

**SEMESTER 1**  
**MICROBIOLOGY AND PHYCOLOGY (2015-16)**

**COURSE OUTCOMES:**

Understand the world of microbial diversity

Understand the reproductive behaviour in Algae and microbes

Understand ecological significance of the lower groups of plants and protists

Understand economic significance of the lower groups of plants and protists

Collect various algal forms and classify them in the laboratory

Compare various algal forms and on the basis of their thallus structure

**Basic Reference**

1. Aneja K. R. 1996. *Experiments in Microbiology, Plant pathology, Tissue culture and Mushroom cultivation*. Wishwa Prakasan, Delhi.
2. Carpenter P L, 1967. *Microbiology.*, W. B Saunder & Co, Philadelphia
3. Chapman, V J 1962. *The Algae.*: Macmillan & co. Ltd, London
4. Christiaan Hoek, 1995. *Algae: An Introduction to Phycology*, Cambridge University Press.
5. Dube.H.C 2008. *Fungi, Bacteria and Viruses*, Agrobios, Meerut.
6. Frazier W C & Westhoff D C 1978. *Food Microbiology*. TMH Edn.
7. Fritsch F E 1945. *Structure and Reproduction of Algae*. Vol.1: Cambridge University Press, London.
8. Hans G Schlegel 1995. *General Microbiology*. Cambridge University Press, London.
9. John J & Francis M S, 2013. *An Illustrated Algal Flora of Kerala*, Vol.I: Pranatha Books, Cochin.
10. *Karthick, B., Hamilton P B and Kociolek, J.P., 2013. An Illustrated Guide on Common Freshwater Diatoms of Peninsular India*. Gubbi Labs, Gubbi.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
<b>MICROBIOLOGY</b>				
1	Session 1	Introduction, Scope of Microbiology	Presentation/Chalk and Board	
2.	Session 2	Fine structure - cell wall	Presentation/Chalk and Board	
3	Session3	Peptido glycan- cytoplasm - Nucleoid, Flagella	Presentation/Chalk and Board	
4	Session 4	Reproduction- Binary fission	Assignment	
5	Session 5	Genetic recombination - Conjugation,	Presentation/Chalk and Board	
6	Session 6	Transformation & transduction	Presentation/Chalk and Board	
7	Session 7	Archaeobacteria, Mycoplasma - general characters	Presentation/Chalk and Board	
8	Session 8	Virus - General morphology and structure.	Presentation/Chalk and Board	
9	Session 9	Plant viruses – architecture of TMV	Presentation/Chalk and Board	
10	Session 10	RNA viruses, DNA viruses (Examples only)	Assignment	
11	Session 11	Brief account of virus replication.	Presentation/Chalk and Board	
12	Session 12	Biofertilizers & Bio pesticides. Biogas production.	Presentation/Chalk and Board	
13	Session 13	Reconversion of waste products. Bioremediation	Presentation/Chalk and Board	

14	Session 14	Antibiotics. Production of single cell protein and Probiotics.	Presentation/Chalk and Board	
PRACTICLS				
15	Session 15	Preparation of bacterial smear.	Laboratory Demonstration	
16	Session 16	Grams staining	Laboratory Demonstration	
17	Session 17	Isolation of microbes from soil (Streaking method).	Laboratory Demonstration	
PHYCOLOGY				
18	Session 18	Introduction - General characters of algae	Assignment	
19	Session 19	Classification (Fritsch F. E, 1935; 1945.	Presentation/Chalk and Board	
20	Session 20	Cyanophyceae: <i>Nostoc</i>	Assignment	
21	Session 21	Chlorophyceae: <i>Chlamydomonas</i> , <i>Volvox</i> , <i>Spirogyra</i> , <i>Oedogonium</i> , <i>Chara</i>	Presentation/Chalk and Board	
22	Session 22	Xanthophyceae: <i>Vaucheria</i>	Presentation/Chalk and Board	
23	Session 23	Bacillariophyceae: <i>Pinnularia</i>	Presentation/Chalk and Board	
24	Session 24	Phaeophyceae : <i>Sargassum</i>	Presentation/Chalk and Board	
25	Session 25	Rhodophyceae : <i>Polysiphonia</i>	Presentation/Chalk and Board	
26	Session 26	Algae as pollution indicator and in waste water treatment	Presentation/Chalk and Board	
27	Session 27	Commercial products: Agar, Alginates, Carrageenin, Diatomaceous earth	Presentation/Chalk and Board	

28	Session 28	Algae in soil fertility, Fertilizer, Nitrogen fixation, minerals, soil algae and symbiosis	Presentation/Chalk and Board	
29	Session 29	Sources of food & medicine	Assignment	
30	Session 30	Diatoms and nanotechnology	Presentation/Chalk and Board	
31	Session 31	As a source of Hydrogen as fuel Toxic algae – Algal blooms, red tides & fish poisoning	Presentation/Chalk and Board	
32	Session 32	Role of algae in aquacultur	Presentation/Chalk and Board	
33	Session 33	Algal culture: scope and methods (Brief account only)	Assignment	
PRACTICALS				
34	Session 34	<ul style="list-style-type: none"> <li>• Make micro preparation of vegetative and reproductive structures of the types mentioned in the syllabus.</li> <li>• Identify the algal specimens up to the generic level by noting their key characters.</li> <li>• Make labeled sketches of the specimens observed.</li> </ul>	Laboratory Demonstration	

**SEMESTER 3**  
**MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY (2015-16)**

**COURSE OUTCOMES:**

The students will have a through basic understanding about the diversity and life forms of fungi and lichens.

Students would be able to identify major groups of fungi and lichens.

Students would be able to understand different plant diseases and their impacts on agriculture.

Students would be able to determine different measures to control plant diseases.

**Basic Reference**

1. Ahamadjian Vernon and Hale M.E (eds) 1973. The Lichens, Academic press, New Delhi.
2. Ainsworth G.C ., Sparrow K.F & Sussman A.S (eds) 1973. The Fungi an advanced Treatise, Vol. 4 a & 4b, a Taxonomic review with keys , academic press New York.
3. Alexopoulos C.J, Mims, C.W & C.W Blackwell,M 1996 Introductory Mycology .John Willy and sons, INC . New York.
4. Bilgrami K.S and Dube H.C 1976 A Text book of Modern Plant pathology ,: Vikas
5. Campbell R 1987 Plant Microbiology , ELBS Edward Arnold , London .
6. George N. Agrios 1988. Plant Pathology, Academic Press Ltd., London.
7. Greth Jones,D 1989 Plant Pathology –Principles and Practice , Aditya books, New Delhi.
8. Gupta V .K & Paul T.S 2004, Fungi & Plant deseases. Kalyani publishers , New Delhi
9. Hale M.E 1983 The Biology of Lichen,3rd edition Edward Arnold, London.
- 10.Jim Deacon 2007 Fungal Biology , 4th edition , Blackwell Publishing ,Ane Books Pvt. Ltd.
- 11.Jim Deacon, 2007. Fungal Biology. Black Well Publishing.
- 12.Krishnamurthy K.V. 2004. An Advanced Text Book on Biodiversity Principles and practice. Oxford and IBH Publishing Co. Pvt. Ltd.
- 13.Malhotra & Aggarwal Ashok 2003 Plant Pathology, Tata Mc Graw Hill Publishing Co
- 14.Mamatha Rao, 2009, Microbes and Non flowering plants- impact and application Ane Boopks Pvt Ltd.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
1	Session 1	Introduction, structure, reproduction, life cycle, evolutionary trends. Classification based on Ainsworth (1973)	Presentation/Chalk and Board	
2.	Session 2			
3	Session 3			
4	Session 4	Distinguishing characters of different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group; a) Myxomycotina – General Characters b) Mastigomycotina – Albugo c) Zygomycotina - Rhizopus	Presentation/Chalk and Board	
5	Session 5			
6	Session 6			
7	Session 7	Distinguishing characters of different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group; Ascomycotina Hemiascomycetes -- Saccharomyces Plectomycetes -- Pencillium Pyrenomycetes – Xylaria Discomycetes -- Peziza	Presentation/Chalk and Board	
8	Session 8			
9	Session 9			

10	Session 10	Distinguishing characters of different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group;  e) Basidiomycotina  Teliomycetes ---Puccinia  Hymenomycetes—Agaricus	Presentation/Chalk and Board	
11	Session 11			
12	Session 12			
13	Session 13	Distinguishing characters of different classes of fungi with special reference to reproductive structures and life history of the genera mentioned in each group; f) Deuteromycotina – Fusarium	Presentation/Chalk and Board	
14	Session 14			
15	Session 15			
16	Session 16	Economic importance of Fungi – useful and harmful aspects	Assignment	
17	Session 17	Fungi of Agricultural importance – mycoherbicides, myconematicides, mycoparasites, Mycorrhiza – diversity, function and significance	Presentation/Chalk and Board	
18	Session 18			
19	Session 19			

20	Session 20	Fungal biotechnology- Fundamental principles. Mushrooms- edible and poisonous types. cultivation technique-Spawn production. Cultivation of Oyster mushroom.	Presentation/Chalk and Board	
21	Session 21	General account, economic and ecological importance of lichen Structure, reproduction and life cycle of Parmelia.	Assignment	
22	Session 22	History of plant pathology, Classification of plant diseases on the basis of causative organism and symptoms, Host parasite interaction, Defense mechanism in host, Mechanism of infection, transmission and dissemination of diseases	Presentation/Chalk and Board	
23	Session 23			
24	Session 24			
25	Session 25	Control of plant diseases – Prophylaxis-quarantine measures, seed certification Therapeutic – physical therapy, chemotherapy. Biological control.	Presentation/Chalk and Board	
26	Session 26	Study of the following diseases with emphasis on symptoms, disease cycle	Presentation/Chalk and Board	
27	Session 27			



	Session 28	and control Bunchy top of Banana, Cassava Mosaic Disease Citrus Canker Root wilt of Coconut. Abnormal leaf fall of Rubber.		
	Session 29	Fungicides - Bordeaux mixture, Tobacco Neem decotion, preparation. (Brief account only)	Presentation/Chalk and Board	
	Session 30			
	Session 31	Medical mycology- Mention about fungal infections of man – Fungal allergens Athlet's foot, aspergillosis, candidiosis, aflatoxin	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
	Session 32	1. Students are expected to identify the following types by making suitable microprepartions and make labeled sketches Albugo, Rhizopus, Saccharomyces, Pencillium, Xylaria, Peziza, Puccinia, Fusarium and Parmelia. 2. Isolation and culture of Oyster mushroom mycelium. 3 Preparation of bed for mushroom cultivation. 4. Staining of endomycorrhiza or fungus using Trypan Blue	Laboratory	
	Session 33			
	Session 34			
	Session 35			
	Session 36	Students are expected to:	Laboratory	

	Session 37	1. Identify the diseases mentioned		
	Session 38	in the syllabus with respect to causal organisms and symptoms		
	Session 39	<p>2. Submit herbarium preparations of various stages (3stages) of any one of the diseases mentioned.</p> <p>3. Students should be trained to prepare the fungicide – Bordeaux mixture, Tobacco decoction.</p>		

### SEMESTER 3

#### BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALAEOBOTANY (2015-16)

#### COURSE OUTCOMES:

The students will have a thorough knowledge in identifying different groups of Bryophytes, Pteridophytes and Gymnosperms.

Students would be able to understand the evolutionary trends in plants.

Students would be able to understand anatomical variation in the plants included in the course.

Students will have a thorough understanding on basic paleobotany.

#### Basic Reference

1. Arnold H.N ,1967. *Introduction to Paleobotany*, Tata Mc Graw- Hill, New Delhi
2. Biswas & John B .M, 2004. *Gymnosperms*, Naresa Publishing house.
3. Bower F.O ,1935. *Primitive Land Plants*. Cambridge, London.
4. Chopra R.N and Kumar P. K ,1988. *Biology of Bryophytes*, Wiley Eastern Ltd, New Delhi.
5. Coutler J.M & Chamberlain C. J ,1958. *Morphology of Gymnosperms*. Central Book Depot Allahabad.
6. Dutta S.C, 1991, *An Introduction To Gymnosperms*, Kalyan Publishing Co. New Delhi.
7. Mamatha Rao, 2009, *Microbes and Non flowering plants- impact and application* Ane Boopks Pvt Ltd.
8. Rasheed A. 1999, *An Introduction to Pteridophyta*, Vikas Publishing House, New Delhi.

1.	Date	Topic	Method	Remarks/Reference
<b>BRYOLOGY</b>				
1	Session 1	Introduction, general characters	Presentation/Chalk and Board	
2.	Session 2	Classification, Evolution of Bryophytes.	Presentation/Chalk and Board	
3	Session3	Morphology, anatomy and reproduction in	Presentation/Chalk and Board	

		<i>Riccia</i>		
4	Session 4	Morphology, anatomy and reproduction in <i>Marchantia</i>	Presentation/Chalk and Board	
5	Session 5	Morphology, anatomy and reproduction in <i>Anthoceros</i>	Presentation/Chalk and Board	
6	Session 6	Morphology, anatomy and reproduction in <i>Funaria</i>	Presentation/Chalk and Board	
7	Session 7	Evolution of sporophyte and gametophyte	Presentation/Chalk and Board	
8	Session 8	Importance of Bryophytes, Prevention of soil erosion,	Assignment	
9	Session 9	Pollution monitoring and control, Antibiotics, Horticultural importance	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
10	Session 10	Make micro preparations of the types mentioned. Study vegetative and reproductive structures.	Laboratory Demonstration	
<b>PTERIDOLOGY</b>				
11	Session 11	Introduction, general characters	Assignment	
12	Session 12	Classification, evolution of Pteridophytes	Presentation/Chalk and Board	
13	Session 13	Structural organization of sporophyte and gametophyte Of <i>Psilotum</i>	Presentation/Chalk and Board	
14	Session 14	Structural organization of sporophyte and	Presentation/Chalk and Board	

		gametophyte of Lycopodium		
15	Session 15	Structural organization of sporophyte and gametophyte of Selaginella	Presentation/Chalk and Board	
16	Session 16	Structural organization of sporophyte and gametophyte of Equisetum	Presentation/Chalk and Board	
17	Session 17	Structural organization of sporophyte and gametophyte of Pteris	Presentation/Chalk and Board	
18	Session 18	Structural organization of sporophyte and gametophyte of Marsilea	Presentation/Chalk and Board	
PRACTICALS				
19	Session 19	Make micropreparations to study stelar structure and sporangia of the mentioned types.  Identify at sight, noting the morphology.	Laboratory Demonstration	
GYMNOSPERMS				
20	Session 20	Introduction, general characters	Presentation/Chalk and Board	
21	Session 21	Classification, origin and evolutionary significance	Presentation/Chalk and Board	
22	Session 22	Study of morphology, anatomy and reproductive features of Cycas	Presentation/Chalk and Board	
23	Session 23	Study of morphology, anatomy and	Presentation/Chalk and Board	

		reproductive features of Pinus		
24	Session 24	Study of morphology, anatomy and reproductive features of Gnetum	Presentation/Chalk and Board	
PRACTICLAS				
25	Session 25	Study of the morphology, anatomy and reproductive structures of the types mentioned.	Laboratory Demonstration	
PALEOBOTANY				
26	Session 26	Introduction, Study of geological time scale	Presentation/Chalk and Board	
27	Session 27	Formation of fossil, fossil types	Assignment	
28	Session 28	Technique of study, fossil as a fuel	Assignment	
29	Session 29	Detailed study of Fossil Pteridophyte: <i>Rhynia</i>	Presentation/Chalk and Board	
30	Session 30	Fossil Gymnosperm: <i>Williamsonia</i>	Presentation/Chalk and Board	
31	Session 31	Fossil Angiosperm: <i>Palmoxylon</i>	Presentation/Chalk and Board	
32	Session 32	Indian contribution to Palaeobotany	Presentation/Chalk and Board	

## SEMESTER 4

### ANATOMY AND ANGIOSPERM MORPHOLOGY (2015-16)

#### COURSE OUTCOMES:

The students will be able to identify different anatomical features of angiosperms

Students will be equipped in using anatomical characters in taxonomic and phylogenetic problems.

Students would be able to identify different morphological features of angiosperms

Students would be equipped to learn plant taxonomy easily.

#### Basic Reference

1. Cornquist A. 1968. The Evolution and Classification of Flowering plants.
2. Crang, R. and Vassilyev, A. 2003. Plant Anatomy, McGraw-Hill
3. David F. Cutler, Ted Botha, Dennis Wm. Stevenson, 2008. Plant Anatomy: An Applied Approach. Wiley-Blackwell.
4. Davis P.H. and Heywood V.H. 1967. Principles of Angiosperm taxonomy. Oliver and Boyd, Edinburgh.
5. Eames A.J. 1961. Morphology of Angiosperms Mc. Graw Hill, New York.
6. Esau, K.2010. Anatomy of Seed Plants, Wiley Eastern Limited.
7. Fahn A. 1982. Plant Anatomy (3rd edition) Pergamon Press Oxford.
8. Foaster A.S and Giffad E.M. 1962. Comparative Morphology of Vascular Plants, Allied Pacific Pvt. Ltd., Bombay

1.	Date	Topic	Method	Remarks/Reference
1	Session 1	Interdisciplinary applications: -	Presentation/Chalk and Board	
2.	Session 2	Histotaxonomy, Histochemistry, Histoenzymology, Pharmacognosy, Physiological Anatomy, Ecological	Assignment	

		Anatomy, Evolutionary trends in plant anatomy		
3	Session 3	Gross structure of primary and secondary cell walls, simple and bordered pits.	Presentation/Chalk and Board	
4	Session 4	Structure and function of plasmodesmata. Submicroscopic structure of cell wall- Cellulose, micelle, micro fibril and macro fibril. Different types of Cell wall thickening in tracheary elements	Presentation/Chalk and Board	
5	Session 5	Extra cell wall thickening materials: -	Presentation/Chalk and Board	
6	Session 6	Lignin, cutin, suberin and callose. Origin of cell wall; Growth of Cell wall- Apposition and intussusceptions – cavities & ducts, schizogenous & lysigenous developments		
7	Session 7	Non living inclusions in plant cell: - Reserve food materials -carbohydrate (starch), protein (Aleurone grain) and lipids (fats and oil);	Assignment	
8	Session 8	Secretory products- pigments, enzymes and nectar.	Presentation/Chalk and Board	
9	Session 9			



		Metabolic byproducts: - tannin, gums, resins, essential oils, mucilage, latex, mineral crystals and alkaloids		
10	Session 10	Meristematic tissue- definition, structure, function and classification	Presentation/Chalk and Board	
11	Session 11	Apical organization and theories; Shoot apex- Apical cell theory, Histogen theory and Tunica-Corpus theory.		
12	Session 12	Root apex - Histogen theory and Korper-Kappe theory.	Presentation/Chalk and Board	
13	Session 13	Permanent Tissue: - Structure and function of simple and complex tissues.		
14	Session 14	Distribution and function of mechanical tissues in plants. Plant fibres-economic importance.	Presentation/Chalk and Board	
15	Session 15	Secretory tissues: - a). External secretory tissue- glands and nectaries, b). Internal secretory tissues- laticifers, epithelial cells.	Presentation/Chalk and Board	
16	Session 16			
17	Session 17	Structure and Function in root, stem and leaves.	Presentation/Chalk and Board	
18	Session 18		Presentation/Chalk and Board	

19	Session 19	Epidermal Tissue System- Epidermis, Cuticle, Trichome, Stomata, Different types of stomata, Bulliform cells, Cork and Silica cells.		
20	Session 20			
21	Session 21	Ground Tissue System- Cortex, Endodermis, Pericycle, Pith and Pith rays		
22	Session 22	Vascular Tissue System- Different types of vascular bundles and their arrangement in root and stem	Presentation/Chalk and Board	
23	Session 23			
24	Session 24	Development, structure and function, Activity of cambium, role of cambium in budding, grafting and wound healing.	Presentation/Chalk and Board	
25	Session 25			
26	Session 26			
27	Session 27	Components of secondary xylem and phloem, Wood anatomy- basic structure, heart wood, sap wood, Histological difference between hard wood and soft wood, growth rings and dendrochronology, porous and non porous wood, ring porous and diffuse porous wood, tyloses, knots.	Presentation/Chalk and Board	
28	Session 28			
29	Session 29			
30	Session 30			
31	Session 31			
32	Session 32	Wood rays: Structure and cell types, uniseriate and multiseriate rays; heterocellular and homocellular rays.	Presentation/Chalk and Board	
33	Session 33	Reaction wood- Tension wood and compression wood.	Presentation/Chalk and Board	

		Properties, defects and seasoning of wood. Stem thickening in monocots.		
34	Session 34	Periderm: Structure and development- phellum, phellogen, phelloderm, bark, polyderm, rhytidome and lenticel.	Presentation/Chalk and Board	
35	Session 35	Bougainvillea stem, Bignonia stem and Dracaena stem.	Presentation/Chalk and Board	
36	Session 36	Leaf Morphology (types, venation, phyllotaxy), Stem and Root	Presentation/Chalk and Board	
37	Session 37	Morphology of flower - Parts of a flower- description of flower and it's parts in technical terms.	Presentation/Chalk and Board	
38	Session 38	Inflorescence:	Presentation/Chalk and Board	
39	Session 39	(a) Racemose types-Simple Raceme, Corymb, Umbel, Spike, Spadix and Head. (b) Cymose types-Simple Cyme, Monochasial- Scorpid and Helicoid, Dichasial (c) Special type- Cyathium, Hypanthodium		
40	Session 40	Fruits: Simple-Fleshy, Dry- dehiscent, indehiscent, Aggregate, Multiple (Sorosis and Syconus)	Assignment	
<b>PRACTICALS</b>				
	Session 41	1.Cell types and tissues.	Laboratory	

Session 42	<p>2. Non living inclusions – starch grains, cystolith, raphides, aleurone grains.</p> <p>3. Primary structure of stem root and leaf-Dicots and Monocots.</p> <p>4. Stomatal types: - anomocytic, anisocytic, paracytic, diacytic and grass type.</p> <p>5. Secondary structure of dicot stem and root.</p> <p>6. Anomalous secondary structure of Bougainvillea stem, Bignonia stem and Dracaena stem.</p> <p>7. Maceration of wood elements</p>		
Session 43			
Session 44			
Session 45	<p>1. Based on the theory topics</p>	Laboratory	
Session 46			
Session 47			
Session 48			
Session 49			

## SEMESTER 5

### ANGIOSPERM SYSTEMATICS, FLORAL MORPHOLOGY AND ECONOMIC BOTANY (2015-16)

#### COURSE OUTCOMES:

The students will have a through basic understanding about plant taxonomy.

Students would be able to identify plant families included in the course.

Students would be able to develop deductive reasoning ability.

Students would be able to identify economic importance of different angiosperms.

#### Basic Reference

1. Ashok Bendra and Ashok Kumar ,1980. *Economic botany.*: Rastogi publications, Meerut.
2. Cornquist A. ,1968. *The evolution and Classification of FloweringPlants.*
3. Davis P.H and Heywood V.H. 1967 *Principles of Angiosperm Taxonomy.* Edinburgh: Oliver and Boyl.
4. Eames A.J. 1961 *Morphology of Angiosperms.* New York: Mc Graw Hill.
5. Foaster A.S. and Giffad E.M. 1962 *Comparative Morphology of Vascular Plants.* Allied Pacific Pvt. Ltd. Bombay.
6. Henry and Chandra Bose 2001 *An Aid to the International Code of Botanical Nomenclature.* Botanical Survey of India. Coimbatore.
7. Heywood V.H. 1967. *Plant Taxonomy.* London: Edward Arnold.
8. Hill A.F. 1982. *Economic Botany.*: Mc Graw Hill ,New York.
9. Jain S. K. 1981. *Glimpses of Indian Ethnobotany.*: Oxford and IBH. New Delhi
10. Jain S. K. 1987. *A Manual of Ethnobotany.* Jodhpur Scientific Publishers.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
<b>ANGIOSPERM SYSTEMATICS AND FLORAL MORPHOLOGY</b>				
1	Session 1	Types of flower – Hypogyny, Perigyny and Epigyny, Symmetry of flowers.	Presentation/Chalk and Board	
2.	Session 2	Aestivation types; Placentation types	Presentation/Chalk and Board	
3	Session3	Floral Diagram and Floral Formula with examples for actinomorphic, zygomorphic, Monochlamydeae and Monocot flowers	Presentation/Chalk and Board	
4	Session 4	Aim, Scope and Significance, identification, field inventory, Monographs	Presentation/Chalk and Board	
5	Session 5	Types of Classification- Artificial (Brief account)	Presentation/Chalk and Board	
6	Session 6	Natural – Bentham and Hooker (Detailed account) and Phylogenetic (Brief account)	Presentation/Chalk and Board	
7	Session 7	Binomial Nomenclature, ICBN- Brief account	Presentation/Chalk and Board	
8	Session 8	Interdisciplinary approach in Taxonomy- Cytotaxonomy and Chemotaxonomy	Presentation/Chalk and Board	
9	Session 9	Palynology, Phylogeny and Molecular Systematic	Presentation/Chalk and Board	
10	Session 10	Herbarium technique- Preparation of herbarium, their preservation.	Assignment	

11	Session 11	Important herbaria, Botanical Garden and BSI	Assignment	
12	Session 12	Concept of eflora and other online groups that enumerate plant diversity	Presentation/Chalk and Board	
13	Session 13	Important flora works of India	Presentation/Chalk and Board	
14	Session 14	Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Annonaceae, Nymphaeaceae, Malvaceae, Sterculiaceae, Rutaceae, Meliaceae, Anacardiaceae	Presentation/Chalk and Board	
15	Session 15	Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Leguminosae (Mimosaceae, Caesalpiniaceae and Fabaceae), Combretaceae, Myrtaceae, Cucurbitaceae, Apiaceae, Rubiaceae	Presentation/Chalk and Board	
16	Session 16	Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Compositae (Asteraceae), Sapotaceae, Apocynaceae, Asclepiadaceae,	Presentation/Chalk and Board	

		Solanaceae, Convolvulaceae, Scrophulariaceae		
17	Session 17	Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Acanthaceae, Verbenaceae, Lamiaceae (Labiatae), Amaranthaceae, Euphorbiaceae	Presentation/Chalk and Board	
18	Session 18	Study the following families of Bentham and Hooker's System with special reference to their morphological and floral characters. Orchidaceae, Liliaceae, Arecaceae, Graminae (Poaceae)	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
19	Session 19	Preparation of floral formula from floral description. Identification of aestivation and placentation types.	Laboratory Demonstration	
20	Session 20	Identify the families mentioned in the syllabus by noting their key, vegetative and floral characters. Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one	Laboratory Demonstration	



		flower from each family.		
21	Session 21	Study the finished products of plants mentioned in the syllabus of economic botany with special reference to the morphology, botanical name and family. Prepare herbarium of 25 plants with field notes.	Laboratory Demonstration	
22	Session 22	Conduct field work for a minimum of 5 days under the guidance of a teacher Identify and describe the ethnobotanical uses of the items mentioned in the syllabus.	Laboratory Demonstration	
<b>ECONOMIC BOTANY</b>				
23	Session 23	Study of the following groups of plants based on their uses with special reference to the botanical name, family and morphology of the useful part Cereals- Rice, Wheat Millets- Ragi Pulses- Green gram, Bengal gram, Black gram Sugar yielding plants – Sugarcane Fruits:- Apple, Pineapple, Orange, Mango and Banana Vegetables:- Bittergourd, Ladies finger, Carrot and Cabbage. Timber yielding plants:- Teak wood and Jack wood	Presentation/Chalk and Board	

		Beverages- Tea, Coffee		
24	Session 24	<p>Study of the following groups of plants based on their uses with special reference to the botanical name, family and morphology of the useful part</p> <p><b>Fibre yielding plants-</b> Coir, Jute, Cotton  <b>Oil yielding plants-</b> Ground nut, Gingelly  <b>Rubber yielding plants-</b> Para rubber  <b>Gums and Resins-</b> White damer, Gum Arabic, Asafoetida  <b>Spices –</b> Cardamom, Pepper, Cloves , Ginger  <b>Insecticide yielding Plants-</b> Tobacco and Neem</p>	Presentation/Chalk and Board	
25	Session 25	<p>Study of the following plants used in daily life by tribals and village folks for Food, Shelter and Medicine</p> <p><b>Food :-</b> <i>Artocarpus, Corypha, Phoenix</i>  <b>Shelter -</b> <i>Bambusa, Ochlandra and Calamus</i></p>	Presentation/Chalk and Board	
26	Session 26	<p>Study of the following plants used in daily life by tribals and village folks for Food, Shelter and Medicine</p> <p><b>Medicine -</b> <i>Curcuma, Trichopus zeylanicus and Alpinia galanga</i></p>	Presentation/Chalk and Board	

**SEMESTER 5**  
**ENVIRONMENTAL SCIENCE AND ECOTOURISM (2015-16)**

**COURSE OUTCOMES:**

Students will develop an insight in the significance of environmental science.

This course will help create responsible citizens with values inculcate on conservation of natural resources and prevention of pollution.

Students will develop an ability to design novel mechanism for the sustainable utilization of natural resources.

A thorough understanding of the nature and interactions of populations in the ecosystem.

Students will have a thorough knowledge on structure and function of the ecosystems, various movements in the protection of nature and natural resources and extent of the total biodiversity and their conservation.

They will have acquaintance with various environmental laws in India.

They develop ability to assess the positive and negative impacts of Ecotourism and its role in the sustainable utilization of resources for tourism.

**Basic Reference**

1. Ahmedullah, M. & Nayar, M.P 1987. *Endemic Plants of the Indian Region*. Botanical Survey of India, Calcutta.
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3. Amal Raj S. *Introduction to Environmental Science & Technology*; Laxmi Publications Pvt. Ltd., New Delhi.
4. Asthana D.K. & Meera Asthana. 2006. *A Text Book of Environmental Studies* S. Chand.
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6. Bharucha, Erach 2003. *The Biodiversity of India*. Mapin Publishing Co., New Delhi
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8. Champion, H. G. 1936. *A Preliminary Survey of Forests of India and Burma*. Ind. For. Rec. (n.s.) 1: 1-236.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
<b>ENVIRONMENTAL SCIENCE</b>				
1	Session 1	Introduction, relevance and scope, public awareness	Presentation/Chalk and Board	
2.	Session 2	Types of resources-renewable and non renewable Forest resources: Timber extraction, mining, dams, over exploitation, deforestation, MFP (minor Forest products), Joint Forest Management (JFM), Rights of Tribals to forests.	Presentation/Chalk and Board	
3	Session3	Water resources: surface and ground water, drinking water, dams-benefits and problems, conflict over water, Rain water harvesting, Water shed conversation, importance of hills and mountains in water conservation	Presentation/Chalk and Board	
4	Session 4	Food resources: major food crops in India. Causes of food shortage. Food security, world food problems.	Presentation/Chalk and Board	
5	Session 5	Energy resources: Energy plantation, - Jatropha, Wind energy and Solar energy Land resources: Land use, land	Presentation/Chalk and Board	

		degradation, desertification, EFL( Ecologically Fragile Land), Ecological sensitive area		
6	Session 6	Conservation of Biodiversity, ecological footprints, umbrella species and keystone species conservation.	Presentation/Chalk and Board	
7	Session 7	Structure and function of ecosystem	Presentation/Chalk and Board	
8	Session 8	Ecosystem components- abiotic and biotic	Presentation/Chalk and Board	
9	Session 9	Productivity – primary and secondary- gross and net productivity	Presentation/Chalk and Board	
10	Session 10	Decomposition in nature, homeostasis in ecosystem	Presentation/Chalk and Board	
11	Session 11	Ecological energetics: energy flow, trophic levels, food chain and food web, ecological pyramids	Assignment	
12	Session 12	Nutrient cycles: Biogeochemical cycles of C, N and S.	Presentation/Chalk and Board	
13	Session 13	Population: size, density, natality, mortality.	Presentation/Chalk and Board	
14	Session 14	Community characteristics: Species diversity and species richness, dominance, growth forms and structure, trophic structure	Presentation/Chalk and Board	

15	Session 15	Association of communities: plant association, ecotypes, ecotone, edge effect, ecological indicators.	Presentation/Chalk and Board	
16	Session 16	Ecological succession: types of succession, process – migration, ecesis, colonization, stabilization and climax community; hydrosere, xerosere, lithosere	Presentation/Chalk and Board	
17	Session 17	Ecological complexes and factors affecting plants growth and response: Climatic factors: temperature and pressure; water - precipitation, humidity, soil water holding capacity; light - global radiation	Presentation/Chalk and Board	
18	Session 18	Topographic factors: altitude and aspects	Presentation/Chalk and Board	
19	Session 19	Edaphic factors - profile and physical and chemical properties of soil Biotic factors: interactions – positive and negative.	Presentation/Chalk and Board	
20	Session 20	Species – ecosystem interaction: Habitat, ecological niche, microclimate	Assignment	
21	Session 21	Adaptation of plants to environment: To Water- Xerophytes, Hydrophytes; Temperature – thermo periodicity,	Presentation/Chalk and Board	

		vernalization; light – photoperiodism, heliophytes, sciophytes; salinity – halophytes, mangroves		
22	Session 22	Definition and general introduction	Presentation/Chalk and Board	
23	Session 23	Air pollution: Causes and sources, types of pollutants-particulates-aerosol, mist, dust, smoke, fume, plume, fog, smog. Effect of air pollution on plants and animals, Bhopal Gas Tragedy.	Assignment	
24	Session 24	Water pollution: Sources and types of pollutants. Water quality standards, water quality assessment. Ground water pollution-blue baby syndrome. Cycling of heavy metals, hydrocarbons. Eutrophication, BOD, Minamata disease.	Assignment	
25	Session 25	Soil pollution: Causes and sources-waste dumps, municipal wastes, agrochemicals, mining, solid waste management-vermi composting.	Presentation/Chalk and Board	
26	Session 26	Noise pollution: Sources, standards and measurements, effect on health, control techniques. Thermal pollution: Sources and effects, management	Presentation/Chalk and Board	
27	Session 27	Nuclear hazards: Sources and impacts, management, Chernobyl incident EIA: Environmental Impact Assessment	Presentation/Chalk and Board	

		in polluted areas		
28	Session 28	Climate change, global warming and green house gases, IPCC, Acid rain	Presentation/Chalk and Board	
29	Session 29	Ozone layer depletion, nuclear accidents and nuclear holocaust	Presentation/Chalk and Board	
30	Session 30	Environment (protection) Act, 1986, (2) Air (Prevention and control of pollution) Act, 1981, (3) Water (Prevention and control of pollution) Act, 1974, (4) Wildlife (protection) Act, 1972, (5) Forest (Conservation) Act, 1980 (briefly)	Presentation/Chalk and Board	
31	Session 31	Endemism: Definition-types-factors. Hotspot of endemism-hotspots in India. IUCN-threat categories. Red data book., Western Ghats as the hottest spot and its conservations.	Presentation/Chalk and Board	
32	Session 32	Biodiversity loss: Causes and rate of biodiversity loss, extinction-causes. Alien species, negative and positive impacts	Presentation/Chalk and Board	
33	Session 33	Conservation efforts: Rio Earth Summit, Agenda 21, Kyoto protocol, COP 15(15th Conference of the Parties under the U N Framework Convention on Climate Change), IPCC (Inter Governmental Panel for Climate Change) and its contribution	Presentation/Chalk and Board	
34	Session 34	Conservation strategies and efforts in India and Kerala, In situ and ex situ conservation	Presentation/Chalk and Board	



		methods. Role of NGOs in biological conservation		
35	Session 35	Organizations: BNHS, WWF, CSE, NEERI, , MoEF, Green Peace, Chipko	Presentation/Chalk and Board	
36	Session 36	Famous contributors of Ecology in India: Salim Ali, M.S. Swaminathan, Madhav Gadgil, M.C. Mehta, Anil Agarwal, Medha patkar, John C. Jacob, Sunderlal Bahuguna	Presentation/Chalk and Board	
37	Session 37	Definition, concept, introduction, history, relevance and scope.	Presentation/Chalk and Board	
38	Session 38	Components of ecotourism: Forms and types of ecotourism in India and Kerala	Presentation/Chalk and Board	
39	Session 39	Ecotourism resources- biological, historical, cultural, and geographical.	Presentation/Chalk and Board	
40	Session 40	Ecotourism centers in Kerala. Positive and negative impacts of ecotourism	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
41	Session 41	Estimation of CO <sub>2</sub> , Cl, and salinity of water samples (Titremetry) Determination of pH of soil and water Assessment of diversity, abundance,	Laboratory Demonstration	

		and frequency of plant species by quadrat method (Grasslands, forests)		
42	Session 42	<p>Study of the most probable number (MPN) of coliform bacteria in water samples</p> <p>EIA studies in degraded areas (Sampling – line transect, Quadrat)</p> <p>Visit to any forests types including grasslands and preparation of the list of Rare and threatened (R&amp;T) plants (no collection of specimens)</p>	Laboratory Demonstration	
43	Session 43	<p>Collection, identification and preparation of the list of exotic species in the locality.</p> <p>Identification of pollutant to respective pollution types.</p> <p>Study of anatomical, morphological, physiological adaptation of plants to the environment (Xerophytic, Hydrophytic, Epiphytic, Halophytic).</p>	Laboratory Demonstration	

		Collection and recording of rain data by using simple rain gauge.		
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**SEMESTER 5**  
**GENETICS AND PLANT BREEDING (2015-16)**

**COURSE OUTCOMES:**

This enables the student a detailed basic understanding about genetics.

Students will be able to understand inheritance pattern of nuclear and extra nuclear genes.

It also enables the student to understand the basics in plant breeding.

They will be equipped with different methods of crop improvement.

**Basic Reference**

1. Gardner, E.J. and Snustad D.P. (1984) *Principles of Genetics*. John Wiley, New York.
2. Gerald Karp 1985. *Cell Biology*. Mc Graw Hill co.
3. Gupta P.K ,1994. *Genetics* Rastogi Pub.
4. John Ringo, 2004. *Fundamental Genetics*. Cambridge University Press India Pvt. Ltd.
5. Sadhu M.K. 1996. *Plant propagation*. New age international publishers, N. Delhi.
6. Schilletter J.C., Richey H.W. 1999. *Text Book of General Horticulture*. Biotech Books, New Delhi.
7. Shukla R.S., Chandel P.S. 2004. *Cytogenetics Evolution and Plant breeding*. S. Chand&Co.Ltd New Delhi.
8. Swanson C.P. 1957. *Cytology and Genetics*. Englewood cliffs, New York.
9. Peter Sunstard & Michael. J. Simmons 2003, *Principles of Genetics* (3<sup>rd</sup> edition) John Wiley & Sonc, Inc.
10. Singh B.D., 1983, *Plant breeding*. Kalyani Publishers, Ludhiana.

1.	Date	Topic	Method	Remarks/Reference
<b>GENETICS</b>				
1	Session 1	Origin of a new branch of Biology-	Presentation/Chalk and Board	

		Genetics- A short life sketch of Gregor Mendel		
2.	Session 2	Basic laws governing genetics, Mendelian ratios	Assignment	
3	Session3	Growth of Genetics- post Mendelian period- modified Mendelian ratios	Presentation/Chalk and Board	
4	Session 4	Incomplete dominance-flower color in <i>Mirabilis</i> : Interaction of genes- comb pattern in poultry (9:3:3:1)	Assignment	
5	Session 5	Epistasis- recessive- coat color in mice (9:3:4)	Presentation/Chalk and Board	
6	Session 6	Dominant epistasis- fruit color in summer squash (12:3:1)	Assignment	
7	Session 7	Complementary genes- flower color in <i>Lathyrus</i> (9:7)	Presentation/Chalk and Board	
8	Session 8	Multiple alleles- general account: ABO blood groups in man	Presentation/Chalk and Board	
9	Session 9	Co dominance; self sterility in <i>Nicotiana</i>	Presentation/Chalk and Board	
10	Session 10	Quantitative characters- polygenic inheritance	Presentation/Chalk and Board	
11	Session 11	Continuous variation- skin colour inheritance in man; ear size in maize	Presentation/Chalk and Board	

12	Session 12	Linkage and crossing over- importance of linkage, linkage and independent assortment.	Presentation/Chalk and Board	
13	Session 13	Complete and incomplete linkage	Presentation/Chalk and Board	
14	Session 14	Crossing over- general account, cytological basis of crossing over- two point test cross; determination of gene sequences	Presentation/Chalk and Board	
15	Session 15	Interference and coincidence; mapping of chromosomes.	Presentation/Chalk and Board	
16	Session 16	Sex determination- sex chromosomes and autosomes- chromosomal basis of sex determination; XX-XY, XX-XO mechanism; genic balance theory of sex determination in Drosophila	Presentation/Chalk and Board	
17	Session 17	hormonal theory of sex determination; sex chromosomal abnormalities in man- Down's syndrome, Klinefelter's syndrome, Turner's syndrome	Presentation/Chalk and Board	
18	Session 18	Sex linked inheritance- eye color in Drosophila	Presentation/Chalk and Board	
19	Session 19	Haemophilia in man; Y-linked inheritance	Presentation/Chalk and Board	

20	Session 20	Extra nuclear inheritance- general account- maternal influence		
21	Session 21	Plastid inheritance in <i>Mirabilis</i> , kappa particle in <i>Paramecium</i>	Presentation/Chalk and Board	
22	Session 22	Population genetics-Hardy Weinberg law	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
23	Session 23	Students are expected to work out and record the problems in: 1. Monohybrid, dihybrid cross and back crosses. 2. All types of modified Mendelian ratios mentioned in the syllabus.	Chalk and Board	
<b>PLANT BREEDING</b>				
24	Session 24	An Introduction to and objectives of plant breeding	Presentation/Chalk and Board	
25	Session 25	Plant introduction- procedure of plant introduction, quarantine regulations, acclimatization- agencies of plant introduction in India, major achievements.	Assignment	
26	Session 26	Selection- mass, pureline, clonal- genetic basis of selection- some achievements	Presentation/Chalk and Board	
27	Session 27	Semi dwarf wheat and Rice	Presentation/Chalk and Board	

28	Session 28	Hybridization- Introduction, history, objectives and procedure- choice of parents, evaluation of parents, emasculation procedures such as hand method, succession method, hot water method, alcohol method and cold treatment methods	Presentation/Chalk and Board	
29	Session 29	Intergeneric, interspecific and intervarietal hybridization with examples- composite and synthetic varieties- heterosis in plant breeding	Presentation/Chalk and Board	
30	Session 30	Inbreeding depression; genetics of heterosis and inbreeding depression	Presentation/Chalk and Board	
31	Session 31	Single cross, pedigree method, bulk population method, multiple cross, back cross, polyploidy breeding, male sterility in plant breeding	Presentation/Chalk and Board	
32	Session 32	Use of apomixis in plant breeding	Presentation/Chalk and Board	
33	Session 33	Mutation breeding- methods- achievements in India	Assignment	
34	Session 34	Breeding for pest, disease and stress resistance	Presentation/Chalk and Board	
35	Session 35	Modern tools for plant breeding	Presentation/Chalk and Board	
36	Session 36	Genetic Engineering and products of genetically modified crops	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
37	Session 37	Emasculation and bagging	Laboratory Demonstration	



		2. Comparison of percentage of seed germination and the effect of any one chemical on the rate of elongation of radicle in any three crop seeds		
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**SEMESTER 5**  
**CELL MOLECULAR BIOLOGY AND EVOLUTION (2015-16)**

**COURSE OUTCOMES:**

This course enables the student to understand the ultrastructure in submicroscopic and molecular level.

Students will have a better understanding about the origin, concept of continuity and complexity of life activities.

It also enables the student to understand different cytological aspects of growth and development.

They would know that the DNA is the basis of heredity and variation.

Students will be able develop their understanding around the concept of evolution as the basis of biodiversity.

**Basic Reference**

1. Aggarwal SK, 2009. Foundation Course in Biology, 2nd Edition, Ane Books Pvt. Ltd.
2. Avinash & Kakoli Upadhyay 2005. *Basic Molecular Biology*. Himalaya Publishing House, Mumbai.
3. Cohn, N.S.,1964. *Elements of Cytology*. Brace and World Inc., New Delhi.
4. Darlington, C.D, 1965. *Cytology*, Churchill, London.
5. Darnel, J. Lodish, Hand Baltimore, D, 1991. *Cell and molecular biology*. Lea and Fibiger, Washington.
6. De Robertis, E.D.P. and Robertis, E.M.P ,1991. *Cell and molecular biology* Scientific American books.
7. Dobzhansky, B, 1961. *Genetic and origin of species*, Columbia university Press New York.
8. Gardner, E.J. and Snustad, D.P. 1984, *Principles of Genetics*. John wiley, New York.
9. Gerald Karp, 1985. *Cell Biology*,2006. Mc Graw Hill company.
10. Gupta, P.K. *Genetics*, Rastogi Publications.
11. Jha AP 1993 *Genes and evolution* Macmillan, India Ltd.
12. Lewin, B, 1999. *Genes*, Oxford University Press, New York
13. Lewis,W.H, 1980. *Polyploidy*. Plenum Press, New York
14. Paul Ames Moody 2002- *Introduction to Evolution* , Kalyani Publishers , New Delhi

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
<b>CELL BIOLOGY</b>				
1	Session 1	Historical account of cell Biology, Cell theory, Protoplasm theory	Assignment	
2.	Session 2	The physio-chemical nature of plasma membrane and cytoplasm Eukaryotic, Prokaryotic cell.	Assignment	
3	Session 3	The ultra-structure of plant cell with brief description and function of the following organelles: Endoplasmic reticulum, Plastids, Mitochondria, Ribosomes, Dictyosome	Presentation/Chalk and Board	
4	Session 4	The ultra-structure of plant cell with brief description and function of the following organelles: Microbodies, lysosomes. Vacuole and cell sap	Presentation/Chalk and Board	
5	Session 5	The ultra-structure of plant cell with brief description and function of the following organelles: Nucleus - ultra structure, nucleolus structure and function.	Presentation/Chalk and Board	
6	Session 6	Morphology - fine structure Dupraw	Assignment	

		model - Nucleosome model – chemical organization of nucleosome – nucleoproteins, karyotype and idiogram		
7	Session 7	Special type of chromosomes - salivary gland, Lampbrush and B chromosome	Presentation/Chalk and Board	
8	Session 8	Cell cycle, mitosis, meiosis: significance of mitosis and meiosis. Change in number of chromosomes -Aneuploidy and Euploidy	Presentation/Chalk and Board	
9	Session 9	Change in the structure of chromosomes - Chromosomal aberrations deletion, duplication, inversions and translocations.	Presentation/Chalk and Board	
10	Session 10	Meiotic behaviour of chromosomes. Lagging of chromosomes and Chromosome Bridge	Presentation/Chalk and Board	
11	Session 11	Spontaneous and induced. Mutagens- Physical and Chemical mutagens.	Presentation/Chalk and Board	
12	Session 12	Chromosomal and point mutations. Molecular mechanism of mutation - Transition, Transvesion and Substitution.	Presentation/Chalk and Board	
13	Session 13	Stem cells; definition, sources and applications	Presentation/Chalk and Board	

**PRACTICALS**

14	Session 14	<ol style="list-style-type: none"> <li>1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.</li> <li>2. Study the Mitotic Index of onion root tip cells</li> <li>3. Study of meiosis in any flower bud by smear preparation of PMC's</li> </ol>	Laboratory Demonstration	
15	Session 15	<ol style="list-style-type: none"> <li>4. Identification of Barr body</li> <li>5. Identification of salivary gland chromosome.</li> <li>6. Identify and study photographs and diagrams of cell division anomalies like lagging chromosomes, chr. bridge, aneuploidy, polyploidy. study the chromosomal patterns/ Karyotype in auto-, allo-, and aneuploids</li> </ol>	Laboratory Demonstration	
<b>MOLECULAR BIOLOGY</b>				
16	Session 16	Nucleic acids - structure of DNA and RNA - basic features, alternate forms of DNA - types and structure of RNA	Presentation/Chalk and Board	
17	Session 17	Replication of DNA - Meselson-Stahl	Presentation/Chalk and Board	

		experiment - details of semiconservative replication of DNA		
18	Session 18	Gene expression - concept of gene, definitions - the central dogma	Assignment	
19	Session 19	Details of transcription in prokaryotes and eukaryotes	Presentation/Chalk and Board	
20	Session 20	RNA processing, details of translation - genetic code features		
21	Session 21	Control of gene expression - positive and negative control - operon model - lac operon	Presentation/Chalk and Board	
22	Session 22	trp operon -attenuation	Presentation/Chalk and Board	
23	Session 23	Genetic basis of cancer - oncogenes - tumor suppressor genes - metastasis	Chalk and Board	
EVOLUTION				
24	Session 24	Problems based on DNA, RNA and Proteins	Presentation/Chalk and Board	
25	Session 25	Introduction, Origin of life – biochemical origins of life, Progressive, Retrogressive, Parallel and Convergent evolution	Assignment	
26	Session 26	Theories of evolution - Lamarck's, Darwin's, Weismann's and De Vries.	Presentation/Chalk and Board	

27	Session 27	Reproductive isolation, Mutation, Genetic drift, Speciation	Presentation/Chalk and Board	
28	Session 28	Variation and evolution, hybridization and evolution, Polyploidy and evolution	Presentation/Chalk and Board	
29	Session 29	Mutation and evolution	Presentation/Chalk and Board	

**SEMESTER 5**  
**AGRIBASED ENTERPRISES OPEN COURSE (2015-16)**

**COURSE OUTCOMES:**

This course enables the student to understand business opportunities in plant sciences.

Students from other disciplines would generate a basic knowledge on agriculture and farming.

Students will develop a genuine interest in ornamental gardening, nursery management, floriculture and mushroom cultivation.

**Basic Reference**

1. Chandha.,K.L (2003) Handbook of Horticulture. ICAR. New Delhi.
2. George Acquiah. (2004) Horticulture – Principles and Practices. II Edn. Prentice Hall. India.
3. Gopal Chandha De. (2002) Fundamentals of Agronomy. Oxford and IBH Publishing House.
4. Hudson. T., Hartmann., Dale E. Kester. (2001) Plant Propagation, Principles and Practices. 6th Edn. Prentice Hall. India.
5. John J. (2012) Elements of Agribased Microenterprises, Bulbul Scientific Publishers, Kottayam.
6. Kalian Kumar De. (1996) Plant Tissue Culture. New Central Book Agency (P) Ltd.
7. Kaul, T.N. Biology and Conservation of Mushroom (2002) Oxford and IBH Publishing Co.
8. Kunte, Kawthalkar and Yawalker.(1997) Principles of Horticulture and Fruit Growing. Agri –Horticulture Co.
9. Neshamani, S. (2003) Pazhangal, Pazhavibhavangal (Malayalam). Kerala Bhasha Institute.
10. Pandey, R.K and S.K. Ghosh. (1996) A Hand Book on Mushroom Cultivation. Emkey Publications.

1.	Date	Topic	Method	Remarks/Reference
<b>CELL BIOLOGY</b>				
1	Session 1	Organic manures and fertilizers.	Assignment	
2.	Session 2	Composition of fertilizers – NPK content	Assignment	



		of various fertilizers		
3	Session 3	Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost.	Presentation/Chalk and Board	
4	Session 4	Preparation of compost –aerobic and anaerobic- advantages of both	Presentation/Chalk and Board	
5	Session 5	Vermicompost – preparation, vermiwash	Presentation/Chalk and Board	
6	Session 6	Biofertilizers – definition, types – Trichoderma, Rhizobium, PGPR	Assignment	
7	Session 7	Biopesticides – Tobacco and Neem decoction.	Presentation/Chalk and Board	
8	Session 8	Biological control. Sustainable agriculture	Presentation/Chalk and Board	
9	Session 9	Soil components. Preparation of potting mixture. Common Garden tools and implements. Methods of plant propagation – by seeds – advantages and disadvantages. Vegetative propagation – advantages and disadvantages. Natural methods of vegetative propagation.	Presentation/Chalk and Board	
10	Session 10	Artificial methods – cutting, grafting, budding and layering. Use of growth regulators for rooting. Micropropagation	Presentation/Chalk and Board	

		by tissue culture. Gardening – Types of garden – ornamental, indoor garden, kitchen garden, vegetable garden for marketing.		
11	Session 11	Rockery and artificial ponds. Ornamental garden designing – garden components – flower beds, borders, hedges, edges, drives and paths, garden adornments. Lawn - preparation by seeds, by transplanting seedling and by turfing.	Presentation/Chalk and Board	
12	Session 12	Bonsai preparation. Pruning of plants. Types of Nurseries – Management aspects and Maintenance. Irrigation Methods: surface, drip and mist chamber.	Presentation/Chalk and Board	
13	Session 13	Plant growth structures – advantages of green house, polyshed, fernery and orchidarium. Packaging of fruits, vegetables, nursery products and flowers.	Presentation/Chalk and Board	
14	Session 14	Prospects and problems of floriculture in Kerala, Scope of floriculture, especially anthurium, orchids and jasmine in Kerala	Presentation/Chalk and Board	
15	Session 15	Common cut flowers- Rose, Gerbera, Gladiolus, Aster, Chrysanthemum,	Presentation/Chalk and Board	

		Carnation, Anthurium, Liliun		
16	Session 16	Orchids; Common leaves in flower arrangement – Cyprus, Podocarpus, Asparagus, palms, cycads, ferns	Presentation/Chalk and Board	
17	Session 17	Flower arrangement types – western, eastern (Japanese), modern, wases, flower holders, floral foam, dry flower arrangement	Presentation/Chalk and Board	
18	Session 18	Significance of Mushrooms, General outline of life cycle. Types of mushrooms - button mushroom, oyster mushroom and milky mushroom, poisonous mushroom	Assignment	
19	Session 19	Methods of identification. Spawn – isolation and preparation. Cultivation of oyster and milky mushrooms – using paddy straw and saw dust by polybag.	Presentation/Chalk and Board	
20	Session 20	Farm design and control of pests and diseases. Value added products from mushroom – pickles, candies, dried mushrooms		
21	Session 21	Protoplasm- basic structure and function	Presentation/Chalk and Board	

		of plant cell concept of totipotency- differentiation and dedifferentiation.		
22	Session 22	Infra structure of a tissue culture laboratory. Solid and liquid media- composition and preparation.	Presentation/Chalk and Board	
23	Session 23	Sterilization- dry, wet and filter sterilization.	Chalk and Board	
24	Session 24	Explant- inoculation and incubation techniques. Callus induction- organogenesis and embryogenesis	Presentation/Chalk and Board	
25	Session 25	Transplanting, hardening, package and transportation of tissue cultured plantlets.	Assignment	
26	Session 26	Funding Agencies and self employment schemes	Presentation/Chalk and Board	
27	Session 27	Procedure to get financial support, special scheme for women empowerment	Presentation/Chalk and Board	
28	Session 28	1. Prepare a chart showing the NPK composition of minimum 6 manures and fertilizers. 2. Identification and familiarization of the following organic manures- cow dung (Dry), Coconut cake, Vermicompost, neem cake, Organic mixture, Bone meal.	Laboratory/Demonstration	

		<p>3. Preparation of potting mixture.</p> <p>4. Make a Vermicompost pit /pot in the campus/ house of the student.</p> <p>5. Familiarization of common garden tools and implements.</p> <p>6. Estimation of germination percentage of seeds</p> <p>7. Demonstrate the effect of a rooting hormone on stem cutting.</p>		
29	Session 29	<p>8. Demonstration of T budding, epicotyle grafting and air layering on live plants</p> <p>9. Familiarization of garden components from photographs</p> <p>10. Familiarization of different mushrooms and preparation of a polybag of Pleurotus using straw/sawdust</p> <p>11. Visit to a well established tissue culture lab, nursery and mushroom cultivation unit.</p> <p>12. Familiarization of common cut flowers in Kerala</p> <p>13. Fresh cut flower arrangement</p> <p>14. Preparation and arrangement of dry flowers</p> <p>15. Interaction with funding agencies</p>	Laboratory/Demonstration	




**SEMESTER 6**  
**PLANT PHYSIOLOGY AND BIOCHEMISTRY (2015-16)**

**COURSE OUTCOMES:**

This course will create knowledge and understanding of basic mechanisms of various physiological processes related to plant life.

Insight in to the water relationships and effect of stress in plants.

A thorough understanding of most vital plant physiological functions like photosynthesis and respiration.

Ability to critical thinking and logical reasoning of various plant physiological mechanisms in real life situations.

Knowledge on both theory and practical aspects of plant growth regulators.

Acquaintance with basic skills and techniques related to plant physiology.

Perception on structure and importance of the bio molecules associated with plant life.

**Basic Reference**

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2. Dayananda, B. (1999). Experiments in Plant Physiology, Narosa Publishing House, New Delhi.
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4. Hopkins, W.G. 1999. Introduction to Plant Physiology. John Wiley and sons, New York.
5. Jain J.L. Sanjay Jain & Nitin Jain 2005. Fundamentals of Biochemistry. S. Chand & Company Ltd., New Delhi.
6. Jain, V. K. 1996. Fundamentals of Plant Physiology, S Chand and Company, Delhi .
7. Kochar, P.L. 1964. A Text Book of Plant Physiology, Atmaram & Sons, Delhi.
8. Lehninger A.L.1961. Biochemistry, Lalyan Publishers, Ludhiana.
9. Leopald, A.C. and Kriedemann, P.E. Plant Growth and Development. Tata McGraw Hill, New Delhi.
10. Malik, P.C. 1980. Plant Physiology, Kalyani Publishers, New Delhi.
11. Nelson, D.L. and Cox, M.M. 1993. Principles of Biochemistry. MacMillan Worth Publications.



<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
1	Session 1	Physical aspects of absorption-Diffusion, imbibition, osmosis, OP, DPD, TP, WP, Concept of Water potential, matrix potential, pressure potential.	Presentation/Chalk and Board Assignment	
2.	Session 2			
3	Session 3			
4	Session 4	Absorption of water-active & passive, Ascent of sap-cohesion adhesion theory, Transpiration-types-mechanism-theories-(starch-sugar, proton-K <sup>+</sup> ion exchange)-significance – antitranspirants, Guttation	Presentation/Chalk and Board	
5	Session 5			
6	Session 6			
7	Session 7	Essential and non-essential elements-macro& micro- role- deficiency symptoms. Absorption of minerals– active & passive-ion exchange, carrier concept.	Presentation/Chalk and Board	
8	Session 8			
9	Session 9			
10	Session 10	History - Photosynthetic pigments, photo excitation- Fluorescence, Phosphorescence - Absorbtion and action spectra, Red drop and Emerson enhancement effect	Presentation/Chalk and Board	
11	Session 11			
12	Session 12	Concept of photo systems, Cyclic & Non-Cyclic photophosphorylation	Presentation/Chalk and Board	
13	Session 13			

14	Session 14	Carbon assimilation pathways-C3, C4, CAM- Photorespiration –factors affecting photosynthesis.		
15	Session 15			
16	Session 16	Pathway-phloem transport-mechanism-pressure flow-phloem loading and unloading.	Presentation/Chalk and Board	
17	Session 17			
18	Session 18	Aerobic and Anaerobic, Glycolysis, Krebs cycle, Electron transport system & Oxidative phosphorylations,	Presentation/Chalk and Board	
19	Session 19			
20	Session 20			
21	Session 21			
22	Session 22	ATPases - chemi osmotic hypothesis-RQ –significance-factors affecting respiration.	Presentation/Chalk and Board	
23	Session 23			
24	Session 24			
25	Session 25			
26	Session 26	Allelochemicals- herbivory	Assignment	
27	Session 27	Physiological effects and practical application of hormones-Auxins, Giberillins, Cytokinins, ABA, ethylene.		
28	Session 28	Physiology of flowering–phytochrome-photoperiodism-vernalisation	Presentation/Chalk and Board	
29	Session 29	Abiotic - concept of plant responses to water, salt and temperature stresses; Biotic- pathogens	Assignment	
30	Session 30			

31	Session 31	Physical and chemical properties of water, Acid and bases, pH definition, significance, measurement, pH indicators, buffer action, pH and life	Presentation/Chalk and Board/Assignment	
32	Session 32			
33	Session 33	Carbohydrates- structure and role of mono-di & poly-saccharides-common sugars seen in plants Proteins-peptide bond-essential and non-essential amino acids-primary structure-physiologically important proteins.	Presentation/Chalk and Board/Assignment	
34	Session 34			
35	Session 35			
36	Session 36			
37	Session 37			
38	Session 38	Lipids - general features and their roles - fatty acid types and structure - fatty acid derivatives- fats and oils, structure and functions - compound lipids	Presentation/Chalk and Board	
39	Session 39			
40	Session 40			
41	Session 41	Nomenclature, characteristics mechanism and regulation of enzyme action, enzyme kinetics, factors affecting enzyme action	Presentation/Chalk and Board	
42	Session 42			
43	Session 43			
<b>PRACTICALS</b>				
44	Session 43	1. Determination of osmotic pressure of plant cell sap by plasmolytic method. 2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes. 3. Separation of plant pigments by thin layer chromatography (TLC) and paper chromatography.	Laboratory	
45	Session 43			
46	Session 43			
47	Session 43			
48	Session 43			

		<p>4. Measurement of photosynthesis by Willmott's bubbler/any suitable method.</p> <p>5. Estimation of plant pigments by colorimeter.</p>		
49	Session 43	<p>General test for carbohydrates- Molischs test, Benedicts's tests, Fehling's test.</p> <p>2. Colour test for starch – Iodine test.</p> <p>3. Colour tests for proteins in solution. Biuret test, Million's test, Ninhydrin test.</p> <p>4. Detect the presence of any three major organic compounds in the given food stuff/material viz. reducing /non-reducing sugar/fat proteins/starch.sucrose.</p> <p>5. Action of various enzymes in plant tissues: peroxidases, dehydrogenase.</p> <p>6. Estimation of protein using colorimeter.</p>	Laboratory	
50	Session 43			
51	Session 43			
52	Session 43			

## SEMESTER 6

### Perspectives of Science, Methodology and General Informatics (2015-16)

#### COURSE OUTCOMES:

This enables the student a detailed basic understanding on principles of science and research methodology.

Students will be able to understand different steps involved in research methodology.

It also enables the student to understand the basics in general informatics.

They will be equipped with using different application in computer related to education.

They will be able to prepare a dissertation using MS office.

They will be able to prepare power point presentations of research works.

#### Basic Reference

1. Agarwal SK, 2008, *Foundation course in Biology*, Ane Books Pvt.Ltd., New Delhi.
2. Collins H. and T Pinch 1993 *The Golem: What every one should know about science*, University Press, Cambridge.
3. ColRuxton R, S N. Colegrave.2006. *Experimental Design for the life Science*, Oxford University Press
4. Cotteril R, 2002. *Biophysics an Introduction* .John Wiley and Sons.
5. Dany Spencer Adams, 2004. *Lab Math* I.K. International Pvt. Ltd. New Delhi.
6. David A Micklos, Greg A Freyer 2003. *DNA science: A first course*. Cold Spring Harbor Laboratory Press.
7. Day R.A, 1998. *How to Write and Publish a Scientific Paper*, University Press Cambridge.
8. Dwivedi J .N and R.B Singh (1990) *Essentials of Plant Techniques* – Scientific Publishers, Jodhpur.
9. GW Stout, DJ Taylor,2008. *Biological Sciences*. NPO Green, University Press, Cambridge.
10. Harold C Bold, 1999. *The Plant Kingdom*. Prentice Hall of India Pvt. Ltd.
11. Holmes D Moody P and D.Dine 2006 , *Research Methods for the Biosciences* Oxford University Press
12. Holmes D Moody P and D.Dine 2006, *Research Methods for the Biosciences* Oxford University Press
13. Jeffrey A. Lee 2009; *The Scientific Endeavor Methodology and Perspectives of sciences*, Pearson

14. Johnson DA, 1940. *Plant Microtechnique*, McGraw Hill Co., New York.  
 15. Judson HF, 1979. *The eighth day of creation*. Simon Schuster, New York.  
 16. Krishnamurthy K.V (2004) *Advanced text book on biodiversity, principles and practice* IBH Pub Oxford.

1.	Date	Topic	Method	Remarks/Reference
1	Session 1	Introduction to science	Presentation/Chalk and Board	
2.	Session 2	-Steps in scientific methods - observation and thoughts - formulation of a hypothesis - designing of experiments - testing of hypothesis - formulation of theories		
3	Session 3	- Selection of a problem - Searching the literature - Selection of variables, study area, and a suitable design Necessity of units and dimensions	Presentation/Chalk and Board	
4	Session 4			
5	Session 5			
6	Session 6	Units of length, volume, area, concentration, temperature, pressure - Setting of hypothesis, Null-hypothesis and alternative hypothesis - Need of control, treatments and replication - Analysis, presentation and interpretation of data	Presentation/Chalk and Board	
7	Session 7			

		<ul style="list-style-type: none"> <li>- Testing of hypothesis, need of statistical tools</li> <li>- Examples of great experiments in life sciences</li> </ul>		
8	Session 8	<ul style="list-style-type: none"> <li>-An example of moving from a question to hypothesis and then to an experimental design</li> <li>-Contributions and the great experiments of Louis Pasteur, and Robert Koch</li> <li>-Ethics in science</li> </ul>		
9	Session 9	<ul style="list-style-type: none"> <li>- Introduction</li> </ul>	Presentation/Chalk and Board	
10	Session 10	<ul style="list-style-type: none"> <li>- Microscopy:- simple, compound, phase contrast, fluorescent, confocal and electron microscopes (working principle and application only)</li> <li>- Microtome:- rotary, sledge, cryotome (application only)</li> </ul>		
11	Session 11	<ul style="list-style-type: none"> <li>- Sectioning:- Hand sections, microtomy</li> </ul>	Presentation/Chalk and Board	
12	Session 12	<ul style="list-style-type: none"> <li>- Staining technique:- Principle of staining</li> </ul>		

		<p>Stains:- Safranin, Hematoxylin, Acetocarmine</p> <p>Vital stains: Purpose, Examples: Neutral red and Evan's blue</p> <p>Mordents : Purpose and examples</p> <p>Single staining and Double staining</p>		
13	Session 13	<ul style="list-style-type: none"> <li>- Mounting and Mounting Media, Purpose of mounting media, Glycerin, DPX, Canada balsam</li> <li>- Use of permanent whole mounts, permanent sections</li> <li>- Maceration</li> <li>- Smear and squash preparation</li> </ul>	Presentation/Chalk and Board	
14	Session 14			
15	Session 15	<ul style="list-style-type: none"> <li>- Principles and applications of colorimeter, spectrophotometer and centrifuge, Beer-Lambert's Law,</li> </ul>	Presentation/Chalk and Board	
16	Session 16			
17	Session 17	<ul style="list-style-type: none"> <li>- Separation methods :- chromatography; thin layer, paper, column (principle and applications only), electrophoresis; PAGE, Agarose</li> </ul>	Presentation/Chalk and Board	
18	Session 18			



		gel electrophoresis(Principle and applications only)		
19	Session 19	- pH:- concept of pH, methods to measure pH ; pH paper and pH meter,	Presentation/Chalk and Board	
20	Session 20			
21	Session 21	- Buffers:- definition, functions of buffers in biological systems, use of buffers in biological research, examples of commonly used buffers	Presentation/Chalk and Board	
22	Session 22			
23	Session 23	- Introduction, statistical terms and symbols - Sample:- concept of sample, sampling methods	Presentation/Chalk and Board	
24	Session 24			
25	Session 25	- Collection and representation of data, graphic representation of data( Line graph, bar diagram, Pie diagram & Histogram) - Measures of central tendency:- mean, mode, median	Presentation/Chalk and Board	
26	Session 26			
27	Session 27	- Measures of dispersion:- standard deviation, standard error - Distribution patterns:- normal distribution, binomial distribution	Presentation/Chalk and Board	
	Session 28			
	Session 29		Presentation/Chalk and Board	

Session 30	<ul style="list-style-type: none"> <li>- t-test :- introduction, uses, procedure</li> <li>- chi-square test:- introduction, uses, procedure</li> </ul>		
Session 31	<ul style="list-style-type: none"> <li>- Need for research</li> <li>- Types of research</li> <li>- Scientific literature, Books, Research Journals, Reputed National and International journals in life sciences, Research paper</li> <li>- INSDOC services</li> <li>- Laboratory Etiquette</li> <li>- Laboratory Hygiene</li> </ul>	Presentation/Chalk and Board	
Session 32			
Session 33	<p>Features of the modern personal computers and peripherals.</p> <p>-Internet as a knowledge repository, e-mail, search engines (Google,), study of educational sites related to life sciences (DNAi, Scitable) , academic search techniques, (Science direct and INFLIBNET)</p> <p>-Introduction to the use of information technology in teaching and learning</p>	Presentation/Chalk and Board	
Session 34			
Session 35			
Session 36	DOS – The basic concept of operating systems (Study of commands not required)	Presentation/Chalk and Board	
Session 37	MS-WINDOWS:- logging to windows, organizing files and folders, copying,	Presentation/Chalk and Board	

		moving, deleting and saving documents, installing software, installing hardware		
	Session 38	MS-WORD:- word processing using WORD, editing tools ( cut , copy, paste, ) formatting tools ( font, paragraph) use of spell check, inserting tables (draw), inserting graphs and pictures	Presentation/Chalk and Board	
	Session 39	MS-EXCEL:- Creating a worksheet, data entry, sorting (ascending and descending), use of statistical tools in EXCEL (SUM, MEAN, MODE, MEDIAN), preparation of graphs (bar diagram, pie chart and line graph)	Presentation/Chalk and Board	
	Session 40	MS-POWERPOINT:- Creating a presentation, Inserting tables, charts and pictures into slides, Use of animation tools	Presentation/Chalk and Board	
<b>PRACTICALS</b>				
	Session 41	1. Prepare CuSO <sub>4</sub> . H <sub>2</sub> O solution of different molarity using a stock solution	Laboratory/Demonstration	
	Session 42			
	Session 43	2. Determination of the area of different types of leaves using graph paper.		
	Session 44			
	Session 45	1. Maceration and identification of tracheary elements		
	Session 46			

Session 47	<ol style="list-style-type: none"> <li>Preparation of 0.1M sodium phosphate buffer (pH 6 and 7)</li> <li>Measurement of pH using pH meter</li> <li>Paper chromatography of plant pigments (demonstration)</li> <li>Electrophoresis of nucleic acids (demonstration)</li> <li>Column chromatography of plant pigments (demonstration)</li> <li>Determination of the concentration of a given solution of CuSO<sub>4</sub> using colorimetry</li> </ol>		
Session 48			
Session 49			
Session 50			
Session 51			
Session 52		<ol style="list-style-type: none"> <li>Collect numerical data and find out the central tendencies and prepare different types of graph mentioned in the syllabus</li> <li>Familiarize with situations requiring t-test, chi-square test</li> </ol>	
Session 53			
Session 54			
Session 55		<ol style="list-style-type: none"> <li>Gather information and pictures on a given topic using the internet. Make a list of the sites visited for the purpose</li> <li>Prepare a project report using MS-WORD based on the information and pictures gathered from the internet.</li> <li>Prepare a worksheet using a set of data collected and find out the SUM, MEAN, MEDIAN and MODE using EXCEL</li> </ol>	
Session 56			
Session 57			
Session 58			
Session 59			
Session 60			
Session 61			

		<p>4. Prepare suitable tables/ charts/graphs based on the data using EXCEL</p> <p>5. Prepare a powerpoint presentation based on the 1 &amp; 2 exercises</p>		
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**SEMESTER 6**  
**BIOTECHNOLOGY AND BIOINFORMATICS (2015-16)**

**COURSE OUTCOMES:**

This enables the student a detailed basic understanding on the fundamentals of Biotechnology and Bioinformatics.

Students will be able to understand various developments in biotechnology and potential applications.

It also enables the student to understand the basics in bioinformatics.

They will be equipped with use of computer in handling experimental data..

**Basic Reference**

1. Attwood TK & Parry, Smith DJ. 2003. *Introduction to Bioinformatics*. Pearson Education.
2. Balasubramanian, D. – Bryce CFA , Dharmalingam K. Green J, Kunthala Jayaraman, 2007. *Concepts in Biotechnology* – University Press India Pvt. Ltd.
3. Becker JM, Coldwell GA and Zachgo EA. 2007. *Biotechnology* – A Laboratory Course Academic Press.
4. Bhojwnis abd Razdan Mk 2000 *Plant Tissue Culture* – Theory and practice Elsevier India Pvt. Ltd.
5. Brown T.A. *Gene cloning and DNA analysis*. Black Well publishing.
6. Colin Ratledge and Bjorn Krishansen, 2008. *Basic Biotechnology*, Cambridge University Press.
7. Dixon R.A, 2003. *Plant Cell Culture*, IRC Press
8. Dubey R.C 2006. *A Text Book of Biotechnology* S.Chand and Company, New Delhi
9. Gupta PK. ,2006. *Biotechnology and Genomics*. Rastogi Publications.
10. Jogdand S.N. 1999. *Advances in Biotechnology*, Himalaya Publishers, Mumbai.
11. John E Smith 2006. *Biotechnology*, Cambridge University Press
12. Lewin. B. 2008 *Gene IX*. Jones and Barlett Publications.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
1	Session 1	Introduction – The concept of biotechnology, landmarks in biotechnology.	Presentation/Chalk and Board	
2.	Session 2			
3	Session 3	Plant tissue culture – Principles and techniques. Cellular totipotency, in vitro differentiation –de differentiation and re-differentiation , callus induction, organogenesis and somatic embryogenesis	Presentation/Chalk and Board	
4	Session 4			
5	Session 5			
6	Session 6	Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium – suspension culture. Murashige and Skoog medium – composition and preparation.	Presentation/Chalk and Board	
7	Session 7			
8	Session 8	Aseptic techniques in tissue culture – sterilization – different methods – sterilization of instruments and glass wares, medium, explants	Assignment	
9	Session 9	Working principle of laminar air flow and autoclave; preparation of explants – surface sterilization. Inoculation, incubation, subculturing.	Presentation/Chalk and Board	
10	Session 10			

11	Session 11	4. Micropropagation - Different methods – axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis. Different phases of micropropagation – hardening, transplantation and field evaluation Advantages and disadvantages of micropropagation. Somaclonal variation		
12	Session 12			
13	Session 13			
14	Session 14			
15	Session 15	5. Methods and Applications of tissue culture - Shoot tip and meristem culture Synthetic seed production, embryo culture, In vitro mutagenesis, Protoplast isolation culture and regeneration – transformation and transgenics, Somatic cell hybridization-cybrids. In vitro secondary metabolite production — cell immobilization, bioreactors In vitro production of haploids – anther and pollen culture, In vitro preservation of germplasm.	Presentation/Chalk and Board Presentation/Chalk and Board	
16	Session 16			
17	Session 17			
18	Session 18			
19	Session 19	Recombinant DNA Technology  Gene cloning strategies – recombinant DNA construction – cloning vectors – plasmids pBR322, bacteriophage based vectors, Ti plasmids. Restriction	Presentation/Chalk and Board	
20	Session 20			
21	Session 21			
22	Session 22			



		endonucleases and ligases – Ligation techniques, transformation and selection of transformants – using antibiotic resistances markers, southern blotting; PCR.		
23	Session 23	Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, transduction, electroporation, microinjection, microprojectiles, Agrobacterium mediated gene transfer gene library, gene banks.	Presentation/Chalk and Board	
24	Session 24			
25	Session 25			
26	Session 26			
27	Session 27	Important achievements in Biotechnology: Production of human insulin, Bt Brinjal and Bt cotton, Golden rice, Flavr Savr tomato, Shikonin pigments	Assignment	
28	Session 28			
29	Session 29	Current trends in Biotechnology: Tissue Engineering, Stem cell culture, Nanobiotechnology	Presentation/Chalk and Board	
30	Session 30			
31	Session 31	Strategic Applications of Biotechnology: Production of disease/ stress resistant plants, Gene therapy, DNA fingerprinting	Presentation/Chalk and Board	
32	Session 32			
33	Session 33		Presentation/Chalk and Board	

34	Session 34	Social and ethical issues, biosafety, biowar, patenting and IPR issues.		
35	Session 35			
36	Session 36	1. Introduction to Bioinformatics, scope and relevance, genome, transcriptome, proteome. 2. Biological data bases – Nucleotide sequence database – EMBL, Gen Bank, DDBJ. Protein sequence database – PDB, SWISS PROT	Presentation/Chalk and Board	
37	Session 37			
38	Session 38	Organismal database – Saccharomyces genome database Biodiversity database – Species 2000 3. Information retrieval from Biological database, sequence alignment types and tools: pair wise sequence alignment multiple sequence alignment, use of BLAST, FASTA.	Presentation/Chalk and Board	
39	Session 39			
40	Session 40	Genomics : DNA sequencing Sangers procedure-automation of DNA sequencing, genome sequence assembly, Genome projects – Major findings of the following genome projects – Human, Arabidopsis thaliana, Rice, Haemophilus influenza, Application of genome projects.	Assignments and Discission	
41	Session 41			
42	Session 42			
43	Session 43			
44	Session 44		Presentation/Chalk and Board	

45	Session 45	Proteomics : Protein sequencing- Edman degradation method, automation of sequencing, protein structure prediction and modelling (Brief account only)		
46	Session 46			
47	Session 47	A brief account on 1. Molecular phylogeny and phylogenetic trees. 2. Molecular visualization – use of Rasmol. 3. Molecular docking and computer aided drug design	Presentation/Chalk and Board	
48	Session 48			
49	Session 49			
50	Session 50			
<b>PRACTICALS</b>				
51	Session 51	1. Preparation of nutrient medium – Murashige and Skoog medium, sterilization, preparation of explants, inoculation. 2. Extraction of DNA from plant tissue. 3. Immobilization of whole cells or tissues in sodium alginate. 4. Determination of appropriate flower bud containing uninucleate pollen for anther culture using cytological techniques 5. Study of genetic engineering tools and techniques using photographs/diagram (Southern blotting, DNA finger printing, PCR)	Laboratory/Demonstration	
52	Session 52			
53	Session 53			
54	Session 54			
55	Session 55			
56	Session 56			
57	Session 57			
58	Session 58			

		6. Visit a well-equipped biotechnology lab and submit a report along with the practical record.	
59	Session 59	1. Familiarizing with the different data bank mentioned in the syllabus. 2. Molecular visualization using Rasmol. 3. Blast search.	
60	Session 60		
61	Session 61		
62	Session 62		
63	Session 63		
64	Session 64		
65	Session 65		

## SEMESTER 6

### HORTICULTURE, NURSERY MANAGEMENT, EMBRYOLOGY AND REPRODUCTIVE BIOLOGY (2015-16)

#### COURSE OUTCOMES:

This enables the student a detailed basic understanding Horticulture and Nursery Management.

Students will be able to understand the importance of horticulture in human welfare.

It also enables the student to understand the basics in embryology.

They will have a clear knowledge on the development of fruit and seed.

#### Basic Reference

1. Adams C.R., Early M.P. 2004. *Principles of Horticulture*. Elsevier, N. Delhi.
2. Barton West R. 1999. *Practical Gardening in India*. Discovery Pub. House, New Delhi.
3. Edmond J.B., Senn T.L., Andrews F.S., Halfacre P.G. 1975. *Fundamentals of Horticulture*. 4<sup>th</sup> Edn. TMH N. Delhi.
4. John J. (2012). *Elements of Agribased Microenterprises*. Bulbul Scientific Publishers, Kottayam.
5. John Weathers. 1993. *Encyclopaedia of Horticulture*. Discovery Pub. House. New Delhi
6. Jules Janick. 1979 *Horticultural Science*. Surjeet publications, Delhi
7. Kumar N. 1994. *Introduction to Horticulture*. Rajalakshmi Pub. Nagarcoil
8. Manibhushan Rao K. 1991. *Text Book of Horticulture*. Macmillan India Ltd.
9. Randhawa G.S., Mukhopadhyay A. 1986. *Floriculture in India*. Allied Publishers Pvt. Ltd. Ahamedabad
10. Sadhu M.K. ,1996. *Plant Propagation*. New age International publishers, N. Delhi
11. Schilletter J.C., Richey H.W. 1999. *Text Book of General Horticulture*. Biotech Books, New Delhi.
12. Mazundar B.C. and P.M. Mukhopadhyay 2006, *Principles & Practices of Herbal Garden*. Daya Publishing House – Delhi.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
1	Session 1	Introduction to horticulture - definition, history, classification of horticultural plants, disciplines of horticulture; Garden tools and implements. Irrigation methods- surface, sub, drip and spray irrigations, mist chambers - advantages and disadvantages	Presentation/Chalk and Board	
2.	Session 2			
3	Session 3	Propagation of horticultural plants- by seeds- Seed viability, seed dormancy, seed testing and certification, seed bed preparation, seedling transplanting, hardening of seedling; advantages and disadvantages of seed propagation.	Presentation/Chalk and Board/Assignment	
4	Session 4			
5	Session 5			
6	Session 6	Vegetative propagation- organs used in propagation- natural and artificial vegetative propagation; methods- cutting, layering, grafting and budding;	Presentation/Chalk and Board	
7	Session 7			
8	Session 8	Advantages and disadvantages of vegetative propagation.	Assignment	
9	Session 9	Gardening- ornamental gardens, indoor gardens, home gardens- terrestrial and aquatic gardens- garden adornments;	Presentation/Chalk and Board	
10	Session 10			

		garden designing- garden components- lawns, preparation of lawns by seeds, seedling, turfing.		
11	Session 11	Shrubs and trees, borders, hedges, edges, walks, drives- famous gardens of India; Landscape architecture- home landscape design, parks. Physical control of plant growth- training and pruning; repotting; disease and pest control selection of plant for bonsai, bonsai containers and method of bonsai formation	Presentation/Chalk and Board	
12	Session 12			
13	Session 13	General account and interdisciplinary relevance of embryology, embryology in relation to taxonomy; experimental embryology.	Presentation/Chalk and Board	
14	Session 14			
15	Session 15	Structure and development of anther, microsporogenesis, development of male gametophyte, anthesis and anther dehiscence	Presentation/Chalk and Board	
16	Session 16			
17	Session 17	Structure of pollen, pollen germination, pollen tube growth and pollen viability	Presentation/Chalk and Board/Assignment	
18	Session 18			
19	Session 19	Structure and development of ovule, megasporogenesis, embryosacs- monosporic (polygonum type),	Presentation/Chalk and Board	
20	Session 20			

		bisporic ( <i>Allium</i> type) and tetrasporic ( <i>Peperomia</i> type)		
21	Session 21	Structure of mature embryo sac	Presentation/Chalk and Board	
22	Session 22			
23	Session 23	Breeding/Reproductive systems and pollination syndromes (with examples for each syndrome) in angiosperms	Presentation/Chalk and Board	
24	Session 24			
25	Session 25	Pollen stigma interaction; self-compatibility and incompatibility; syngamy and fusion; apomixis.	Presentation/Chalk and Board	
26	Session 26			
27	Session 27	Development of endosperm and embryo in Dicots and Monocots; Poly-embryony; Development and general structure of fruits (dry and fleshy) and seed	Presentation/Chalk and Board	
28	Session 28			
29	Session 29	Any Indian example from a reputed journal to study the pollination mechanisms and methods (eg. <i>Azadirachta indica</i> , <i>Strobilanthes kunthiana</i> )	Presentation/Chalk and Board/Assignment	
30	Session 30			
31	Session 31	Preparation of potting mixtures, polybags. Plant Growth structures – green houses, shaded houses, polyshed, mist chamber, sprinkling system, drip irrigation. Modern strategies in propagation by root initiation of cutting,	Presentation/Chalk and Board	
32	Session 32			



		layering technique, budding and grafting technique		
33	Session 33	Micropropagation; Planting, Transplanting and Hardening of seedlings, After care of seedlings. Packing and transporting of seedlings	Presentation/Chalk and Board	
34	Session 34			
35	Session 35			
36	Session 36	Organic manures and fertilizers, Composition of fertilizers. NPK content of various fertilizers and preparation of fertilizer mixtures. Common organic manures – bone meal, cow dung, poultry waste, oil cakes, organic mixtures and compost	Presentation/Chalk and Board	
37	Session 37			
38	Session 38	Preparation of compost –aerobic and anaerobic- advantages and limitations. Vermicompost – preparation - Vermiwash. – preparation. Biofertilizers – Definition and preparation of different types – Trichoderma, Rhizobium, PGPR, PSB, mycorrhiza. Application of Biofertilizers. Biopesticides – Tobacco and Neem decoction.	Presentation/Chalk and Board	
39	Session 39			
40	Session 40	Biological control of disease and pests. Organic traps – Natural dyes	Assignment	
41	Session 41	Types–Home gardening, Market gardening and Truck gardening. Packing and Transporting of Vegetables.	Presentation/Chalk and Board	
42	Session 42			
43	Session 43			

44	Session 44	Organic farming of fruit crops – Packing and Transporting of fruits.	
45	Session 45	Induction of flowering and weed control.	
46	Session 46	Cultivation of Medicinal and Aromatic plants of common use and great demand.	
47	Session 47	Traditional production techniques and Post-harvest techniques	
48	Session 48	Problems and prospects of Floriculture in Kerala.	
49	Session 49	Scope of growing Anthurium, Orchids and Jasmine in Kerala.	
50	Session 50		
51	Session 51	Common cut flowers – Rose, Gerbera, Gladiolus, Aster,	
52	Session 52	Chrysanthemum, Daisys, Carnation,	
53	Session 53	Golden rod, Anthurium, Orchids, Liliun and Limolium.	
54	Session 54	Common leaves used in flower arrangement – Cyprus, Podocarpus, Asparagus, Palms, Cycads, Ferns and Eucalyptus.	
55	Session 55		
56	Session 56	Floral arrangement: Types - Western, Eastern (Japanese/ Ikebana) and Modern.	
57	Session 57		
58	Session 58	Wases, Flower Holders and Floral Foam.	
59	Session 59	Wase life of flowers and leaves.	
60	Session 60	After care of flower arrangements – Bouquets.	
61	Session 61		

		Packing and Maintenance of flowers and leaves.		
62	Session 62	Funding Agencies and self employment schemes, Procedure to get financial support, special scheme for women empowerment	Presentation/Chalk and Board	
63	Session 63			
64	Session 64			
<b>PRACTICALS</b>				
65	Session 65	Tongue grafting, budding ('T' and patch), air layering 2. Identification of different garden tools and their uses 3. List out the garden components in the photograph of the garden given 4. Preparation of potting mixture in the given proportion.	Laboratory/Demonstration	
66	Session 66			
67	Session 67			
68	Session 68	1. Identification of C.S. of anther, embryo sac and embryo. 2. Identification of various anther types-monothealous, dithealous 3. Identification of placentation types. 4. Observation of pollen and locating pollen pore 5. Pollen germination study	Laboratory/Demonstration	
69	Session 69			
70	Session 70			
71	Session 71	1. Preparation of potting mixture 2. Preparation of Tobacco/ Neem decoction	Laboratory/Demonstration	
72	Session 72			

		<ol style="list-style-type: none"><li>3. Familiarization of common fertilizers and manures</li><li>4. Familiarization of common cut flowers and leaves used in flower arrangements</li><li>5. Different flower arrangement types (demonstration)</li></ol>		

**SEMESTER 6**  
**PHYTOCHEMISTRY AND PHARMACOGNOSY (2015-16)**

**COURSE OUTCOMES:**

This enables the student a detailed basic understanding Horticulture and Nursery Management.

Students will be able to understand the importance of horticulture in human welfare.

It also enables the student to understand the basics in embryology.

They will have a clear knowledge on the development of fruit and seed.

**Basic Reference**

1. Ashutosh Kar, 2006, *Pharmacognosy and Pharmacobiotechnology*, New Age International, New Delhi
2. Atal.C.K. and Kapur, B.M. 1982. *Cultivation and Utilization of Medicinal Plants*.
3. Bhattacharjee S K, 2003, *Hand Book of Medicinal Plants*, Pointer Publishers, Jaipur
4. Daniel, M.,1991. , *Methods in Plant Chemistry and Economic Botany*, Kalyani publishers ,New Delhi.
5. *Glossary of Indian Medicinal Plants with Active Principles Part I & II*, 1980. CSIR ,New Delhi.
6. *Indian Medicinal Plants (5Vols)* 1994. Arya Vaidya Sala Kottackal, Orient longoman New Delhi.
7. Irfan Ali Khan, 2008, *Medicinal and Aromatic plants of India*, Ukaaz Publishers, Hyderabad
8. Jain S K 2004, *A Manual Of Ethnobotany*, Scientific Publishers, India
9. Jain S.K. 1981. *Glimpses of Indian Ethnobotany*, Oxford and IBH, New Delhi
10. Khory R N 1999 *Materia Medica of India and their Therapeutics*, Komal Prakashan, Delhi

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
1	Session 1	Introduction to phytochemical approaches –morphological-organoleptic-microscopic- to study drug and aromatic plants	Presentation/Chalk and Board	
2.	Session 2			
3	Session 3	Cold extraction- hot extraction—soxhlet-clevenger apparatus; Solvents - petroleum ether, chloroform, ethanol, water. Separation technique-TLC, Column, HPLC.	Presentation/Chalk and Board/Assignment	
4	Session 4			
5	Session 5			Characterization technique-GC/MS, HPTLC, UV Spectra, IR Spectra.
6	Session 6	Alkaloids – introduction, properties, occurrence, structure, classification, functions, and pharmacological uses.	Presentation/Chalk and Board	
7	Session 7			
8	Session 8		Assignment	
9	Session 9	B. Triterpenoids. Introduction, properties, occurrence, classification, functions and pharmacological uses.	Presentation/Chalk and Board	
10	Session 10			
11	Session 11		Presentation/Chalk and Board	
12	Session 12			
13	Session 13		Presentation/Chalk and Board	

14	Session 14	C. Phenolics. Quinines- benzoquinones, naphthoquinones, anthraquinone, and coumarins.		
15	Session 15	Habit, habitat and systematic position and morphology of the useful part. (2) Organoleptic, anatomical and chemical evaluation of the officinal part. (3) Phytochemistry and major pharmacological action of plant drugs. (4) Ayurvedic formulations using the plant Tinospora cordifolia, Papaver somniaferum, Aegle marmelos ,	Presentation/Chalk and Board	
16	Session 16			
17	Session 17	Habit, habitat and systematic position and morphology of the useful part. (2) Organoleptic, anatomical and chemical evaluation of the officinal part. (3) Phytochemistry and major pharmacological action of plant drugs. (4) Ayurvedic formulations using the plant Punica granatum, Plumbago rosea, Adhatoda vasica, Withania somnifera,	Presentation/Chalk and Board/Assignment	
18	Session 18			
19	Session 19	Habit, habitat and systematic position and morphology of the useful part. (2) Organoleptic, anatomical and chemical evaluation of the officinal part.	Presentation/Chalk and Board	
20	Session 20			

		<p>(3) Phytochemistry and major pharmacological action of plant drugs.</p> <p>(4) Ayurvedic formulations using the plant</p> <p>Achyranthes aspera, Asparagus racemosus, Kaempferia galanga, , Sida acuta, Carica papaya,</p>		
21	Session 21	<p>Habit, habitat and systematic position and morphology of the useful part.</p> <p>(2) Organoleptic, anatomical and chemical evaluation of the officinal part.</p> <p>(3) Phytochemistry and major pharmacological action of plant drugs.</p> <p>(4) Ayurvedic formulations using the plant</p> <p>Azadirachta indica, Glycyrrhiza glabra, Phyllanthus neruri, Datura stramonium, ,</p>	Presentation/Chalk and Board	
22	Session 22			
23	Session 23	<p>Habit, habitat and systematic position and morphology of the useful part.</p> <p>(2) Organoleptic, anatomical and chemical evaluation of the officinal part.</p> <p>(3) Phytochemistry and major pharmacological action of plant drugs.</p> <p>(4) Ayurvedic formulations using the plant</p>	Presentation/Chalk and Board	
24	Session 24			



		Hemidesmus indicus, Aloe veera, Tylophora indica, Acorus calamus		
25	Session 25	Study of the following aromatic plants - volatile oils and methods of extraction Vetiveria zizanoides, Cinnamomum zeylanica,.	Presentation/Chalk and Board	
26	Session 26			
27	Session 27	Study of the following aromatic plants - volatile oils and methods of extraction Sisygium aromaticum, Santalum album	Presentation/Chalk and Board	
28	Session 28			
29	Session 29	Study of the following aromatic plants - volatile oils and methods of extraction Eucalyptus, Ocimum bacilicum,	Presentation/Chalk and Board/Assignment	
30	Session 30			
31	Session 31	Study of the following aromatic plants - volatile oils and methods of extraction Rosa, Mentha piperita, Cympopogon, Cananga, Pelargonium	Presentation/Chalk and Board	
32	Session 32			
33	Session 33	Introduction, tools for identifying adulteration; methods in pharmacognosy- microscopy,	Presentation/Chalk and Board	
34	Session 34			
35	Session 35			
36	Session 36	phytochemical methods- study of starch grains of maize, wheat, rice, potato, curcuma	Presentation/Chalk and Board	
37	Session 37			
38	Session 38		Presentation/Chalk and Board	

39	Session 39	Traditional plant medicines as a source of new drugs – The process of modern drug discovery using ethnopharmacology – Taxol, Artemisinin, Galathamine and Flavopyridole as examples of drug discovery based on ethanopharmacological approach.		
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**SEMESTER 1**  
**COMPLEMENTARY COURSE –I**  
**CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY (2015-16)**

**COURSE OUTCOMES:**

The students will have a thorough knowledge in identifying different groups of Bryophytes, Pteridophytes and Gymnosperms.

Students would be able to understand the evolutionary trends in plants.

Students would be able to understand anatomical variation in the plants included in the course.

**Basic Reference**

1. Ahamdijan, Vernon and Mason H. E (1973) The Lichens. New York: Academic press.
2. Alexopoulose C. J. and Mims C. W. (1983) Introductory Micology, New York: Wiley Eastern
3. Bhatia K. N (1975) A treatise on Algae. New Delhi. S. Chand and co. Publishing, New Delhi, Vikas publishing House Pvt.Ltd.
4. Bilgramic K. S and Dube H. C (1976). Text Book of Modern Plant Pathology. New Delhi. Vikas Publishing House Pvt.Ltd
5. Bishwas S.B and Biswas A. (1973). An Introduction to Viruses. New Delhi. Vikas Publishing House Pvt. Ltd.
6. Chaube H. S. and Ramji S. (2000) Introductory Plant Pathology, International Book Distributing Co. Lucknow.
7. Chopra R.N and Kumra P. K (1988) Biology of Bryophytes. New Delhi, Wiley Eastern Ltd.
8. Fritsch F. B (1945), Structure and Reproduction of Algae Vol. I & II. Cambridge University Press.
9. Gangulee H. C and Kar A. K(1993) College Botany Vol. II Calcutta, New Central Book Agency.
10. Kanika Sharma (2009), Manual of Microbiology, Ane Books Pvt. Ltd.
11. Mamatha Rao(2009) Microbes and Non- flowering plants, Impact and applications, Ane Books Pvt.Ltd..

1.	Date	Topic	Method	Remarks/Reference
<b>CRYPTOGAMS</b>				
1	Session 1	Viruses : General account, structure of	Assignment	

		Tobacco Mosaic Viruses (TMV), mode of infection- T phages		
2.	Session 2	Bacteria: Classification, structure, nutrition chemosynthesis, respiration, reproduction(binary fission). Economic importance – agriculture, industry and medicine. Archaeobacteria	Assignment	
3	Session 3	Algae (Phycology) Classification, main features of structure, and life history of the following groups Cyanophyceae : Nostoc	Presentation/Chalk and Board	
4	Session 4	Algae (Phycology) Classification, main features of structure, and life history of the following groups Chlorophyceae : Volvox	Presentation/Chalk and Board	
5	Session 5	Algae (Phycology) Classification, main features of structure, and life history of the following groups Oedogonium, Cladophora	Presentation/Chalk and Board	
6	Session 6	Algae (Phycology) Classification, main features of structure, and life history of the following groups Phaeophyceae : Ectocarpus	Assignment	

7	Session 7	Algae (Phycology) Classification, main features of structure, and life history of the following groups Rhodophyceae : Polysiphonia	Presentation/Chalk and Board	
8	Session 8	Economic importance of Algae (general account)	Presentation/Chalk and Board	
9	Session 9	Fungi (Mycology): Classification, main features of structure, and life history of the following groups. Phycomycetes : Phytophthora	Presentation/Chalk and Board	
10	Session 10	Fungi (Mycology): Classification, main features of structure, and life history of the following groups. Ascomycetes : Peziza	Presentation/Chalk and Board	
11	Session 11	Fungi (Mycology): Classification, main features of structure, and life history of the following groups. Basidiomycetes: Puccinia	Presentation/Chalk and Board	
12	Session 12	Economic importance of Fungi (general account)	Presentation/Chalk and Board	
13	Session 13	Lichens (Lichenology): Classification	Presentation/Chalk and Board	

		and general account. Type Usnea		
14	Session 14	Bryophytes (Bryology): General account of Bryophytes Type: Riccia	Presentation/Chalk and Board	
15	Session 15	Pteridophytes (Pteridology): General account of Pteridophytes Type: Selaginella	Presentation/Chalk and Board	
GYMNOSPERMS				
16	Session 16	General account of Gymnosperms Type: Cycas	Presentation/Chalk and Board	
17	Session 17	Classification of plant diseases on the basis of causative organism and symptoms	Presentation/Chalk and Board	
18	Session 18	Study of the following diseases with name of disease, causative organism, symptoms and control measures: a. Nut fall of Arecanut	Assignment	
19	Session 19	Study of the following diseases with name of disease, causative organism, symptoms and control measures: b. Bacterial blight of Rice	Presentation/Chalk and Board	
20	Session 20	Study of the following diseases with		

		name of disease, causative organism, symptoms and control measures: c. Leaf mosaic of Tapioca		
<b>PRACTICALS</b>				
21	Session 21	1. Identify Cryptogamic and Gymnosperm specimens and their parts prescribed in the syllabus; make micro- preparations wherever necessary 2. Identify plant diseases mentioned in the syllabus.	Laboratory/Demonstration	
22	Session 22			
23	Session 23			
24	Session 24			
25	Session 25			
26	Session 26			
27	Session 27			

**SEMESTER 2**  
**COMPLEMENTARY COURSE –II**  
**PLANT PHYSIOLOGY (2015-16)**

**COURSE OUTCOMES:**

This course will create knowledge and understanding of basic mechanisms of various physiological processes related to plant life.

Insight in to the water relationships and effect of stress in plants

A thorough understanding of most vital plant physiological functions like photosynthesis and respiration

Ability to critical thinking and logical reasoning of various plant physiological mechanisms in real life situations.

Knowledge on both theory and practical aspects of plant growth regulators

**Basic Reference**

1. Devlin and Witham - Plant Physiology, C B S Publishers
  2. Jain V. K., 2008. Fundamentals of Plant Physiology, S. Chand and Co.
  3. Kochhar P. L. & Krishnamoorthy H. N. Plant Physiology, Atmaram and Sons, Delhi, Lucknow.
  4. Kumar & Purohit Plant Physiology – Fundamentals & Applications, Agrobotanical Publishers
  5. Malik C. P. 2002. Plant Physiology, Kalyani Publishers
  6. Malik C. P. and Srivastava A. K- Text Book of Plant Physiology – Kalyani Publishers, New Delhi.
  7. Mukherjii. S. & Ghosh A.K, 2005. Plant Physiology, Calcutta New Central Book Agency.
  8. Noggle G. R. & Fritz G.J- Introductory Plant Physiology- Prentice Hall of India.
  9. Pandey S. N & Sinha B.K – Plant Physiology- Vikas Publishing House, New Delhi.
- Salisbury F.B & Ross C.W –Plant Physiology- Wadsworth Publishing Co



1.	Date	Topic	Method	Remarks/Reference
<b>PLANT PHYSIOLOGY</b>				
1	Session 1	Water relations of plants: (a) Physical aspects of water absorption –imbibition, diffusion and osmosis. Plant cell as an osmotic system.	Presentation/Chalk and Board	
2.	Session 2	Diffusion pressure deficit, water potential, plasmolysis (b) Mechanism of absorption of water. Active and passive absorption.	Assignment	
3	Session 3	Transpiration – types, structure and mechanism of stomatal transpiration, (theories)	Presentation/Chalk and Board	
4	Session 4	Significance and factors affecting transpiration, antitranspirants, Guttation.	Presentation/Chalk and Board	
5	Session 5	Stress Physiology – Water and salt stress, adaptations	Presentation/Chalk and Board	
6	Session 6	Photosynthesis: Structure of chloroplast, Pigments, Red drop and Emerson's enhancement effect	Assignment	
7	Session 7	Two pigments systems, light and dark	Presentation/Chalk and Board	
8	Session 8	reaction C3 – C4 and CAM mechanisms	Presentation/Chalk and Board	

9	Session 9		Presentation/Chalk and Board	
10	Session 10	Factors affecting Photosynthesis: External and Internal, photo respiration	Presentation/Chalk and Board	
11	Session 11	Translocation of organic solutes: Path and mechanism of Translocation, Munch mass flow hypothesis.	Presentation/Chalk and Board	
12	Session 12		Presentation/Chalk and Board	
13	Session 13	Nitrogen fixation, Nitrogen Cycles.	Presentation/Chalk and Board	
14	Session 14	Dormancy of seeds, factors causing dormancy, photoblastisms	Presentation/Chalk and Board	
15	Session 15		Presentation/Chalk and Board	
16	Session 16	Techniques to break dormancy, germination – mobilization of food reserves, physiology of fruit ripening.	Presentation/Chalk and Board	
17	Session 17	Growth and Movements: Sigmoid curve, measurement of growth, regions of growth, general account of natural growth hormones, synthetic auxins (brief account) effect of ABA.	Assignment	
18	Session 18			
19	Session 19	Senescence and Abscission. Tropic and nastic movements with reference to geotropism, phototropism	Presentation/Chalk and Board	
20	Session 20	Seismonastic and nyctinastic movements. Photoperiodism and Vernalization.	Presentation/Chalk and Board	

**PRACTICLAS**

21	Session 21	Determination of osmotic pressure by plasmolytic method Separation of Chlorophyll pigments by paper chromatography.	Laboratory	
22	Session 22			
23	Session 23	Determination of transpiration under different environmental conditions using Ganong's / Farmer's Potometer Demonstration of osmosis using plant membrane	Laboratory	
24	Session 24			
25	Session 25	1. Effect of carbon dioxide concentration on the rate of photosynthesis by Hydrilla plants 2. Relation between transpiration and absorption 3. Evolution of O <sub>2</sub> during photosynthesis 4. Light screen expt. 5. Mohl's experiment 6. Experiment with variegated leaf 7. Measurement of growth using Arc Auxanometer 8. Experiment with Kleinostat. 9. Effect of hormones on growth	Demonstration	
26	Session 26			
27	Session 27			

**SEMESTER 3**  
**COMPLEMENTARY COURSE –III**  
**ANGIOSPERM TAXONOMY AND ECONOMIC BOTANY (2015-16)**

**COURSE OUTCOMES:**

The students will have a through basic understanding in identification of different plants.

Students would be able to identify plants with respective scientific names.

Students would be able to identify economic importance of different angiosperms

**Basic Reference**

1. Eames, A. J. 1969. Morphology of Angiosperms. Mc Graw – Hill, New York.
2. Hill, A.F. 1952. Economic Botany: A Text book of Useful Plants and Plant Products. Tata McGraw-Hill Publishing Company Limited, New Delhi.
3. Kochhar, S.L. 1981. Economic Botany in the Tropics. Macmillan India Limited, Delhi.
4. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. Oxford & IBH, New Delhi.
5. Naik, V.N. 1984. Taxonomy of Angiosperms. Tata McGraw – Hill Publishing Co; New Delhi.
6. Sharma, O.P. 1993. Plant Taxonomy. Tata McGraw – Hill Publishing Co Ltd., New Delhi.
7. Simpson, B.S and M. Conner – Ogorzaly. 1986. Economic Botany: Plants in Our World. McGraw – Hill Book Company, New York.
8. Singh, G. 1999. Plant Systematics – Theory and Practice. Oxford & IBH, New Delhi.

1.	Date	Topic	Method	Remarks/Reference
<b>ANGIOSPERM TAXONOMY</b>				
1	Session 1	Importance of plant classification, types	Presentation/Chalk and Board	
2.	Session 2	of classification, binomial nomenclature;		
3	Session 3	ICBN, cytotaxonomy, chemotaxonomy		

4	Session 4				
5	Session 5	Herbarium techniques: Field study, field note, vasculum, plant press, disinfecting and mounting, labeling, importance of herbarium	Assignment		
6	Session 6				
7	Session 7	Bentham and Hooker's system of classification.	Presentation/Chalk and Board		
8	Session 8				
9	Session 9				
10	Session 10	Morphology of Angiosperms – flowers, inflorescence, fruits	Presentation/Chalk and Board		
11	Session 11				
12	Session 12				
13	Session 13				
14	Session 14	Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance: Annonaceae, Malvaceae, Rutaceae, ,	Presentation/Chalk and Board		
15	Session 15			Presentation/Chalk and Board	
16	Session 16			Presentation/Chalk and Board	
17	Session 17	Study of the following families of Bentham and Hookers system of classification with special reference to	Presentation/Chalk and Board		
18	Session 18				
19	Session 19				

		major identifying characters and economic importance: Leguminosae, Apiaceae (Umbelliferae), Rubiaceae,		
20	Session 20	Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance: Asteraceae, Apocynaceae, Lamiaceae (Labiatae)	Presentation/Chalk and Board	
21	Session 21			
22	Session 22			
23	Session 23	Study of the following families of Bentham and Hookers system of classification with special reference to major identifying characters and economic importance: Euphorbiaceae, Arecaceae (Palmae), Poaceae (Gramineae)	Presentation/Chalk and Board	
24	Session 24			
25	Session 25			
26	Session 26	Classification of economic plants based on their uses. (Cereals, legumes and pulses. tuber crops, spices, beverages etc.)	Presentation/Chalk and Board	
27	Session 27	Study of the following economic plants with special reference to their botanical name, family, morphology of useful part, economic products and uses.	Assignment	
	Session 28			
	Session 29			

Session 30	Cereals: Paddy, Wheat.		
Session 31	Pulses: Green gram, Bengal gram.		
Session 32	Tuber crops: Tapioca.		
Session 33	Spices : Pepper, Cardamom. Beverages: Tea, Coffee. Oil yielding plants: Coconut, Groundnut Fibre yielding plants: Cotton, Coir. Timber yielding plants: Teak, Rose wood. Latex yielding plants: Para rubber. Bio pesticides: Neem, Tobacco. Ornamental plants: Rose, Orchids, Anthurium.		
Session 34	Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses. 1. Adhatoda, 2. Aloe, 3. Brahmi (Bacopa),4. Catharanthus, 5. Eclipta, 6. Neem,7. Ocimum, 9. Phyllanthus amarus, 9. Rauvolfia, 10. Sida	Presentation/Chalk and Board	
Session 35			
Session 36			
Session 37			
<b>PRACTICALS</b>			
Session 38	Students should be able to identify typical plants belonging to the families prescribed in the syllabus. They should be able to describe the floral parts in	Laboratory	
Session 39			
Session 40			

	Session 41	technical terms.		
	Session 42	Students should study the botanical name, family, morphology of the useful part and the uses of the plants listed in the syllabus.		



**SEMESTER 3**  
**COMPLEMENTARY COURSE –IV**  
**ANATOMY AND APPLIED BOTANY (2015-16)**

**COURSE OUTCOMES:**

The students will be able to identify different anatomical features of angiosperms.

Students will learn to differentiate different types of tissues in plants.

Students will be able to identify normal and anomalous secondary thickening in plants

Students will be knowledgeable in common economically important plants.

**Basic Reference**

1. Christopher, E.P. 1958. Introductory Horticulture. McGraw – Hill, New York.
2. Esau, K. 1965. Plant Anatomy. Wiley, New York.
3. Fahn. 1985. Plant Anatomy. Pergamon Press, Oxford.
4. Hartman, H.T. and D.E. Kester. 1991. Plant Propagation – Principles and Practices. Prentice – Hall of India, New Delhi.
5. Kumar, N. 1994. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil.
6. Pandey, B.P. 1984. Plant Anatomy. S. Chand and Company, New Delhi.
7. Vasishta, V.C. 1978. Plant Anatomy. S. Nagin and Company, Jallundhur.

<b>1.</b>	<b>Date</b>	<b>Topic</b>	<b>Method</b>	<b>Remarks/Reference</b>
<b>ANATOMY</b>				
1	Session 1	Cell types, electron microscopic studies on plant cell – living and nonliving inclusions, cell wall – ultra structure of	Presentation/Chalk and Board	

		cell wall (brief account only)		
2.	Session 2	Tissues: simple and complex; meristems, secretory tissues	Assignment	
3	Session 3	Cambium: origin, structure, function, role in budding and grafting	Presentation/Chalk and Board	
4	Session 4	Primary structure of stem and root in dicots and monocots	Presentation/Chalk and Board	
5	Session 5	Secondary thickening in dicot stem and dicot root; growth rings, heart wood and sap wood; hard wood and soft wood; ring porous wood and diffuse porous wood, Anomalous secondary thickening in Bignonia.	Presentation/Chalk and Board	
6	Session 6			
7	Session 7			
8	Session 8			
9	Session 9	Anatomy of monocot and dicot leaf	Presentation/Chalk and Board	
10	Session 10			
11	Session 11			
12	Session 12	Ecological anatomy: Study of the morphological and anatomical adaptations of the following groups; Hydrophytes (Nymphaea), Xerophytes (Nerium), Epiphytes (Vanda) and	Presentation/Chalk and Board	
13	Session 13			
14	Session 14			
15	Session 15			
16	Session 16			

		Halophytes (Avicinia/ Rhizophora).		
<b>APPLIED BOTANY</b>				
17	Session 17	Plant breeding: Objectives, sexual and asexual reproduction; apomixis, apogamy, apospory, amphimixis, parthenogenesis, parthenocarpy, polyembryony.	Presentation/Chalk and Board	
18	Session 18			
19	Session 19			
20	Session 20	Methods of plant improvement  a.Plant introduction, acclimatization plant quarantine. b. Selection: Mass selection; pureline selection and clonal selection. c.Hybridization; intervarietal, interspecific and intergeneric; procedure of hybridization.	Presentation/Chalk and Board	
21	Session 21	Special methods of plant breeding.		
22	Session 22	a. Mutation breeding. b. Polyploidy breeding		
23	Session 23	Horticultural practices	Presentation/Chalk and Board/ Assignment	
24	Session 24	Propagation through cutting, layering, budding and grafting		
25	Session 25			

26	Session 26			
27	Session 27			
	Session 28	Tissue culture Principles, techniques and applications; culture media, asepsis, callus, organogenesis, somatic embryogenesis, anther culture, artificial seeds.	Presentation/Chalk and Board	
	Session 29			
	Session 30			
	Session 31			
	Session 32			
	Session 33			
<b>PRACTICALS</b>				
	Session 34	a. Types of tissue – simple and complex. b. Primary structure of stem and root of dicots and monocots. c. Structure of dicot stem and dicot root after secondary thickening. d. Anomalous secondary thickening in Bignonia. e. Anatomy of monocot and dicot leaf. f. Morphological and anatomical adaptations of Hydrophytes (Nymphaea petiole), Xerophytes (Nerium leaf), Epiphytes (Velamen root of Vanda), Halophyte (Pneumatophore and vivipary of Avicinia or Rhizophora).	Laboratory	
	Session 35			
	Session 36			
	Session 37			
	Session 38			
	Session 39			
	Session 40			

		<p>g. Emasculation of pea or Caesalpinia flower.</p> <p>h. 'T'budding , approach grafting, air layering.</p> <p>i. Demonstration of tissue culture techniques: culture media, callus induction and organogenesis..</p>		
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