University of Kerala

Discipline	**BOTANY**				
Course Code	**UK4DSCBOT204**				
I	**Diversity of Non-Flowering Plants and Palaeobotany**				
Type of Course	**DSC**				
Semester	IV				
Academic Level	200 – 299				
Course Details	Credit	Lecture per week	Tutorial per week	Practical per week	Total Hours/Week
	4	3 hours	-	2	5 hours
Pre-requisites	UK3DSCBOT200				
Course Summary	• To create awareness about non-flowering plant groups like Bryophytes, Pteridophytes, and Gymnosperms. • To generate awareness about the lifecycle of Bryophytes, Pteridophytes, and Gymnosperms. • To impart knowledge about fossil formation and its significance				

Detailed Syllabus:

Module	Unit	Content	Hrs
I		**Bryophytes**	**7**
	1	General features, Distinctive characters of three major groups – Liverworts, Hornworts, and Mosses. Morphology, anatomy, and reproduction of Riccia, Anthoceros, and Polytrichum (Developmental details are not required); Evolution of Gametophyte and Sporophyte in Bryophytes.	6
	2	Ecological roles, economic importance, and horticultural significance of bryophytes.	1
II		**Pteridophytes**	**8**
	3	Introduction, general characters, Outline classification (Sporne, 1975) up to Order	2

	4	Study of the habit, internal structure, reproduction, and life cycle of the following types (Developmental details not required): *Selaginella, Equisetum,* and *Adiantum.*	4
	5	Stelar evolution in Pteridophytes; Heterospory and Seed habit, Economic importance of Pteridophytes, and ethnobotanical importance of ferns.	2
III		**Gymnosperms**	**10**
	6	Introduction – General characters and Outline classification (Sporne, 1965) up to Order with example.	2
	7	Important characters of Cycadopsida, Coniferopsida, and Gnetopsida; Study of the habit, anatomy, reproduction, and life cycle of the following types (Developmental details are not required): *Cycas, Pinus,* and *Gnetum*	6
	8	Economic importance with reference to Wood, Resins, Essential oils, and Drugs.	2
IV		**Paleobotany**	**5**
	9	Definition of fossil, Conditions required for fossilisation, and the fossilisation process.	2
	10	Fossil Pteridophytes- *Rhynia, Lepidodendron, Lepidocarpon*.	2
	11	Fossil gymnosperms—*Lyginopteris.*	1
V		**Origin and evolution of non-flowering plants and Basic Paleobotanical Principles**	**15**
	12	Bryophytes: Origin of Bryophytes-Adaptation to Land Habitat-Pollution indicators -Relationships with other organisms- Peat formation -biologically active compounds in bryophytes- Threats to Bryophytes.	
	13	Pteridophytes: Pteridophytes: Origin of pteridophytes-theories of algal and bryophytes origins- Evolution of sorus – Apospory and Apogamy.	
	14	Gymnosperms: Origin and Distribution of Gymnosperms in India – Model Systems (Physcomitrella, Ceratopteris, Ephedra) and Their Applications in Genetic, Molecular, and Evolutionary Studies.	
	15	Paleobotany: History and contributions of Indian Paleobotanist: Dr. Birbal Sahani- Ginkgo biloba – living fossil-Techniques for studying plant fossils. Principles of radiometric fossil dating (brief idea).	
		Practicals	**30hrs**
		• *Riccia* - Habit, Internal structure of thallus. • *Anthoceros*- Habit with sporophyte, Internal structure of thallus and sporophyte. • *Polytrichum*- Habit - V.S. of Archegonial and Antheridia cluster, Sporophyte V.S. • *Selaginella* – Habit, T.S of stem and rhizophore, V.S of Strobilus, Megasporophyll, and Microsporophyll, entire and	•

		(permanent slide/ images of V.S) • *Equisetum*- Habit, Stem T.S, V.S of strobilus • *Adiantum*- Habit, T.S. of Rachis, T.S. of Sporophyll, Prothallus • *Cycas*- T.S. of leaflet, coralloid root, Micro and megasporophyll entire. • *Pinus*- Branch of indefinite growth, spur shoot, T.S. of needle, male and female cone, V.S. • *Gnetum*- T.S of leaf, male and female cone V.S. • Permanent slide/ images of Fossils – *Rhynia, Lepidocarpon, Lyginopteris.*	

REFERENCES

1. Andrews H.N. (1967) - Studies on Palaeobotany – C.J.Felix.
2. Arnold C. A (1947) - Introduction to Palaeobotany - McGraw-Hill Co., New Delhi.
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4. Coutler. J. M. - and Chamberlain, C. J. (1958) – Morphology of Gymnosperms Central Book Depot, Allahabad
5. Gupta V K. and Varshneya U. D (1967). An Introduction to Gymnosperms– Kedarnath, Ramnath –Meerut.
6. Pandey B. P. (2010). College Botany Vol II, Chand Publications, New Delhi
7. Parihar N S (2015) An Introduction to Embryophyta- Pteridophytes Surjeet Publications
8. Rashid A (2012). An Introduction to Bryophytes, Vikas Publishers, N Delhi
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11. Sharma OP (2016). Gymnosperms. Pragathi Prakashan. Meerut
12. Smith G.M. (1955). Cryptogamic Botany – Vol.II – McGraw-Hill Co. New Delhi
13. Sporne K. R. (1966). Morphology of Pteridophytes - Hutchins University Library, London
14. Sporne K. R. (1967). Morphology of Gymnosperms - Hutchin University Library, London
15. Vashista B. R. (1993). Pteridophyta – S.Chand and Co., New Delhi
16. Vashista B. R. (1993). Gymnosperms - S. Chand and Co., New Delhi
17. Vasishta P C, Sinha A K, and Anilkumar (2005). Botany for Degree Students – Gymnosperms S Chand and Co
18. Vasishta PC (2010). Botany for degree students. S. Chand Publications.
19. Watson E V (2015). The Structure and Life of Bryophytes edition, Scientific Publishers -Jodhpur

Course Outcomes

No.	Upon completion of the course, the graduate will be able to	Cognitive Level	PSO addressed
CO-1	Understand the diversity and general characteristics of various groups of non-flowering plants and the formation of fossils.	R, U	PSO-1,2
CO-2	Understand the classification, morphology, reproduction, and life cycle patterns of various groups of non-flowering plants.	U, An	PSO- 1,2
CO-3	Compare the structure and evolution of gametophyte and sporophyte of Bryophytes, Pteridophytes, and gymnosperms.	U, An	PSO-2,3
CO-4	Assess the economic and ecological significance of Bryophytes, Pteridophytes, and gymnosperms.	An, Ap	PSO-4,6
CO-5	The capacity to analyze various types of fossils based on their characteristics and their significance.	An, E	PSO-8
CO-6	Enhance collaborative learning and communication skills through field study, teamwork, group discussions, and home assignments.	An,E,C	PSO- 8, 9

R-Remember, U-Understand, Ap-Apply, An-Analyse, E-Evaluate, C-Create

Note: 1 or 2 COs/module

Name of the Course: Credits: 4:0:0 (Lecture:Tutorial:Practical)

CO No.	CO	PO/PSO	Cognitive Level	Knowledge Category	Lecture (L)/Tutorial (T)	Practical (P)

1	**CO-1**	1,2	R, U	F, C	L	P
2	**CO-2**	1,2	U, An	c	L	p
3	**CO-3**	2,3	U, An	C, P	L	P
4	**CO-4**	4,6	An, Ap	C	L	P
5	**CO-5**	8	An, E	C, P	L	P
6	**CO-6**	8,9	An, E, C	P,M	L/P	

F-Factual, C- Conceptual, P-Procedural, M-Metacognitive

Mapping of COs with PSOs and POs :

	PSO 1	**PSO 2**	**PSO 3**	**PSO4**	**PSO5**	**PSO 6**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**
CO 1	1	-	-	-	-	-						
CO 2	2	3	-	-	-	-						
CO 3	-	-	1	-	-	-						
CO 4	-	-	2	3	-	-						
CO 5	-	1	-	-	-	-						
CO 6	-	-	-	3	-	-						

Assessment Rubrics:

- Quiz / Assignment/ Quiz/ Discussion / Seminar

- Midterm Exam
- Programming Assignments
- Final Exam

Mapping of COs to Assessment Rubrics :

	Internal Exam	Assignment	Project Evaluation	End Semester Examinations
CO 1	✓			✓
CO 2	✓			✓
CO 3	✓			✓
CO 4		✓		✓
CO 5		✓		✓
CO 6			✓	