**SEMESTER 1**

**MICROBIOLOGY AND PHYCOLOGY** (2018-19)

## 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.

| 1. | Date | Topic | Method | Remarks/Reference |
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| MICROBIOLOGY | | | | |
| 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 | Archaebacteria, 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 | Reconvertion of waste products. Bioremediation | Presentation/Chalk and Board | |

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| 14 | Session 14 | Antibiotics.<br>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: *Nostoc* | Assignment | |
| 21 | Session 21 | Chlorophyceae: *Chlamydomonas, Volvox, Spirogyra*, *Oedogonium*, *Chara* | Presentation/Chalk and Board | |
| 22 | Session 22 | Xanthophyceae: *Vaucheria* | Presentation/Chalk and Board | |
| 23 | Session 23 | Bacillariophyceae: *Pinnularia* | Presentation/Chalk and Board | |
| 24 | Session 24 | Phaeophyceae : *Sargassum* | Presentation/Chalk and Board | |
| 25 | Session 25 | Rhodophyceae :*Polysiphonia* | 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 | |

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| 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<br>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 | • Make micro preparation of vegetative and reproductive structures of the types mentioned in the syllabus.<br>• Identify the algal specimens up to the generic level by noting their key characters.<br>• Make labeled sketches of the specimens observed. | Laboratory Demonstration | |

**SEMESTER 3**

**MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY (**2018-19)

## 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. Alexopaulos 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.

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| 1 | Session 1 | Introduction, structure, reproduction, life cycle, evolutionary trends.<br>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;<br>a) Myxomycotina – General Characters<br>b) Mastigomycotina – Albugo<br>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;<br>Ascomycotina<br>Hemiascomycetes -- Saccharomyces<br>Plectomycetes -- Pencillium<br>Pyrenomycetes – Xylaria<br>Discomycetes -- Peziza | Presentation/Chalk and Board | |
| 8 | Session 8 | | | |
| 9 | Session 9 | | | |

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| 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;<br>e) Basidiomycotina<br>Teliomycetes ---Puccinia<br>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 | | | |

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| 20 | Session 20 | Fungal biotechnology- Fundamental principles.<br>Mushrooms- edible and poisonous types.<br>cultivation technique-Spawn production.<br>Cultivation of Oyster mushroom. | Presentation/Chalk and Board | |
| 21 | Session 21 | General account, economic and ecological importance of lichen<br>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 –<br>Prophylaxis-quarantine measures, seed certification<br>Therapeutic – physical therapy, chemotherapy.<br>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 | | | |

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| | Session 28 | and control<br>Bunchy top of Banana, Cassava Mosaic Disease<br>Citrus Canker<br>Root wilt of Coconut.<br>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 Athelet's foot, aspergillosis, candidiosis, aflatoxin | Presentation/Chalk and Board | |
| PRACTICALS | | | | |
| | 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.<br>2. Isolation and culture of Oyster mushroom mycelium.<br>3 Preparation of bed for mushroom cultivation.<br>4. Staining of endomycorrhiza or fungus using Trypan Blue | Laboratory | |
| | Session 33 | | | |
| | Session 34 | | | |
| | Session 35 | | | |
| | Session 36 | Students are expected to: | Laboratory | |

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

**SEMESTER 3**

**BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS & PALAEOBOTANY** (2018-19)

## 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 Gymnosperm*s. 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** |
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| **BRYOLOGY** | | | | |
| 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 | |

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| | | *Riccia* | | |
| 4 | Session 4 | Morphology, anatomy and reproduction in *Marchantia* | Presentation/Chalk and Board | |
| 5 | Session 5 | Morphology, anatomy and reproduction in *Anthoceros* | Presentation/Chalk and Board | |
| 6 | Session 6 | Morphology, anatomy and reproduction in *Funaria* | 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 | |
| PRACTICALS | | | | |
| 10 | Session 10 | Make micro preparations of the types mentioned. Study vegetative and reproductive structures. | Laboratory Demonstration | |
| PTERIDOLOGY | | | | |
| 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 Psilotum | Presentation/Chalk and Board | |
| 14 | Session 14 | Structural organization of sporophyte and | Presentation/Chalk and Board | |

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| | | 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.<br>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 | |

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| | | 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<br>Fossil Pteridophyte: *Rhynia* | Presentation/Chalk and Board | |
| 30 | Session 30 | Fossil Gymnosperm: *Williamsonia* | Presentation/Chalk and Board | |
| 31 | Session 31 | Fossil Angiosperm: *Palmoxylon* | Presentation/Chalk and Board | |
| 32 | Session 32 | Indian contribution to Palaeobotany | Presentation/Chalk and Board | |

**SEMESTER 4**

**ANATOMY AND ANGIOSPERM MORPHOLOGY (**2018-19)

## 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 Boyl, 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: - Histotaxonomy, Histochemistry, Histoenzymology, Pharmacognosy, Physiological Anatomy, Ecological | Presentation/Chalk and Board | |
| 2. | Session 2 | | Assignment | |

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| | | Anatomy, Evolutionary trends in plant anatomy | | |
| 3 | Session 3 | Gross structure of primary and secondary cell walls, simple and bordered pits. 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 | |
| 4 | Session 4 | | Presentation/Chalk and Board | |
| 5 | Session 5 | Extra cell wall thickening materials: - Lignin, cutin, suberin and callose. Origin of cell wall; Growth of Cell wall- Apposition and intussusceptions – cavities & ducts, schizogenous & lysigenous developments | Presentation/Chalk and Board | |
| 6 | Session 6 | | | |
| 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 | | | |

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| | | Metabolic byproducts: - tannin, gums, resins, essential oils, mucilage, latex, mineral crystals and alkaloids | | |
| 10 | Session 10 | Meristematic tissue- definition, structure, function and classification<br>Apical organization and theories; Shoot apex- Apical cell theory, Histogen theory<br>and Tunica-Corpus theory. | Presentation/Chalk and Board | |
| 11 | Session 11 | | | |
| 12 | Session 12 | Root apex - Histogen theory and Korper-Kappe theory.<br>Permanent Tissue: - Structure and function of simple and complex tissues. | Presentation/Chalk and Board | |
| 13 | Session 13 | | | |
| 14 | Session 14 | Distribution and function of mechanical tissues in plants.<br>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 | |

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| 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 | |

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| | | Properties, defects and seasoning of wood.<br>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:<br>(a) Racemose types-Simple Raceme, Corymb, Umbel, Spike, Spadix and Head.<br>(b) Cymose types-Simple Cyme, Monochasial- Scorpoid and Helicoid, Dichasial<br>(c) Special type- Cyathium, Hypanthodium | Presentation/Chalk and Board | |
| 39 | Session 39 | | | |
| 40 | Session 40 | Fruits:<br>Simple-Fleshy, Dry- dehiscent, indehiscent, Aggregate, Multiple (Sorosis and Syconus) | Assignement | |
| PRACTICALS | | | | |
| | Session 41 | 1.Cell types and tissues. | Laboratory | |

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

**SEMESTER 5**

**ANGIOSPERM SYSTEMATICS, FLORAL MORPHOLOGY AND ECONOMIC BOTANY** (2018-19)

## 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.

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| **ANGIOSPERM SYSTEMATICS AND FLORAL MORPHOLOGY** | | | | |
| 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 | Interdiciplinary 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 | |

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| 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 | |

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| | | 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 | |
| PRACTICALS | | | | |
| 19 | Session 19 | Preparation of floral formula from floral description.<br>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 | |

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| | | 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.<br>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<br>Identify and describe the ethnobotanical uses of the items mentioned in the syllabus. | Laboratory Demonstration | |
| **ECONOMIC BOTANY** | | | | |
| 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<br>Cereals- Rice, Wheat<br>Millets- Ragi<br>Pulses- Green gram, Bengal gram, Black gram<br>Sugar yielding plants – Sugarcane<br>Fruits:- Apple, Pineapple, Orange, Mango and Banana<br>Vegetables:- Bittergourd, Ladies finger, Carrot and Cabbage.<br>Timber yielding plants:- Teak wood and Jack wood | Presentation/Chalk and Board | |

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| | | Beverages- Tea, Coffee | | |
| 24 | Session 24 | 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<br>**Fibre yielding plants**- Coir, Jute, Cotton<br>**Oil yielding plants**- Ground nut, Gingelly<br>**Rubber yielding plants**- Para rubber<br>**Gums and Resins**- White damer, Gum Arabic, Asafoetida<br>**Spices** – Cardamom, Pepper, Cloves , Ginger<br>**Insecticide yielding Plants**- Tobacco and Neem | Presentation/Chalk and Board | |
| 25 | Session 25 | Study of the following plants used in daily life by tribals and village folks for Food, Shelter and Medicine<br>**Food** :- *Artocarpus, Corypha, Phoenix*<br>**Shelter** - *Bambusa, Ochlandra and Calamus* | Presentation/Chalk and Board | |
| 26 | Session 26 | Study of the following plants used in daily life by tribals and village folks for Food, Shelter and Medicine<br>**Medicine** - *Curcuma, Trichopus zeylanicus and Alpinia galanga* | Presentation/Chalk and Board | |

**SEMESTER 5**

**ENVIRONMENTAL SCIENCE AND ECOTOURISM** (2018-19)

## 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.
2. AK Bhatacharya, 2005. *Ecotourism and Livelihoods*. Concept Publishing Co. New Delhi
3. Amal Raj S. *Introduction to Environmental Science & Technology*; Laxmi Publications Pvt. Ltd., New Delhi.
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7. Ceballos-Lascurian, Hector, 1996. *Tourism, Ecotourism and Protected areas*. IUCN, Cambrige UK.
8. Champion, H. G. 1936. *A Preliminary Survey of Forests of India and Burma*. Ind. For. Rec. (n.s.) 1: 1-236.

| 1. | Date | Topic | Method | Remarks/Reference |
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| **ENVIRONMENTAL SCIENCE** | | | | |
| 1 | Session 1 | Introduction, relevance and scope, public awareness | Presentation/Chalk and Board | |
| 2. | Session 2 | Types of resources-renewable and non renewable<br>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<br>Land resources: Land use, land degradation, desertification, EFL( Ecologically Fragile | Presentation/Chalk and Board | |

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| | | 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, | Presentation/Chalk and Board | |

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| | | process – migration, ecesis, colonization, stabilization and climax community; hydrosere, xerosere, lithosere | | |
| 17 | Session 17 | Ecological complexes and factors affecting plants growth and response:<br>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<br>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, vernalization; light – photoperiodism, heliophytes, sciophytes; salinity – halophytes, mangroves | Presentation/Chalk and Board | |
| 22 | Session 22 | Definition and general introduction | Presentation/Chalk and Board | |

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| 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.<br>Thermal pollution: Sources and effects, management | Presentation/Chalk and Board | |
| 27 | Session 27 | Nuclear hazards: Sources and impacts, management, Chernobyl incident<br>EIA: Environmental Impact Assessment in polluted areas | Presentation/Chalk and Board | |
| 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 | |

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| 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 methods. Role of NGOs in biological conservation | Presentation/Chalk and Board | |
| 35 | Session 35 | Organizations: BNHS, WWF, CSE, NEERI, , MoEF, Green Peace, Chipko | Presentation/Chalk and Board | |

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| 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 | |
| PRACTICALS | | | | |
| 41 | Session 41 | Estimation of CO2, Cl, and salinity of water samples (Titremetry)<br>Determination of pH of soil and water<br>Assessment of diversity, abundance, and frequency of plant species by quadrate method (Grasslands, forests) | Laboratory Demonstration | |
| 42 | Session 42 | Study of the most probable number (MPN) of coliform bacteria in water samples | Laboratory Demonstration | |

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| | | EIA studies in degraded areas (Sampling – line transect, Quadrate)<br>Visit to any forests types including grasslands and preparation of the list of Rare and threatened (R&T) plants (no collection of specimens) | | |
| 43 | Session 43 | Collection, identification and preparation of the list of exotic species in the locality.<br>Identification of pollutant to respective pollution types.<br>Study of anatomical, morphological, physiological adaptation of plants to the environment (Xerophytic, Hydrophytic, Epiphytic, Halophytic).<br>Collection and recording of rain data by using simple rain gauge. | Laboratory Demonstration | |

**SEMESTER 5**

**GENETICS AND PLANT BREEDING (**2018-19)

## 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. *Genetic*s 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.
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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* (3rd edition) John Wiley & Sonc, Inc.
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| **1.** | **Date** | **Topic** | **Method** | **Remarks/Reference** |
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| **GENETICS** | | | | |
| 1 | Session 1 | Origin of a new branch of Biology- | Presentation/Chalk and Board | |

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| | | 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 *Mirabilis*: 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 *Lathyrus* (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 *Nicotiana* | 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 | |

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| 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 | |

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| 20 | Session 20 | Extra nuclear inheritance- general account- maternal influence | | |
| 21 | Session 21 | Plastid inheritance in Mirabilis, kappa particle in Paramecium | Presentation/Chalk and Board | |
| 22 | Session 22 | Population genetics-Hardy Weinberg law | Presentation/Chalk and Board | |
| PRACTICALS | | | | |
| 23 | Session 23 | Students are expected to work out and record the problems in:<br>1. Monohybrid, dihybrid cross and back crosses.<br>2. All types of modified Mendelian ratios mentioned in the syllabus. | Chalk and Board | |
| **PLANT BREEDING** | | | | |
| 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 | |

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| 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 breedin | 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 | |
| PRACTICALS | | | | |
| 37 | Session 37 | Emasculation and bagging | Laboratory Demonstration | |

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| | | 2. Comparison of percentage of seed germination and the effect of any one<br>chemical on the rate of elongation of radicle in any three crop seeds | | |

**SEMESTER 5**

**CELL MOLECULAR BIOLOGY AND EVOLUTION (**2018-19)

## 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


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2. Avinash & Kakoli Upadhyay 2005. *Basic Molecular Biology*. Himalaya Publishing House, Mumbai.
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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.
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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

| 1. | Date | Topic | Method | Remarks/Reference |
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| **CELL BIOLOGY** | | | | |
| 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 | |

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| | | 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 | |

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| PRACTICALS | | | | |
| 14 | Session 14 | 1. Make acetocarmine squash preparation of onion root tip to identify mitotic stages.<br>2. Study the Mitotic Index of onion root tip cells<br>3. Study of meioses in any flower bud by smear preparation of PMC's | Laboratory Demonstration | |
| 15 | Session 15 | 4. Identification of Barr body<br>5. Identification of salivary gland chromosome.<br>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 | Laboratory Demonstration | |
| MOLECULAR BIOLOGY | | | | |
| 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 | |

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| | | 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 prosessing.details of translation - genetic cod 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 | |
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| 24 | Session 24 | Problems based on DNA, RNA and Proteins | Presentation/Chalk and Board | |
| EVOLUTION | | | | |
| 25 | Session 25 | Introduction, Origin of life – biochemical origina of life, Progressive, Retrogressive, Parallel and Convergent evolution | Assignment | |
| 26 | Session 26 | Theories of evolution - Lamark's, Darwin's, Weisman's and De Vries. | Presentation/Chalk and Board | |

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| 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 | |
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**SEMESTER 5**

**AGRIBASED ENTERPRISES OPEN COURSE (**2018-19)

## 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.
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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.
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10. Pandey, R.K and S.K. Ghosh. (1996) A Hand Book on Mushroom Cultivation. Emkey Publications.


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

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| | | 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 | |

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| | | 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 | |

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| | | Carnation, Anthurium, Lilium | | |
| 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 | |

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| | | of plant cell<br>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.<br>2. Identification and familiarization of the following organic manures- cow dung (Dry), Coconut cake, Vermicompost, neem cake, Organic mixture, Bone meal. | Laboratory/Demonstration | |

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

**PLANT PHYSIOLOGY AND BIOCHEMISTRY (**2018-19)

## 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


1. Datta, S.C.1989. Plant Physiology, Central Book Depot, Allahabad.
2. Dayananda, B. (1999). Experiments in Plant Physiology, Narosa Publishing House, New Delhi.
3. De Robertis, E.D.P. and De Robertis, E.M.F.Jr. 2002. Cell and Molecular Biology, Lipponcott Williams and Wilkins. USA.
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. 1680. Plant Physiology, Kalyani Publishers, New Delhi.
11. Nelson, D.L. and Cox, M.M. 1993. Principles of Biochemistry. MacMillan Worth Publications.

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| 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+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 exitation- 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 | | | |

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| 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 | | | |

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| 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<br>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 | | | |
| PRACTICALS | | | | |
| 44 | Session 43 | 1. Determination of osmotic pressure of plant cell sap by plasmolytic method.<br>2. Compare the stomatal indices of hydrophytes, xerophytes and mesophytes.<br>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 | | | |

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| | | 4. Measurement of photosynthesis by Willmott's bubbler/any suitable method.<br>5. Estimation of plant pigments by colorimeter. | | |
| 49 | Session 43 | General test for carbohydrates- Molischs test, Benedicts's tests, Fehling's test.<br>2. Colour test for starch – lodine test.<br>3. Colour tests for proteins in solution. Biuret test, Million's test, Ninhydrin test.<br>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.<br>5. Action of various enzymes in plant tissues: peroxides, dehydrogenase.<br>6. Estimation of protein using colorimeter. | Laboratory | |
| 50 | Session 43 | | | |
| 51 | Session 43 | | | |
| 52 | Session 43 | | | |
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**SEMESTER 6**

# Perspectives of Science, Methodology and General Informatics (2018-19)

## 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. 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 ScientificPaper*, 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.
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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<br>-Steps in scientific methods<br>- observation and thoughts<br>- formulation of a hypothesis<br>- designing of experiments<br>- testing of hypothesis<br>- formulation of theories | Presentation/Chalk and Board | |
| 2. | Session 2 | | | |
| 3 | Session 3 | - Selection of a problem<br>- Searching the literature<br>- Selection of variables, study area, and a suitable design<br>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<br>- Setting of hypothesis, Null-hypothesis and alternative hypothesis<br>- Need of control, treatments and replication<br>- Analysis, presentation and interpretation of data | Presentation/Chalk and Board | |
| 7 | Session 7 | | | |

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| | | - Testing of hypothesis, need of statistical tools<br>- Examples of great experiments in life sciences | | |
| 8 | Session 8 | - An example of moving from a question to hypothesis and then to an experimental design<br>- Contributions and the great experiments of Louis Pasteur, and Robert Koch<br>-Ethics in science | | |
| 9 | Session 9 | - Introduction | Presentation/Chalk and Board | |
| 10 | Session 10 | - Microscopy:- simple, compound, phase contrast, fluorescent, confocal and electron microscopes (working principle and application only)<br>- Microtome:- rotary, sledge, cryotome (application only) | | |
| 11 | Session 11 | - Sectioning:- Hand sections, microtomy | Presentation/Chalk and Board | |
| 12 | Session 12 | - Staining technique:- Principle of staining | | |

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| | | Stains:- Safranin, Hematoxylin, Acetocarmine<br>Vital stains: Purpose, Examples: Neutral red and Evan's blue<br>Mordents : Purpose and examples<br>Single staining and Double staining | | |
| 13 | Session 13 | - Mounting and Mounting Media, Purpose of mounting media, Glycerin, DPX, Canada balsam<br>- Use of permanent whole mounts, permanent sections<br>- Maceration<br>- Smear and squash preparation | Presentation/Chalk and Board | |
| 14 | Session 14 | | | |
| 15 | Session 15 | - Principles and applications of colorimeter, spectrophotometer and centrifuge, Beer-Lambert's Law, | Presentation/Chalk and Board | |
| 16 | Session 16 | | | |
| 17 | Session 17 | - Separation methods :- chromatography; thin layer, paper, column (principle and applications only), electrophoresis; PAGE, Agarose | Presentation/Chalk and Board | |
| 18 | Session 18 | | | |

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| | | 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<br>- 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)<br>- Measures of central tendency:- mean, mode, median | Presentation/Chalk and Board | |
| 26 | Session 26 | | | |
| 27 | Session 27 | - Measures of dispersion:- standard deviation, standard error<br>- Distribution patterns:- normal distribution, binomial distribution | Presentation/Chalk and Board | |
| | Session 28 | | | |
| | Session 29 | | Presentation/Chalk and Board | |

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| | Session 30 | - t-test :- introduction, uses, procedure<br>- chi-squire test:- introduction, uses, procedure | | |
| | Session 31 | - Need for research<br>- Types of research<br>- Scientific literature, Books, Research Journals, Reputed National and International journals in life sciences, Research paper<br>- INSDOC services<br>- Laboratory Etiquette<br>- Laboratory Hygiene | Presentation/Chalk and Board | |
| | Session 32 | | | |
| | Session 33 | Features of the modern personal computers and peripherals.<br>-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)<br>-Introduction to the use of information technology in teaching and learning | 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 | |

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| | | 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 | |
| PRACTICALS | | | | |
| | Session 41 | 1. Prepare CuSO4. H2O solution of different molarity using a stock solution<br>2. Determination of the area of different types of leaves using graph paper. | Laboratory/Demonstration | |
| | Session 42 | | | |
| | Session 43 | | | |
| | Session 44 | | | |
| | Session 45 | 1. Maceration and identification of tracheary elements | | |
| | Session 46 | | | |

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| | Session 47 | 1. Preparation of 0.1M sodium phosphate buffer (pH 6 and 7)<br>2. Measurement of pH using pH meter<br>3. Paper chromatography of plant pigments (demonstration)<br>4. Electrophoresis of nucleic acids (demonstration)<br>5. Column chromatography of plant pigments (demonstration)<br>6. Determination of the concentration of a given solution of CuSO4 using colorimetry | | |
| | Session 48 | | | |
| | Session 49 | | | |
| | Session 50 | | | |
| | Session 51 | | | |
| | Session 52 | 1. Collect numerical data and find out the central tendencies and prepare different types of graph mentioned in the syllabus<br>2. Familiarize with situations requiring t-test, chi-squire test | | |
| | Session 53 | | | |
| | Session 54 | | | |
| | Session 55 | 1. Gather information and pictures on a given topic using the internet. Make a list of the sites visited for the purpose<br>2. Prepare a project report using MS-WORD based on the information and pictures gathered from the internet.<br>3. Prepare a worksheet using a set of data collected and find out the SUM, MEAN, MEDIAN and MODE using EXCEL | | |
| | Session 56 | | | |
| | Session 57 | | | |
| | Session 58 | | | |
| | Session 59 | | | |
| | Session 60 | | | |
| | Session 61 | | | |

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| | | 4. Prepare suitable tables/ charts/graphs based on the data using EXCEL<br>5. Prepare a powerpoint presentation based on the 1 & 2 exercises | | |

**SEMESTER 6**

# BIOTECHNOLOGY AND BIOINFORMATICS (2018-19)

## 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.

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| 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 | | | |

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| 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 micropropogation. 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 culure 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 | |
| 16 | Session 16 | | Presentation/Chalk and Board | |
| 17 | Session 17 | | | |
| 18 | Session 18 | | | |
| 19 | Session 19 | Recombinant DNA Technology<br><br>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 | | | |

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| | | 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:<br>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 Biotechnolgy:<br>Tissue Engineering, Stem cell cuture, Nanobiotechnology | Presentation/Chalk and Board | |
| 30 | Session 30 | | | |
| 31 | Session 31 | Strategic Applications of Biotechnology:<br>Production of disease/ stress resistant plants, Gene therapy, DNA fingerprinting | Presentation/Chalk and Board | |
| 32 | Session 32 | | | |
| 33 | Session 33 | | Presentation/Chalk and Board | |

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| 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.<br>2. Biological data bases –<br>Nucleotide sequence database – EMBL, Gen Bank, DDBJ.<br>Protein sequence database – PDB, SWISS PROT | Presentation/Chalk and Board | |
| 37 | Session 37 | | | |
| 38 | Session 38 | Organismal database – Saccharomyces genome database<br>Biodiversity database – Species 2000<br>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 | |

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| 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<br>1. Molecular phylogeny and phylogenetic trees.<br>2. Molecular visualization – use of Rasmol.<br>3. Molecular docking and computer aided drug design | Presentation/Chalk and Board | |
| 48 | Session 48 | | | |
| 49 | Session 49 | | | |
| 50 | Session 50 | | | |
| PRACTICALS | | | | |
| 51 | Session 51 | 1. Preparation of nutrient medium – Murashige and Skoog medium, sterilization, preparation of explants, inoculation.<br>2. Extraction of DNA from plant tissue.<br>3. Immobilization of whole cells or tissues in sodium alginate.<br>4. Determination of appropriate flower bud containing uninucleate pollen for anther culture using cytological techniques<br>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 | | | |

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| | | 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.<br>2. Molecular visualization using Rasmol.<br>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 (**2018-19)

## 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*. 4th Edn.TMH N.Delhi.
4. John J. (2012). *Elements of Agribased Microenterprises*. Bulbul Scintific 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.

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| 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 | | | |

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| | | 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 | | | |

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| | | bisporic (Allium type) and tetrasporic (Peperomia 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. Adathoda vasica, Strobilanthes kunthianus | 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 | | | |

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| | | 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 | | | |

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

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| | | 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 | | | |
| PRACTICALS | | | | |
| 65 | Session 65 | Tongue grafting, budding ('T' and patch), air layering<br>2. Identification of different garden tools and their uses<br>3. List out the garden components in the photograph of the garden given<br>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.<br>2. Identification of various anther types-monothecous, dithecous<br>3. Identification of placentation types.<br>4. Observation of pollen and locating pollen pore<br>5. Pollen germination study | Laboratory/Demonstration | |
| 69 | Session 69 | | | |
| 70 | Session 70 | | | |
| 71 | Session 71 | 1. Preparation of potting mixture<br>2. Preparation of Tobacco/ Neem decoction | Laboratory/Demonstration | |
| 72 | Session 72 | | | |

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| | | 3. Familiarization of common fertilizers and manures<br>4. Familiarization of common cut flowers and leaves used in flower arrangements<br>5. Different flower arrangement types (demonstration) | | |
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**SEMESTER 6**

**PHYTOCHEMISTRY AND PHARMACOGNOSY (**2018-19)

## 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

| 1. | Date | Topic | Method | Remarks/Reference |
|---|---|---|---|---|
| 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 | |

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| 14 | Session 14 | C. Phenolics. Quinines-benzoquinones, napthoquinones, anthraquinone, and coumarins. | | |
| 15 | Session 15 | Habit, habitat and systematic position and morphology of the useful part.<br>(2) Organoleptic, anatomical and chemical evaluation of the officinal part.<br>(3) Phytochemistry and major pharmacological action of plant drugs.<br>(4) Ayurvedic formulations using the plant<br>Tinospora cordifolia, Papaver somniferum, Aegle marmelos , | Presentation/Chalk and Board | |
| 16 | Session 16 | | | |
| 17 | Session 17 | Habit, habitat and systematic position and morphology of the useful part.<br>(2) Organoleptic, anatomical and chemical evaluation of the officinal part.<br>(3) Phytochemistry and major pharmacological action of plant drugs.<br>(4) Ayurvedic formulations using the plant<br>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.<br>(2) Organoleptic, anatomical and chemical evaluation of the officinal part. | Presentation/Chalk and Board | |
| 20 | Session 20 | | | |

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

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| | | 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 Sysygium 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 pharmocognosy- 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 | |

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| 39 | Session 39 | Traditonal 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. | | |

**SEMESTER 1**

COMPLEMENTARY COURSE –I

**CRYPTOGAMS, GYMNOSPERMS AND PLANT PATHOLOGY (**2018-19)

## 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 |
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| **CRYPTOGAMS** | | | | |
| 1 | Session 1 | Viruses : General account, structure of | Assignment | |

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| | | 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. Archaebacteria | Assignment | |
| 3 | Session 3 | Algae (Phycology) Classification, main features of structure, and life history of the following groups<br>Cyanophyceae : Nostoc | Presentation/Chalk and Board | |
| 4 | Session 4 | Algae (Phycology) Classification, main features of structure, and life history of the following groups<br>Chlorophyceae : Volvox | Presentation/Chalk and Board | |
| 5 | Session 5 | Algae (Phycology) Classification, main features of structure, and life history of the following groups<br>Oedogonium, Cladophora | Presentation/Chalk and Board | |
| 6 | Session 6 | Algae (Phycology) Classification, main features of structure, and life history of the following groups<br>Phaeophyceae : Ectocarpus | Assignment | |

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| 7 | Session 7 | Algae (Phycology) Classification, main features of structure, and life history of the following groups<br>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.<br>Phycomycetes : Phytophthora | Presentation/Chalk and Board | |
| 10 | Session 10 | Fungi (Mycology): Classification, main features of structure, and life history of the following groups.<br>Ascomycetes : Peziza | Presentation/Chalk and Board | |
| 11 | Session 11 | Fungi (Mycology): Classification, main features of structure, and life history of the following groups.<br>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 | |

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| | | 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 Pteidophytes<br>Type: Selaginella | Presentation/Chalk and Board | |
| GYMNOSPERMS | | | | |
| 16 | Session 16 | General account of Gymnosperms<br>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 organisam, symptoms and control measures:<br>a. Nut fall of Arecanut | Assignment | |
| 19 | Session 19 | Study of the following diseases with name of disease, causative organisam, symptoms and control measures:<br>b. Bacterial blight of Rice | Presentation/Chalk and Board | |
| 20 | Session 20 | Study of the following diseases with | | |

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| | | name of disease, causative organisam, symptoms and control measures:<br>c. Leaf mosaic of Tapioca | | |
| PRACTICALS | | | | |
| 21 | Session 21 | 1. Identify Cryptogamic and Gymnosperm specimens and their parts prescribed in the syllabus; make micro-preparations wherever necessary<br>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 (**2018-19)

## 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 |
|---|---|---|---|---|
| **PLANT PHYSIOLOGY** | | | | |
| 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 stomtal 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 reaction C3 – C4 and CAM mechanisms | Presentation/Chalk and Board | |
| 8 | Session 8 | | Presentation/Chalk and Board | |

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| 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 | | | | |
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| 21 | Session 21 | Determination of osmotic pressure by plasmolytic method<br>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<br>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<br>2. Relation between transpiration and absorption<br>3. Evolution of O2 during photosynthesis<br>4. Light screen expt.<br>5. Mohl's experiment<br>6. Experiment with variegated leaf<br>7. Measurement of growth using Arc Auxanometer<br>8. Experiment with Kleinostat.<br>9. Effect of hormones on growth | Demonstration | |
| 26 | Session 26 | | | |
| 27 | Session 27 | | | |

**SEMESTER 3**

COMPLEMENTARY COURSE –III

**ANGIOSPERM TAXONOMY AND ECONOMIC BOTANY (**2018-19)

## 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. Macmillion 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** |
|---|---|---|---|---|
| **ANGIOSPERM TAXONOMY** | | | | |
| 1 | Session 1 | Importance of plant classification, types of classification, binomial nomenclature; ICBN, cytotaxonomy, chemotaxonomy | Presentation/Chalk and Board | |
| 2. | Session 2 | | | |
| 3 | Session 3 | | | |

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| 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 | | | |

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| | | 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 | | | |

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| | Session 30 | Cereals: Paddy, Wheat.<br>Pulses: Green gram, Bengal gram.<br>Tuber crops: Tapioca.<br>Spices : Pepper, Cardamom.<br>Beverages: Tea, Coffee.<br>Oil yielding plants: Coconut, Groundnut<br>Fibre yielding plants: Cotton, Coir.<br>Timber yielding plants: Teak, Rose wood.<br>Latex yielding plants: Para rubber.<br>Bio pesticides: Neem, Tobacco.<br>Ornamental plants: Rose, Orchids, Anthurium. | | |
| | Session 31 | | | |
| | Session 32 | | | |
| | Session 33 | | | |
| | Session 34 | Study of the following medicinal plants with special reference to their binomial, family, morphology of useful parts and uses.<br>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 | | | |
| PRACTICALS | | | | |
| | 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 | | | |

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

**SEMESTER 3**

COMPLEMENTARY COURSE –IV

**ANATOMY AND APPLIED BOTANY (**2018-19)

## 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.


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

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| | | cell wall (brief account only) | | |
| 2. | Session 2 | Tissues: simple and complex; meristems, secretary 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 | | | |

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| | | Halophytes (Avicinia/ Rhizophora). | | |
| **APPLIED BOTANY** | | | | |
| 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<br><br>a.Plant introduction, acclimatization plant quarantine.<br>b. Selection: Mass selection; pureline selection and clonal selection.<br>c.Hybridization; intervarietal, interspecific and intergeneric; procedure of hybridization. | Presentation/Chalk and Board | |
| 21 | Session 21 | Special methods of plant breeding.<br>a. Mutation breeding.<br>b. Polyploidy breeding | | |
| 22 | Session 22 | | | |
| 23 | Session 23 | Horticultural practices<br>Propagation through cutting, layering, budding and grafting | Presentation/Chalk and Board/ Assignment | |
| 24 | Session 24 | | | |
| 25 | Session 25 | | | |

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| 26 | Session 26 | | | |
| 27 | Session 27 | | | |
| | Session 28 | Tissue culture<br>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 | | | |
| PRACTICALS | | | | |
| | Session 34 | a. Types of tissue – simple and complex.<br>b. Primary structure of stem and root of dicots and monocots.<br>c. Structure of dicot stem and dicot root after secondary thickening.<br>d. Anomalous secondary thickening in Bignonia.<br>e. Anatomy of monocot and dicot leaf.<br>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 | | | |

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