSMENT RUBRICS	Marks
End Semester Evaluation ESE	
• University Examination	70
Continuous Evaluation CE	
• Examinations (multiple choice, true-false, fill-in-the-blank, matching, short answer and critical thinking questions)	10
• Writing assignment	5
• Laboratory reports	5
• Practical Examination	10

Sample Questions to test Outcomes.

2 Marks Question

1. What is agro-biodiversity?
2. What are landraces?
3. When is the International Day for Biological Diversity celebrated?
4. When did the Convention on Biological Diversity come into force?
5. Why is agro-biodiversity important for food security?
6. Why should traditional farming practices be preserved?
7. How can farmers contribute to the conservation of agro-biodiversity?
8. How does climate change impact agro-biodiversity?

3 Marks Questions (Applying and Analyzing):

1. Explain the role of agro-biodiversity in enhancing ecosystem services in agricultural landscapes.
2. Analyze the impact of monoculture practices on agro-biodiversity and suggest alternative practices that could mitigate these impacts.
3. Discuss how traditional agricultural knowledge contributes to the conservation of agro-biodiversity and provide an example.
4. Evaluate the effectiveness of in-situ conservation methods for agro-biodiversity compared to ex-situ conservation. Provide examples to support your evaluation.
5. How does agro-biodiversity contribute to climate change mitigation and adaptation in agricultural systems?

5 Marks Questions (Evaluating and Creating):

1. Evaluate the impact of global agricultural policies on agro-biodiversity and propose policy changes that could promote the conservation and sustainable use of agro- biodiversity.
2. Design a comprehensive community-based program to enhance agro-biodiversity in a rural agricultural setting. Outline key components, stakeholder roles, and expected outcomes.
3. Critically assess the role of modern biotechnology in agro-biodiversity conservation. Include potential benefits and risks, and suggest strategies for integrating biotechnology with traditional conservation methods.
4. Evaluate the role of agro-biodiversity in sustainable food systems and propose a model for integrating agro-biodiversity into urban agriculture.

Employability for the Course / Programme

This foundation course on agro-biodiversity offers students a comprehensive understanding of the intricate relationships between agriculture, biodiversity, and sustainability. By delving into topics such as genetic diversity, ecosystem services, and conservation strategies, students gain valuable insights into the importance of maintaining diverse agricultural systems for food security and environmental resilience. Armed with this knowledge, graduates are well- prepared to pursue diverse career paths, from agricultural research and conservation to policy development and sustainable farming practices, thereby contributing significantly to the global efforts towards a more sustainable and biodiverse agricultural future.