

# **SACRED HEART COLLEGE (AUTONOMOUS)**

**Department of BOTANY**

**MASTER OF SCIENCE IN BOTANY**

**Course plan**

**Academic Year 2018-19**

**Semester III**

**COURSE PLAN:**

PROGRAMME	MASTERS IN BOTANY	SEMESTER	3
COURSE CODE AND TITLE	16P3BOTT09: TAXONOMY OF ANGIOSPERMS	CREDIT	4
HOURS/WEEK	6.5	HOURS/SEM	117
FACULTY NAME	EBIN P J		

<b>Course Objectives</b>
To define the scope and significance of angiosperm taxonomy and ethnobotany
To explain the various systems of angiosperm classification and its merits and demerits
To apply the different taxonomic keys and approaches for the exact identification of angiosperms up to the species level
To examine the vegetative and reproductive characters of various angiosperm families
To evaluate the evolutionary trends in angiosperms
To develop methodology for the ethnobotanical study and bioprospecting of the products.

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SESSION	Topic/Module	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
<b>Module 1: Classification (8 hrs)</b>				
Session 1	Linnaeus System	PPT/Lecture	Seminar	
Session 2	Bentham & Hooker's System	PPT/Lecture	Seminar	
Session 3	De Candolle's System	PPT/Lecture		
Session 4	Engler & Prantl System	PPT/Lecture		
Session 5	Bessey's System	PPT/Lecture		
Session 6	Takhtajan's System	PPT/Lecture		
Session 7	APG System	PPT/Lecture		
Session 8	Merits and demerits of different systems	PPT/Lecture	Seminar	
<b>Module 2: Tools of Taxonomy (6 hrs)</b>				
Session 9	Functions of field study, , botanical gardens, BSI,	PPT/Lecture	Seminar	
Session 10	Taxonomic literature- Floras, eFlora,	PPT/Lecture	Seminar	
Session 11	Monographs & Revision	PPT/Lecture	Seminar	
Session 12	Journals (Rheede & Taxon/Blumea)	PPT/Lecture		
Session	Construction of taxonomic keys-	PPT/Lecture	Video	

13	Indented			
Session 14	Construction of taxonomic keys- Bracketed	PPT/Lecture	Video	
<b>Module 3: Angiosperm diversity with special reference to Tropical flora (48 hrs)</b>				
Session 15	Rununculaceae	PPT/Lecture		
Session 16	Magnoliaceae	PPT/Lecture		
Session 17	Menispermaceae	PPT/Lecture		
Session 18	Brassicaceae & Capparidaceae	PPT/Lecture		
Session 19	Polygalaceae	PPT/Lecture		
Session 20	Caryophyllaceae	PPT/Lecture		
Session 21	Guttiferae & Dipterocarpaceae	PPT/Lecture		
Session 22	Tiliaceae	PPT/Lecture		
Session 23	Geraniaceae	PPT/Lecture		
Session 24	Rutaceae	PPT/Lecture	Seminar	
Session 25	Vitaceae	PPT/Lecture		
Session 26	Sapindaceae	PPT/Lecture		
Session 27	Fabaceae	PPT/Lecture	Seminar	
Session 28	Caesalpiniaceae	PPT/Lecture		
Session 29	Mimosaceae	PPT/Lecture		
Session 30	Rosaceae	PPT/Lecture		
Session 31	Lythraceae & Melastomaceae	PPT/Lecture		
Session 32	Rhizophoraceae	PPT/Lecture		
Session 33	Combretaceae	PPT/Lecture		
Session 34	Myrtaceae	PPT/Lecture	Seminar	
Session 35	Cucurbitaceae	PPT/Lecture		
Session 36	Apiaceae	PPT/Lecture		
Session 37	Aizoaceae	PPT/Lecture		
Session 38	Asteraceae	PPT/Lecture	Seminar	
Session 39	Campanulaceae	PPT/Lecture		

Session 40	Myrsinaceae	PPT/Lecture		
Session 41	Loganiaceae	PPT/Lecture		
Session 42	Oleaceae	PPT/Lecture		
Session 43	Apocynaceae & Asclepiadaceae	PPT/Lecture	Seminar	
Session 44	Boraginaceae	PPT/Lecture		
Session 45	Scrophulariaceae & Acanthaceae	PPT/Lecture		
Session 46	Bignoniaceae	PPT/Lecture		
Session 47	Verbenaceae & Lamiaceae	PPT/Lecture		
Session 48	Polygonaceae	PPT/Lecture		
Session 49	Aristolochiaceae	PPT/Lecture		
Session 50	Piperaceae	PPT/Lecture		
Session 51	Lauraceae	PPT/Lecture		
Session 52	Loranthaceae	PPT/Lecture		
Session 53	Euphorbiaceae	PPT/Lecture	Seminar	
Session 54	Moraceae & Urticaceae	PPT/Lecture		
Session 55	Orchidaceae	PPT/Lecture	Seminar	
Session 56	Cannaceae	PPT/Lecture		
Session 57	Dioscoriaceae	PPT/Lecture		
Session 58	Liliaceae	PPT/Lecture		
Session 59	Zingiberaceae	PPT/Lecture		
Session 60	Musaceae	PPT/Lecture		
Session 61	Araceae	PPT/Lecture	Seminar	
Session 62	Cyperaceae & Poaceae	PPT/Lecture		
<b>Module 4: Evolution of flowering plants (4 hrs)</b>				
Session 63	Evolution and diversity of woody and seed plants.	PPT/Lecture	Video	
Session 64		PPT/Lecture	Video	
Session 65		PPT/Lecture		
Session		PPT/Lecture		

66				
<b>Module 5: Ethnobotany (6 hrs)</b>				
Session 67	Scope and importance of ethnobotany	PPT/Lecture		
Session 68	sources and methods of ethnobotanical studies	PPT/Lecture		
Session 69	Two typical ethno botanical studies from Kerala	PPT/Lecture	Video	
Session 70	Bioprospecting	PPT/Lecture		
Session 71	Patenting and Marketing of Plants of Ethnobotanical importance (based on any case study from Kerala).	PPT/Lecture		
		PPT/Lecture		
Session 72	Utility indices of ethnobotanical products	PPT/Lecture		
<b>Practicals (45 hrs)</b>				
Session 73	Rununculaceae, Magnoliaceae	Hands-on		
Session 74	Menispermaceae, Brassicaceae	Hands-on		
Session 75	Capparidaceae, Polygalaceae	Hands-on		
Session 76	Caryophyllaceae, Guttiferae	Hands-on		
Session 77	Dipterocarpaceae, Tiliaceae	Hands-on		
Session 78	Geraniaceae, Rutaceae	Hands-on		
Session 79	Vitaceae, Sapindaceae	Hands-on		
Session 80	Fabaceae, Caesalpiniaceae	Hands-on		
Session 81	Mimosaceae, Rosaceae	Hands-on		
Session 82	Lythraceae, Melastomaceae	Hands-on		
Session 83	Rhizophoraceae, Combretaceae	Hands-on		
Session 84	Myrtaceae, Cucurbitaceae	Hands-on		
Session 85	Apiaceae, Aizoaceae	Hands-on		
Session 86	Asteraceae, Campanulaceae	Hands-on		
Session 87	Myrsinaceae, Loganiaceae	Hands-on		
Session 88	Oleaceae, Apocynaceae	Hands-on		
Session 89	Asclepiadaceae, Boraginaceae	Hands-on		
Session 90	Scrophulariaceae, Bignoniaceae	Hands-on		

Session 91	Acanthaceae, Verbenaceae	Hands-on		
Session 92	Lamiaceae, Polygonaceae	Hands-on		
Session 93	Aristolochiaceae, Piperaceae	Hands-on		
Session 94	Lauraceae, Loranthaceae	Hands-on		
Session 95	Euphorbiaceae, Moraceae	Hands-on		
Session 96	Urticaceae, Orchidaceae	Hands-on		
Session 97	Cannaceae, Dioscoriaceae	Hands-on		
Session 98	Liliaceae, Zingiberaceae	Hands-on		
Session 99	Musaceae, Araceae	Hands-on		
Session 100	Cyperaceae, Poaceae	Hands-on		
Session 101	Study of flora, construction of keys and use of floras in the identification up to species from field study.	Hands-on		
Session 102		Hands-on		
Session 103		Hands-on		
Session 104		Hands-on		
Session 105		Hands-on		
Session 106		Hands-on		
Session 107		Hands-on		
Session 108	Preparation of dichotomous keys based on four sample plant materials from the same family	Hands-on		
Session 109		Hands-on		
Session 110		Hands-on		
Session 111		Hands-on		
Session 112		Hands-on		
Session 113	Ethnobotany	Hands-on		
Session 114		Hands-on		
Session 115		Hands-on		
Session 116		Hands-on		

Session 117		Hands-on		
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### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	20.06.2018	Plant collection and identification
2	14.07.2018	Collection of ethnobotanical specimens

### References

- Jain S K (1991). Dictionary of Indian Folkmedicine and Ethnobotany.
- Paye G D (2000). Cultural Uses of Plants: A Guide to Learning about Ethnobotany. The New York Botanical Garden Press.
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- Simpson M G (2010). Plant Systematics.
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- Anilkumar N, Sivadasan M and Ravi N (2005). Flora of Pathanamthitta. Daya Publishing House.
- Sasidharan N (2012). Flowering Plants of Kerala. KFRI.
- Ramesh B.R, Ayyappan N, Grard P, Prosperi J, Aravajy S and Pascal J P (online). BIOTIK Western Ghats. <http://www.biotik.org/>

## COURSE PLAN

PROGRAMME	MASTER OF SCIENCE BOTANY	SEMESTER	3
COURSE CODE AND TITLE	16P3BOTT10: GYMNOSPERMS, EVOLUTION & PALEOBOTANY	CREDIT	3
HOURS/WEEK	5.5	HOURS/SEM	99
FACULTY NAME	Dr. LESLY AUGUSTINE, ANTO JOSEPH		

### COURSE OBJECTIVES

To analyze the morphological diversity of gymnosperms
To examine the reproductive behaviour in gymnosperms
To predict evolutionary trends in biological systems
To evaluate ecological and economic significance of gymnosperms
To explain and interpret the origin and phylogeny organisms
To justify the diversity and distributions of prehistoric flora

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
<b>GYMNOSPERMS MODULE I</b>				
1	Origin, general characteristics, distribution and classification of Gymnosperms	PPT	video	
2	Distribution of living gymnosperms in India	PPT/Lecture		
3	DNA barcoding of gymnosperms.	PPT/Lecture		
<b>MODULE II</b>				
4	Class Progymnospermopsida: Aneurophyton	PPT/Lecture		
5	Class Cycadopsida: <i>Heterangium</i>	PPT/Lecture		
6	<i>Lyginopteris</i>	PPT/Lecture		
7	<i>Lagenostoma</i>	Lecture		
8	<i>Glossopteris</i>	Lecture		
9	<i>Medullosa</i>	Lecture		
10	<i>Caytonia</i>	Lecture		
11	<i>Bennettites</i>	PPT/Lecture		
12	<i>Williamsoniella</i>	PPT/Lecture		
13	<i>Nilsonia</i>	PPT/Lecture		
14	<i>Cycas</i>	PPT/Lecture	Video	
15	<i>Zamia</i>	PPT/Lecture		
16	<i>Pentoxylon</i>	Lecture		
17	Class Coniferopsida: General account of families, <i>Pinus</i>	Lecture	Video	
18	<i>Taxodium</i>	Lecture		
19	<i>Cupressus</i>	Lecture		
20	<i>Podocarpus</i>	PPT/Lecture		
21	<i>Agathis</i>	PPT/Lecture		
22	<i>Araucaria</i>	PPT/Lecture		
23	<i>Taxus</i>	PPT/Lecture		



24	<i>Ginkgo</i>	Lecture		
25	Class Gnetopsida: <i>Gnetum</i>	Lecture	Video	
CIA-1				
<b>Module III</b>				
26	General account on the male and female gametophyte development in Gymnosperms ( <i>Cycas</i> )			
27	Economic importance of Gymnosperms.		Group discussion	
<b>Practical</b>				
28	<i>Cycas</i> - leaf	Hands on session		
29	<i>Cycas</i> - Stem	Hands on session		
30	<i>Cycas</i> – Reproductive structures	Hands on session		
31	<i>Zamia</i> - leaf	Hands on session		
32	<i>Zamia</i> - Stem	Hands on session		
33	<i>Zamia</i> – Reproductive structures	Hands on session		
34	<i>Pinus</i> - leaf	Hands on session		
35	<i>Pinus</i> - Stem	Hands on session		
36	<i>Pinus</i> – Reproductive structures	Hands on session		
37	<i>Cupressus</i> - leaf	Hands on session		
38	<i>Cupressus</i> - Stem	Hands on session		
39	<i>Cupressus</i> – Reproductive structures	Hands on session		
40	<i>Agathis</i> - leaf	Hands on session		
41	<i>Agathis</i> - Stem	Hands on session		
42	<i>Agathis</i> – Reproductive structures	Hands on session		
43	<i>Araucaria</i> - leaf	Hands on session		
44	<i>Araucaria</i> - Stem	Hands on session		
45	<i>Araucaria</i> – Reproductive structures	Hands on session		
46	<i>Gnetum</i> - leaf	Hands on session		
47	<i>Gnetum</i> - Stem	Hands on session		
48	<i>Gnetum</i> – Reproductive structures	Hands on		

		session		
49	Study of fossil gymnosperms through photographs	Hands on session		
50	Study of fossil gymnosperms through photographs	Hands on session		
51	Study of fossil gymnosperms through photographs	Hands on session		
52	Study of fossil gymnosperms through permanent slides	Hands on session		
53	Study of fossil gymnosperms through permanent slides	Hands on session		
54	Study of fossil gymnosperms through permanent slides	Hands on session		
<b>EVOLUTION</b>				
<b>Module 1</b>				
55	Abiogenesis, Biogenesis experiment of Miller (1953).	Lecture	Debate	
56	Theory of Organic evolution - Biochemical origin of life, Concept of Oparin and Haldane.	Lecture	Debate	
<b>Module 2</b>				
57	Morphology and Comparative Anatomy, Embryology, Physiology and Biochemistry – Evidence of evolution	PPT/Lecture		
58	Evidence of evolution - Paleontology, Biogeography, Micro and Macro-evolution and Punctuated Equilibrium	PPT/Lecture		
<b>Module 3</b>				
59	Character Evolution	PPT/Lecture		
60	Convergent, divergent and parallel evolution	PPT/Lecture		
61	Phylogeny and patterns of Evolution	PPT/Lecture		
62	Coevolution and coadaptation, Adaptive radiation.	PPT/Lecture		
CIA – II				
<b>Module 4</b>				
63	Biodiversity, Genetic variation, phenotypic variation	Lecture		
64	Macro evolution; evolution above the species level.	Lecture		
65	Sex and Reproductive success; Paradox of sex, Inbreeding and outcrossing	Lecture	Group discussion	
66	Concept of sexual selection, sexual selection by mate choice.	Lecture		
<b>Module 5</b>				
67	Species concept; Morphological Species, Biological Species and Evolutionary Species.	PPT/Lecture		
68	Types of speciation - Phyletic speciation and True speciation.	PPT/Lecture		
69	Mechanism of speciation - Genetic divergences and isolating mechanisms.	PPT/Lecture		
70	Patterns of speciation - allopatric, sympatric	PPT/Lecture	Video	
71	quantum and parapatric speciation.	PPT/Lecture	Video	
<b>Module 6</b>				

72	Natural selection and adaptation; Limiting factors	PPT/Lecture		
73	Origin of races and species	PPT/Lecture		
74	Kin Selection and Hamilton's Rule	PPT/Lecture		
75	Nature of adaptations, Significance of Genetic drift in natural selection.	PPT/Lecture		
<b>Module 7</b>				
76	Modern synthetic theory of evolution	PPT/Lecture	Group discussion	
77	molecular evolution, concepts of natural evolution	PPT/Lecture		
78	molecular divergence and molecular clocks	PPT/Lecture		
79	molecular tools in phylogeny.	PPT/Lecture		
<b>Module 8</b>				
80	Symbiosis, Plant-animal Co-evolution; Mutualism	PPT/Lecture		
81	Commensalism. Protective - Colouration and Shape. Mimicry: Batesian and Mullerian- mimicry.	PPT/Lecture		
<b>PALAEOBOTANY</b>				
<b>Module 1</b>				
82	Techniques in Palaeontology - mega fossils - microfossils - nanofossils – ichnofossils	PPT/Lecture	Group discussion	
83	collection, reformation & illustration - binomial nomenclature.	PPT/Lecture		
84	Plant fossils – Preservation, preparation, age determination.	PPT/Lecture		
<b>Module 2</b>				
85	<i>Lyginopteris, Pentoxylon, Lagenostroma</i>	PPT/Lecture		
86	<i>Cordaites, Cardiocarpus, Calamites</i>	PPT/Lecture		
87	<i>Sphenophyllum, Calamostachys</i> and <i>Glossopteris</i> .	PPT/Lecture		
<b>Module 3</b>				
88	Fossil record – systematic	PPT/Lecture		
89	reconstruction and nomenclature	PPT/Lecture	Group discussion	
90	Applied aspects of paleobotany	PPT/Lecture		
<b>Practicals</b>				
91	Study of fossil plants based on permanent slides	Hands on session		
92	Study of fossil plants based on permanent slides	Hands on session		
93	Study of fossil plants based on permanent slides	Hands on session		
94	Study of fossil plants based on permanent slides	Hands on session		
95	Study of fossil plants based on Photographs	Hands on session		
96	Study of fossil plants based on Photographs	Hands on session		
97	Study of fossil plants based on Photographs	Hands on session		

98	Study of fossil plants based on Photographs	Hands on session		
99	Study of fossil plants based on Photographs	Hands on session		

### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	05/08/2018	Compare the morphology of living gymnosperms
2	18/08/2018	Explain the evolution of land plants

### References

1. Andrews H N Jr (1961). *Studies in Palaeobotany*. John Wiley and sons.
2. Arnold C A (1947). *An introduction to Palaeobotany*. John Wiley and sons.
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12. Sporne A R (1974). *The morphology of gymnosperms*. Hutchinson Univ. Library.
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22. Martin Ingrouille and Bill Eddie (2006). *Plants Diversity and Evolution*. Cambridge University Press.
23. Maxtoshi Nei and Sudhir Kumar (2000). *Molecular Evolution and phylogenetics*. Oxford University Press.
24. Monroe W. Strickberger (1990). *Evolution*. Jones and Bartlett publishers.
25. Paul Amos Moody (1970). *Introduction to Evolution*. Harper and Row publishers, Newyork.

26. Roderic D. M. Page and Edward C. Holmes (1998). *Molecular Evolution: A Phylogenetic approach*. Blackwell Science Ltd.
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S.Chand and Company Ltd. New Delhi.
28. Victor Rico-Gray, Paulo S. Oliveira (2007). *The Ecology and Evolution of Ant-Plant Interactions*.  
University of Chicago Press.
29. Volpe E. Peter (1993). *Understanding Evolution*. Universal Book Stall, New Delhi.
30. Willis K. J. and J. C. Mc Elwain (2002). *The Evolution of Plants*. Oxford University Press.
31. Ruap, D.M, Stanley, S.M, 1999: Principles of Palaeontology.W.H. Freeman and Co, Toppan Co. Ltd.
32. Stewart, W.N. and Rothwell G.W. (1993), Palaeobotany and the Evolution of Plants, Cambridge University Press.
33. Agashe, S.N. (1995), Palaeobotany, Oxford & IBH, New Delhi.
34. Siddiqui, K.A. (2002) Elements of Palaeobotany, Kitab Mahal, Allahabad.
35. Thomas, B.A. & Spicer R.A. (1987): The Evolution and Palaeobiology of land plants. Discordies Press, Fortland, USA.

#### COURSE PLAN 2018 - 19

PROGRAMME	<b>M.Sc. BOTANY</b>	SEMESTER	<b>3</b>
COURSE CODE AND TITLE	<b>16P3BOTT11: PLANT PHYSIOLOGY AND METABOLISM</b>	CREDIT	<b>4</b>
HOURS/WEEK	<b>6.5</b>	HOURS/SEM	<b>Theory 72 hrs; Practical 36 hrs</b>
FACULTY NAME	<b>PRINCY MOL A. P.</b>		

<b>COURSE OBJECTIVES</b>
To explain the relationship of plant with its habitat
To relate mineral nutrition with the mechanism of absorption
To examine the mechanism of photosynthesis, nitrogen metabolism, plant growth regulators and sensory photobiology
To evaluate the transport mechanism in plant system
To examine the respiration mechanism in plants
To classify the plant responses to various environmental stresses

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
	<b>Introduction to the Course</b> (a) Structure and properties of water. Diffusion and Osmosis. Water Potential. Cohesion-tension theory. Entry of minerals into roots; bulk flow, diffusion. Passive and active transport.	PPT/ Lecture		
<b>MODULE I - Plant water relations</b>				
1	(a) Cell wall and membrane properties in relation with water	PPT/ Lecture	video	
2	Turgor Pressure and Hydraulic conductivity.	PPT/ Lecture		
3	Aquaporins. Plant water status and Physiological processes.	PPT/ Lecture	E resource	
4	(b) Bulk flow of water. Water absorption by roots-pathways, root pressure and guttation.	PPT/ Lecture		
5	Water transport through xylem - pressure driven bulk flow.	PPT/ Lecture	E resource	
6	Water movement from the leaf to the atmosphere – hydraulic resistance	PPT/ Lecture		
7	Driving force of transpiration, pathway resistances.	PPT/ Lecture		
8	Leaf anatomy for regulating transpiration.	PPT/ Lecture	E resource	
9	Control of stomatal mechanism.	PPT/ Lecture	E resource	
10	Theories of stomatal movement. Soil-plant-atmosphere continuum.	PPT/ Lecture	E resource	
<b>MODULE II - Absorption of minerals</b>				
11	(a) Classification of mineral nutrients based on biological function.	PPT/ Lecture	E resource	
12	(b) Soil characters influencing nutrient availability – size and charge of soil particles, soil pH. (c) Role of Mycorrhizae in nutrient uptake.	PPT/ Lecture		
13	(d) Theories of mineral salt absorption.	PPT/ Lecture	video	
<b>MODULE III - Transport of ions, solutes and macromolecules</b>				
14	(a) Electrical properties of membranes, Membrane potential.	PPT/ Lecture		
15	(b) Transport across cell membranes: Passive – diffusion, facilitated diffusion	PPT/ Lecture	video	
16	Membrane channels; gap junctions, porins	PPT/ Lecture		
17	Ion channels – gated channels, structure and working of K <sup>+</sup> ion channels.	PPT/ Lecture	E resource	
18	Active transport: Carrier proteins; Na <sup>+</sup> K <sup>+</sup> pump	PPT/ Lecture	video	
19	ABC transporters, Inophores, Symport, Antiport	PPT/ Lecture		
<b>MODULE IV - Photosynthesis</b>				

20	Basic principles of light absorption	PPT/ Lecture		
21	Excitation energy transfer, mechanism of electron transport.	PPT/ Lecture		
22	Light harvesting complexes: PS I, PSII	PPT/ Lecture	E resource	
23	Structure and composition of reaction centers, photooxidation of water	PPT/ Lecture		
24	organization of light-absorbing antenna systems, mechanism of chloroplast electron transport-complexes	PPT/ Lecture	video	
25	Proton transport and ATP synthesis.	PPT/ Lecture		
26	Repair and Regulation of Photosynthetic Machinery- Photoprotection, Photoinhibition.	PPT/ Lecture		
27	Structure and function of RuBisco.	PPT/ Lecture	E resource	
28	CO <sub>2</sub> fixation- Regulation of Calvin cycle.	PPT/ Lecture	video	
29	Photorespiration, role of photorespiration in plants.	PPT/ Lecture		
30	CO <sub>2</sub> concentrating mechanisms - C4 cycle	PPT/ Lecture	E resource	
31	CAM pathway	PPT/ Lecture	E resource	
32	Synthesis and mobilization of chloroplast starch, starch degradation, Regulation of synthesis and degradation.	PPT/ Lecture	video	
33	Biosynthesis of sucrose and signalling.	PPT/ Lecture		
<b>MODULE V - Translocation in the Phloem</b>				
34	Materials translocated in the phloem- Sucrose and other materials.	PPT/ Lecture	E resource	
35	Mechanism of phloem translocation - Pressure flow model of phloem transport.	PPT/ Lecture		
36	Phloem loading and unloading.	PPT/ Lecture		
37	Photosynthate allocation and partitioning.	PPT/ Lecture	e-resource	
CIA I				
<b>MODULE VI - Respiration and lipid metabolism</b>				
38	Three stages of respiratory metabolism. (brief study only).	PPT/ Lecture	e-resource	
39	Gluconeogenesis.	PPT/ Lecture		
40	Pentose phosphate pathway and its regularion.	PPT/ Lecture		
41	Mitochondrial electron transport and ATP synthesis – structure of electron transfer complexes (complex I – IV).	PPT/ Lecture	e-resource	
42	ATPase - detailed structure of F1 and Fo subunits	PPT/ Lecture	e-resource	

43	Chemiosmotic hypothesis	PPT/ Lecture		
44	Binding change mechanism of ATP synthesis.	PPT/ Lecture	e-resource	
45	Comparison of mitochondrial and chloroplast ATP synthesis.	PPT/ Lecture	e-resource	
46	Mechanisms that lower ATP yield- alternative oxidase	PPT/ Lecture	e-resource	
47	Uncoupling proteins	PPT/ Lecture		
48	Rotenone- Insensitive NADH dehydrogenase	PPT/ Lecture		
49	Lipid metabolism: glyoxylate cycle.	PPT/ Lecture	e-resource	
<b>MODULE VII - Nitrogen metabolism</b>				
50	N cycle. Nitrate assimilation- nitrogen reductase.	PPT/ Lecture		
51	Ammonium assimilation, Aminoacid biosynthesis	PPT/ Lecture		
52	Biological Nitrogen fixation - free living and symbiotic.	PPT/ Lecture	e-resource	
53	Symbiotic N fixation – nodule formation, leghaemoglobin.	PPT/ Lecture		
54	Process of N fixation	PPT/ Lecture	e-resource, video	
55	Structure of nitrogenase enzyme complex. Transport of amides and ureides.	PPT/ Lecture		
<b>MODULE VIII - Stress physiology</b>				
56	Response of plants to biotic (pathogen and insects) stress	PPT/Lecture	e-resource	
57	Abiotic stress -(water, temperature – low and high	PPT/Lecture	e-resource	
58	Stress - salt, oxygen deficiency	PPT/Lecture	e-resource	
59	Stress - heavy metal and air pollution.	PPT/Lecture	e-resource	
60	Mechanisms of resistance to biotic stress and tolerance to abiotic stress.	PPT/Lecture	e-resource	
<b>MODULE IX - Sensory photobiology</b>				
61	Structure, function and mechanisms of action of phytochromes, cryptochromes and phototropins.	PPT/Lecture	e-resource	
62	Responses to UV radiation.	Lecture		
63	Photoperiodism and biological clocks – circadian rhythms.	PPT/Lecture		
64	Vernalization. Floral induction and development.	PPT/Lecture	e-resource	
<b>MODULE X - Plant growth regulators</b>				
65	Biosynthesis, storage, breakdown, transport,	PPT/Lecture		



66	physiological effects, and mechanism of action of plant growth hormones; Auxin			
67	Cytokinin	PPT/Lecture	e-resource	
68	Gibberellins	PPT/Lecture		
69				
70	Abscisic acid	PPT/Lecture	e-resource	
71	Brassinosteroids	PPT/Lecture	e-resource	
72	Elicitors	PPT/Lecture	e-resource	
CIA II				
<b>PRACTICAL</b>				
73	Preparation of Molal, Molar and Percentage solutions.	Lab based experiment		
74	Estimation of proline in plant tissues under various abiotic stresses.	Lab based experiment		
75	Estimation of phenol in plant tissues affected by biotic stress.	Lab based experiment		
76	Determination of peroxidase activity in plant tissues affected by biotic/abiotic stresses.	Lab based experiment		
77	Estimation of free amino acids in senescing leaves to understand the source to sink transformation phenomenon.	Lab based experiment		
78	Determination of osmotic potential by tissue weight method.	Lab based experiment		
79	Separation of photosynthetic pigments by TLC/paper chromatography and calculating the R <sub>f</sub> value.	Lab based experiment		
80	Demonstration of amylase activity and GA effect in germinating cereal seeds.	Lab based experiment		
81	Estimation of pigment composition of a leaf.	Lab based experiment		
82	Separation and collection of leaf pigments by silica gel column chromatography.	Lab based experiment		
83	Determination of nitrate reductase activity.	Lab based experiment		
84	Extraction and estimation of leghaemoglobin from root nodules.	Lab based experiment		

#### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual – Graded)	Nature of Assignment
1	18/10/2018	Stress – water	Report writing based on additional
2	18/10/2018	Transport mechanism - pumps	
3	18/10/2018	Transport mechanism – channels	

4	18/10/2018	Biological nitrogen fixation	information
5	18/10/2018	Photosynthetic pigments	

### References

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### COURSE PLAN 2018 - 19

PROGRAMME	M.Sc. BOTANY	SEMESTER	3
COURSE CODE AND TITLE	<b>16P3BOTT12 : PLANT REPRODUCTIVE BIOLOGY, PALYNOLOGY AND PLANT BREEDING</b>	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
TEACHERS IN CHARGE	<b>Dr. Giby Kuriakose, MS. Princy Mol A P, Dr. Ima Neerakkal</b>		

### COURSE OBJECTIVES

To understand basic concepts of developmental biology, Palynology and plant breeding
To define plant breeding systems and self-incompatibility and their role in plant breeding in plants
To explain different pollination syndromes and pollination and post pollination changes in flowering plants

To compare structure of pollen grains and analyse pollen ultra-structural characters
To apply pollination-, palynology- and plant breeding- techniques

<b>PLANT REPRODUCTIVE BIOLOGY, PALYNOLOGY AND PLANT BREEDING</b>				
<b>SESSION</b>	<b>TOPIC</b>	<b>LEARNING RESOURCES</b>	<b>VALUE ADDITIONS</b>	<b>REMARKS</b>
	<b>Module 1: Basic concepts of developmental Biology</b>			
1	An overview of plant and animal development, Potency, Commitment, Specification, Induction, Competence.	Lecture/PPT	Q & A Session	
2	Applications of reproductive biology (research, agriculture, Industry, Forensic & Horticulture).	Lecture/PPT		
	<b>Module 2: Pollination</b>			
3	Sexuality of flowers and plants. Pollination agents and floral adaptations	Lecture/PPT	Q & A Session	
4--8	b) Pollination syndromes; study of common pollinators from each syndromes)	Lecture/PPT		
9	Breeding systems in plants, Types of pollen; wet and dry, types of stigma; wet and dry types (along with significance of each types)	Lecture/PPT		
	<b>Module 4: Post pollination changes</b>			
10	Pollen pistil interactions; pollen on stigma, pollen tube through style, pollen tube entry to the ovule.	Lecture/PPT		
11--15	Fertilization: Double fertilization; Embryogenesis - different types, Origins of polarity, factors influencing embryogenesis.	Lecture/PPT		
16	Endosperm-development and function, types of endosperm, endosperm haustoria.	Lecture/PPT		
17	Apomixis and Polyembryony and their applications in agri-horticulture	Lecture/PPT		
	<b>Module 4: Breeding system and Self incompatibility</b>			
18	Breeding system: Outbreeding devises and their efficacy	Lecture/PPT	Q & A Session	
19-21	Self-incompatibility: Genetic basis of SI. Gametophytic and sporophytic SI Physiology and Biochemistry of incompatibility	Lecture/PPT		

22	Biological significance of incompatibility.	Lecture/PPT		
23-26	Methods to overcome SI and interspecific incompatibility.	Lecture/PPT		
	<b>Module 5: Seed Biology</b>			
27	Seed development, Classification of Seeds	Lecture/PPT	Q & A Session	
28	Importance of seeds	Lecture/PPT		
29	Seed dispersal; significance, agents and ecology of dispersal	Lecture/PPT		
30	Seed dormancy, Methods of breaking seed dormancy	Lecture/PPT		
31	soil seed banks	Lecture/PPT		
32-33	seed germination	Lecture/PPT		
34	Millennium seed project	Lecture/PPT		
<b>PALYNOLOGY</b>				
	<b>Module 6. Introduction</b>			
35	Introduction to pollen analysis, :History and scope of palynology	Lecture/PPT	Q & A Session	
36	Terminologies used in spore and pollen description, forensic palynology, paleopalynology	Lecture/PPT		
	<b>Module-7: Pollen structure and development</b>			
37	A. Development of pollen grains	Lecture/PPT		
38	B. Pollen morphology- Shape and size, apertures types -and ornamentation	Lecture/PPT		
39	Special ornamentation features--bladders, viscin threads, -spines, lipids	Lecture/PPT		
40	The pollen wall - Pollen wall development and formation, Pollen wall structure, Surface ornamentation and its importance.	Lecture/PPT		
41	Pollen wall chemical composition and its relationship to pollen preservation.	Lecture/PPT		
42	Pollen apertures - Inaperturate grain, simple and compound, Types, function and arrangement. Role -and use in pollen identification	Lecture/PPT		
	<b>Module- 8: Pollen Analysis</b>			
43	Laboratory techniques	Lecture/PPT	Q & A Session	
44	Finding pollen in sediments forensic samples honey, rocks, archaeological sites and shipwrecks, etc.	Lecture/PPT		

45	Production and Dispersal of pollen grains, where pollen is deposited. Purpose of Pollen collection and storage.	Lecture/PPT		
46	Pollenviability- factors that affect pollen viability.	Lecture/PPT		
47	Viability Test: - Germination assay, <i>in vitro</i> , <i>in vivo</i> . Non Germination assay FCR Test, FDA test (both are same). Acetocarmine test for assessing sterility. Acetocarmine test for assessing sterility.	Lecture/PPT		
48	R values and pollen coefficients Factors affecting pollen deposition	Lecture/PPT		
	<b>Module – 9 Applications and Methods in palynology</b>			
49	Palynology and Systematics, Pollen sampling and data gathering (how many samples to collect and what to collect) Modern pollen rain sampling and collecting important floral data, Stratigraphic sampling of geologic terrestrial deposits (i.e., natural vs. artificial levels),	Lecture/PPT		
50	Sampling lake and underwater archaeological deposits, Terrestrial archaeological site sampling, Forensic samples, Entomo-palynological sampling, Melisso-palynology sampling, The statistical validity of using multiple vs. single samples from given locations	Lecture/PPT		
51	Tools and methods used for pollen sampling.	Lecture/PPT		
52	Uses of pollen in pharmaceuticals, Nutrition and in Cosmetics. Pollen allergy.	Lecture/PPT		
	<b>PLANT BREEDING</b>			
	<b>Module 10: Introduction</b>			
53	Objectives of plant breeding, important achievements and future prospects. Genetic variability and its role in plant breeding. Domestication and centers of origin of cultivated plants.	Lecture/PPT		
	<b>Module 11: Systems of reproduction in plants</b>			
54	Reproductive systems and pollination control mechanisms; Sexual reproduction - Cross and self pollination;	Lecture/PPT		

55	asexual reproduction, Incompatibility and Male sterility, their types.	Lecture/PPT		
	<b>Module 12: Hybridization</b>			
56	Hybridization - role and methods, Inter-varietal, inter specific and inter generic crosses.	Lecture/PPT		
57	Back-cross breeding.	Lecture/PPT		
58	Heterosis, Inbreeding dep	Lecture/PPT		
	<b>Module 13: Breeding for resistance</b>			
59	Breeding for biotic (disease) and abiotic (drought) stresses; loss due to diseases,	Lecture/PPT		
60	Disease development, disease escape, disease resistance, vertical and horizontal resistances of biotic stress	Lecture/PPT		
61	Methods of breeding for disease resistance.	Lecture/PPT		
	<b>Module 14: Mutation breeding</b>			
62	Mutagens and crop improvement. Spontaneous and induced mutations, effects of mutation.	Lecture/PPT		
63-65	Physical and chemical mutagens; principles and working of Gamma gardens, methods of mutation breeding,	Lecture/PPT		
66-67	Mutations in oligogenic traits, mutations in polygenic traits, limitations of mutation breeding,	Lecture/PPT		
68	Achievements of mutation breeding.	Lecture/PPT		
69	Role of mutations in Plant Breeding.	Lecture/PPT		
	<b>Module 15: Modern breeding methods</b>			
71-72	Modern trends in plant breeding	Lecture/PPT		
73	Modern agricultural techniques and practices	Lecture/PPT		
74	Poly house farming, hydroponics,	Lecture/PPT		
75	aquaponics and precision farming.	Lecture/PPT		

### Suggested Assignments

1. Sampling procedures in palynology- Melisso-palynology and Entomo-palynology.
2. Pollinators - Insects, birds, and bats, unique evolution of specific plant taxa and their pollinators.

3. Melisso-palynology.
4. Floral nectar types and pollen used by honeybees, history of the discipline.
5. Extraction of pollen from honey samples.
6. Counting pollen in honey: What are pollen coefficient values in honey? Why use them and how to establish them? Pollen concentration values, correct number and type of pollen counts needed, methods of reporting honey pollen data.
7. Determining geographical origins and honey blends based on the pollen.
8. Insects (other than bees) and pollen.
9. Crop pollination.
10. Pollen as a method to track the migration movements of adult forms of many agricultural insect pests. Role in predicting insect migration routes (i.e., butterflies, moths).
11. Importance of pollen as a dietary item in the life cycle of insect pests (i.e., moths, butterflies, boll weevils, etc.).
12. Techniques used to examine pollen on the surface and gut of insects.
13. SEM analyses and the development of photographic pollen keys.
14. What are relative pollen counts, absolute counts, secondary counts, and large-fraction-analysis counts?
15. Establishing pollen concentration values and the value of these data.
16. When and how to use pollen influx techniques.
17. Recognition of real vs. artificial vegetational changes.
18. How to avoid making errors in pollen data interpretations.
19. Computer programs used to plot pollen data.
20. Are statistical methods valid for explaining pollen data?

### References

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