

SACRED HEART COLLEGE (AUTONOMOUS)

Department of BOTANY

MASTER OF SCIENCE IN BOTANY

Course plan

Academic Year 2016 - 17

Semester II

COURSE PLAN

PROGRAMME	M. Sc. Botany	SEMESTER	2
COURSE CODE AND TITLE	BRYOLOGY AND PTERIDOLOGY (16P2BOTT05)	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	(Theory 36 + 36 hrs; Practical 18 + 36 hrs)
FACULTY NAME	Lesly Augustine		

COURSE OBJECTIVES

To understand the diversity of primitive land plants.
To familiarize with the morphological and anatomical features of Bryophytes and Pteridophytes.
To identify the main characteristics of Bryophytes and Pteridophytes.
To chart the development of land adaptations in the Bryophytes and Pteridophytes.
To know the various lifecycle events in the bryophyte and Pteridophytes.
To understand the evolutionary trends primitive plant groups.
To identify various Bryophytes and Pteridophytes in their habitats.

BRYOLOGY (Theory 36 hrs; Practical 18 hrs)

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
Introduction to Course				
	(a) General characters, Classification, evolution of bryophytes	PPT/Lecture	Seminar	
	(b) Morphology, anatomy and reproduction of Riccia, Marchantia & Anthoceros	PPT/Lecture	Seminar	
	(c) Importance of bryophytes	PPT/Lecture	Seminar	
MODULE I; General introduction (5 hrs)				
1	Introduction to bryophytes, their fossil history and evolution.	PPT/Lecture		
2	Concept of algal and pteridophytic origin of bryophytes. General characters of bryophytes.	PPT/Lecture		
3	History of classification of bryophytes. Modern trends in classification of bryophytes.	PPT/Lecture		
4	DNA barcoding of bryophytes.	PPT/Lecture		
5	Systematic way of collection, preservation and identification of bryophytes with special reference to mosses. Conservation biology of bryophytes.	PPT/Lecture	Article reading	
MODULE II, Ecology and Economic importance of bryophytes (5 hrs)				
6	Bryophyte habitats.	PPT/Lecture		
7	Water relations - absorption and conduction, xerophytic adaptations	PPT/Lecture	video	
8	Water relations – drought tolerance, desiccation and rehydration, ectohydric, endohydric and myxohydric bryophytes	PPT/Lecture		
9	Ecological significance of bryophytes - role as pollution indicators.	PPT/Lecture	video	
10	Economic importance of bryophytes; i) Sphagnum as 'Peat Moss' ii) Medicinal Uses iii) as source of food iv) as pollution indicators v) in experimental studies vi) Horticultural uses.	PPT/Lecture	video	
Module 3: Thallus structure (26 hrs)				
11	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not	PPT/Lecture		

	necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).			
12	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
13	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
14	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
15	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
16	Comparative structural organization of gametophytes and sporophytes in an	PPT/Lecture		

	evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).			
17	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
18	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (a) Hepaticopsida (Sphaerocarpales, Marchantiales, Metzgeriales, Jungermanniales and Calobryales).	PPT/Lecture		
19	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture	video	
20	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned	PPT/Lecture	video	

	in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).			
21	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture		
22	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture	video	
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23	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture		
24	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture		

25	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture		
26	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (b) Anthocerotopsida (Anthocerotales).	PPT/Lecture		
27	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagiales, Polytrichales, and Bryales).	PPT/Lecture		
28	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagiales, Polytrichales, and Bryales).	PPT/Lecture		,
29	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual	PPT/Lecture		,

	<p>reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary).</p> <p>(c) Bryopsida (Sphagnales, Polytrichales, and Bryales).</p>			
30	<p>Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary).</p> <p>(c) Bryopsida (Sphagnales, Polytrichales, and Bryales).</p>	PPT/Lecture		
31	<p>Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary).</p> <p>(c) Bryopsida (Sphagnales, Polytrichales, and Bryales).</p>	PPT/Lecture		
32	<p>Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary).</p> <p>(c) Bryopsida (Sphagnales, Polytrichales, and Bryales).</p>	PPT/Lecture		
33	<p>Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal</p>	PPT/Lecture		

	mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagnales, Polytrichales, and Bryales).			
34	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagnales, Polytrichales, and Bryales).	PPT/Lecture	video	
35	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagnales, Polytrichales, and Bryales).	PPT/Lecture	videos	
36	Comparative structural organization of gametophytes and sporophytes in an evolutionary perspective. Asexual and sexual reproductive structures, spore dispersal mechanisms and germination of the following groups with reference to the types mentioned in the practical (development of sex organs not necessary). (c) Bryopsida (Sphagnales, Polytrichales, and Bryales).	PPT/Lecture	video	
Practical 18 hrs				
Detailed study of the structure of gametophytes and sporophytes of the following genera of bryophytes by suitable micro preparation:				

37 - 38	Riccia	Hands-on Session	video	
39	Targionia	Hands-on Session	video	
40	Cyathodium	Hands-on Session	video	
41	Marchantia	Hands-on Session	video	
42	Lunularia	Hands-on Session	video	
43	Dumortiera	Hands-on Session	video	
44	Reboulia	Hands-on Session	video	
45	Pallavicinia	Hands-on Session	video	
46	Fossombronia	Hands-on Session	video	
47	Porella	Hands-on Session	video	
48	Anthoceros	Hands-on Session	video	
49	Sphagnum	Hands-on Session	video	
50	Pogonatum	Hands-on Session	video	
51	Bryum	Hands-on Session	video	
52	Fissidens	Hands-on Session		
53	Hyophila	Hands-on Session		
54	Students are expected to submit 5 bryophyte specimen's herbarium and also a report of field trip to bryophyte's natural habitats to familiarize with the diversity of bryophytes.	Experiential learning		

References

1. Kashyap S R (1932). Liverworts of Western Himalayas and the Punjab plains (Vol. I & II). Research Co. Publications.
2. Chopra R N, P K Kumar (1988). Biology of Bryophytes. Wiley Eastern Ltd.

3. Chopra R S, S S Kumar (1981). Mosses of Western Himalayas and adjacent plains. Chronica Botanica.
4. Kumar S S (1984). An approach towards phylogenetic classification of Mosses. Jour. Hattori Bot. Lab. Nichinan, Japan.
5. Rashid A (1981). An Introduction to Bryophyta. Vikas publishing house Pvt. Ltd.
6. Richardson D H S (1981). Biology of Mosses. Blackwell Scientific publications, Oxford.
7. Sheffield W B (1983 – '84). Introduction to Bryology (Vol. 1, 2). Jour. Hattori Bot. Lab, Nichinan, Japan.
8. Vashishta B R, A K Sinha, A Kumar (2003). Bryophyta. S Chand & Co. Ltd.
9. Udak R (1976). Bryology in India. ChronicaBotanica Co.
10. Pandey B P (1994). Bryophyta. S Chand and Co. Ltd.
11. Goffinet B, A J Shaw (2009). Bryophytic Biology (II Edn). Cambridge University Press.
12. Dyer A F, J G Duckett (Eds) (1984). The experimental Biology of Bryophytes. Academic Press.
13. Bonver F O (1935). Primitive land plants. MacMillan & Co. Ltd.
14. Campbell, Ditt (1940). The evolution of land plants. Stanford University Press.
15. Srivastava S N (1992). Bryophyta. Pradeep Publications.
16. Watson E V, P Ricards (1963). British Mosses and Liverworts. Cambridge University Press.
17. Nair M C, Rajesh K P, Madhusoodanan P V (2005). Bryophytes of Wayanad in Western Ghats. Malabar Natural History Society.

PTERIDOLOGY (Theory 36 hrs; Practical 36 hrs)

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
Introduction to Course				
	Introduction to the Course	PPT/Lecture	video	
	(a) Introduction, general characters, classification and evolution of pteridophytes	PPT/Lecture	Seminar/ videos	
	(b) Structural organization of sporophyte and gametophyte of pteridophytes with special reference to stellar structure, heterospory and seed habit.	PPT/Lecture	Seminar/ videos	
Module 1: General introduction and classification (4 hrs)				
1	Introduction, origin, general characteristics	PPT/Lecture	vedio	
2	History of the classification of pteridophytes.	PPT/Lecture	vedio	
3	Brief account on Smith's classification (2006).	PPT/Lecture		
4	DNA barcoding of pteridophytes.	PPT/Lecture		
Module 2: Structure of the plant body (26 hrs)				
Distribution, habitat, range, external and internal morphology of sporophytes, spores, mechanism of spore dispersal, gametophytic generation, sexuality, embryogeny of the following classes of Pteridophytes with reference to the genera mentioned (development of sex organs is not necessary):				
5	(a) Psilopsida (i) Rhyniales; Rhynia	PPT/Lecture		
6	(b) Psilotopsida (i) Psilotales; Psilotum	PPT/Lecture		
7	(b) Psilotopsida (i) Psilotales; Psilotum	PPT/Lecture		
8	(c) Lycopsida (i) Protolepidodendrales; Protolepidodendron	PPT/Lecture		
9	(ii) Lycopodiales; Lycopodium	PPT/Lecture		
10	(ii) Lycopodiales; Lycopodium	PPT/Lecture		
11	(iii) Isoetales; Isoetes	PPT/Lecture		
12	(iii) Isoetales; Isoetes	PPT/Lecture		
13	(iv) Selaginellales; Selaginella.	PPT/Lecture		
14	(iv) Selaginellales; Selaginella.	PPT/Lecture		
15	(iv) Selaginellales; Selaginella.	PPT/Lecture		
16	(d) Sphenopsida (i) Hyeniales (ii) Sphenophyllales; Sphenophyllum	PPT/Lecture		
17	(iii) Calamitales; Calamites	PPT/Lecture		

18	(iv) Equisetales; Equisetum	PPT/Lecture		
19	(iv) Equisetales; Equisetum	PPT/Lecture		
20	(e) Pteropsida (A) Primofilices: (i) Cladoxylales; Cladoxylon (ii) Coenopteridales	PPT/Lecture		
21	(B) Eusporangiatae: (i) Marattiales; Angiopteris	PPT/Lecture		
22	(ii) Ophioglossales; Ophioglossum	PPT/Lecture		
23	(C) Osmundales; Osmunda.	PPT/Lecture		
24	(C) Osmundales; Osmunda.			
25	(D) Leptosporangiatae: (i) Marsileales; Marsilea	PPT/Lecture		
26	(ii) Salviniiales; Salvinia	PPT/Lecture		
27	(ii) Salviniiales; Azolla	PPT/Lecture		
28	(ii) Filicales; Pteris,	PPT/Lecture		
29	(ii) Filicales; Lygodium, Acrostichum,	PPT/Lecture		
30	(ii) Filicales; Gleichenia, Adiantum.	PPT/Lecture		
Module 3: Comparative study of Pteridophytes (4 hrs)				
31	Stelar organization, soral and sporangial characters	PPT/Lecture		
32	Gametophytes and sporophytes of Pteridophytes in an evolutionary perspective	Hands-on Session		
33	Gametophytes and sporophytes of Pteridophytes in an evolutionary perspective	PPT/Lecture		
34	An account on DNA barcoding of pteridophytes	PPT/Lecture		
Module 4: Ecology and Economic importance (2 hrs)				
35	Ecological and economic significance of Pteridophytes.	PPT/Lecture		
36	Ecological and economic significance of Pteridophytes.	PPT/Lecture		
Practical				
Study of morphology and anatomy of vegetative and reproductive organs using clear whole mounts/sections of the following genera:				
38	Psilotum	Hands-on Session		
39	Psilotum	Hands-on Session		
40	Lycopodium	Hands-on Session		

41	Lycopodium	Hands-on Session		
42	Selaginella	Hands-on Session		
43	Selaginella	Hands-on Session		
44	Equisetum	Hands-on Session		
45	Equisetum	Hands-on Session		
46	Angiopteris	Hands-on Session		
47	Angiopteris	Hands-on Session		
48	Ophioglossum	Hands-on Session		
49	Marsilea	Hands-on Session		
50	Marsilea	Hands-on Session		
51	Salvinia	Hands-on Session		
52	Azolla	Hands-on Session		
53	Azolla	Hands-on Session		
54	Lygodium	Hands-on Session		
55	Lygodium	Hands-on Session		
56	Acrostichum	Hands-on Session		
57	Acrostichum	Hands-on Session		
58	Gleichenia	Hands-on Session		
59	Gleichenia	Hands-on Session		
60	Pteris	Hands-on Session		
61	Pteris	Hands-on Session		
62	Adiantum	Hands-on Session		

63	Adiantum	Hands-on Session		
64	Polypodium	Hands-on Session		
65	Polypodium	Hands-on Session		
66	Study of fossil Pteridophytes with the help of specimens and permanent slides.	Hands-on Session		
67	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		
68	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		
69	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		
70	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		
71	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		
72	Field trips to familiarize with the diversity of Pteridophytes in natural habitats and preparation of 5 pteridophyte herbarium and submit the report along with the recorded.	Experiential learning		

References

1. Agashe S N (1995). Palaeobotany. Oxford and IBH publishing House.
2. Arnold C R (1977). Introduction to Palaeobotany. McGraw Hill Book Com.
3. Chandra S, Srivastava M (Eds) (2003). Pteridology in the New Millennium. Khuwar Acad. Publishers.
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15. Nayar B K, S Kaur (1971). Gametophytes of homosporous ferns. Bot. Rev.

COURSE PLAN

PROGRAMME	M.Sc. BOTANY	SEMESTER	2
COURSE CODE AND TITLE	16P2BOTT06: PLANT ANATOMY, PRINCIPLES OF ANGIOSPERM SYSTEMATICS & MORPHOLOGY	CREDIT	4
HOURS/WEEK	7.5	HOURS/SEM	135
FACULTY NAME	FR. JOSE JOHN		

COURSE OBJECTIVES

To understand the plant cell structure and tissue level organization in a detailed manner
To know and carry out the plant anatomical specimen preparations
To understand the details of wood anatomy, plant fibres and secretory tissues
To compare different wood types looking into anatomical peculiarities
To assess the morphological features of angiosperms
To apply the principles of angiosperm systematics

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I Introduction				
1	Scope and significance of plant anatomy, interdisciplinary relations	PPT/ Lecturing		
MODULE II Meristems				
2	MERISTEMS - Apical organization: Stages of development of primary meristem and theories of apical organization, origin of branches and lateral roots.	PPT/ Lecturing		
3	MERISTEMS - Apical organization: Stages of development of primary meristem and theories of apical organization, origin of branches and lateral roots.	PPT/ Lecturing		

4-6	Primary thickening meristem (PTM) in monocots. Reproductive apex in angiosperms.	PPT/ Lecturing		
7-9	Secretory tissues in plants: Structure and distribution of secretory trichomes (Drosera, Nepenthes), salt glands, colleter, nectaries, resin ducts and laticifers.	PPT/ Lecturing		
10	Structure of bark and distribution pattern of laticifers in <i>Hevea brasiliensis</i> .	PPT/ Lecturing		
MODULE III Secondary Structure				
11-12	Vascular cambium and cork cambium: Structure and function, factors affecting cambial activity.	PPT/ Lecturing		
13-14	Secondary xylem and phloem: Ontogeny, structure and function. Lignification patterns of xylem.	PPT/ Lecturing/ Demo		
15-16	Reaction wood: Compression wood and tension wood. Factors affecting reaction wood formation.	PPT/ Lecturing/ Demo		
17-19	Wood: Physical, chemical and mechanical properties	PPT/ Lecturing		
20-21	Plant fibers: Distribution, structure and commercial importance of coir, jute, and cotton.			
MODULE IV Leaf and Node				
22-23	Leaf: Initiation, plastochronic changes, ontogeny and structure of leaf. Structure, development and classification of stomata and trichomes.	PPT/ Lecturing/ Demo		
24-25	Kranz anatomy, anatomical peculiarities in CAM plants. Leaf abscission.	PPT/ Lecturing/ Demo		
26-29	Nodal anatomy: Unilacunar, trilacunar and multilacunar nodes, nodal evolution.	PPT/ Lecturing/ Demo		
30	Root-stem transition in angiosperms.	PPT/ Lecturing/ Demo		
MODULE V Reproductive Anatomy				
31-33	Floral Anatomy: Anatomy of floral parts - sepal, petal, stamen and carpel; Floral vasculature (<i>Aquilegia</i> and <i>Pyrola</i>). Vascular anatomy.	PPT/ Lecturing		

	Development of epigynous ovary - appendicular and receptacular theory.			
34-36	Fruit and seed anatomy: Anatomy of fleshy and dry fruits - follicle, legume, berry. Dehiscence of fruits. Structure of seeds. Anatomical factors responsible for seed dormancy and drought resistance.	PPT/ Lecturing		
MODULE VI Ecological Anatomy				
37-40	Morphological and structural adaptations in different ecological groups - hydrophytes, xerophytes, epiphytes and halophytes.	PPT/ Lecturing		
MODULE VII Applied Anatomy				
41-42	Applications of anatomy in systematics (histotaxonomy) and Pharmacognosy. Research prospects in anatomy.			
PRACTICAL				
43	Study of cambia - non storied and storied.	Lab Work		
44-49	Study of the anomalous primary and secondary features in <i>Amaranthus</i> , <i>Boerhaavia</i> , <i>Mirabilis</i> , <i>Nyctanthes</i> , <i>Piper</i> and <i>Strychnos</i> .			
50-51	Study of stomata, trichomes, and laticifers. Determination of stomatal index.			
52-53	Study of the anatomical peculiarities of C4 and CAM plants (Leaf/Stem).			
54-56	Study of nodal patterns.			
57	Preparation of a histotaxonomic key.			
58-59	Study of the pericarp anatomy of a legume, follicle and berry.			
60	Identification of wood - soft wood and hard wood.			

Assignments and Seminars

	Topic	Nature of Assignment
1	Secondary Xylem and Phloem: Ontogeny, Structure and Function; Lignification patterns of Xylem	Written and Seminar Presentation
2	Comparison of Anomalous Secondary Thickening in Nyctanthes, Piper and Strychnose stems	Written and Seminar Presentation
3	Vascular Cambium	Written and Seminar Presentation
4	Plant Fibres - Distribution, Structure and Importance of Coir, Jute and Cotton	Written and Seminar Presentation
5	Comparison of Anomalous Secondary Thickening in Boerhaavia, Mirabilis and Amaranthus stems	Written and Seminar Presentation

TEXT BOOKS AND REFERENCES

1. Eames A J, McDaniel (1976). An introduction to plant Anatomy. Tata McGraw-Hill, New Delhi
2. Edred John, Henry Corner (1976). The seeds of dicotyledons (Vol. I, II). Cambridge University Press.
3. Ella Werker (1997). Seed Anatomy. Borntreager. University of Michigan
4. Elizabeth G Cutter (1978). Plant Anatomy Part I & II. Clive and Arnald Ltd.
5. Elizabeth G Cutter (1978). Applied Plant Anatomy. Clive and Arnald Ltd.
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7. Esau K (1977). Anatomy of seed plants. Wiley and sons.
8. Fahn A. (1997). Plant anatomy. Aditya Publishers. New Delhi
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10. Reghu C P (2002). Structural features of Rubber wood. Rubberwood Processing and utilization in India. Ganesh Publications, Bangalore
11. Wardrop A B (1964). Reaction wood Anatomy in Arborescent angiosperms. Formation of wood in forest trees (Ed, Zimmerman). Academic press, New York.
12. Wardrop A B (1961). The structure and formation of reaction wood in Angiosperm: Problems of tree physiology. Recent advances in Botany (Vol II). University of Toronto press.

PRINCIPLES OF ANGIOSPERM SYSTEMATICS & MORPHOLOGY

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
PRINCIPLES OF ANGIOSPERM SYSTEMATICS & MORPHOLOGY				
MODULE I				
37	Historical background of classification - Artificial, natural and phylogenetic systems	PPT/Lecture		
38	Importance of taxonomy	PPT/Lecture	e-resource	
MODULE II				
39	Species/Genus/Family and other categories	PPT/Lecture		
40	Species concept and intraspecific categories - subspecies, varieties and forms	PPT/Lecture	Quiz	
MODULE III				
41	Plesiomorphic and Apomorphic characters	PPT/Lecture	video	
42	Homology and Analogy	PPT/Lecture		
43	Parallelism and Convergence	PPT/Lecture	e-resource	
44	Monophyly, Paraphyly and Polyphyly	PPT/Lecture		
45	Phylogenetic tree - Cladogram	PPT/Lecture		
46	Phylogenetic tree - Phenogram	PPT/Lecture	Quiz	
MODULE IV				
47	Sources of taxonomic characters - Anatomy & Cytology	PPT/Lecture		
48	Sources of taxonomic characters - Phytochemistry	PPT/Lecture		
49	Sources of taxonomic characters - Molecular taxonomy	PPT/Lecture	Quiz	
MODULE V				
50	Phenetic - Numerical Taxonomy - principles	PPT/Lecture		
51	Numerical Taxonomy- methods	PPT/Lecture	e-resource	
52	Cladistic - Principles	PPT/Lecture		
53	Cladistic - methods	PPT/Lecture		
MODULE VI				
54	History of ICN	PPT/Lecture	e-resource	
55	ICN - aims and Principles	PPT/Lecture		
56	ICN - rules and recommendations	PPT/Lecture		
57	Rules of priority, typification, author citation	PPT/Lecture		

58	Retention, rejection and changing of names	PPT/Lecture		
59	Effective and valid publication	PPT/Lecture	Quiz	
MODULE VII				
60	Chemotaxonomy - Theory	PPT/Lecture		
61	Chemotaxonomy - Applications	PPT/Lecture	video	
62	DNA barcoding - Procedure	PPT/Lecture		
63	DNA barcoding - Applications	PPT/Lecture	e-resource	
MODULE VIII				
64	Habitat and habit			
65	Morphology of root	PPT/Lecture		
66	Morphology of stem	PPT/Lecture		
67	Morphology of leaf,	PPT/Lecture		
68	bract and bracteoles	PPT/Lecture		
69	inflorescence	PPT/Lecture		
70	Flowers	PPT/Lecture		
71	Fruits	PPT/Lecture		
72	Seeds	PPT/Lecture	Quiz	
PRINCIPLES OF ANGIOSPERM SYSTEMATICS & MORPHOLOGY - PRACTICAL				
109	1. Morphology of leaf: Leaf attachment, Stipules, Patterns of leaf, Phyllotaxy, Shapes of leaf lamina, bases, margins and tips, Venation. 2. Inflorescence: Racemose - Simple raceme, Compound raceme, Spike, Spikelet, Catkin, Spadix, Corymb, Simple umbel, Compound umbel, Panicle, Capitulum. Cymose - Solitary cyme, Mono-, Di- and polychasial cyme. Special types - Cyathium, Verticillaster, Hypanthodium, Coenanthium. 3. Morphology of stamens: Mono-, Di- and Polyadelphous; Epipetalous, Syngenesious, Synandrous, Polyandrous, Didynamous, Tetradynamous, Basifixed, Dorsifixed, Versatile. 4. Morphology of carpels: Apocarpous,	Hands -on		
110		Hands -on		
111		Hands -on		
112		Hands -on		
113		Hands -on		
114		Hands -on		
115		Hands -on		
116		Hands -on		
117		Hands -on		
118		Hands -on		
119		Hands -on		
120		Hands -on		
121		Hands -on		
122		Hands -on		
123		Hands -on		
124		Hands -on		
125		Hands -on		
126		Hands -on		
127		Hands -on		
128	Hands -on			
129	Hands -on			

130	Syncarpous, Gynostegium. Placentation - Marginal, Parietal, Axile, Free central, Basal and Pendulous. 5. Morphology of fruits: Berry, Drupe, Hesperidium, Pepo, Balausta, Amphisarca, Achene, Follicle, Capsule, Legume, Lomentum, Nut, Caryopsis, Cypsela, Samara, Cremocarp, Siliqua, Carcerule, Regma. 6. Aggregate fruits; Composite fruits - Sorosis and Syconus; Pome. 7. Draw the L.S and floral diagram of at least 10 flowers having different ovary positions - hypogyny, perigyny and epigyny. 8. Workout nomenclatural problems regarding priority and author citations.	Hands -on		
131		Hands -on		
132		Hands -on		
133		Hands -on		
134		Hands -on		
135		Hands -on		

ASSIGNMENT /SEMINAR

Sl. No.	Topic	Nature of Assignment
1	Collection and identification of vegetative and reproductive structures of angiosperms	Collection and submission of specimens
2	Interdisciplinary approach of taxonomy	Written and Seminar Presentation

References

1. Lawrence George H M (1951). Taxonomy of vascular plants. Oxford and IBH Publ. Co. Pvt. Ltd.
2. Jeffrey C (1968). An Introduction to principles of Plant Taxonomy.
3. Cole A J (1969). Numerical Taxonomy. Academic Press.
4. Davis P H, Heywood V M (1973). Principles of Angiosperm Taxonomy. Robert E Kereiger Publ.
5. Harrison H J (1971). New Concepts in Flowering Plant Taxonomy. Heiman Educational Books Ltd.
6. Cronquist A (1981). An Integrated system of classifications of flowering plants. Columbia University Press.
7. Heywood V H, D M Moore (Eds) (1984). Current concept in Plant Taxonomy.
8. Naik V V (1984). Taxonomy of Angiosperms. Tata McGraw Hill Publ. Co. Ltd.
9. Radford A E (1986). Fundamentals of Plant Systematics. Harper & Row Publ.
10. Davis P H, V H Heywood (1991). Principles of Angiosperm Taxonomy. Today and Tomorrow Publications.

11. Stace C A (1989). *Plant Taxonomy and Biosystematics*. Edward Arnold.
12. Woodland D W (1991). *Contemporary Plant Systematics*. Prentice Hall.
13. Sivarajan V V (1991). *Introduction to Principles of Plant Taxonomy*. Oxford IBH.
14. Takhtajan A L (1997). *Diversity and Classification of Flowering Plants*. Columbia Univ. Press.
- 15 Taylor D V, L J Hickey (1997). *Flowering plants: Origin, evolution and phylogeny*. CBS Publishers & Distributors.
16. Stuessy T F (2002). *Plant taxonomy: The systematic Evaluation of comparative data*. Bishen Singh, Mahendra Pal Singh. Dehradun.
17. Gurcharan Singh (2004). *Plant Systematics: Theory and practice*. Oxford and IBH Publishing.
18. Wendy B Zomlefer (2006). *Guide to Flowering Plant Families*. Overseas Press India Private Ltd.
19. *International Code of Botanical Nomenclature* (latest)
20. Henry A N, Chandrabose M (1980). *An aid to the International Code of Botanical Nomenclature*.

COURSE PLAN

PROGRAMME	M.Sc. BOTANY	SEMESTER	2
COURSE CODE AND TITLE	16P2BOTT07: MOLECULAR BIOLOGY AND IMMUNOLOGY	CREDIT	4
HOURS/WEEK	5.5	HOURS/SEM	Theory 54+18 hrs; Practical 9+18 hrs
FACULTY NAME	PRINCY MOL A. P.		

COURSE OBJECTIVES

To explain the basic properties, structure and functions of genetic materials.
To explain the central dogma of molecular biology.
To develop a thorough knowledge in gene expression mechanisms.
To explain the mechanism of DNA repair systems
To compare the alternate forms of DNA and its significance
To compare the diversity of RNA molecules and its diverse functions in biological systems.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MOLECULAR BIOLOGY				
MODULE I - Genetic material and its molecular structure				
1	Alternative conformations of DNA – A-DNA, Z-DN, C-DNA, E – DNA, triplex DNA, H-DNA and quadruplex DNA Circular and linear DNA, Single-stranded DNA.	PPT/Lecture		
2		PPT/Lecture	e-resource	
3		PPT/Lecture		
4		PPT/Lecture		
5		PPT/Lecture		
6	Structure and function of different types of RNA - mRNA, tRNA, rRNA, SnRNA, and Micro RNA. RNA tertiary structures.	PPT/Lecture		
7		PPT/Lecture		
8		PPT/Lecture	e-resource	
9		PPT/Lecture		
10	Ribozymes – Hammerhead ribozymes.	PPT/Lecture		
11	C-value paradox, DNA renaturation kinetics, T _m , Cot curve.	PPT/Lecture		
12	Unique and Repetitive DNA – mini- and microsatellites	PPT/Lecture		
MODULE II - DNA replication, repair and recombination				
13	DNA replication: Unit of replication, enzymes and proteins involved in replication (in both procaryotes and eucaryotes). Structure of the replication origin (in both procaryotes and eucaryotes), priming (in both procaryotes and eucaryotes), replication fork, fidelity of replication. Process of replication – initiation, elongation and termination. Replication in the telomere - telomerase.	PPT/Lecture	e-resource	
14		PPT/Lecture	video	
15		PPT/Lecture		
16		PPT/Lecture		
17	DNA repair mechanisms: Direct repair, excision repair – base excision repair and nucleotide excision repair (NER), eucaryotic excision repair – GG-NER, TC-NER. Mismatch repair, Recombination repair – homologous recombination repair, nonhomologous end joining, SOS response – Transletion DNA polymerase.	PPT/Lecture	video	
18		PPT/Lecture		
19		PPT/Lecture		

20	Recombination: Homologous and nonhomologous recombination, molecular mechanism of homologous recombination. Site-specific recombination.	PPT/Lecture	e-resource	
21		PPT/Lecture		
22	Transposable elements: General features, Types of transposons, Cut and paste transposons- IS Elements, Composite Transposons, Ac and Dselements, P Elements. Replicative transposon- Tn3 Elements. Retrotransposons- retrovirus like elements: Ty1 Element, Retroposons- LINES, SINEs.	PPT/Lecture	e-resource	
23		PPT/Lecture		
24		PPT/Lecture		
25		PPT/Lecture		
MODULE III - Gene expression				
26	Gene: Concept of gene; structural and genetic definitions – complementation test.	PPT	video	
27		PPT/Lecture		
28		PPT/Lecture		
29		PPT/Lecture	e-resource	
30	Transcription in procaryotes: Initiation – promoter structure, structure of RNA polymerase, structure and role of sigma factors. Elongation – elongation complex, process of RNA synthesis. Termination – rho-dependent and rho-independent termination.	PPT/Lecture		
31		PPT/Lecture		
32		Lecture		
33		Lecture		
34		Lecture		
35		Lecture		
36	Transcription in eucaryotes: Types, structure and roles of RNA polymerases. Promoters – important features of class I, II, & III promoters. Enhancers and silencers. General transcription factors and formation of pre-initiation complex. Elongation factors, structure and function of transcription factors. Post-transcriptional events: Split genes, splicing signals, splicing mechanisms of group I, II, III, and tRNA introns. Alternative splicing, exon shuffling, cis and transsplicing. Structure, formation and functions of 5' cap and 3' tail of mRNA, RNA	PPT/Lecture		
37		PPT/Lecture		
38		PPT/Lecture		
39		PPT/Lecture		
40		PPT/Lecture		
41		Lecture		
42		Lecture		
43		Lecture		
44		Lecture		
45	PPT/Lecture			

	editing, mRNA export. rRNA and tRNA synthesis and processing.			
46	Translation: Important features of mRNA – ORF, RBS. Fine structure, composition and assembly of procaryotic and eukaryotic ribosomes. tRNA charging, initiator tRNA. Stages in translation: Initiation – formation of initiation complex in procaryotes and eucaryotes, initiation factors in procaryotes and eucaryotes, Kozak sequence.	PPT/Lecture		
47		PPT/Lecture		
48		PPT/Lecture		
49		Lecture		
50		Lecture		
51	Elongation – process of polypeptide synthesis, active centers in ribosome - 3-site model, peptidyl transferase, elongation factors. Termination – process of termination, release factors, ribosome recycling revision	Lecture		
52		Lecture		
53		PPT/Lecture		
54		PPT/Lecture		
55		PPT/Lecture		
56				
CIA I				
57	Genetic code: Cracking the genetic code – simulation synthetic polynucleotides and mixed copolymers, synthetic triplets.	PPT/Lecture		
58		PPT/Lecture		
59		PPT/Lecture		
60	Important features of the genetic code, proof for the triplet code, Exceptions to the standard code.	Lecture	Quiz	
61		Lecture	Q & Ans Session	
62	Protein sorting and translocation: Cotranslational and posttranslational – signal sequences, SRP, translocon.	PPT/Lecture		
63	Membrane insertion of proteins. Post-translational modification of proteins. Protein folding – self-assembly, role of chaperones in protein assembly	PPT/Lecture		
64		PPT/Lecture		
MODULE IV - Control of gene expression				
65	Viral system: Genetic control of lytic and lysogenic growth in λ phage, lytic cascade	PPT/Lecture		
66		Lecture		
67	Procaryotic system: Transcription switches, transcription regulators.	PPT/Lecture		

68	Regulation of transcription initiation; Regulatory proteins - activators and repressors. Structure of Lac operator, CAP and repressor control of lac genes. Regulation after transcription initiation – regulation of amino acid biosynthetic operons- attenuation of trp operon, riboswitches.	PPT/Lecture		
69		PPT/Lecture		
70	Eucaryotic system: Changes in chromatin and DNA structure – chromatin compaction, transcriptional activators and repressors involved in chromatin remodelling, gene amplification, gene rearrangement, alternate splicing, gene silencing by heterochromatization, and DNA methylation. Effect of regulatory transcription factors on transcription. Post-transcriptional control – mRNA stability, RNA interference. Role of small RNA in heterochromatization and gene silencing.	PPT/Lecture		
71		PPT/Lecture		
72	RNA interference- Discovery, RNAi path way, miRNA, siRNA, piwiRNA	PPT/Lecture		

IMMUNOLOGY

MODULE I

73	a. Innate and acquired immunity. Cells and molecules involved in innate and acquired immunity	Lecture/ Interaction/ PPT		
74	a. Humoral and cellular immunity, Antigens, Epitopes	Lecture/ Interaction/ PPT		
75	b. Structure, function and types of antibody molecules. Antigen-antibody interactions.	Lecture/ Interaction/ PPT	e-resource	
76	b. Antigen processing and presentation.	Lecture/ Interaction/ PPT		
77	c. Activation and differentiation of B cells – formation, role.	Lecture/ Interaction/ PPT	Video, e-resource	
78	c. T cells – types, roles, T cell receptors.	Lecture/ Interaction/ PPT/ Audio visual learning/ Practical	Video, e-resource	
79	d. Primary and secondary immune modulation	Lecture/ Interaction/ PPT/Audio visual learning	e-resource	

80	d. complement system, pattern recognition receptors – toll-like receptors.	Lecture/ Interaction/ PPT/Audio visual learning	e-resource	
81	d. MHC molecules. Cell-mediated effector functions, inflammation	Lecture/ Interaction/ PPT/Audio visual learning	e-resource	
82	Hypersensitivity and autoimmunity, congenital and acquired immunodeficiencies.	Lecture/ Interaction/ PPT/Audio visual learning		
MODULE II				
83	a. Generation of antibody diversity.	Lecture/ Chalk and board/ Interaction/ PPT	e-resource	
84	b. Production and uses of monoclonal antibodies	Lecture/ Interaction/ PPT/ Assignment		
85	Antibody engineering.	Lecture/ Interaction/ PPT/ Assignment		
MODULE III				
86	a. Vaccines: Basic strategies, inactivated and live attenuated pathogens,	Lecture/ Interaction/ PPT		
87	b. subunit vaccines	Lecture/ Interaction/ PPT	e-resource	
88	recombinant vaccines (e.g., Hepatitis B vaccine)	Lecture/ Interaction/ PPT		
89	DNA vaccines	Lecture/ Interaction/ PPT	e-resource	
90	b. Modern approaches to vaccine development - edible vaccines.	Lecture/ Interaction/ PPT		
PRACTICAL				
91	Molecular Biology Problems	Demonstration		
92	Virtual lab experiments	Computer based practical		
CIA - II				

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual – Graded)	Nature of Assignment
1	02/01/2017	Viral System	
2	28/01/2017	Genetic code	
3	14/02/2017	Vaccines: Basic strategies, inactivated and live attenuated pathogens,	Review report on recent research works in the respective fields
4	14/02/2017	Subunit vaccines, recombinant vaccines (e.g., Hepatitis B vaccine)	
5	14/02/2017	Modern approaches to vaccine development - edible vaccines.	

References

1	Goldsby, R. A., Kindt, T. J., Osborne, B. A. and Kuby, J. (2003). Kuby Immunology (5th edition). W H Freeman and Company.
2	Roitt, I. M. and Delves, P. J. (2001). Roitt's Essential Immunology (10th edition). Blackwell Publishing
3	Krebs, J. E., Goldstein, E. S. and Kilpatrick, S. T. (2014) Lewin's Genes XI. Jones & Bartlett learning
4	Talaro, K. P. and Chess, B (2012). Foundations in Microbiology (8th edition). Mc Graw Hill
5	Abbas, A. K. and Lichtman, A. H. (2004) Basic Immunology – Functions and Disorders of the Immune System (2 nd edition). Saunders - Elsevier
6	Rabson, A., Roitt, I. M. and Delves, P. J. (2005) Really Essential Medical Immunology (2nd edition). blackwell publishing
7	Wayne M Becker, Lewis J Kleinsmith, Jeff Hardin (2007). <i>The world of the cell</i> (VI Edn). Pearson.
8	Geoffrey M Cooper, Robert E Hausman (2009). <i>The Cell: A molecular approach</i> (V Edn). Sinaeur.
9	Harvey Lodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell (2000). <i>Molecular cell biology</i> (IV Edn). W H Freeman & Company.
10	Gerald Karp (2008). <i>Cell and Molecular biology: Concepts and experiments</i> (V Edn). John Wiley & Sons.
11	Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). <i>Molecular biology of the cell</i> (IV Edn). Garland Science, Taylor and Francis group.
12	Robert J Brooker (2009). <i>Genetics: analysis and principles</i> (III Edn). McGraw Hill.
13	Jocelyn E Krebs, Elliott S Goldstein, Stephen T Kilpatrick (2011). <i>Lewin's Genes X</i> . Jones and Bartlett Publishers.
14	Bob B Buchanan, Wilhelm Gruissem, Russel L Jones (2000). <i>Biochemistry and Molecular biology of plants</i> . I K International Pvt. Ltd.
15	Daniel L Hartl, Elizabeth W Jones (2012). <i>Genetics: Analysis of genes and genomes</i> (VII Edn). Jones and Bartlett publishers.
16	James D Watson, Tania A Baker, Stephen P Bell, Alexander Gann, Michael Levine, Richard Losick (2009). <i>Molecular biology of the gene</i> (V Edn). Pearson.

COURSE PLAN

PROGRAMME	MASTERS IN BOTANY	SEMESTER	2
COURSE CODE AND TITLE	16P2BOTT08: GENETICS AND BIOCHEMISTRY	CREDIT	3
HOURS/WEEK	6	HOURS/SEM	108
FACULTY NAME	EBIN PJ		

COURSE OBJECTIVES

To define Mendelian and Non-Mendelian modes of inheritance that governs passage of genetic traits across generation.

To explain the Hardy-Weinberg equilibrium.

To analyse and solve problems related to map distance, gene order, coefficient of coincidence, interference and population genetics

To identify and compare the structure and functions of biomolecules.

To explain genetics behind cancer, enzymology, nucleotide metabolism and secondary metabolites.

To know the detailed account on enzymology, nucleotide metabolism and secondary metabolites.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
GENETICS				
Module 1: History of Genetics (3 hrs)				
Session 1	Transmission genetics, Molecular genetics and Population genetics (brief introduction). Mendelism – basic principles (brief study).	PPT/Lecture	Seminar	
Session 2	Extensions of Mendelism, penetrance and expressivity of genes.	PPT/Lecture		
Session 3	Nonmendelian inheritance – cytoplasmic inheritance. Sex determination in animals and plants.	PPT/Lecture	Seminar	

Module 2: Linkage and genetic mapping (6 hrs)				
Session 4	Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments	PPT/Lecture	Video	
Session 5	single cross over, multiple cross over, two-point cross, three-point cross, map distances, gene order,	PPT/Lecture		
Session 6	interference and co efficient of coincidence.	PPT/Lecture		
Session 7	Haploid mapping (Neurospora)	PPT/Lecture	video	
Session 8	Mapping in bacteria and bacteriophages	PPT/Lecture	Seminar	
Session 9	Inheritance of traits in humans; pedigree analysis, determination of human genetic diseases by pedigree analysis, genetic mapping in human pedigrees.	PPT/Lecture		
Module 3: Quantitative genetics (2 hrs)				
Session 10	Polygenic inheritance, QTL,	PPT/Lecture		
Session 11	effect of environmental factors and artificial selection on polygenic inheritance.	PPT/Lecture		
Module 4: Population genetics (7hrs)				
Session 12	Gene pool, allele and genotype frequency	PPT/Lecture		
Session 13	Hardy-Weinberg law and its applications	PPT/Lecture		
Session 14	estimation of allele and genotype frequency of dominant genes, co-dominant genes, sex-linked genes and multiple alleles	PPT/Lecture		
Session 15	Genetic equilibrium, genetic polymorphism.	PPT/Lecture		
Session 16	(b) Factors that alter allelic frequencies; (i) mutation (ii) genetic drift - bottle neck effect and founder effect	PPT/Lecture		
Session 17	migration (iv) selection (v) nonrandom mating, inbreeding coefficient	PPT/Lecture		
Session 18	Balancing of evolutionary forces	PPT/Lecture	Seminar	

Genetics Practical (18 hrs)				
Session 19	problems related to linkage, crossing over and gene mapping, human pedigree analysis.	hands-on		
Session 20		hands-on		
Session 21		hands-on		
Session 22		hands-on		
Session 23		hands-on		
Session 24		hands-on		
Session 25		hands-on		
Session 26		hands-on		
Session 27		hands-on		
Session 28		problems related to population genetics - gene and genotype frequency, Hardy Wienberg equilibrium	hands-on	
Session 29	hands-on			
Session 30	hands-on			
Session 31	hands-on			
Session 32	hands-on			
Session 33	hands-on			
Session 34	hands-on			
Session 35	hands-on			
Session 36	hands-on			
BIOCHEMISTRY (Theory 54 hrs; Practical 18 hrs)				
Module 1: pH and Buffer (5 hrs)				
Session 37	Acids and bases, strength of acids – strong acids, weak acids	PPT/Lecture	Seminar	
Session 38	Ionization of water – Kw, pH. Dissociation of acids – pKa, Henderson-Hasselbalch equation	PPT/Lecture	Seminar	
Session 39	Buffers – definition, chemical composition, requirements for a good buffer	PPT/Lecture	Seminar	

Session 40	buffer action, buffer capacity	PPT/Lecture	Seminar	
Session 41	Measurement of pH – colorimetric methods and electrometric methods	PPT/Lecture	Seminar	
Module 2: Carbohydrates (3 hrs)				
Session 42	Sugar derivatives:Glycoproteins	PPT/Lecture		
Session 43	proteoglycans, mucoproteins	PPT/Lecture		
Session 44	Lectins.	PPT/Lecture		
Module 3: Lipids (3 hrs)				
Session 45	Structural lipids – membrane lipids	PPT/Lecture		
Session 46	Lipid biosynthesis	PPT/Lecture		
Session 47	fat breakdown – β oxidation	PPT/Lecture	Video	
Module 4: Amino acids (3 hrs)				
Session 48	Structure of amino acids	PPT/Lecture		
Session 49	Classification of amino acids	PPT/Lecture		
Session 50	Biosynthesis of amino acids	PPT/Lecture		
Module 5: Proteins (8 hrs)				
Session 51	Classification of proteins based on structure and function.	PPT/Lecture	Video	
Session 52	Oligo- and polypeptides	PPT/Lecture		
Session 53	Primary structure – peptide bond.	PPT/Lecture		
Session 54	Secondary structure – Ramachandran plots, α -helix, β sheet.	PPT/Lecture		
Session 55	Tertiary structure – forces that stabilize tertiary structure	PPT/Lecture		
Session 56	Quaternary structure, domains, motif and folds	PPT/Lecture		
Session 57	Protein sequencing – Edman method.	PPT/Lecture		
Session 58	Functions of proteins.	PPT/Lecture		
Module 6: Protein turnover and amino acid catabolism (5 hrs)				

Session 59	Degradation of proteins to amino acids	PPT/Lecture		
Session 60	Protein turnover and its tight regulation	PPT/Lecture		
Session 61	steps involved in amino acid degradation.	PPT/Lecture		
Session 62	Structure of Proteasome complex	PPT/Lecture		
Session 63	working mechanism of Proteasome complex	PPT/Lecture	Video	
Module 7: Enzymes (15 hrs)				
Session 64	Principles of catalysis: Activation energy of a reaction	PPT/Lecture		
Session 65	General characters of enzymes - specificity, catalytic power, regulation.	PPT/Lecture		
Session 66	IUB system of enzyme classification and naming.	PPT/Lecture	Seminar	
Session 67	Mechanism of enzyme activity: Formation of ES complex	PPT/Lecture		
Session 68	acid-base catalysis, covalent catalysis, metal ion catalysis	PPT/Lecture		
Session 69	proximity and orientation effect, strain and distortion theory.	PPT/Lecture		
Session 70	Factors affecting enzyme activity	PPT/Lecture		
Session 71	Enzyme Kinetics: Michaelis-Menton kinetics	PPT/Lecture		
Session 72	Lineweaver-Burk plot.	PPT/Lecture		
Session 73	Mechanism of multi substrate reaction – Ping Pong, Bi-Bi mechanism.	PPT/Lecture		
Session 74	Regulation of enzyme activity: Allosteric effect, control proteins, reversible covalent modification, proteolytic activation	PPT/Lecture		
Session 75	Enzyme inhibition – reversible and irreversible inhibition, competitive, noncompetitive, uncompetitive inhibition, dixon plot	PPT/Lecture		

Session 76	Cofactors and coenzymes: Essential ions, Coenzymes; structure and role of metabolite coenzymes – ATP;	PPT/Lecture	Seminar	
Session 77	structure and role of vitamin derived coenzymes – NAD ⁺ , NADP ⁺ , FAD, FMN, TPP, PLP	PPT/Lecture	Seminar	
Session 78	Biotin. Isozymes.	PPT/Lecture		
Module 7:Nucleotide metabolism (4 hrs)				
Session 79	Structure of nucleotides	PPT/Lecture		
Session 80	Functions of nucleotides	PPT/Lecture		
Session 81	nucleotide biosynthesis by de novo pathway	PPT/Lecture		
Session 82	nucleotide biosynthesis by salvage pathways	PPT/Lecture		
Module 8:Secondary metabolites (6 hrs)				
Session 83	Classification of secondary metabolites	PPT/Lecture	Seminar	
Session 84	biosynthesis and functions of terpenoids	PPT/Lecture		
Session 85	biosynthesis and functions of alkaloids	PPT/Lecture		
Session 86	biosynthesis and functions of phenolics	PPT/Lecture		
Session 87	biosynthesis and functions of flavonoids	PPT/Lecture		
Session 88	biosynthesis and functions of coumarins	PPT/Lecture		
Biochemistry Practical (18 hrs)				
Session 89	Preparation of buffers of various strength and pH	hands-on		
Session 90		hands-on		
Session 91	Differentiating sugars based on osazone formation.	hands-on		
Session 92		hands-on		
Session 93	Quantitative estimation of reducing sugar using Dinitro salicylic acid (DNS) or Anthrone.	hands-on		
Session 94		hands-on		
Session 95	Separation and analysis of lipids and amino acids by TLC.	hands-on		

Session 96		hands-on		
Session 97	Quantitative estimation of protein by Lowry's method.	hands-on		
Session 98		hands-on		
Session 99	Preparation of molal, molar, normal and percentage solutions and their dilutions.	hands-on		
Session 100		hands-on		
Session 101	Estimation of purity of DNA (By DNA protein ratio).	hands-on		
Session 102		hands-on		
Session 103	Estimation of catalase activity.	hands-on		
Session 104		hands-on		
Session 105	Isolation and assay of amylase enzyme from germinating Pea seeds/appropriate plant material.	hands-on		
Session 106		hands-on		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Date of completion	Topic of Assignment & Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	By February	Enzyme mechanism
2		Hardy-Weinberg law

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