ST. JOSEPH'S COLLEGE (AUTONOMOUS)
IRINJALAKUDA
THRISSUR DISTRICT, KERALA – 680 121

SYLLABUS FOR M.Sc. BOTANY PROGRAMME
CREDIT AND SEMESTER SYSTEM (CSS)

(Effective from 2018 Admission)

MEMBERS OF BOARD OF STUDIES

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M.Sc. BOTANY PROGRAMME (CSS)

Admission:

The norms of admission as per the existing university regulations will be followed.

Duration of the Course:

Four semesters (2 years)

Number of courses and credits required:

I^{st,} IInd and Illrd semesters with four core courses (three theory and one practical), each with 4 credits (total 16 credits per semester) and IV semester with four elective courses (two theory and two practical) each with 4 credits, one dissertation with 4 credits and one viva voce with 4 credits (total 24 credits in the semester). Total credits required for the completion of the programme is (16x3)+(1x24)=72.

Selection of subject for dissertation:

A subject is to be selected by each student for dissertation based on the facilities available and the specializations of the supervising teachers.

Evaluation:

Evaluation is to be carried out both by internal continuous evaluation and external terminal evaluation. Out of the total weightage for each course, 25% is to be given for internal continuous evaluation and 75% for external terminal evaluation.

1. Internal continuous evaluation:

Internal continuous evaluation should have five components of equal weightage as shown below. Internal evaluation will be carried out by the teacher/ teachers offering the course. The marks should be displayed on the notice board of the department and the students shall be given a chance to redress grievances if any.

a. Theory courses:

ATTENDANCE	ASSIGNMENT	SEMINAR	TEST1	TEST 2
90%:Full weightage	A:Full weightage	A:Full weightage	A:Fullweightage	A:Full weightage
80%:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage
75%:1/2 weightage	C:1/2 weightage	C:1/2 weightage	C:1/2 weightage	C:1/2 weightage
Below75%: Noweightage	D:No weightage	D:No weightage	D:No weightage	D:No weightage

b.**Practical courses:**

ATTENDANCE	PRACTICAL SKILL	DRAWING SKILL	TEST1	TEST 2
90%:Full weightage	A:Full weightage	A: Full weightage	A: Full weightage	A: Full weightage
80%:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage
75%:1/2 weightage	C:1/2 weightage	C:1/2 weightage	C:1/2weightage	C:1/2 weightage
Below75%: No weightage	D: No weightage	D: No weightage	D:No weightage	D: No weightage

c. Dissertation:

REGULARITY	INVOLVMENT/ LEVEL OF KNOWLEDGE	LITERATURE COLLECTION	PRESENTATION 1	PRESENTATION 2
90%:Full weightage	A: Full weightage	A:Full weightage	A:Full weightage	A:Full weightage
80%:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage	B:3/4 weightage
75%:1/2 weightage	C:1/2 weightage	C:1/2weightage	C:1/2 weightage	C:1/2 weightage
Below 75%:	D: No weightage	D:No	D:No weightage	D:No weightage

Noweightage		weightage		

DISTRIBUTION OF WEIGHTAGE OF MARKS:

1. **Theory:** Essay questions: 25%; Paragraph questions: 40%; Short answer questions: 35%
2. **Practicals:** Practical work: 85%; Practical records: 10%; Submissions and tour report: 5%
3. **Dissertation:** Written account: 80%; Presentation: 10%; Discussion: 10%
4. **Viva voce:** Viva voce at the end of the 4th semester based on the entire syllabus with 100% external evaluation.

DISTRIBUTION OF WORK BASED ON CREDITS:

1 credit = 1.5 hours of teaching per week.

(**1st semester to 3rd semester:** 16 credits = 24 teaching hours per week

1 hour per week for seminar

4th semester: 16 credits for elective courses = 24 teaching hours per week

1 hour for CE of Dissertation).

The credits of Dissertation (4) are to be acquired by the candidate through a project work and that for Viva voce (4) are to be acquired by appearing for a comprehensive viva at the end of the course.

END SEMESTER EXTERNAL EVALUATION (EE)

THEORY EXAMINATIONS

At the end of each semester, there will be external evaluation for each course. The theory examination will be of 3-hour duration and will have a total of 36 weightage. There will be two evaluations for the theory papers - one by an internal examiner and the other by an external examiner.

THEORY EXAMINATIONS – PATTERN OF QUESTION PAPER:

Duration – 3 hours

Maximum weightage - 36

Part A – Answer all questions - 14 questions (14 x 1 = 14 weightage) - Short questions

Part B – Answer any 7 out of 10 questions (7 x 2 = 14 weightage) each answers approximately in not more than 100 words

Part C – Answer any 2 out of 4 questions (2 x 4 = 8 weightage)

Essay types - Answer in 300 words

PRACTICAL EXAMINATIONS

The structure of the course envisages a practical examination at the end of even semester. The 1st and 2nd semester examinations are conducted at the end of the 2nd semester. Similarly 3rd and 4th semester examinations are conducted at the end of the 4th semester. Each practical examination will be of 6 hour duration with a break in between. The practical question paper is therefore to be set with two sections. The practical examinations are to be conducted by two examiners preferably one examiner from an outside institution and one internal examiner. The

institution shall select the external examiner. It is the duty of the external examiner to provide the specimens for the examination.

The students will have to submit their tour reports and practical records on the day of the practical examinations. Every student has to submit a bound certified laboratory record of practical for evaluation. All the experiments of each practical course should be recorded properly with the experiment results. A candidate submitting a certified practical record alone is eligible for appearing for the Practical Examination.

PRACTICALS

Total - 36 weightage

Practical: 30 weightage

Practical records: 4 weightage

Submissions and Tour Report: 2 weightage

PRACTICAL EXAMINATIONS – PATTERN OF QUESTION PAPERS:

Duration – 6 hours

Maximum weightage - 36

SELECTION OF SUBJECT FOR DISSERTATION:

A subject is to be selected by each student for dissertation based on the facilities available and the specializations of the supervising teachers.

DISSERTATION EVALUATION

Each student has to undertake a project work in consultation with the supervising teacher. The project report shall be submitted to the board of examiners during the practical examinations of the IV semester. The student has to present the salient features of his/her work and dissertation by way of power point (PPT) presentations to the team of examiners and will have to appear for a viva voce.

COMPREHENSIVE VIVA VOCE

At the end of the 4th semester practical examinations the candidate has to appear for a comprehensive viva voce of 4 credits based on the entire programme content. There is no internal assessment for viva voce.

PROGRAMME OUTCOME

- To know the scope and importance of Botany
- To inculcate interest in nature with its myriad living forms
- To develop scientific temper among students
- To equip the students to undertake scientific projects
- To give better exposure to the diversity of life forms
- To give awareness about natural resources and their importance in sustainable development
- To provide opportunities for the application of the acquired knowledge in day to day life
- To develop skill in doing practical experiments, familiarizing equipments and biological specimens
- To make them conscious about the degradation of natural habitat
- Develop an ability to work on their own and to make them fit for the society
- Make them think scientifically so that students can be open-minded, critical and curious
- To find a scientific solution for the problems around them

PROGRAMME SPECIFIC OUTCOME

- Students can pursue their studies further for M.Phil. or Ph.D.
- Students who prefer teaching and research can enter into Colleges and Universities
- They have employment opportunities in Food and Herbal Industry, Pharmaceutical Companies, Nursery farms
- They can work as Farming consultant, Environment Consultant, Plant Biochemist, Ecologist, Forester, Plant Taxonomist, Molecular Biologist etc.

M.Sc. BOTANY PROGRAMME (CSS)				
COURSE CODE	TITLE OF PAPER	INTERNAL	EXTERNAL	TOTAL CREDITS
SEMESTER I				
BO01 CT01	PHYCOLOGY, BRYOLOGY, PTERIDOLOGY AND GYMNOSPERM	25%	75%	4
BO01 CT02	MYCOLOGY & LICHENOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY	25%	75%	4
BO01 CT03	ANGIOSPERMANATOMY, ANGIOSPERM EMBRYOLOGY, PALYNOLOGY & LAB TECHNIQUES	25%	75%	4
BO01 CP04	PRACTICALS OF PHYCOLOGY, BRYOLOGY, PTERIDOLOGY GYMNOSPERM, MYCOLOGY ,LICHENOLOGY, MICROBIOLOGY PLANT PATHOLOGY, ANGIOSPERM ANATOMY, ANGIOSPERM EMBRYOLOGY, PALYNOLOGY AND LAB TECHNIQUES	25%	75%	4
SEMESTER II				
BO02 CT05	CELL BIOLOGY, MOLECULAR BIOLOGY AND BIOPHYSICS	25%	75%	4
BO02CT06	CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING, EVOLUTION	25%	75%	4
BO02CT07	PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAPHY ANDFOREST BOTANY	25%	75%	4
BO02CP08	PRACTICALS OF CELL BIOLOGY, MOLECULAR BIOLOGY BIOPHYSICS, CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING, EVOLUTION, PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAPHY AND	25%	75%	4

	FOREST BOTANY			
SEMESTER III				
BO03CT09	PLANT PHYSIOLOGY, METABOLISAM AND BIOCHEMISTRY	25%	75%	4
BO03CT10	ANGIOSPERM MORPHOLOGY, TAXONOMY, AND PLANT RESOURSES	25%	75%	4
BO03CT11	BIOTECHNOLOGY AND BIOINFORMATICS	25%	75%	4
BO03CP12	PRACTICALS OF PLANT PHYSIOLOGY, METABOLISAM BIOCHEMISTRY, ANGIOSPERM MORPHOLOGY, TAXONOMY, PLANT RESOURSES, BIOTECHNOLOGY AND BIOINFORMATICS	25%	75%	4
SEMESTER IV				
BO04ET13	GENETIC ENGINEERING (ELECTIVE 1)	25%	75%	4
BO04ET14	PATHOLOGY OF PLANTATION CROPS (ELECTIVE 2)	25%	75%	4
BO 04ET15	ELECTIVE III-ENVIRONMENTAL BIOLOGY AND BIODIVERSITY CONSERVATION	25%	75%	4
BO04EP16	PRACTICALS OF ELECTIVE I-GENETIC ENGINEERING,ELECTIVE II-PATHOLOGY OF PLANTATION CROPS AND SPICES,ELECTIVE III-ENVIRONMENTAL BIOLOGY AND BIODIVERSITY CONSERVATION	25%	75%	4
BO04DN17	DISSERTATION	25%	75%	4 4 4
BO04VV18	VIVAVOCE	0%	100%	4 4

SEMESTER I

Course Code	Title	Teaching Hours / week	Duration of examination	Weightage		Credits	Page Nos:
BO01 CT01	Phycology, Bryology, Pteridology and Gymnosperms	1½+1+2+ 1½ = 6	3 hrs	36	20	4	11-13
BO01 CT02	Mycology and Lichenology, Microbiology and Plant Pathology	2½+2½+1 =6	3 hrs	36	20	4	14-16
BO01 CT03	Angiosperm Anatomy, Embryology, Palynology and Lab Techniques	2+2+1+1 = 6	3 hrs	36	20	4	17-20
BO01 CP04	Practicals of Phycology, Bryology, Pteridology, Gymnosperms, Mycology, Lichenology, Microbiology, Plant Pathology, Angiosperm Anatomy, Embryology, Palynology and Lab Techniques	½ x 10 + 1 for Lab Techniques = 6	6 hrs	36	20	4	21-23

EE – External evaluation
ICE – Internal continuous evaluation

SEMESTER I

CORE COURSE 1 - PHYCOLOGY, BRYOLOGY, PTERIDOLOGY AND GYMNOSPERMS

COURSE CODE BO01 CT01

(1.5+1+2+1.5=6 hours per week)

COURSE OUTCOME

To impart basic knowledge about the morphology, anatomy, and reproduction of lower taxa such as algae, bryophytes, pteridophytes and gymnosperms and their life cycles.

Phycology

1. **Classification of Algae**-Comparative Survey of important systems - Fritsch-Smith-Round. Criteria for algal classification- Phylogenetic considerations.
2. General account of thallus structure, cell ultra-structure, reproduction, relationships and evolutionary trends in the following'groups: Chlorophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta.
3. **Algal cytology**-Basic ideas of cell features-Electron microscopic study of algal cell, cell wall, flagella, chloroplast, pyrenoid, eyespot- their importance in classification.
4. **Reproduction**-Different types of life cycles in algae.
5. General account of energy sources and pigments in algae.
6. **Economic importance of algae**-Roll of algae in soil fertility, algae in industry-Biological importance of phytoplanktons and water blooms. Biological importance of Planktons.

References:

1. Fritsch, F.E. The structure and Reproduction of Algae.
2. Smith, G.M. Manual of Phycology
3. Round, F.E, The Biology of Algae.
4. Pold and Wyane. Introduction of Algae.
5. Ahluwalia (Amrik Singh), Phycology : Principles,Process And Applications

Bryology

1. General characters and systems of classifications of Bryophytes
2. General account of the anatomy, reproduction, life history and phylogeny of Sphaerocarpales, Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales, Andreales, Funariales and Polytrichales
3. Origin and evolution of Bryophytes- gametophytic and sporophytic.
4. A general account of fossil Bryophytes and their affinities.
5. Economic importance of Bryophytes.

References:

1. Watson E. V. The structure and life of Bryophytes. Hutchinson Univ. Press, London.
2. Cavers F. The interrelationship of Bryophytes. New Phytologist.

3. Kashyap S.R., The Liverworts of Western Himalaya and the Punjab Plains, Vol.l&II. Chronica Botanica
4. Smith G.M. Cryptogamic Botany. McGraw Hill Book Co., N.Y.
5. Parihar N.S. An introduction of Embryophyta: Bryophyta. General Book House, Allahabad.
6. Verdoon, F.M. Mannual of Bryology. Ashor & Co., Amsterdam.
7. Shaw, J. and Goffinet, B. Bryophyte Biology. Cambridge University Press.
8. Manju C. Nair, K.P. Rajesh and Madhusoodanan P. V.Bryophytes of Wayanad in Western Ghats. Malabar Natural History Society, Kozhikode.

Pteridology

1. Classification of Pteridophytes: Holttum, Pichi-Sermolli.
   General account of the contribution of Indian pteridologist
2. General characters and life history of Pteridophytes.
3. Cytology of Pteridophytes- Chromosome number and polyploidy.
4. Structure and evolution of stele in Pteridophytes.
5. Origin and evolution of Sporangium.
6. Heterospory and seed habit.
7. Development and evolutionary trends in the Gametophytes of Pteridophytes.
8. Apogamy, Apospory and Parthenogenesis.
9. Comparative morphology, ecology and phylogeny of the following:
   a) **Psilopsida** : Rhyniales, Psilophytales and Psilotales
   b) **Lycopsida**: Lycopodiales and lsoetales
   c) **Sphenopsida**: Hyeniales, Pseudobomiales, Sphenophyllales, Calamitales and Equisetales.
   d) **Filicopsida**: General account: Primofilicales, Ophioglossales, Marattiales, Osmundales, Schizaeales, Cyatheales, Gleicheniales, Marsileales and alviniales.
10. **Economic importance of Pteridophytes**- Medicinal, Horticulture, Biofertilizer, weeds.

References:

1. Bierhost, D.W. Morphology of Vascular Plants. Mac Miilan Co., New York.
2. Dyer, A.C. The Experimenial Biology of Ferns. Academic Press, London.
3. Jermy, A.C. (Ed.): The phylogeny and Classification of Ferns.
4. Kramer, K.U. and Green, P.S. The Families and Genera of Vascular Plants. Narosa, New Delhi.
5. Nampy, S. and Madhusoodanan, P.V. Fern Flora of South India-Taxonomic Revision of Polypodioid Ferns. Daya Publishing House, New Delhi.
6. Abdul Hameed C., Rajesh K.P. and Madhusoodanan P.V. Filmy Ferns of South India. Penta Book Publishers & Distributors, Calicut.
7. Azeez K, Venugopalakrishna Kurup V. and P.V. Madhusoodanan. Spleenworts (Aspleniaceae) of South India. Malabar Natural History Society, Calicut.

8. Venugopalakrishna Kurup V., Azeez K. and P.V. Madhusoodanan. Primitive Ferns of South India. 'V'Publishers, Kottayam.

Gymnosperms

1. Geological time scale and correlated predominant Gymnosperm flora. Classification of Gymnosperms - Chamberlain's system.
2. Geological horizons. Distribution, morphology, anatomy, reproduction and interrelationship of the following orders (Study of families and genera**,** not required)

a. Pteridospermales; b. Glossopteridales;c. Caytoniales; d. Cycadaeoidales;
e. Pentoxylales; f. Cycadales; g. Ginkgoales; h. Cordaitales; i. Coniferales;
j. Taxales; k. Ephedrales; l. Welwitschiales; m. Gnetales

3. Phylogenetic relationship of Gymnosperms.
4. Economic importance of Gymnosperms

References:

1. Andrews, H.N. Studies in Paleobotany, Wiley, N. Y.
2. Banks, H.P. Evolution and plants of the past. Wadsworth.
3. Bierhost, D.W. Morphology of Vascular Plants. Macmillan.
4. Bower, F.O. Primitive Plants. Macmillan.
5. Chamberlain, C.J. Gymnosperms- Structure and Evolution. Univ. of Chicago Press.
6. Foster, A.S. & E.M. Gifford. Comparative morphology of vascular plants. Freeman.
7. Maheshwari, P & V. Vasil. Gnetum. CSIR, New Delhi.
8. Ramanujam, C.G.K. Indian Gymnosperms in time and space. Today & Tomonow, Dehra Dun.
9. Sewart, W.N. Paleobotany and the Evolution of Plants. Cambridge Univ. Press.
10. Stockey, R.S. Some comments on the origin and evolution of conifers. Canadian J. Bot. 59:75-82.'
11. Taylor, T.N. Reproductive biology in early seed plants.Bioscience 32:23-28.
12. Walton. An Introduction to the Study of Fossil plants.

CORE COURSE 2: MYCOLOGY & LICHENOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY (2.5+2.5+l = 6 hours per week)

COURSE CODE BO01 CT02

COURSE OUTCOME

To inculcate the knowledge about fungi, lichens and the disease caused by these organisms in plants and understanding the various aspects of classical Microbiology.

Mycology

1. General characters of Fungi: cell-ultra structure, unicellular and multicellular organization, hyphal growth, cell wall composition, nutrition (saprobic, biotrophic, symbiotic, predacious) reproduction (vegetative, asexual, sexual), heterothallism, parasexuality.
2. Classification of fungi by Ainsworth & Bisby (1983), Alexopoulos et al. (1996) - Phylogeny of fungi- Characters used in classification.
3. General account of Myxomycota, Mastigomycota, Zygomycota, Ascomycota, Basidiomycota and mitosporic fungi. Different kinds of spores and their dispersal.
4. Fungi as saprophytes: details of the fungal decomposition of organic matter, coprophilous fungi, lignin degrading fungi, role of fungi in degradation of pesticides.
5. Fungi as symbionts: Mycorrhiza - ectotrophic, orchidaceous and Ericoid mycorrhiza, Vesicular Arbuscular Mycorrhiza - their distribution and significance. Endophytes.
6. Lichenology: General account and systematics of lichens, thallus structure, reproductive bodies, ecological significance and economic importance of lichens.

References:

1. Alerxopoulos C. J., Mims, C. W. & Blackwell, M. Introductory Mycology. 4th edition. John Wiley & Sons Inc.
2. Ainsworth, G.C., Sparrow, K.F. & Susmann, A.S.(Eds.). The Fungi - An Advanced Treatise. Vol 1-4. Academic Press.
3. Burnett, J.H. Fundamentals of Mycology. Edward Arnolds.
4. Cariile, M. J. & Watkinson S.C. The Fungi. Academic Press.
5. Deacon, J.W. Introduction to Modem Mycology. Blackwell.
6. Dubey, H.C. An Introduction to Fungi. Vikas Publishers, New Delhi.
7. Hale Mason, E. The Biology of Lichens. 3rd Ed. Edward Arnold, London.
8. Jennigs, D.H. & Lysek, G. Fungal |Biology. Bios Scientific Publishers.
9. Mehrotra, R.S. & Aneja, K.R. An Introduction to Mycology. New Age International Publishers.
10. Landecker, Elizabeth Moore. Fundamentals of Fungi. 4th Ed. Prentice Hall.
11. Nair, M.C. & Balakrishnan, S. Beneficial fungi and their utilization. Scientific Publishers, Jodhpur.
12. Nash, T.H. Lichen Biology. Cambridge University Press.
13. Webster, John. Introduction to Fungi. Cambridge University Press.

Microbiology

1. Introduction - main groups of microorganisms and their characteristics -prions, viroids, viruses, rickettsia, bacteria, mycoplasmas and actinomycetes.
2. Bacteria - classification based on Bergey's Manual. Archaebacteria and Eubacteria. Morphology, ultrastructure - cell wall, flagella and nucleoids,. nutrition, reproduction in bacteria.
3. Plasmids and their characterization.
4. Cyanobacteria- salient features, morphology, ultrastructure, classification and economic importance.
5. Viruses- General account of plant and animal viruses, bacteriophages and their classification. Isolation, purification, infection, replication and transmission of plant viruses. Detailed study of TMV and T4Phage.
6. Microbial ecology- microbiology of rhizosphere and phylloplane. Sewage disposal, bioremediation and. water purification. Detection of microbes in air and water. Sterilization techniques in microbiology**.** Agricultural microbiology - management of agricultural soils, bio fertilizers, biopesticides.
7. Food Microbiology -.Food spoilage and preservation methods. Microbiology of fermented food - dairy products, bread and other fermented plant products. Microorganisms as source of food- single cell protein.
8. Industrial Microbiology - Production of alcohol, vinegar, antibiotics, vitamins, steroids, vaccines, organic acids, amino acids.

References:

1. Adams, M R & Moss, M.O. Food Microbiology. New Age International Publishing Ltd., New Delhi.
2. Brock, T. D. Biology of Microorganisms. Prentice Hall.
3. Campbell, R. Microbiology. ELBS-Edward Arnold, London.
4. Carpemter, P.L. Microbiology. W.B. Sunders &Company, Philadelphia.
5. Dubey, R.C. & Maheswari, E).K. A text book of Microbiology. S. Chand.
6. Desikachary. Cyanophyta- Monograph.
7. Goodfellow, M. et.al. The Biology of Actinomycetes. Academic press.
8. Kumar, H.D. & Swati Kumar. Modem Concepts of Microbiology.
9. Mathew, R.E.F. Plant Virology, Academic press.
10. Pelczar, M.J., Chan, E.C.S. & Krieg, N.R. Microbiology. Tata Me Graw Hill.
11. Sharma, P.D. Microbiology & Plant Pathology. Rastogi Publishers, Meerut.
12. Pelczar.Tata McGraw-Hill Education,1998.

Plant Pathology

1. Principles of Plant Pathology- Causal agents of plant diseases - Biotic causes (fungi, bacteria, virus, mycoplasma, nematodes, angiospermic parasites. Abiotic causes (nutrient

and mineral deficiencies, effect of pollution). Koch's postulates. Iatrogenic diseases. Seed pathology.

2. Details of different symptoms of plant diseases.
3. Process of infection- mechanical, physiological and enzymatic action. Penetration and entry of pathogens in to host tissue.
4. Host- parasite interaction. Enzymes and toxins in pathogenesis. Defense mechanisms in plants (structural and biochemical).
5. Details of different ways of spread and transmission of plant diseases- wind and water-mediated, seed borne and vector borne.
6. Plant disease management- exclusion, eradication and protection. Different pesticides and fungicides and their application. Biocides in plant protection.
7. Study of the following diseases with reference to the symptoms, causal organisms, disease cycle and control measures:

a) Bunchy top of banana, b) Bacterial blight of paddy, c) Bud rot of coconut, d) Mahali of Arecanut, e) Powdery mildew of rubber, f) Abnormal leaf fall of rubber, g) tikka disease of Ground nut, h) Late blight of potato, i) Blister blight of tea, j) wheat rust, k) Coffee rust, l) grey leaf spot of coconut,

m) Phytophthora foot rot of pepper, n) rhizome rot of ginger, o)rhizome rot of turmeric,

8. Angiospermic parasites-Viscum, Dendropthoe.

References:

1. Agrios, G.N. Plant pathology. 4th Ed., Academic Press.
2. Bilgrami, K.H. & Dube, H C. A Text Book of Modem Plant Pathology. Vikas Publishers, New Delhi.
3. Chaube, H.S. & Ramji Singh . Introductory Plant Pathology. International Book Distributing Co., Lucknow.
4. Gareth-Jones, D. Plant Pathology: Principles and Practice. Open University Press.
5. Horsfall J.G. & Cowling E. B. (Ed.). Plant Disease:An Advanced Treatise. Academic Press.
6. Lucas, J. A. Plant Pathology and Plant pathogens. Blackwell.
7. Manners, J.G. Principles of Plant Pathology. Cambridge Univ Press.
8. Mehrotra, R.S. Plant Pathology. Tata Me Graw Hill.
9. Pandey, B. P. Plant Pathology -pathogen and plant disease. S. Chand & Co.
10. Pathak, V.N., Khatri, N.K. & Pathak, M. Fundamentals of Plant Pathology. Agro-bios India.
11. Rangasvvami, G. Diseases of Crop Plants of India. Prentice Hall India.
12. Tarr, S.A. J. The Principles of Plant Patholgy. Winchester Press.
13. Wheeler, H. Plant Pathogenesis. Springer Verlag.
14. Wood, R.K.S. Physiological Plant Pathology. Blackwell

CORE COURSE 03. ANGIOSPERM ANATOMY, ANGIOSPERM EMBRYOLOGY, PALYNOLOGY & LAB TECHNIQUES (2+2+1+1= 6 hours per week)
COURSE CODE BO01 CT03

COURSE OUTCOME

The course is aimed to give a thorough understanding about the anatomy of the flowering plants and its relationship to the physiology and environmental adaptability of the plants. It also gives a basic idea on the reproduction and development of the flowering plants. To equip the students to make permanent slides of the different plant parts for the preservation and future study. To impart the knowledge of spore morphology, dispersal mechanisms and its economic importance.

Angiosperm Anatomy

1. Cell wall and its development. Chemistry of cell wall- cellulose, hemicellulose, polysaccharides, cell wall proteins, water. Organisation of primary wall. Cytokinesis and growth. Plasmodesmata. Secondary wall chemical constituents- lignin, suberin, callose; organisation of secondary wall.
2. Node - nodal patterns: Unilacunar, trilacunar, multilacunar and split lateral. .Phylogenetic considerations. Leaf trace and branch trace- origin, departure; effect on stele and pith. Secondary growth in leaf traces.
3. Cambium: Development of vascular cambium, and cork cambium in root and stem; cell types in vascular cambium, infected vascular cambia, seasonal variations in cambial activity; role of cambium in wound healing and grafting. Conversion of fusiform initials in to ray initials; cambium in arborescent monocotyledons (Liliflorae).
4. Development and differentiation: The structure of specialized cells. Vascular differentiation (procambium, residual meristem, interfascicular and intrafascicular cambia); acropetal and basipetal differentiation in leaves, stem and roots. Sieve tube differentiation. Control of phloem differentiation. Tracheary elements differentiation. Ultra structure of phloem and xylem, brief account of transfer cells. Secondary wall thickening, cytoplasmic changes and autolysis. Control of differentiation. Genetic aspects- lnduction of vessel elements. Induction of secondary xylem structure in relation to function in water conduction.
5. Anomalous secondary growth: Concepts; modification of the common type of vascular cambium, unequal activity of the vascular cambium. Successive cambia. Anomalous placement of vascular cambium. Discontinuous, unidirectional and bidirectional activity of cambium. Anomalous secondary growth in storage roots (Beet root, sweet potato).
6. Seedling anatomy: Concepts: anatomy of cotyledons, hypocotyl, seedling root, mesocotyl differentiation
7. Leaf anatomy: Unifacial, bifacial and centric leaf (onion); structure of epidermis, stomatal types; foliar sclereids; oil cells; crystal idioblasts.
8. Anatomy in relation to taxonomy.

9. Wood anatomy- general account.

References:

1. Easu, K. Plant Anatomy - Wiley Eastern Limited.
2. Fahn, A. Plant Anatomy. Pergamon Press.
3. Cutter, E.G. & Edward, E. Plant Anatomy: Experiment and Interpretations Part I and II.
4. Mauseth, J.D. Plant Anatomy - The Nenjamin Cumming Publishing Co.
5. Forester, A.S. Practical Plant Anatomy. D. Van Nostrand Company Inc.
6. Roberts, L.W. Cytodifferentiation in Plants - Cambridge University Press, Cambridge.

Angiosperm Embryology

1. Introduction to angiosperm embryology - structure of dithecous and monothecous anther.
2. Microsporogenesis: Structure and function of wall layers, role of tapetum in pollen development
3. Male gametophyte: Pollen mitosis, division of generative cells, heterospory.
4. Megasporogenesis: Megaspore triad, dyad, coenomegaspore.
5. Embryo sac - different types- ultra-structure of components- synergid and antipodal. Theories of the morphological nature of embryo sac.
6. Pollination -Artificial pollination - ultra-structural and dis-ultrastructural and histo-chemical sigma. Significance of pollen - pistil interaction. Role of pollen wall proteins and stigma. In vitro pollination and fertilization.
7. Fertilization: Role of synergids - filiform apparatus, heterospermy and triple fusion.
8. Structure and development of typical dicot and monocot embryos- structure and function of suspensor.
9. Endosperm: classification and type-ruminate endosperm- mosaic endosperm- endosperm haustoria - physiology and cytology of endosperm.
10. Polyembryony - classification - practical value.
11. Apomixis - general account, genetics of apomixis.
12. Parthenocarpy -seedless fruits
13. Experimental embryology-embryo culture, anther culture, ovule culture.
14. Embryology in relation to taxonomy.

References:

1. Bhojwani S.S. and Bhatnagar S. S. The embryology of Angiosperms. Vikas Publication, New Delhi.
2. Bouman F. Ovule initiation, ovule development and seed coat astructure in angiosperms. Today and Tomarrow Publishers, New Delhi.
3. Davis C.L. Systematic embryology of Angiosperms. John Wiley.
4. Eames A. J. Morphology of Angiosperms. Me Graw Hill.
5. Johanson D. Plant Embryology. Waltham, Massachusetts.
6. John B.D. (Ed.). Embryology of Angiosperms. Springer Verlag.

7. Maheswari P. An introduction to the Embryology of Angiosperms. Me Graw Hill.
8. Raghavan V. Experimental embryogenesis in plants. Academic Press.
9. Wardlaw C.W. Embryogenesis in Plants. Methusen, London.

Palynology

1. Introduction- contributions of Erdtman and P K K Nair.
2. Development and structure of pollen wall. Pollen morphology and its application. Pollen evolution
3. Aero-palynology- methods of aerospore survey and analysis
4. Melittopalynology- nutritional and medical value of honey- Unifloral and multifloral honey.
5. Recent advances in palynological studies- forensic- pollen allergy- oil exploration- paleopalynology.
6. Palynology in relation to taxonomy- eurypalynous and stenopalynous taxa.

References:

1. Sripad N. Agashe. Palynology and its Application.
2. Kahinath Bhattacharya et. al. A Text Book of Palynology.

Laboratory Techniques

1. Study of the following instruments - their uses and principles:
   a) Microscope: microscopic measurements - camera lucida, micrometry.
   b) Microtomes- Sledge, Rocking, Rotary.
2. Killing, fixing and staining of plant tissues:
   a) Important reagents and chemicals used in the preparation of fixatives and their properties.
   b) Fixatives - FAA, Camoy's fluid, chrome acetic, Nawaschins fluid, Craf, Flemings- composition, preparation and specific uses.
   c) Dehydrating agents, clearing agents, mounting media. Examples and brief description.
   d) Stains - classification, composition and specific uses - safranin, crystal violet, cotton blue, fast green, Orange - G, hematoxylin, carmine.
   e) Staining techniques and Methods – Single Staining, Double staining, Triple staining. Progressive staining, regressive staing, counter staining**.** Brief account on vital staining***.**
3. Methods of embedding plant materials in paraffin wax - TBA method; embedding for Electron microscopy.
4. Sectioning of embedded paraffin wax materials using Rotary Microtome.
5. Double staining of microtome serial sections embedding in paraffin wax - Saffranin - fast green; Crystal violet - Orange G / Erythrosin.
   General account on -Whole mounts, Maceration, smears
6. Histochemical tests -
   i) PAS Test - insoluble polysaccharides.

ii) Sudan black -lipids
iii)Fuelgen reaction - Nucleic Acids.

References:

1. Gray, P. (1964). Handbook of Basic Microtechnique. McGraw Hill Company.
2. John E. Sass. Botanical Microtechnique, Oxford & IBH Publishing Co.
3. John R. Baker. Principles of Biological Microtechnique - Univ. press.
4. A guide book to microscopical methods. A. V. Grimstone and R.J. Saker, Cambridge Univ. press.
5. Krishnamurthy, K.V. (1987). Methods in Plant Histochemistry. S. Viswanathan printers, Anand book depot, Madras
6. Prasad, M.K. and Krishna Prasad, M. (1983). Outlines of Microtechnique. Emkay Publication

BO01CP04. PRACTICALS OF PHYCOLOGY, BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS, MYCOLOGY, LICHENOLOGY, MICROBIOLOGY, PLANT PATHOLOGY, ANGIOSPERM ANATOMY, ANGIOSPERM EMBRYOLOGY, PALYNOLOGY AND LAB TECHNIQUES

(½ x 10 + 1 for Lab Techniques = 6 hours per week)

PHYCOLOGY [½ hour per week]

1. Collection, preservation and preparation of algal herbarium (5 numbers).
2. Collection and study of the types mentioned below and their identification up to generic level using algal monographs:

Chlorophyta: *Pediastrum*, *Scenedesmus*, *Hydrodyctyon*, *Ulva*, *Cladophora*, *Pithophora*, *Bulbochaete*, *Cephaleuros*, *Draparnaldiopsis*, *Bryopsis*, *Codium*, *Caulerpa*, *Halimeda*, *Desmids* (*Closterium*, *Cosmarium*), *Nitella*.

Xanthophyta: *Botrydium*.

Bacillariophyta: *Biddulphia*, *Coscinodiscus*, *Cymbella*.

Phaeophyta: *Ectocarpus, Dictyota, Padina, Turbinaria*.

Rhodophyta: *Batrachospermum, Gracilaria, Champia*.

BRYOLOGY [½ hour per week]

Morphological and structural study of representative members of the following types using whole mount preparations, dissections and transactions:

Asterella, Targionia, Cyathodium, Lunularia, Pallavicinia, Dumortiera, Porella, Anthoceros, Sphagnum, Bryum.

PTERIDOLOGY [½ hour per week]

1. Study of vegetative and reproductive features of:

Lycopodium, Ophioglossum, Angiopteris, Osmunda, Lygodium, Ceratopteris, Pteris, Asplenium, Blechnum, Cyathea, Gleichenia, Trichomanes, Salvinia, Azolla.

2. Study of the following fossils: *Rhynia*, *Lepidodendron*, *Sphenophyllum*, *Calamites*, *Calamostachys*, *Zygopteris* and *Anachoropteris*.
3. Spore germination and development of prothallus in Knop's Agar medium.
4. A study of Pteridophytes in their natural habitats.

GYMNOSPERMS [½ hour per week]

1. Identification of petrifications, compressions and impressions: *Lyginopteris, Heterangium, Medullosa, Trignocarpus, Glossopteris, Caytonia, Pentoxylon, and Cordaites*.
2. Study of vegetative and reproductive structures of:
Zamia, Ginkgo, Pinus, Cryptomeria, Cupressus, Araucaria, Agathis, Podocarpus, Cephalotaxus, Ephedra, Gnetum.

MYCOLOGY & LICHENOLOGY [½ hour per week]

Critical study of the following types with the help of fresh/preserved materials by making suitable micro-preparations giving emphasis on systematic position, details of vegetative and reproductive structures:
Stemonitis, Saprolegnia, Phytophthora, Albugo, Mucor, Pilobolus, Saccharomyces, Xylaria, Chaetomium, Peziza, Puccinia, Auricularia, Polyporus, Ganoderma, Lycoperdon, Dictyophora, Geastrum, Cyathus, Aspergillus, Curvularia, Alternaria, Fusarium, Colletotrichum, Parmelia, Usnea.

MICROBIOLOGY [½ hour per week]

1. Test for the presence of coliform bacteria in contaminated water.
2. Isolation of Eubacteria and Cyanobacteria from soil by dilution plate method.
3. Isolation of pure bacterial culture by streak plate method.
4. Staining of bacteria (negative staining, Gram staining and spore staining).
5. Demonstration of bacterial motility by hanging drop method.
6. Morphological studies on *Scytonema*, *Aphanocapsa*, *Spirulina*, *Oscillatoria*, *Anabaena.*

PLANT PATHOLOGY [½ hour per week]

1. Detailed lab study of the following diseases:
a) Bunchy top of Banana
b) Bacterial blight of Paddy
c) Bud rot of Coconut
d) Mahali of Areca nut
e) Powdery mildew of Rubber
f) Abnormal leaf fall of Rubber
g) Tikka disease of Ground nut
h) Late blight of Potato
i) Blister blight of Tea
j) Wheat rust, Coffee rust
k) Grey leaf spot of Coconut
l) *Phytophthora* foot rot of Pepper

m) Rhizome rot of Ginger and Turmeric
2. Angiospermic parasites - *Loranthus* and *Dendropthoe*.
3. Technique of isolation and pure culture of pathogens.

ANGIOSPERM ANATOMY [½ hour per week]

1. Study of anomalous secondary growth in roots and stems of *Aristolochia*, *Strychnos*, Amaranthaceae, Nyctaginaceae, Bignoniaceae and Agavaceae.
2. Nodal anatomy of different types.
3. Leaf anatomy: Epidermal peels and T.S. of lamina.

EMBRYOLOGY [½ hours per week]

1. Study of anther development of *Datura*.
2. Preparation of dissected whole mounts of microsporangium.
3. Study of megaspore mother cell, megaspore and embryo sac.
4. Study of the receptivity of stigma and *in situ* germination of pollen.
5. Dissection of stages in the development of embryo and endosperm.
6. Pollen germination using hanging drop technique.
7. Demonstration of intra ovarian pollination.

PALYNOLOGY [½ hours per week]

1. Analysis of honey for microscopic examination of pollen.
2. Calculation of percentage of pollen viability using T Z test.
3. Study of pollen wall by acetolysis

LAB TECHNIQUES [1 hour per week]

1. Measurement of microscopic objects - Micrometry.
2. Camera Lucida drawing - calculation of magnification
3. Double stained permanent sections - free hand section, Microtome serial sections.
4. Preparation of whole mounts, macerations and smears.
5. Submission of 10 permanent slides - which should include microtome serial sections, free hand sections, macerations, whole mounts and smears.

PRACTICAL RECORDS

Submission of certified record of practicals at the time of terminal evaluation.

FIELD WORK AND OTHER SUBMISSION

3 days of Field work for the *in situ* study of the types of the above areas of study and submission of a field report.

SEMESTER II

Course Code	Title	Teaching Hours / week	Duration of examination	Weightage		Credits	Page Nos:
BO02CT05	Cell Biology, Molecular Biology and Biophysics	2½+2½ +1 = 6	3 hrs	36	20	4	25-27
BO02 CT06	Cytogenetics, Genetics, Biostatistics, Plant Breeding and Evolution	1+1½+1 ½+1+1= 6	3 hrs	36	20	4	28-32
BO02CT07	Plant Ecology, Conservation Biology, Phytogeography and Forest Botany	2½+1½ +1+1 = 6	3 hrs	36	20	4	33-35
BO02 CP08	Practicals of Cell Biology, Molecular Biology, Biophysics, Cytogenetics, Genetics, Biostatistics, Plant Breeding, Plant Ecology, Conservation Biology, Phytogeography and Forest Botany	½+½+½ +½+1+1 +½+½+ ½ +¼+¼ = 6	6 hrs	36	20	4	36-37

EE – External evaluation

ICE – Internal continuous evaluation

CORE COURSE 05. CELL BIOLOGY, MOLECULAR BIOLOGY AND BIOPHYSICS
[2½+2½+1 = 6 hours per week]
COURSE CODE BO02 CT05

COURSE OUTCOME

The students willbe able to understand the fundamentals of biophysics and the general instrument al techniques and to develop analytical skills in students. To provide a deep knowledge on the composition, structure and function of organelles and other cellular components.

CELL BIOLOGY [2½ hours per week]

1. **The nucleus:** Interphase nucleus, chromatin organization, nucleosomes, scaffold. Organization of eukaryotic chromosome, Heterochromatin – constitutive, facultative and condensed Euchromatin, Satellite DNA, Chromosome banding and its significance.
2. **Cell reproduction:** Cell cycle, Specific events – G1, S, G2 and M phases, significance of G0, Control of cell cycle, significance, Gene expression during cell cycle, Mitotic inducers.
3. **Meiosis:** Types, Synaptonemal complex, Significance of meiosis, Genetic control and consequences of meiosis, Restriction points and check points, Cell cycle regulation of meiotic events, behavior of sex chromosomes in meiosis, Suppression of DNA replication between Meiosis I and II, Meiotic defects and human diseases.
4. **Programmed cell death:** Necessity, classes, signals, Genetic analysis of cell death, Proteins regulating apoptosis, Pathways leading to cell death – significance, Aging – Cellular and extra cellular, Cell signaling.
5. **Cell interactions:** Communication, recognition and adhesion, Application.
6. Cellular differentiation and specialization, General characteristics, intrinsic interactions, Nucleo-cytoplasmic, Extrinsic interactions, Molecular mechanisms of cellular differentiations.
7. **Cancer:** Carcinogenic agents, Phenotype of the transformed cells, Genetic basis of malignant transformation, Oncogenes, Tumour suppressor genes, Cancer and cell cycle, Metastasis, Interaction of cancer cells with normal cells.

Reference Books:

1. Cooper Jeffrey.M. The cell- A molecular Approach.ASM,Washington.
2. Karp Gerald.cell Biology.John Wiley and sons.
3. De Robertis and De Robertis. Cell and Molecular Biology .Holt Rinehart & Winst
5. Pollard T.D. and Earn Shaw, W.C. Cell Biology Saunders.
6. Alberts, B., Bray, D., Hopkin, K., Johnson, A., Lewis, J., Raff, M. & Walter, P. (2013). Essential cell biology. Garland Science.
7. Berk, A., and Zipursky, S. L. (2000). Molecular cell biology (Vol. 4). New York: WH Freeman.
8. Cooper, G.M. and Robert E Hausman (2009). The Cell: A molecular approach (5th Edn). Sinaeur.
9. De Robertis and De Robertis. Cell and Molecular Biology Holt Rinehart & Winston
10. Karp, G. (2008). Cell and Molecular biology: Concepts and experiments (5th Edn). John

Wiley & Sons.
11. Lewis R. Human Genetics, Concepts and applications, WCB McGraw Hill.
12. Tropp, B. E. 2008. *Molecular Biology, Genes to Proteins,* 3rd ed. Jones & Bartlett Publishers.
13. Twyman, R. M. (1998). Advanced molecular biology: a concise reference. Westview Press.

MOLECULAR BIOLOGY [2½ hours per week]

1. **Molecular Biology of Gene:** Structure of DNA,(A- DNA, B -DNA,Z- DNA Repetitive DNA, *c*-value paradox ,DNA damage and repair mechanism,homologus and site specific recombination.
2. **Replication of DNA:** Enzymology of replication, Replication in prokaryotes and eukaryotes, Primosomes and replisomes, Telomerase and its function.
3. **Gene Expression:** Regulation of gene expression, Operon Concept, Gene regulation in prokaryotes and eukaryotes, Enhancers and silencers.
4. **Protein synthesis:** Transcription, post transcriptional events, Introns and their significance, Translation, Post translation events, Role of chaperons.
5. **Mutation:** Spontaneous and induced, Physical and chemical mutagens, Molecular mechanism of mutation, Mutation and cancer, Mutator and antimutator genes, DNA repairing mechanisms.
6. **Molecular evolution:** The origin of genomes, Evolution of new genes, Origin of eukaryotic genomes, Phylogenetics, Application of molecular phylogenetics.

Reference Books:

1. Lewin Benjamin . Genes. Oxford university press.
2. Brown, T.A. Genomes, John Wiley and sons
3. Snustad,Simmons and Jenkins.Principles og genetics.john Wiley and sons.
4.Weaver and Hendrick. Genetics. Wm. C. Brown Publishers.
5. Hawkins, J.D. Gene structure and Expression, Cambridge University Press.
6. Gardner E.J., Simmons M.J., Snustad D.P. (1991). *Principles of Genetics* (3rd Edn). John Wiley and Sons Inc
7. Snustad, D.P. and Simmons, M.J. (2010). *Principles of genetics* (5th Edn). John Wiley and Sons.
8. Tropp, B. E. 2008. *Molecular Biology, Genes to Proteins,* 3rd ed. Jones & Bartlett Publishers
9.Weaver. R.F. (2002). Molecular biology (II Edn). McGraw Hill.

BIOPHYSICS [1 hour per week]

1. **pH and Buffer Solutions**: Hydrogen ion concentration and pH, Dissociation of acids and bases, Measurement of pH using organic indicator molecule and potentiometric method, Functions of Buffers in a biological system, Use of buffers in biological and biochemical research, pH and life, Henderson and Hasselbalch equation.
2. **Chromatography**: Principles of chromatography, Types of chromatography (Brief account).
3. **Electrophoresis**: Electrophoretic mobility, Principles, PAGE, Agarose gel electrophoresis, Separation and detection of macromolecules by electrophoresis, Electrophoretic apparatus, technique and procedure.

4. **Centrifugation**: Theory of centrifugation, Centrifuge – Types, Methodology of centrifugation, Application.

5. **Colorimetry and Spectrophotometry**: Beer-Lambert's Law, Measurement of extinction, Colorimeters and spectrophotometers, Techniques and applications in biological and biochemical research, Comparison between colorimetry and spectrophotometry.

6. **Radiobiology:** Autoradiography, Principles, Types, Methods and application in biological research.

7. **Immunochemistry**: Immune response, Antigens, Antibodies, Histo-incompatibility antigens, Structure of IgG, Immunochemical assays - RIA & ELISA.

8. **Cryobiology:** Freeze drying (Lyophilization) - Applications.

References

1. Hoppe, W. (Ed.) Biophysics. Springer Verlag.

2. Cooper T. G. (2011). The tools of Biochemistry. Star Educational Book Distributors, New Delhi

3. Roy, R.N. A Text Book of Biophysics. New Central Book agency Pvt. Ltd., Calcutta.

4. Sasidharan, A. Selected topics of Biophysics. Frontier Area Publishers

5. Slayter, E.M. Optical methods in Biology. Wiley Intersciences

6. Wong, C.H. Radiation Tracer Methodology in Biophysical Sciences, Prentice Hall.

7. Plummer D.T. (1990). An introduction to practical biochemistry. Tata McGraw - Hill Publishing Company, New Delhi.

8.. Keith Wilson and John Walker (1994) Practical Biochemistry. Foundation Books, New Delhi

9. Rogers, A.W. Techniques of Autoradiography. Elsevier.

10. Veerakumari L. (2007) Bioinstrumentation. MPJ Publishers, Chennai.

CORE COURSE 06. CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING AND EVOLUTION

COURSE CODE BO02 CT06

[1+1½+1½+1+1= 6 hours per week]

COURSE OUTCOME

To give basic knowledge in Genetics and Mendelian concepts. To introduce the structure and functions of cellular components and its differentiation. To make the students aware about the importance and applications of plant breeding techniques in today's life, and equip them in hybridization techniques. Introduction of the statistical applications in Biology. To assist the students to understand the heritage and evolution of plants.

CYTOGENETICS [1 hour per week]

1. **Cytogenetics of aneuploids, euploids and structural heterozygotes:** Effect of aneuploidy on phenotype, Transmission of monosomics and Trisomics and their uses, Breeding behavior and genetics of structural heterozygotes; translocation heterozygotes; Robertsonian translocation; B-A translocation, Karyotype – concepts and its importance, Structural chromosome aberrations - types and significance in evolution, Heteroploidy, aneuploidy, monosomy, trisomy (primary, secondary, tertiary and compensating), Nullisomy, Uses of aneuploidy in cytogenetics, Euploidy - autoploidy, alloploidy and segmental allopolyploidic diploidization, Role of aneuploidy and euploidy in evolution.
2. **Molecular cytogenetics**: Multigenic families and their evolution; *in-situ* hybridization - concept, Computer assisted chromosome analysis, chromosome micro-dissection and micro-cloning, flow cytometry.
3. **Polytene and lampbrush chromosome:** Cytogenetic importance
4. **Supernumerary chromosomes:** B- chromosomes.

Reference Books:

1. Alberts B. D., Bray, J., Lewis, K. Roberts and J. D. Watson. Molecular Biology of the Cell, Gartand Publishing Inc. New York.
2. Atherly A. G., J. R. Girton and J. F. McDonald. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
3. Burnharm C. R. Discussions in Cytogenetics. Burgess Publishing Co., Minnesota
4. De Robertis E.D.P. and De Roberties E.M.F. Cell and Molecular Biology, ISBN, Hong Kong.
5. Dupraw E.J. DNA and Chromosomes. Holt, Reinhart and Winston Inc. New York.
6. Hart D.L. and E.W. Jones. Genetics: Principles and Analysis. Jones & Barlett publishers, Massachusetts, USA.
7. Khush, G.S. Cytogenetics of Aneuploids. Academic Press.
8. Karp G. Cell and Molecular Biology: Concepts and Experiments. John Wiley & Sons, Inc. USA.
9. Lewin, B. Gene. Oxford University Press, New York, USA.
10. Lewis R. Human Genetics: Concepts and application. WCB Mc Graw Hill, USA.

11. Malacinski G. M. and D. Freidfelder. Essentials of Molecular Biology. Jones and Bastlet Publishers Inc., London.
12. Rieger R., A. Michaelis and M.M. Green Glossary of Genetics and Cytogenetics- Classical and Molecular. Springer-Verlag, New York.
13. Swanson, C.P., Merz T., Young, W.J. 1978. *Cytogenetics – The Chromosome in Division, Inheritance and Evolution.* Prentice Hall of India Pvt. Ltd., New Delhi
14. Hillis, D.M., Mortiz, C., Mable, B.K. 1996. *Molecular Systematics.* Sinauer Associates Inc. Publishers, Sunderland, Massachussetts, U.S.A.

GENETICS [1½ hours per week]

1. **Relevance of Mendelism in modern genetics:** A critical evaluation of Mendelism on the basis of modern concept of genes. Medelian principles, pleiotropy,genomic imprinting, phenocopy ,penetrance and expressivity , concept of gene(allele, multiple alleles, pseudoalleles, complementation test)
2. **Linkage and gene mapping:** Three point test cross, linkage map, interference, Tetrad analysis and centromere mapping, Pedigree analysis, Genetic recombination and mapping of genes in bacteria and bacteriophages.
3. **Mobile genetic elements**: Transposable elements in bacteria – IS elements, Tn elements, composite transposons, Copia and P elements in *Drosophila*, Ac, Ds and Mu elements in maize, Retrotransposons, Molecular characteristics and significance in development and evolution.
4. **Extranuclear inheritance**: Analysis of mitochondrial and chloroplast genomes and their utility, Cytoplasmic male sterility, maternal inheritance .
5. **Quantitative genetics**: polygenic inheritance, heritability and its measurements, QTL mapping.
6. **Population genetics**: Systems of mating. The Hardy-Weinberg principle. Estimation of gene frequencies, Factors affecting genetic equilibrium – natural selection, mutation, migration and genetic drift.
7. **Human genetics:** Human pedigree analysis, Linkage in Humans,Lod score for linkage testing, genetic disorders.

Reference Books:

1. Snustad,Simmons,and Jenkins.Principles iof genetics.John willey And sons.
2. Weaver and Hendrick. Genetics, Wm C. brown Publishers
3. Goodenough . Genetics Sanders, College, Publishers.
4. Stansfield . Theory and Problems of Genetics, McGraw Hills
5. Strickberger . Genetics .Macmillan.
6. Burnet L.Essential Genetics.Cambridge University Press
7. Friefelder. Microbial genetics. Narosa Publishing House.
8. Gardner ,Simmons, Snustad. *Principles of Genetics* . John Wiley and Sons . New York, USA.
9. Singh B.D. Fundamental of Genetics. Kalyani Publishers, New Delhi.

10. Robert, J. Brooker. (2009). Genetics: Analysis and principles (III Edn). McGraw Hill, New York

BIOSTATISTICS [1 hour per week]

1. **The science of Statistics** and its application in biological research.
2. **Types and collection of data** - Census, sampling –theory and methods.
3. **Tabulation and presentation of data** –diagrammatic and graphic presentation.
4. **Analysis of data** – central tendencies -**Mean, Median, Mode**
5. **Measures of dispersion –** range,Quartile deviation,Mean deviation, standard deviation and standard error – relative measures of dispersion – coefficient of variation.
6. **Tests of significance** – formulation and testing of hypothesis, testing the probability of committing type 1 and type 2 errors. *z* test, *t* test, and chi-square test.
7. **Analysis of variance** – One-Way classification and two-way classifications. F test,F value calculation, F table.
8. **Correlation and regression analysis** - Coefficient of correlation- significance testing, rank correlation, lines of regression, coefficient of regression.
9. **Experimental designs**: designing an experiment, - CRD, RBD, LSD, factorial experiment.
10. **Probability: Application of the principles of probability**-Theorems of probability (**statement only)** Applications.-Probability distributions-Binomial, Multinomial, Normal and Poisson distributions .
11. **Statistical software** – SPSS, SPAR, MINITAB

Reference Books:

1. Chandal, S.R.S. A handbook of Agricultural statistics. Achal Prakashan Mandir, Kanpur, India.
2. Das M.N. and N.C. Giri. Designs and Analysis of Experiments. Wiley Eastern Ltd.
3. Elhance and Elhance. Fundamentals of Mathematical Statistics. Kithab Mahal, New Delhi, India.
4. Gupta, S.K. and Kapoor V.K. Fundamentals of Mathematical Statistics. S.chand & sons, New Delhi
5. Gupta, C.B. An introduction to Statistical Methods. Vikas Publishing Pvt. House Ltd.
6. Kempthrone, O. An introduction to Genetic Statistics. John Wiley and Sons Inc, New York.
7. Mather, K. And Links, J.L. Biometrical Genetics. Chapman and Hall, London.
8. Panse, V.G. and Sukatme, P. Statistical Methods for Agricultural Workers. ICAR, New Delhi
9. Rao C.A. Advanced statistical methods in Biometrical Research. Wiley and Sons, New York.
10. Singh, P. and Narayanan, S.S. Biometrical Methods in Plant Breeding. Kalyani Publishers, New Delhi.
11. Singh R.K. and Chaudhary, B.D. Biometrical Methods in Quantitative Genetic Analysis. Kalyani Publishers, New Delhi.
12. Daniel, W.W. 2013. *Biostatistics – Basic concepts and methodology for Health Science.* Wiley Publications

13. Prasad S. Elements of Biostatitics. 2003. Rastogi Publications, Meerut.
14. Norman T. J. and Bailey 2008. Statistical Methods in Biology, University press, Cambridge.
15. Gupta S.P. 2014. Statistical methods. Sultan Chand and sons educational publishers, New Delhi.
16. Jasra P.K. and Gurdeep Raj 2000. Biostatistics. Krishna Prahkashan media private limited, Meerut.

PLANT BREEDING [1 hour per week]

1. **Plant Breeding:** Introduction and objectives
2. Organizations involved in Plant Breeding. NBPGR,NIPGR, IRRI IARI, FRI, ICAR, IIHR, IICPT, Regional Agricultural Research Station, Pattambi, Central Plantation Crops Research Institute, CTCRI,KFRI, BSI, and Sugarcane Breeding Institute, Kozhikode.
3. **Breeding systems in sexually propagated plants:** Floral Biology and its significance in Plant Breeding, Sterility and incompatibility systems.
4. **Genetic Resources:** Centers of Crop Genetic diversity, Conservation of plant genetic resources, reasons for conservation, genetic erosion and its causes, approaches to germplasm conservation - *In situ* conservation, *Ex situ* conservation ; types of germplasm collection-base collections, back-up collections, active collections, working or breeders collections.
5. **Conventional Methods of Plant Breeding:**

a) Domestication of wild plants: Changes under domestication. Domestication syndrome.
b) Plant introduction: History, Types, Principles, Plant introduction agencies in India - Rules and Regulations, Major achievements.
c) Selection: Selection methods in sexually and vegetatively propagated species, Selection in segregating populations, Major achievements.
d) Hybridization: History, Objectives, Techniques, consequences and major achievements.
e) Heterosis Breeding: Genetic basis of heterosis and inbreeding depression.

6. **Modern methods of Plant Breeding:**

a) Mutation Breeding - History, Methodology, Applications, Merits, demerits and achievements.
b) Polyploidy Breeding - Methodology, Applications, Merits, demerits and achievements.
c) Biotechnological approaches in Plant Breeding - Molecular Marker (RFLP) and their uses, Transgenic plants – Critical evaluation.

7. **Breeding for special purposes:**

a) Resistance breeding: A brief account of disease resistance
b) Breeding for pest resistance: Mechanism of pest resistance
c) Stress resistance: Achievements
d) Quality Breeding: Objectives and achievements.

8. **Biometrical Techniques in Plant Breeding:** Analysis of variability, heritability, genetic advance and combining ability.
9. **IPR:** Protection of plant variety and farmer's right Act.

Reference Books:

1. Allard, R. W. Principles of Plant Breeding. John Wiley and Sons, New York.
2. Chahal G.S. and Gosal S.S. Principles and procedure of Plant breeding. Narosa Publishing House, New Delhi.
3. Jain H.K. and Kharkwal, M.C. Plant Breeding – Mendelism to Molecular Approaches. Narosa Publishing House, New Delhi.
4. Roy D Plant Breeding – Analysis and exploitation of variation. Narosa Publishing House, New Delhi
5. Hayward, M. D., Bosemark, N. O., and Romagosa, I. (1993). Plant Breeding: Principles and prospects. Chapman and Hall .
6. Gupta S.K. Plant Breeding – Theory and Techniques. Agrobios (India), Jodhpur.
7 . Khan M.A. Plant Breeding. Biotech Books, New Delhi.
8. Stoskopf N.C. Plant Breeding – Theory and Practice. Scientific Publishers (India), Jodhpur.
9. Sharma, J.R. Principles and practices of Plant Breeding. Tata McGraw-Hill Publishers Company Ltd, New York.
10. Chopra V.L. Breeding Field Crops. Oxford IBH publishing company, New Delhi.
11. Mohanan K.V. Essentials of Plant Breeding. PHI Ltd., New Delhi
12. Mohanan K.V. Essentials of Plantation Science. Penta Book Publishers, Calicut, Kerala.
13. Daniel, L. Hartl. and Elizabeth, W. Jones. (2009). Genetics: Analysis of genes and genomes (7th Edn). Jones and Bartlett publishers, Burlington, USA.
14. Ghahal, G.S. and Gosal, S.S. (2002). Principles and procedures of Plant Breeding, Narosa Publishing House, New Delhi.
15. Singh, B.D. (2005) Plant Breeding. Kalyani Publishers, Ludhiyana.
16. Hill, J., Becker, H. C., Tigerstedt, P. M., & Pooni, H. S. (1998). Quantitative and ecological aspects of plant breeding, Chapman & Hall, London.

EVOLUTION [1 hour per week]

1. **The concept of evolution**: Geological Time Scale and Evidences of Evolution *
2. **Origin of life**: Theories and experimental evidences, chemical evolution and biological evolution. *
3. **Evidences of evolution***
4. **Theories of evolution*:** Pre - Darwinian, Darwinian and Post – Darwinian theories, Modern synthetic theory of Evolution.
5. **Reproductive isolation and origin of species.**
6. **Evolution at the molecular Level**.

Reference Books:

1. Crick F., 1981. Life itself: Its origin and Nature. Simon and Schuster, New York.
2. Dobzhansky, T. 1970. Genetics of the Evolutionary Process. Columbia University press.
3. Stebbins, L. 1971. The Process of Organic Evolution, prentice Hall.
4. Dott R.H., Batten, 1981. Evolution of the earth 3rd ed. McGraw Hill New York.

5. Fox S.W. and K. Dose, 1972. Molecular Evolution and the Origin of Life. W.H. Freeman& Co., San Francisco.
6. Strickberger, 1990. Evolution, Jones and Bastlett Publishers International, England.

CORE COURSE 07. PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAPHY AND FOREST BOTANY

COURSE CODE BO02 CT07

[2½+1½+1+1 = 6 hours per week]

COURSE OUTCOME

To focus the importance of the organism- environment interactions and its balance. Conservations biology aims to conserve the natural resources, minimalize its use and also plays an important role in the prevention of the environmental pollutions. Forest botany aimed to conserve the forest floras and also provide an outline on the economic importance of different forest products.

PLANT ECOLOGY & CONSERVATION BIOLOGY [[2½ +1½ hours per week]

1. **Habitat Ecology:** Salient features of terrestrial (Biomes), freshwater (Limnology), wetland, and marine habitats, **Ecotone and edge effect. Character displacement**
2. **Productivity and energy flow:** Concepts, limits and processes of primary production. Methods of productivity measurements. Global trends in primary productivity. Energy flow models.
3. **Population characteristics:** Density, natality, mortality, distribution, biotic potential, carrying capacity. Aggregation and dispersal.
4. **The environment and its pollution: Types** (Land, air and water). Effect of pollution on living organisms. Control of pollution with emphasis on biological methods. Environmental hazards. Recent and major environmental issues in India.
5. **Threats to the global environment**: Greenhouse effect, ozone depletion, El-Nino and La Nina effects.
6. **Environmental impact assessment** (EIA) and assessment of environmental hazards. Remote sensing.
7. **Problems of conservation:** Causes of threat to environment, human interference, deforestation, habitat destruction and overexploitation of resources.
8. **Identification of threatened plants:** Red List categories – extinct, endangered, vulnerable, rare and out of danger. Extinction process. Hot spots, keystone species and flagship species.
9. **Strategies for conservation:** *in situ* and *ex situ* conservation. Biosphere reserve, national parks, wildlife sanctuaries, gene banks, cryopreservation, seed banks.
10. **Afforestation**: social forestry and agro forestry. International Biological Programme (IBP), Man and Biosphere Programme (MAB), IUCN, World Environment Day, Wildlife Preservation Act (1972), Indian Forest Conservation Act (1980) and United Nations Environment Programme (UNEP), Environment Protection Act .
11. **Environment awareness** – Role of Government and NGOs, Gaia hypothesis.

12. **Biodiversity**: Significance at local, national and global levels. Deep ecology (Paradigm shift from anthropocentric ecology to ecocentric ecology). National Heritages.
13. indian case studies on conservation/management strategy(project tiger, biosphere reserves)

References Books:

1. Negi,S.S.Hand book of national Parks and Sanctuaries in India
2. M.P.Nair And P.K.Sastry-Red Data book of Indian Plants.
3. Mehrotra and B.K.Suri-remote sensing for Environmental and forest Management.
4. Negi,S.S.-Biosphere reserves in India.
5. Lucas and synge-IUCN Red Data Book.IUCN Stockholm.
6. Dasmann R.F.-Environmental conservation.
7. Odum E. P. Fundamentals of ecology.
8. Odum, E.P. 1983, Basics principles of Ecology.
9. Misra.K.R.Ecology Work Book.
10. Puri.G.S.-Indian Forest Ecology.Vol.I.&II.Oxford&IBH.
11. Clarke.G.L.-Elements of Ecology.
12. Chhatwal.G.L.Encyclopedia of environmental Biology.
13. Ray.P.K.-Pollution and Health.Willey-eastern LTD,New Delhi
14. Michael.P.Ecological Methods for Field and laboratory investigations.tata McGraw Hill,New Delhi.
15. Kershaw.K.A.Quantitative and Dynamic Plant Ecology.ELBS.
16. Gurdip Singh (2005), Environmental Law in India, Macmillan India Ltd, New Delhi
17. Sharma, P.D. 2009. Ecology and Environment. Rastogi Publication

PHYTOGEOGRAPHY [1 hour per week]

1. Patterns of plant distribution – Continuous distribution, Circumpolar, Circumboreal, Circum austral, Pan tropical.
2. Discontinuous distribution: Theory of land bridges, Theory of continental drift, Theory of glaciation.
3. Endemic distribution (Neoendemic, Paleoendemic), Age and Area hypothesis.
4. Phytochoria of world and India.

Reference Books:

1.Ronald Good. The Geography of Flowering Plants, Longman Publishers
2. Bharucha, F.R. A Textbook of Plant Geography of India. Oxford University Press
3. Puri, G.S. Indian Forest Ecology., Vol I & II, Oxford,New Delhi.
4. Hugget. R. J. Fundamentals of Biogeography, Routledge, London.

FOREST BOTANY [1 hour per week]

1. **Forest:** Definitions. Study of various types of forests in India and the World.

2. **Forest Products:** Major and minor forest products with special reference to Kerala
3. **Influence of forests on environment:** Consequences of deforestation and industrialization – Sustainable utilization of bioresourses.

Reference Books:

1. Agarwal, A. P. Forests in India, Oxford and IBH
2. Gregorv, G.R. Forest Products, Production, Trade, Consumption, quantity and value of raw material requirements, Ford foundation, New Delhi.
3. Puri, G. S. Indian Forest Ecology I and II, Oxford IBH, New Delhi
4. Champion G.H. and Seth S.K.A. A revised survey of the forest types of India.

BO02CP08 PRACTICALS OF CELL BIOLOGY, MOLECULAR BIOLOGY, BIOPHYSICS, CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING, PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAHY AND FOREST BOTARY

[½ + ½ + ½ + ½ + 1 + 1+ ½ + ½ + ½ + ¼ + ¼ = 6 hours per week]

CELL BIOLOGY [½ hour per week]

1. Study of motosis in root tip cells.
2. Pre-treatment of root tips with Colchicine/Bydroxyquinone/Paradichlorobenzene and study of Chromosomes in Chlorophytum/Zea mays/Crotalaria/Cyanotis.
3. Isolation of plastids and mitochondria

MOLECULAR BIOLOGY [½ hours per week]

1. Working out problems from molecular genetics.
2. Isolation of nucleic acid and identification of histones by SDS - PAGE
3. Isolation of plant DNA and its quantification by spectrophotometric/Colorimetric method.
4. Immunological techniques: ELISA and Western Blot.

BIOPHYSICS [½ hour per week]

1. Preparation of buffers (acetate and phosphate) and measurement of pH using pH meter.
2. Determination of isoelectric pH.
3. Paper chromatography: Separation of sugars.
4. Thin Layer Chromatography: Separation of amino acid mixtures.
5. Colorimetric /Spectrophotometric estimation of proteins by Biuret / Lowry's method.
6. Estimation of amino acids by ninhydrin method (Colorimetric)

CYTOGENETICS [½ hour per week]

1. Induction of polyploidy using colchicine; Different methods of the application of colchicine.
2. Effect of induced and spontaneous polyploidy on plant phenotype, meiosis, pollen and seed fertility and fruit set.
3. Preparation of karyotype and idiogram of plant meristematic cells.
4. Cytological studies in callus tissues.
5. Study of meiosis in translocation heterozygotes (*Rheo discolour).*
6. Study of polytene chromosomes.

GENETICS [1 hour per week]

Problems from linkage, tetrad analysis, quantitative genetics and population genetics.

BIOSTATISTICS [1 hour per week]

Problems from Mean, Standard deviation, Coefficient of variation, Tests of significance, Correlation analysis and computer aided statistical analysis.

PLANT BREEDING [½ hour per week]

1. Study of floral morphology and flower structure in crop plants - Rice, Cashew, Pulses, *Solanum, Capsicum.*
2. Practice of hybridization technique in self and cross pollinated plants mentioned in (1)

3. Biometrical techniques in Plant Breeding - Analysis of variability.
4. Submission of certified report of visit to one Plant Breeding station in India.

ENVIRONMENTAL BIOLOGY [½ hour per week]

1. Determination of food chain and food web in aquatic systems.
2. Determination of the minimum size of the quadrat suitable for an area using species area curve method.
3. Determination of the Importance Value Index (IVI) of plant species in a community by quadrat method.
4. Comparative study of polluted and non-polluted aquatic systems.
5. Visit to a meteorological station, sewage treatment facility, national park, or wild life sanctuary and the report shall be submitted at the time of practical examinations.
6. Estimation of dissolved oxygen content in the water sample by Winkler's method
7. Determination of primary production in aquatic systems by dark and light bottle method.
8. Determination of dissolved carbon dioxide content in water samples.
9. Determination of frequency of plant species of an area and heterogeneity of vegetation using transect method.

PHYTOGEOGRAPHY [½ hours per week]

Identification of the various floristic and vegetational regions of the world and India in maps.

FOREST BOTANY [½ hours per week per week]

Study of the major and minot forest products of Kerala and their uses.

SEMESTER III

Course Code	Title	Teaching Hours / week	Duration of examination	Weightage		Credits	Page Nos:
BO03 CT9	Plant Physiology, Metabolism and Biochemistry	2+2+2 =6	3 hrs	36	20	4	39-41
BO03 CT10	Angiosperm Morphology, Taxonomy and Plant Resources	1+4+1 = 6	3 hrs	36	20	4	42-44
BO03 CT11	Biotechnology and Bioinformatics	3+3 = 6	3 hrs	36	20	4	45-47
BO03 CP12	Practicals of Plant Physiology, Metabolism, Biochemistry, Angiosperm Morphology, Taxonomy, Plant Resources, Biotechnology and Bioinformatics	1+1+1+ ½+1+½ +½+½ =6	6 hrs	36	20	4	48-50

EE – External evaluation
ICE – Internal continuous evaluation

CORE COURSE 09- PLANT PHYSIOLOGY, METABOLISM AND BIOCHEMISTRY
[2+2+2=6 hours]
COURSE CODE BO03 CT09
COURSE OUTCOME
To give basic awareness about the concepts and physical aspects in biochemistry and to familiarize the students with the building blocks of living matter, the biomolecules, their structure, components, reactions, their derivatives, biological significance and the basic tests to identify them**.**

PLANT PHYSIOLOGY

1. Water and plant cells: Properties of water, hydrogen bonding, polarity, cohesion and adhesion. The concept of water potential. Water movement in cells and tissues. Aquaporins (Brief study**)** Soil – plant -atmosphere continuum. Transpiration, stomatal movement, modern theories of stomatal mechanism. The ascent of xylem water and the uptake of water by roots. Absorption of mineral ions –solute absorption
2. Plants and nitrogen: The nitrogen cycle, biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of nitrogen fixation. Export of fixed nitrogen from nodules. Genetics of nitrogen fixation. Nitrogen assimilation. Assimilation of nitrate. Nitrogen nutrition – agricultural and ecological aspects. Biosynthesis of amino acids - reductive amination and transamination. GDH and GS / GOGAT pathway.
3. Photosynthesis: Absorption and fate of light energy, Absorption and action spectra. Photoreceptors – chlorophylls, carotenoids, phycobilins. Bioenergetics and the light dependent reactions of photosynthesis. Photosynthetic electron transport and photophosphorylation. The two pigment systems. Z scheme, Water oxidizing clock. The photosynthetic carbon reduction cycle, C3, C2, C4 and CAM metabolism and ecological significance. Photoinhibition
4. Translocation and distribution of photoassimilates: Phloem transport, Sources and sinks, Mechanism of translocation, Phloem loading and unloading, Distribution of assimilates, Translocation of xenobiotic chemicals.
5. Patterns in plant development: - Growth, differentiation and development, Genetic control and hormonal regulation of development, Seed germination Physiology of hormones in plant development – Auxins, Gibberellins, Cytokinins, Abscisic acid and Ethylene, Role of vitamins and nutrients.
6. Photomorphogenesis: Phytochrome :chemistry and physiological effects, Mechanism of phytochrome and gene action, Cryptochromes and blue light effect. Signal transduction. Classes of signals; receptors, signal perception, signal amplification and transduction reactions, role of Ca++ as second messengers, role of Calmodulin
7. Stress Physiology: Types of stress – Water, temperature, salt, oxygen deficiency stress and heavy-metal pollution stress.stresses caused by pests, pathogens and pollutants

References

William G. Hopkins . Introduction to Plant Physiology. John Wiley and sons Inc.
Lincoln Taiz and Eduardo Zeiger.Benjamine/Cumming publishing company Inc.New York.

METABOLISM [2 hours per week]

1. **Enzymes:** General aspect , classification, Michaelis-Menton equation and its significanceH ill equation ,Mechanism of enzyme action, co-enzymes, inhibition, regulation, allosteric enzymes, covalently modulated enzymes, Kinetics of enzyme catalysis. Isoenzymes.
2. **Intermediary metabolism:** Anabolism, Catabolism, amphibolic pathways and anapleurotic reactions. Link between primary metabolism and secondary metabolism*. Bioenergetics and thermodynamics.
3. **Catabolism of hexoses:** Glycolysis – two phases, overall balance sheet, regulation; fate of pyruvate under aerobic and anaerobic conditions. Pentose phosphate pathway- multifunctional pathway (significance). Tricarboxylic acid cycle. Formation of acetate, reacton of citric acid cycle, anapleurotic reactions of citric acid cycle. Regulation of citric acid cycle. Glyoxylate cycle, Amphibolic nature of TCA cycle.
4. **Oxidation of fatty acids:** Activation and entry of fatty acids, Beta oxidation of saturated and unsaturated fatty acids. Regulation.
5. **Oxidation of amino acids** and entry to TCA cycle.
6. **Oxidative phosphorylation:** Electron transfer reactions in mitochondria. Electron carriers, multienzyme complexes, ATP synthesis. Regulation of oxidative phosphorylation. Shuttle systems- Alternate pathways - Thermogenesis.
7. **Carbohydrate biosynthesis:** Gluconeogenesis, biosynthesis of starch, glucose and other carbohydrates. Involvement of NDP sugars - Regulation.
8. **Lipid biosynthesis:** Biosynthesis of fatty acids.Triacylgycerols, phospholipids and isoprenoids, Regulation.
9. **Biosynthesis of nucleotides:** PRPP and its significance. Purine and pyrimidine biosynthesis. Precursors and regulation. Conversion of NMP to NTP. Biosynthesis of deoxyribonu cleotides.
10. **Secondary metabolism:** Main pathways and their relation to primary metabolism*.

References

1. Lehninger. Principles of Biochemistry, Mcmillan , U.K.
2. Geoffrey Zubay, Biochemistry, Mcmillan Publishing Company, New York.
3. Trevor Palmer, Enzymes – Biochemistry, Biotechnology and Clinical Chemistry, Norwood Publishing chichester.

BIOCHEMISTRY

1. The molecular logic of life.
2. The chemical unity of diverse living organisms.
3. Weak interactions in aqueous systems and the fitness of aqueous environment for living

organisms.

4. **Biomolecules:** a) Carbohydrates- Classification, Structure and function of simple sugars and compound carbohydrates. Sugar derivatives of biological importance. b) Lipids. Classification – storage and structural lipids; lipids in membrane; the supramolecular architecture of membranes. c) Amino acids, peptides and proteins. Amino acids: classification based on polarity; properties. Covalent structure of proteins. Ramachandran plot .Three dimensional structure of proteins. Protein- Secondary(motif,domain,and folds), tertiary and quaternary structures. Denaturation and renaturation. Functions of proteins. d) Nucleotides and nucleic acids. Chemistry- structure of nucleotide- Other functions of nucleotides.
5. **Secondary metabolites:** Secondary metabolites, their physiological roles. Significance - ecological and phylogenetic importance.*

References:

1. Lehninger. Principles of Biochemistry, Mcmillan, U.K.
2. Geoffrey Zubay, Biochemistry, Mcmillan Publishing Company, New york.
3. Sadasivam and Manickam, Biochemical methods, New Age International Publishers. New Delhi.
4. David T. Plummer. An Introduction to Practical Biochemistry. Tata McGraw Hill.

CORE COURSE 10. ANGIOSPERM MORPHOLOGY, TAXONOMY AND PLANT RESOURCES (1+4+1= 6hours)

COURSE CODE BO03 CT10

COURSE OUTCOME

To develop a skill of identifying plants from different families and provide a deep knowledge on its useful parts by visual examination.

Morphology

1. A critical study of the current ideas on the origin of Angiosperms with special reference to their ancestral stock, time and place of origin.
2. The concept of primitive angiosperm flower. Origin and evolution of flower, co-evolution of flowers vis-a-vis pollinators.
3. Origin and evolution of structure and morphology of stamens, nectaries and nectar.
4. Origin and evolution of carpels, different types - concept of foliar origin of carpels, types of ovary; evolution of placental types, inferior ovary, foliar and axial concepts.
5. Role of floral anatomy in interpreting the origin and evolution of flower and floral parts.

References

1. Eames, E, J. Morphology of Angiosperms, McGraw Hill Book Co. New York
2. Bamard, C. The interpretation of Angiosperm flower. Aust. J. Sci. 24: 64-72.1961..
3. Manilal K.S. Vascularization of corolla in Compositae. J. Indian Bot. Soc., 59: 189-196.
4. Meeuse, A.D.J.. Some Fundamental Principles of Interpretive floral Morphology.International Sci.Publ. Hissar.1974
5. Melville, R. New theory of Angiosperm flower. Nature, 188: 14-18. 1960.
6. Puri, V.. Inferior ovary. Phytomorphology, 2: 122. 1952
7. Sporne, K.R. The Morphology of Angiosperms, Hutchinson's Uni. Press. 1974.

Taxonomy [4 hours per week]

1. Principles of Taxonomy: Scope and importance of Taxonomy. Systems of classification. – Artificial, natural and phylogenetic systems, APG system of classification, Phenetic versus phylogenetic systems, Cladistics in taxonomy.
2. Conceptual basis of classification: Essentialism, nominalism, empiricism, phenetics and cladistics, phylogenetic and alternative, Concept of genus, concept of family; infraspecific categories.
3. Definition and terms: Primitive and advanced-Plesiomorphy,apomorphy,synapomorphy; homology and analogy; parallelism and convergence; monophyly and polyphyly, Paraphyly.
4. Taxonomic hierarchy: Concept of taxa – species, genus and family – intraspecificAnd interspecific categories.
5. Plant nomenclature: History of nomenclature, polynomial and binomial systems; detailed study of salient features and major provisions of the International Code of Botanical Nomenclature, Effective and valid publication, Rank of taxa, Rule of priority and its

limitations, Typification, Author citation, Rejection of names and names of hybrids, A brief account of International code of Nomenclature of Cultivated Plants.

6. Concepts of character: Definition, classification of characters – analytic and synthetic; qualitative and quantitative; unit and multiple; good and bad, Correlation of characters, Character weighting.
7. Modern trends in Taxonomy: Cytotaxonomy, chemotaxonomy, biosystematics and numerical taxonomy, Molecular taxonomy,molecular markers(dominant and codominant),Molecular phylogeneticsand phyllogeography DNA bar-coding in plants.
8. History and development of Taxonomy in India. Classification of taxonomic literature – general indices, floras, icons, monographs, reviews and journals; Herbarium – Definition, steps involved in the development of herbarium,Acronym utility of herbarium and its maintenance, Digital Herbarium- advantages.General account of regional and national herbaria with special reference to Central National Herbarium, Calcutta (CAL) and Madras Herbarium (MH).Botanical Survey of India; Botanical Gardens: Types of Gardens and importance of gardens in taxonomic studies, Important National and International Botanical Gardens. – Royal Botanical Garden, Kew; Indian Botanical Garden, Calcutta; National Botanical Garden, Lucknow and.Malabar botanical garden,Olavanna,Kozhikode, Jawaharlal Nehru Tropical botanical Garden and research institute

References

1. Cronquist, A. Evolution and Classification of Flowering Plants, Thomas and Nelson Co.
2. Cronquist, A. An integrated system of classification of flowering plants. New York.
3. Graf, A.B. Tropica, Roechers Publ. NJ, USA.
4. Harbone, J.B. and Turner B.L. Plant Chemosystematics. A.P. London.
5. Haywood, W.H. & Moore, D.M. Current concepts in Plant Taxonomy.
6. Rendle, A.E. Classification of flowering plants
7. Lawrence, G.H.M. Taxonomy of Vascular Plants, Oxford and IBH.
8. Sneeth P.H.A. Numericaln Taxonomy. W.H Freeman Co. Sanfrancisco
9. Sporne K.R. The Morphology of Angiosperms. Hutchinson University Press, London.
10. Sivarajan V.V. Introduction to Principles of Plant Taxonomy, Oxford IBH.
11. Smith P.M. The Chemotaxonomy of plants. Edward Arnold, London.
12. Stace, C.A. Plant Taxonomy and Biosystematics, Edward Arnold, London.
13. Takhtajan, A.L. Diversity and Classification of Flowering Plants, Columbia University Press. New York.
14. Woodland, D.W. Contemporary Plant Systematics. Prentice Hall, New Jersy.
15. Simpson, M.G. Plant Systematics, Elsevier. Amsterdam.
16. Stebbins, G. L. Flowering Plants, - Evolution above Species Level, Edward Arnold.

Plant Resources [1 hour per week]

1. A study of history, occurrence and morphology of useful part and overall chemical composition of the following.

a. Cereals and Millets: Rice, Wheat, Maize, Sorghum, Finger millet, Pearl millet
b. Pulses: Bengal gram, Cluster bean, Common bean, Horse gram, Cow pea
c. Sugar yielding plants: Sugar cane, Beet root
d. Starch yielding tubers: Potato, Tapioca, Arrow root, Taro
e. Fats and oils: Ground nut, Coconut, Castor, Gingelly, Mustard, Oil palm.
f. Beverages: Tea, Coffee, Cocoa
g. Spice and condiments: Pepper, Ginger, Turmeric, Coriander, Cumin, Fennel, Fenugreek, Cardamom, Nutmeg, Cloves, Cinnamon.
h. Fiber yielding plants: Cotton, Jute, Coir
i. Rubber yielding plants: Para rubber
j. Timber yielding plants: Teak, Rose wood, Artocarpus, Ailanthes, Xylia

2. A study of the following medicinal plants with reference to the chemical and pharmacognostic properties: Neem, Turmeric, Adhatoda, Rauwolfia, Catharanthus, Bacopa, Nux-vomica, Sweet-flag, Saraca, Wood apple, Indian Myrobalan, Liquorize.

References

1. Arora R.K. & Nayar, E.K. Wild relatives of crop plants in India. NBPGR Sci. Monograph No. 7.
2. Bole, P.V. & Vaghani, Y. Field guide to common Indian trees. Oxford Uni. Press.
3. Chandel, K.P.S., Shukla, G and Sharma, N. Biodiversity in medicinal and aromatic plants in India. – Conservation and utilization in India. NBPGR, New Delhi
4. Chripeels, M.J. and Sadava, D. Plants, Food and People. W. Freeman and Co. San Francisco.
5. CSIR. The useful plants. Publication and information directorate, CSIR, New Delhi.
6. Kochar, S.L. Economic Botany of the Tropics. McMillan India Ltd.
7. Nair M.N.B. Et.al (eds) Sustainable management of non wood forest products. Faculty of Forestry, Uni. Putra. Malaysia
8. 8.Pandora R.S. and Arora R.K. Plant Genetic Resources and Management. IPGRI Publication, South Asia office, NBPGR, Pusa Campus, New Delhi.
9. Indian Science Academy. Plant wealth in India. Special issue of proceedings, 1997.
10. Sahni, K.C. The book of Indian Trees. Oxford Uni. Press, Mumbai.
11. Sharma O.P. Hill's Economic Botany. Tata Mc Graw Hill Co. New Delhi.
12. Swaminathan, M.S. & Kochar, S.L. (eds.). Plants and Society. Macmillan Pulication, London.
13. Thakur, R.S., Puri, H.S. & Husain, A. Major medicinal plants of India. Central Institute of Medicinal and Aromatic Plants. CSIR, Lucknow.

CORE COURSE 11. BIOTECHNOLOGY AND BIOINFORMATICS

[3+3 = 6 hours per week]

COURSE CODE BO03 CT11

COURSE OUTCOME

To impart the knowledge of various culture techniques. To acquire basic knowledge of vast applications of biotechnology and genetic engineering in agriculture, medicine and industries. It helps in large production of crops within short period of time. organizes data resources that aid in the analysis and interpret the results in a biologically meaningful manner.

BIOTECHNOLOGY (3hours per week)

A. PLANT TISSUE CULTURE

1. Basic concepts and history.
2. General account of laboratory facilities and management.
3. Media for in *vitro* culture, composition and their preparation.
4. Callus culture, Selection of explants and medium, Types of callus – Growth profile of callus.
5. Cell culture: Isolation of single cells – Mechanical and Enzymatic methods, Measurement of growth of cells in suspension culture, Viability tests.
6. Large scale cultivation of cells using bioreactors for secondary metabolite production, hairy root culture, applications ,biotransformations.
7. Organogenesis: direct and indirect, Factors affecting organogenesis.
8. Organ culture: Apical or axillary meristems, embryo, ovary, ovule, endosperm, anther, pollen and root cultures.
9. Applications of plant tissue culture: Clonal propagation, Somaclones, somatic hybrids, somatic hybridization- microcalli, genetic consequences,synthetic seeds, secondary metabolites, germplasm conservation - cryopreservation. Triploid production techniques

B. GENETIC ENGINEERING

1. Molecular analysis of gene and gene products: Southern, Northern and Western blots – restriction maps - RAPD and RFLP, Chromosome walking and jumping, FISH and.PCR and its applications, DNA finger printing. DNA chips.
2. DNA sequencing: Enzymatic method, Gilbert and Maxam method, Messing's shot gun method, Fluorescent detection and automation, The Human genome Project.
3. Recombinant DNA Technology: Enzymes, vectors, gene – cloning strategies, construction and screening of genes and *c* DNA Libraries, Expression of cloned genes in bacteria and mammalian cells, Prospects and achievements.
4. Transgenic plants: Gene Cloning strategies in plants, Vector dependent and vector independent methods, Identification and selection of transformed plants, the reporter enzyme technology, Objectives and achievements – Engineering for secondary metabolites, Resistance against herbicides, pests, pathogens and stress, Improved nutritional and status changes in plants, Plants as bioreactors; Phytopolymers and biodegradable plastics; Antisense RNA technology; Transgene inactivation, Terminator and traitor technologies.

5. Cloning: Objectives, Creation of transgenic animals - other developments in cloning, Human cloning, Ethics of cloning.
6. Patenting of Genes and GMOs, Gene piracy, Ethics and biosafety aspects, , recDNA safety, IPR, Biosafety protocols.

Reference Books

1. Walker J.M. and R. Rapley. Molecular Biology and Biotechnology: Panima Publishing Corporation.
2. Bernard R. Glick and Jack J. Pasternack. Molecular Biotechnology Principles and Applications of Recombinant DNA: ASM Press Washington
3. Brown, T.A. Gene Cloning and DNA Analysis, Blackwell Science Pub.
4. Primrose, S.B. Molecular Biotechnology, Panima Publishing Corporation.
5. Maarten J. Chrispeels and D. E. Sadava. Plants, Genes and Agriculture. Jones and Bartlett Publishers
6. Robert de la Pemere and Franck Seuret. Brave New Seeds: The threat of GM crops to farmers. Global Issues Series.

BIOINFORMATICS (3hours per week)

A. COMPUTER APPLICATIONS

1. Computer in Science with special reference to Biology, the scope and prospects.
2. Information super highway (Internet) – Information networks: Internet, World Wide Web, Web browsers, HTTP, HTML, and URLs, Biological networks.
3. Online Publications with special reference to Biology: Electronic journals, books downloading and uploading, Open Archive Initiative (www.openarchives.org), Biomedcentral, Pubmedcentral, Freedom of scientific information access, e-access debate – concepts and implications, Free Software Movement, Free Software Foundation, GNU/Linux, Online archives, databases, the Public Library of Science (www.publiclibraryofscience.org).

References

1. www.publiclibraryofscience.org
2. www.openarchive.org
3. www.pubmedcentral.gov
4. www.biomedcentral.com
5. www.nature.com/nature/debates/e-ccess/index.html

B. BIOINFORMATICS

1. Introduction: Importance and scope.
2. Biological Databases

a. Nucleic acid databases: EMBL, GenBank – Structure of GenBank entries, Specialized genomic resources, UniGene

b. Protein sequence databases: PIR, SWISSPROT, TrEMBL.
Composite protein databases: NRDB, OWL.

Secondary Databases: PROSITE, PRINTS, BLOCKS, IDENTIFY
Structure classification databases: SCOP, CATH

3. Database searching:

a. Sequence database searching - EST searches, Different approaches to EST analysis, Merck/IMAGE, Incyte, TIGR, EST analytical tools, Sequence similarity, Sequence assembly and Sequence clustering.
b. Pair wise alignment technique: comparison of sequences and sub-sequences, Identity and similarity, Substitution matrices, BLOSUM, DOTPLOT and BLAST.
c. Multiple alignment technique: Objective, Manual, Simultaneous and progressive methods, Databases of multiple alignments, PSI-BLAST, CLUSTAL-W.

4. Protein structure prediction:

a. Secondary structure prediction: Chou-Fasman, J Pred.
b. Tertiary structure prediction: Comparative modeling - Modeller, Rasmol.

5. Emerging areas of Bioinformatics: DNA Microarrays, Functional genomics, Comparative genomics, Pharmacogenomics, Chemoinformatics, Medical Informatics.Next Gen sequencing , , biosequencing and phylosequencing (Brief study)

Reference Books:

1. Attwood, T.K and Arry-Smith, D.J. Introduction to Bioinformatics, Pearson Education.
2. Sundararajan, S. and R. Balaji, Introduction to Bioinformatics, Himalaya Publishing House.
3. http://www.bioinformaticzen.com
4. http://www.bioinformatic.edu/bioinfo_course/note.html.

BO 03 CP 12. PRACTICALS OF PLANT PHYSIOLOGY, METABOLISM, BIOCHEMISTRY, ANGIOSPERM MORPHOLOGY, TAXONOMY, PLANT RESOURCES, BIO TECHNOLOGY AND BIOINFORMATICS (1+1+1+0.5+1+0.5+0.5=6)

Plant Physiology

1. Determination of water potential by tissue weight change method.
2. Extraction of leaf pigments and preparation of absorption spectra of chlorophylls and carotenoids.
3. Demonstration of Hill reaction.
4. Separation of leaf pigments by paper chromatography and column chromatography.
5. Effects of light intensity on photosynthesis by Wilmot's bubbler.
6. Determination of sugars and amino acids in germinating seed by TLC.
7. Extraction of seed prkages from seeds during germination.
8. Biochemical analysis of leakages from seeds during germination.
9. Analysis of proline in water stressed plants.
10. Testing of seed viability by NBT test.
11. Changes in the reserve proteins during germination.

Metabolism

1. Extraction of enzyme: Any enzyme.
2. Effect of substrate on enzyme and determination of its Km value.
3. pH dependent activity profile of enzymes.
4. Ammonium sulphate precipatitation of enzymes.
5. Desalting of proteins by gel filtration using Sophadex G25/dialysis.
6. Separation of isoenzymes by native PAGE.
7. Determination of enzyme/protein sub units by SDS PAGE.
8. Metabolism of germinating seeds – changes in metabolisable carbohydrates.

Biochemistry

1. Qualitative tests for monosaccharides, reducing and non reducing oligosaccharides, starch, amino acids and protein.
2. Quantitative estimation of reducing sugars and starch.
3. Quantitative tests for lipids, Emulsification, saponification, acrolein test, Boundouin's test
4. Quantitative estimation of amino acids.
5. Quantitative estimation of protein by Biurest/Branford's/Lowry et al method.
6. Quantitative estimation of DNA and RNA (colorimetric/ spectrophotometric)
7. Quantitative estimation of total phenolics.

Morphology

1. Preparation of cleared whole mounts of floral parts to show vasculature.
2. Examination of the following with the help of dissections and hand sections: Transmitting tissues/canals in style and stigma: Different types of ovaries, Different types of placentation, vasculature of and rocecium and gynoecium in special types of flowers.

Taxonomy

1. Familiarization with local flora and construction of keys – use of floras in identification up to species.
2. Study of diagnostic features of the families studied in the theory paper with special reference to their economic aspects. 9. Study of the following families swith special reference to morphology of modified parts, economic importance, interrelationships and evolutionary trends. Magnoliaceae, Ranunculaceae, Menispermaceae, Nymphaeace, Polygalaceae, Caryoplyllaceae, Clusiaceae, Sterculiaceae, Meliaceae, Sapindaceae, Rosaceae, Melastomaceae, Rhyzophoraeae, Aizoaceae, Rubiaceae, Sapotaceae, Gentianaceae, Boraginaceae, Convolvulaceae, Scrophulariaceae, Pedaliaceae, Verbanaceae, Nyctaginaceae, Euphorbiaceae, Urticaceae, Casurinaceae, Orchidaceae, Zingiberaceae, Amanyllidaceae, Commelinaceae, Araceae, Cyperaceae and Poaceae.
3. Dissection of at least two members of each family in the laboratory, making suitable sketches, describing them in technical terms and identifying them constructing appropriate floral diagrams.

4. Field study of five days under the guidance and supervision of teachers at an ecologically different locality and submission of a feeld study report certified by the teacher concerned. The report should contain ecology of flora of the area studied. Each student shall collect plant specimens following the standard means of plant collection for preparation of herbarium. Each student shall submit a minimum of 50 such herbarium specimens along with the field book for the Practical examination.
5. Problems in Bar Coding.

Plant Resources

1. Morphological study of the source plants mentioned in the theory syllabus and identification of the plants and plant products.

Biotechnology – A. Tissue Culture.

1. Preparation and sterilization of culture media.
2. Culturing of Carrot/Tobacco/Datura.
3. Estimation of cell growth in callus culture by fresh wt. and dry wt.
4. Induction of multiple shoots using axillary and apical meristems as explants.
5. Plantlet regeneration from callus.
6. Identification of secondary metabolites in cultures.

Biotechnology – B. Genetic Engineering

Isolation of DNA.

Bioinformatics – A. Computer Application

1. Acquiring basic computer operation and internet browsing skills in Windows and Linux platforms.
2. Acquiring basic word processing/data entry skills using popular (both commercial and open source) packages such as MS-Word, K-Word, Open Word, PageMaker.
3. Acquire graphic processing skills using popular packages such as PhotoShop, Corel Draw, Chem Draw.
4. Preparation of scientific presentations using packages such as MS-Power Point.
5. Use of statisti al packages such as SPSS, Biostat, Origin, MS-Excel.

B. Bioinformatics

1. Acquisition of basic skills in Internet browsing.
2. Use of web browsers and search engines.
3. Use of biological and bioinformatic websites Agris, Agricola, BIOSI S, CABWeb.
4. Visit to Bioinformatics websites: NCBI, SWISS PROT, PIR, PDB.

SEMESTER IV

Course Code	Title	Teaching Hours / week	Duration of examination	Weightage		Credits	Pg. No:
BO04 ET13	Elective 1 – Genetic Engineering	6	3 hrs	36	20	4	52
BO04 ET14	Elective 2- Genetic Engineering	6	3 hrs	36	20	4	54
BO04 EP15	Practicals Elective 1 - Genetic Engineering	6	6 hrs	36	20	4	53
BO04 EP16	Practicals Elective 2- Genetic Engineering	6	6 hrs	36	20	4	55
BO04 DN17	Dissertation	-	-	36	20	4	-
BO04 VV18	Viva voce	-	-	-	-	4	-

Elective-1 GENETIC ENGINEERING

[6 hours per week]

COURSE CODE BO04 ET03

COURSE OUTCOME

To provide a knowledge of different cloning aspects both in animals and plants. To provide expertise in DNA isolation techniques and various scopes of nanotechnology.

1. Structure of genes in Prokaryotes and eukaryotes: Genetic code and codons, Gene expression.
2. Recombinant DNA technology: Tools of r DNA technology, Methods of creating rDNA molecules, restriction mapping, isolation and separation of genetic material, southern, northern, western, south western and north western blotting techniques. GISH
3. Gene transfer techniques in plants: Agrobacterium mediated transfer, gene gun method, electroporation, microinjection, chemical methods. RNAase protection and reporter assays.
4. Molecular markers: RAMPO, SSCP, RFLP, RAPD, AFLP, EST markers, Repetitive DNA, Microsatellite and Mini satellite.
5. DNA sequencing: Chemical and enzymatic methods, importance of DNA sequencing. s1 mapping,
6. Gel electrophoresis: Techniques for visualization and reading sequences.
7. Polymerase Chain Reaction: History, methodology of PCR. Variations from basic PCR- reverse transcriptase PCR, nested PCR, inverse PCR- applications of PCR.
8. DNA profiling: History, methodology of genetic finger printing-applications.
9. Genetic engineering for crop improvement: transgenic plants.
10. Cloning of genes and production of vaccines, drugs, growth hormones and chemicals.
11. Gene therapy: Types of gene therapy. Getting transgenes in to patients-viral and non viral approaches. Success of gene therapy. Genetic counseling
12. Abatement of pollution through genetically engineered microorganisms-an emerging approach towards environmental clean-up programmes.
13. Nanotechnology and its applications in genetic engineering.

REFERENCES

1. Hant, D.L. and Jones E. W. Genetics: Analysis of genes and genome. Jones and Bartlett Publishers.
2. Nicholl Desmond, S.T. An introduction to Genetic Engineering. Cambridge Pub
3. Brown, T.A. Gene cloning and DNA analysis. Blackell Science Pub.
4. Dubey, R.C. A text book of Biotechnology. Chand Pub.
5. Singh B.D. Biotechnology. Kalyani Publishers.

6. Walker and Rapley. Molecular Biology and Biotechnology., Panima Pub.
7. Chrispeels, M.J. and Sadava D.E. Plants, Genes and Agriculture.
8. Lewin, B. Genes. Oxford University Press.
9. Mason, A.C. Principles of gene manipulation and genomics.
10. Rissler J. and Mellon M. The Ecological Risks of Engineered Crops. MIT Press, Cambridge.
11. Avice, John C. The Hope, Hype and Reality of Genetic Engineering.
12. McYYan R.P. Genetics and Genetic Engineering. Saras Publications.
13. Narayana LM. Molecular Biology and Genetic Engineering.
14. Khhadpekar, N.R. The age of Nanotechnology. ICFAI University Press, Hyderabad.
15. Nalwa, H.R. Encyclopedia of Nano science and Technology.

Practicals of Elective

1. Working out problems in genetic engineering.
2. Isolation of plant DNA and its quantification by spectrophotometer.
3. Isolation of plasmid DNA from E. coli.
4. Gel electrophoresis – gel preparation, casting, elution and staining.
5. Visualization of DNA by agarose gel electrophoresis and gel reading.
6. Construction of coding sequence of DNA using amino acid sequence.

ELECTIVE 2. PATHOLOGY OF PLANTATION CROPS AND SPICES.

[6 hours per week]

COURSE CODE BO04 ET14

COURSE OUTCOME

To give basic awareness about diseases in crop plants and spices, and various stages of diseases, their symptoms and control measures.

1. Principles of plant pathology.
2. Major pathogens of crop plants.
3. Major pest of crop plants.
4. Fugicides–contact, semi systemic and systemic–antibiotics – chemistry, mode of application and mode of action – effects and side effects.
5. Bactericides – chemistry, mode of application and mode of action.
6. Pesticides – chemistry, mode of application and mode of action.
7. Bio control agents of disease management – fungal and bacterial products – mode of application and mode of action.
8. Botanicals as plant protectants – major sources, active principles, mode of application and mode of action.
9. Integrated pest and disease management.
10. Etiology and control measures of the following diseases:

Bud rot of coconut, stem bleeding of coconut, Nut fall of areacanut , Pod rot of cocoa, Foot root of black pepper, Anthrachnose of black pepper, Fungal soft rot of ginger, Bacterial wilt of ginger, Rhizome rot of cardamom, Capsule rot of cardamom, Abnormal leaf fall of rubber, Brown spot of paddy , foot rot of chilly.

References

1. Rangaswami G. Diseases of Crop Plants in India. Prentice Hall of India, New Delhi.
2. Singh R.P. and Singh U.S. Molecular Methods in Plant Pathology. CRC, Lewis.
3. Agrios, George N. Plant Pathology. Academic Press INC., NY.
4. Mehrotra R. S. Plant Pathology. Tata Mc Graw Hill Publication, New Delhi.
5. Johnson I.F. and Curl E.A. Methods for Research on the Ecology of Soil Bome Plant Pathogens. Burgress Publishing Company, U.S.A.
6. Dhingra O.D. and Sinclair J.B. Basic Plant Pathology Methods. Academic Press, NY.
7. Aneja K.R. Experiments in Microbiology, Plant Pathology and Biotechnology. New Age International Publishers, New Delhi.
8. Pelczar Jr., Michael J. Micorbiology, Tata Mc Graw Hill Publication, New Delhi.
9. Nair i.n. Topics in Mycology and Plant Patholog. New Central Book Agency (P) Ltd., Kolkata.
10. Waller J.M., Lenne J.M. and Waller S.J. Plant Pathologists' Pocket Book. CABI Publication, NY.

11. Riker A.J. and Riker R.S. Introduction to Research on Plant Diseases. John S. Swift Co., St. Louis. MO.

Practicals of Elective 2.

1. Isolation of fungal and bacterial pathogens of the above diseases, growing them in appropriate nutrient media and identification of the pathogens and preparation of drawings and photographs.
2. Field collection and preservation of the infected parts in the case of the above diseases and preparation of morphological and microscopic drawings and photographs and identifications of the diseases at field and lab levels.
3. Study of disease cycle of a pathogen in any one of the above crop plants and demonstration of **Koch's postulates** and preparation of an illustrated report.
4. Visit to two crop research stations and first hand acquaintance with the major plant protection activities in the station and submission of reports or lab placement training in the plant protection division of a crop research station for a period of 30 days and submission of a report.

BO04ET15 ELECTIVE3- Environmental Biology and Biodiversity Conservation

1. Population ecology: Properties (concepts of rate, intrinsic rate of natural increase, carrying capacity, population fluctuations and cyclic oscillations, density independent and density dependent mechanisms of population regulation, patterns of dispersion, Allee principle of aggregation and refuging, home range and territoriality, energy partitioning and optimization, *r* and K selection.

2. Community ecology: Types of interaction between two species, coevolution, evolution of cooperation, group selection, interspecific competition and coexistence, positive and negative interactions, concepts of habitat, ecological niche and guild.

3. Human population: Expansion and its causes, rich and poor nations, consequences, dynamics, Cairo conference 1994.

4. Major global environmental challenges: Acid rain, Ozone depletion, climate disruption, deforestation, land degradation and desertification, freshwater degradation and shortage, marine fisheries decline, loss of biological diversity and excess nitrogen.

5. Global initiatives: Stockholm conference (1972), Rio (1992), Ramsar convention (1971), Kyoto (1997), Johannesburg (2002), Stockholm (2011).

6. Environmental Law- International and National: The Environment Protection Act & Rules 1986; Water (Prevention & Control of Pollution) Act 1974; Biodiversity Act (2002).

7. Thoughts on ecology: Contributions of Buddha, Rabindranatha Tagore, Mahatma Gandhi, Rachel Carson, Gro Herlem Brundtland, Vandana Siva, Edward O Wilson, Aldo Leopald.

8. Biodiversity: a). Genetic diversity, agrobiodiversity and cultivated taxa, causes of decline, value of wild species, conservation practices- traditional (*upavana vinoda*, sacred groves, *sthalavrikshas*) and modern (*in situ* and *ex situ*). b). Biodiversity information management and communication- libraries, databases (taxonomic database working groups for plant sciences, data bases on biodiversity); distribution of biodiversity information, metadatabases, virtual libraries.

9. Ecosystem capital- use and restoration: Global perspective on biological systems; conservation, preservation and restoration. Biomes and ecosystems under pressure (forest biomes, ocean ecosystems).

10. Habitat studies: Wetlands (Ramsar sites), mangroves and forest types of Kerala.

11. Brief study of the following: Cybernetics, ecological foot print, sustainable development, deep ecology, Gaia hypothesis, conservation ethics, peoples' movements for biodiversity conservation, role of NGOs and educational institutions in biodiversity conservation, trade related IPR, ecotourism.

12. Climate change and its impacts- brief study.

13. Disaster management- basic aspects.

Practicals of Elective 2.

1. Studies on the following and submission of reports: Waste water treatment plant, local environmental peculiarities (such as hillocks and forest patches), wet land ecosystem, alien invasive plants, degraded ecosystem, different forest types, effluent treatment system).

2. Physical and chemical analysis of soil and water: Particle size analysis of soil, estimation of particle density using relative density or volumetric flask; Air capacity analysis of soil by field method; Soil pH analysis of soil using pH meter. Water analysis for pH using pH meter, estimation of BOD by Winkler's method (dark and light bottles).

3. Study of community structure: Charting and mapping of vegetation, Raunkiaer's life forms, biological spectrum, profile diagram (soil).

4. Study of ecological succession: Different types of ecological successions.

5. Visit to an ecological sensitive area and submission of a report.

References

Champion H.G. and Seth S.K. A Revised Classification of Forest Types of India. Govt. of India, New Delhi.

Gadgil Madhav. Ecological Journeys. Permanent Black, Delhi.

Jaiswal P.C. Soil Plant and Water Analysis. Kalyani Publishers, Ludhiana.

Krishnamurthy K.V. An Advanced Text Book on Biodiversity Principles and Practice. Oxford IBH.

Misra R. Ecology Workbook. Oxford IBH.

Odum E.P. and Barrett G.W. Fundamentals of Ecology. Thomson Books, Bangalore.

Palmer J.A. Fifty Thinkers on the Environment. Routledge, London.

Puri G.S. Indian Forest Ecology. Oxford IBH.

Pushpangadan P. and Nair K.S.S. Biodiversity and Tropical Forests- The Kerala Scenario. STEC, Thiruvananthapuram.

Sarngdharacharyar. (Translated by Vishnu B.). *Vruksha ayurvedam* Janapriya Pusthakasala, Kottayam.

Sivadasan M. and Mohanan K.V. Biodiversity and Ecology: Concepts and Facts. Department of Botany, University of Calicut, Kerala.

Speth Gustave James and Haas M. Peter. Global Environmental Governance. Pearson Longman, New Delhi.

Vijayalakshmi K. and Shyam Sundar K.M. Vrkshayurveda- An Introduction Indian Plan Science. Lok Swasthya Parampara Samvardhan Samithi, Madras.

Wright T. Richard. Environmental Science- Towards a Sustainable Future. Prentice Hall Learning Pvt. Ltd., New Delhi.

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER 1
BO 01 CT 01- PHYCOLOGY , BRYOLOGY, PTERIDOLOGY AND GYMNOSPERM

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. What is protonema.
2. Write the pigment constitution of phaeophyceae.
3. What are elators.
4. Describe the evolutionary significance of isoetes.
5. What is kieseguhr.
6. Explain false Indusium.
7. Write a brief note on cycadeoidales.
8. Describe fern prothallus.
9. Explain the significance of corolloid root
10. Distinguish between Isogamy and Oogamy.
11. Write a brief note on the diagnostic features of andreals.
12. What is shower of sulphur.
13. Differentiate manoxylic and pycnoxylic wood.
14. What are the aquatic adaptations of salvinia**.** **(14x 1=14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15.Enumerate the importance of bryophytes in monitoring of airpollution.
16. Write down the salient features of Oedogoniales.
17. Explain the characters of lepidodendrales.
18. Describe the sporophyte development in polytricales.
19. Explain the range of thallus variation in chlorophyceae.
20. Write an account on tree ferns.
21. Explain the economic importance of rhodhophyceae.
22. Describe Lyginopteris.
23. Describe gametophores development in homosporous fern.
24. Discuss the evolutionary significance of caytoniales. **(7x 2=14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Explain the range of thallus and pigment variations in algae.
26. Describe the gametophyte variation in bryophytes.
27. Give an account of heterospory and seed habit in pteridophytes.
28. Give a detailed account on economic importance of gymnosperms. (**2x4=8 weightage)**

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER 1
MODEL QUESTION PAPER
BO 01 CT 02- MYCOLOGY, LICHNOLOGY, MICROBIOLOGY AND PLANT PATHOLOGY

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. What are xenobiotics.
2. What is dikaryotic mycelium.
3. Write abrief account on production of single cell protein.
4. Write brief note on hymenium.
5. Write practical applications of biofertilizers.
6. Write a short note on mollicutes.
7. Write a short note on plant viruses.
8. Describe mitosporic fungus.
9. What are the methods of transmission of plant diseases.
10. What are viroids.
11. What is a rhizine
12. Write a short note on Lambda virus.
13. Explain the reproductive bodies of lichen.
14. Write a note on food spoilage. **(14x 1=14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15. Briefly explain the economic importance of lichen.
16. Mention the different modes of nutrition in fungus.
17. What are the different symptoms of plant diseases.
18. What is bioremediation. Add a note on its applications.
19. Mention the role of enzymes in the process of infection.
20. How lichens are classifides.
21. Briefly explain bacteriophages.
22. Describe the industrial production of alcohol.
23. Explain the industrial production of vitamins.
24. Write a short note on heterothallism. **(7x 2=14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Give a broad outline of classification of fungi.
26. Describe the classification of bacteria based on Bergey's manual.
27. Explain the salient features of cyanobacteria. Add a note on its biological importance.
28. Give a general account o lichens .Add a note on their ecological and economical importance.

(**2x4=8 weightage**

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER 1
MODEL QUESTION PAPER
BO 01 CT 03- ANGIOSPERM ANATOMY, EMBRYOLOGY, PALYNOLOGY AND LAB TECHNIQUES

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. Enumerate the chemical constituents of the secondary wall.
2. Elucidate the effect of leaf trace departure on stele and pith.
3. Enumerate the cell types in vascular cambium.
4. What is residual meristem?
5. Differentiate bifacial, unifacial and centric leaf.
6. Explain the role of palynology in forensic medicine.
7. Differentiate Aeropalynology and from Mellitopalynology.
8. What is Parthenocarpy?
9. Distinguish quadrat embryo from octant embryo.
10. What is filiform apparatus?
11. Elucidate male germ unit.
12. What is prime exine?
13. Evaluate nutritional and medicinal value of honey.
14. What is Fuelgen reaction? **(14 × 1 = 14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15. Evaluate the role of cambium in wound healing and grafting.
16. Write briefly on the conversion of fusiform initials into ray initials.
17. What is mosaic endosperm? Explain its development.
18. Write briefly on the classification of polyembryony**.**
19. Write briefly on the role of palynology in oil exploration and paleopalynology.
20. Elucidate the development of cork cambium.
21. Explain the role of palynology in forensic medicine.
22. Explain briefly the embedding plant materials for electron microscope.
23. Comment on the origin of cambium in arborescent monocotyledons (Liliforae).
24. Explain the differentiation of sieve elements. **(7 × 2 = 14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Write an account of anatomy in relation to taxonomy.
26. What is endosperm? Explain the types and endosperm haustoria.
27. Write an account of wood anatomy.
28. Describe the methods of embedding plant materials in paraffin wax through TBA method.

(2 × 4 = 8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER II
MODEL QUESTION PAPER
BO 02 CT 05- CELL BIOLOGY, MOLECULAR BIOLOGY AND BIOPHYSICS

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. What are repetitive DNA?
2. Define Buffer.
3. What is the principle of lyophilization.
4. Mitotic Inducers.
5. Chargaff's rule.
6. C-Value Paradox..
7. Differentiate between Euchromatin and Heterochromatin
8. What are primosomes.
9. structural difference between purines and pyramidines.
10. Define apoptosis.
11. How are proteins denatured.
12. List the significance of meiosis.
13. Elaborate on One gene- One enzyme concept
14. SATchromosome **(14 × 1 = 14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15. Describe the properties of genetic code.
16. How is cell cycle regulated.
17. Discussthe structural organization of proteins.
18. Explain synaptonemal complex and its function.
19. How are amionoacids are classified.
20. Mention the role of different DNA polymerases involved in replication.
21. Explain cell signaling path ways.
22. Explain briefly different banding techniques.
23. Brief account on ion exchange chromatography.
24. List out the applications of Freeze drying. **(7 × 2 = 14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Briefly explain the application and principles of chromatography.
26. What is the genetic basis of malignant transformation? Explain the mechanisms involved in Cancer.
27. Describe different phases of cell cycle.
28. Define mutation.Explain the role of mutator and antimutator genes.

(2 × 4 = 8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER II
MODEL QUESTION PAPER
BO 02 CT 06- CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING AND EVOLUTION

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. What is Flow cytometry?
2. Explain Robertsonian translocation
3. Enumerate the Ac and Ds elements in Maize.
4. Elucidate Hardy-Weinberg principle.
5. Differentiate Mitochondrial and Chloroplast genomes.
6. Distinguish between Coupling and Repulsion.
7. Phenotypic variance.
8. MINITAB
9. Explain ogive graph.
10. Standard error.
11. Sampling.
12. Briefly explain NBPGR.
13. Differentiate interspecific hybridization and introgressive hybridization.
14. What is meant by lamarkisam **(14 × 1 = 14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15. Write a brief note on the Aneuploidy and its phenotypic effects.
16. Write briefly on the factors affecting Population equilibrium.
17. What are Retrotansposons and explain its molecular characteristics.
18. Write briefly on the Cytoplasmic male sterility**.**
19. Write briefly on probability.
20. Differentiate between correlation and regression.
21. Briefly explain Z test and its significance.
22. Explain cryopreservation of germplasm.
23. Elucidate heterosis and inbreeding depression.
24. Briefly explain the evidences of evolution. **(7 × 2 = 14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Write an account of Human pedigree analysis and genetic disorders.
26. Briefly explain theories of evolution.
27. Describe modern methods of plant breeding and its applications.
28. Explain measures of dispersion. **(2 × 4 = 8 weightage)**

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER 11
MODEL QUESTION PAPER
BO 02 CT 07- PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAPHY AND FOREST BOTANY

TIME: 3 HOURS **WEIGHTAGE: 36**

PART A (Answer all questions briefly)

1. What is limnology?
2. Define permafrost.
3. Describe Chapman cycle.
4. Explain biotic potential.
5. Differentiate between autecology and synecology.
6. Explain flagship species with example.
7. Define EIA.
8. Expand and explain MAB.
9. Explain long distance dispersal hypothesis.
10. Define Vicarism
11. What is microendemics?
12. What is MFP
13. Evaluate consequences of deforestation.
14. What is Deforestation . **(14 × 1 = 14 weightage)**

PART B (Answer any seven questions in not more than 100 words)

15. Explain Gaia hypothesis.
16. Briefly explain the characteristics of population.
17. Explain shallow ecology.
18. Explain various red list categories.
19. Differentiate social forestry and agro forestry.
20. Explain water pollution, its consequences and control.
21. Write a short note on Biosphere reserve.
22. Explain age and area hypothesis.
23. Write a short on patterns of distribution of plants.
24. Explain the influences of forest on environment. **(7 × 2 = 14 weightage)**

Part – C (Answer any two questions in 300 words each)

25. Elucidate different types of biomes and its salient features.
26. Write an essay on various threats to global environment.
27. Write an essay on biodiversity and its significance.
28. Explain the different forest types. **(2 × 4 = 8 weightage)**

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER III
BO 03 CT 09: PLANT PHYSIOLOGY, METABOLISM AND BIOCHEMISTRY

TIME: 3 HOURS **WEIGHTAGE: 36**

PART- A (Answer All Questions Briefly)

1) Explain hydrogen bonding in water.
2) Enumerate the ecological significance of CAM metabolism.
3) Significance of ethylene.
4) Allosteric enzyme.
5) List the properties of Zwitter ions.
6) Explain GDH/GS.
7) Explain Michaelis-Menton equation.
8) List out functions of nucleotide.
9) Seed dormancy.
10) Discuss oxidative phosphorylation..
11) Anapleurotic reactions.
12) Nif gene.
13) Explain conversion of NMP to NTP.
14) Explain saponification of lipids. (14 x 1wt= 14wt)

PART B: ANSWER ANY <u>SEVEN</u> QUESTIONS IN NOT MORE THAN 100 WORDS

15) Give an account on Enzyme kinetics.
16) Briefly explain nitrogen fixation
17) Define photomorphogenesis.Give an account on phytochrome.
18) Write an account on classification of aminoacids.
19) Describe GOGAT pathway
20) Give an account of oxidation of aminoacids and entry in to Kreb's cycle.
21) Discuss the biochemistry of nitrogen fixation.
22) Briefly explain the physiological effects of auxin.
23) Point out IUB system of enzyme classification.
24) Elucidate carbon reduction cycle. (7x 2wt=14wt)

PART C: ANSWER ANY <u>TWO</u> QUESTION IN 300 WORDS EACH.

25) Give an account on secondary metabolites. Add a note on their physiological role and significance.
26) Explain the fate of pyruvic acid under aerobic conditions.
27) Describe the mechanism of translocation in plants.
28) Write an essay on stress in plants. (2 x 4wt=8wt)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER III
BO 03 CT 10 - ANGIOSPERM MORPHOLOGY, TAXONOMY AND PLANT RESOURCES

Time : 3 Hours **Maximum** : 36 Weightage

I (Answer all the 14 questions very briefly)

1. Effective & Valid publication.
2. Ranalian concept of primitive flower.
3. Lectotype.
4. Infra specific categories.
5. Distinguish monophyly from polyphyly.
6. Pharmacognostic properties of Turmeric and Saraca.
7. Correlation of characters.
8. ICNCP.
9. Illustrate axile and parietal placentation.
10. Differentiate unit and multiple characters.
11. Economic importance of cotton and jute.
12. Character weighting.
13. Nectarines.
14. Paris code. (14×1= 14 weightage)

II Answer Any seven Questions In Not More Than 100 Words each

15. Write an account on beverages
16. Explain evolution of placentation types.
17. Define Character and explain the classification of different Characters.
18. Write botanical name, family and economic importance of sugar yielding plants.
19. Distinguish primitive and advanced; parallelism and convergence.
20. Write a note on typification.
21. Explain the concept of foliar origin of Carpels.
22. Evaluate the importance of author citation and circumstances under which a name of taxon is to be changed.
23. Co- evolution of flowers vis-à-vis pollinators
24. Explain the rule of priority and its limitation. (7×2= 14 weightage)

III Answer Any two Questions In 300 Words Each :

25. Evaluate the chemical and pharmacognostic properties of medicinal plants you have studied.
26. Write an account on salient features and major provisions of ICBN.
27. Write an account on the origin and evolution of structure and morphology of stamens, nectarines and nectar.
28. Elucidate the broad outline of Bentham and Hooker's system of classification and add note on its merits and demerits. (2×4=8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER III
BO 03 CT 11 – BIOTECHNOLOGY AND BIOINFORMATICS

Time : 3 Hours **Maximum** : 36 Weightage

PART: A (Answer all the 14 questions very briefly)

1. Application of cryopreservation.
2. What are web browsers?
3. Expand VNTR
4. What is chromosome jumping?
5. Differentiate SCOP AND CATH.
6. Mericloning.
7. List out major bioinformatics resources.
8. Define the structure of gen bank entries.
9. Synseed.
10. Define E access debate concept and implications.
11. Write a note on chemo informatics.
12. What are GMOs? Quote few examples.
13. Phytopolymers.
14. What are the factors affecting organogenesis. (14×1= 14 weightage)

PART: B Answer Any seven Questions In Not More Than 100 Words each

15. Explain Gilbert and Maxam method of DNA sequencing.
16. write anote on pharmacogenomics and chemoinformartics.
17. Describe vector dependent methods of gene transfer.
18. Write a short note on DNA finger printing and its applications.
19. Differentiate between northern blott and southern blott.
20. Briefly explain somaclones and its application.
21. Comment on IPR and its significance.
22. Write about internet and its prospects.
23. How will you engineer plants for herbicide tolerance?
24. Briefly explain database search (7×2= 14 weightage)

PART: CAnswer Any two Questions In 300 Words Each :

25. Write an essay on application of plant tissue culture.
26. Explain scope of bioinformatics.
27. Write an account on large scale cultivation of cells using bioreactors for secondary metabolites.
28. Write a detailed note on vectors used in rDNA technology. (2×4=8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER IV
BO 04 ET - Elective Paper 03 – GENETIC ENGINEERING

Time: 3 Hours **Maximum** : 36 Weightage

PART: A Answer *all* the 14 questions very briefly

1. What is Nanotechnology?
2. Define a codon.
3. Write a short note on Golden rice.
4. What is 'vir' gene?
5. What is a primer?
6. Explain TATA box.
7. What are DNA chips?
8. Explain nested PCR.
9. What are the okazaki fragments?
10. What is the significance of exons and introns?
11. Explain biosensors.
12. Comment SSCP markers
13. What are shuttle vectors?
14. What is Annealing temperature? (14×1= 14 weightage)

PART:B Answer *Any seven* Questions In Not More Than 100 Words each

15. Explain any one vector less method of gene transfer in plants.
16. What are the applications of DNA profiling?
17. What are the ethics related with recombinant DNA research.
18. Write on the principle of gene gun method.
19. How growth hormones are produced by r DNA technology.
20. Compare the promoters of prokaryotes with that of eukaryotes.
21. Discuss the important steps involved in translation.
22. Discuss the properties of various endonucleases with suitable examples.
23. Differentiate between linkers and adaptors
24. Discuss the transgenic approaches for control of plant virus. (7×2= 14 weightage)

PART: C Answer *Any two* Questions In 300 Words Each :

25. What are the applications of nanotechnology in genetic engineering?
26. Discuss pollution abatement through GMO's.
27. Discuss the gene expression in prokaryotes.
28. Describe the molecular mechanism of DNA replication in prokaryotes. (2×4=8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MSc BOTANY DEGREE PROGRAMME - SEMESTER IV
BO 04 ET 13(06) - PATHOLOGY OF PLANTATION CROPS ANS SPECIES

TIME: 3 HOURS **WEIGHTAGE: 36**

PART: A answer all questions briefly

1. Name the causative organisms of capsule rot and rhizome rot of cardamom.
2. Write a note *Pseudomonas* sp.
3. Explain the role of sanitation in disease control.
4. What are the advantages of using biopesticides.
5. Name two fungal diseases and their causative organisms.
6. Write a note on the common symptoms caused by viruses.
7. Distinguish between rot and wilt.
8. Give the names of two chemical bactericides.
9. What is a systemic fungicide? Give an example.
10. Write a note on the action of antibiotics in disease control
11. How is Bordeaux mixture prepared?
12. What is pyrethrin? Mention its source.
13. What are the common symptoms caused by nematodes in plants?
14. Write a short on Malathion. (14×1= 14 weightage)

PART:B Answer *Any seven* Questions In Not More Than 100 Words each

15. Discuss the importance of Tobacco in pest management.
16. Describe the mode of application of bactericides.
17. How are fungal biocontrol agents applied to plants?
18. Discuss the common symptoms produced by bacterial pathogens.
19. Explain the method of cultural control of pests.
20. Describe the disease cycle of a fungal pathogen that you have studied.
21. Give an account on the types of crop pests with examples.
22. Discuss the controversies related to the use of biocontrol agents.
23. Write a note on soft rot of ginger.
24. Give an account on the types of crop pests with examples. (7×2= 14 weightage)

PART: C Answer *Any two* Questions In 300 Words Each :

25. Give an account on the mode of action and application of bacterial biocontrol agents with examples.
26. Discuss two important diseases that affect coconut palms emphasizing the etiology and measures to check the spread of the disease.
27. Give an account on the methods of integrated disease management in crop plants.
28. Discuss in detail the different types of fungicides, their chemistry, mode of action and application in disease management. (2×4=8 weightage)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MODEL QUESTION PAPER
M.Sc. BOTANY PRACTICAL EXAMINATION –SEMESTER I
BO 01 P04 - PHYCOLOGY, BRYOLOGY, PTERIDOLOGY, GYMNOSPERMS, MYCOLOGY AND LICHENOLOGY, MICROBIOLOGY, PLANT PATHOLOGY, ANGIOSPERM ANATOMY, EMBRYOLOGY, PALYNOLOGY AND LABORATORY TECHNIQUES

TIME: 6 HOURS **TOTAL WEIGHTAGE: 36**

PART A (9.30am – 12.30 pm)

1. Make suitable micro preparations of materials **A**, **B** and **C**. Identify the materials up to the level of genus giving reasons, draw labelled diagrams and leave the preparation for valuation. (Preparation- 1; Diagram, Reason, and Identification- 2) **[3 x 3 = 9 Weightage]**
2. Demonstrate Gram / Negative staining of bacterial culture **D** and identify the type / morphology of bacteria (Preparation -1; Identification- 1) **[2 Weightage]**
3. Dissect, Display and Identify any one stage of embryo with the help of a diagram from the given material **E**. (Preparation- 1; Diagram and Identification- 1) **[2 Weightage]**
4. Identify the disease, Causative organism and symptoms of the materials **F** and **G**.

[1 x 2 = 2 Weightage]

PART B (1 pm – 4 pm)

5. Make a suitable double stained permanent slide of material **H**. Describe salient anatomical features with the help of a suitable labelled diagram and leave the preparation for valuation. (Preparation- 3; Diagram and anatomical features- 2) **[5 Weightage]**
6. Make a suitable micro-preparation of material **I** and identify the type of stomata / nodal pattern with the help of a diagram. (Preparation- 1; Diagram and Identification- 1) **[2 Weightage]**
7. Make a micro preparation of the material **J** by acetolysis method. Comment on pollen morphology and leave the preparation for valuation. (Preparation- 1; Pollen morphology- 1) **[2 Weightage]**
8. Spot at sight **K, L, M, N, O** and **P** **[1 x 6 = 6 Weightage]**

Record- 4 Weightage
Submissions- 2 Weightage

Total – 36 Weightage

PRACTICAL MODEL QUESTION PAPER
M.Sc BOTANY SECOND SEMESTER PRACTICAL EXAMINATION
BO02CP08 CELL BIOLOGY, MOLECULAR BIOLOGY, BIOPHYSICS, CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING, PLANT ECOLOGY, CONSEVATION BIOLOGY, PHYTOGEOGRAPHY & FOREST BOTANY

TIME: 6 HOURS **WEIGHTAGE: 36**

SCHEME OF VALUATION

PART A (9.30 – 12.30 PM)

1. **A** – Any suitable flower bud for meiosis
   Preparation- 2; Identification – ½ ; Diagram – ½) **3 weightage**

ll. B – 1 molar solution for ph (Preparation – 2; Calculation – 1) **3 weightage**

lll. C – Data is provided **3 weightage**

lV. D – Problem from molecular biology **3 weightage**

V. E – Map of India is provided **1 weightage**

Vl. F and G – Common forest products preferably presented in record/ submission may be given **(1+1 = 2 weightage)**

PART B (1-4 PM)

Vll. H – Water sample may be provided

Vlll. I – and J – Plants suitable for hybridization shall be provided **(2 weightage)**

lX. K – Problem from Linkage **(5 weightage)**

X. L – Problem from biostatistics (Mean/ Median/ Mode/ Standard deviation/ Quartile deviation/ Mean deviation/ Chi-square test/Binomial distribution **(3 weightage)**

Xl. M&N – Photographs/ pictures/ cycles etc. of ecological / environmental/ conservational significance **(1 + 1 = 2 weightage)**

Record- 4 weightage; Submissions – 2 Weightage

SCHEME

PART A (9.30 – 12.30 PM)

l. A, B and C Suitable materials from Algae / fungi / Bryophyta / Pteridophyta / Gymnosperms.

ll. D – Culture/ curd / Root nodules may be given. For gram staining, staining type and for negative staining, morphological type should be identified
(preparation – 1; identification – 1) **2 weightage**

lll. E – Any suitable material (preparation – 1; identification- 1) **2 weightage**

lV. F and G – Any two pathological specimens (Materials / Herbarium specimens)
(Disease ¼; Casual organism ¼; Symptoms- ½) x 2 = **2 weightage**

PART B (1- 4 PM)

V. H – Root/ Stem with normal / Anomalous secondary thickening.
(Preparation – 2; Identification – 1; Diagram – 1; Anatomical features – 1) **5 weightage**

Vl. I- Suitable materials for stomata / node

(preparation – 1; identification- ½; diagram – ½) **2 weightage**

Vll. J- Unopened mature flower buds of any suitable material

(Preparation – 1; Pollen morphology- 1) **2 weightage**

Vlll. K, L, M, N, O and P – Any suitable materials / slides from algae, fungi, lichens, bryophytes, pteridophytes and gymnosperms/ fossil slides from pteridophytes and gymnosperms/ graph or figure from microbiology.

(1x6 = 6 weightage)

Record: 4 Weightage; Submissions – 2 Weightage

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MODEL QUESTION PAPER
M.Sc. BOTANY PRACTICAL EXAMINATION –SEMESTER II
BO02P08 - CELL BIOLOGY, MOLECULAR BIOLOGY, BIOPHYSICS, CYTOGENETICS, GENETICS, BIOSTATISTICS, PLANT BREEDING, PLANT ECOLOGY, CONSERVATION BIOLOGY, PHYTOGEOGRAPHY AND FOREST BOTANY

TIME: 6 HOURS **TOTAL WEIGHTAGE: 36**

PART A (9.30am – 12.30 pm)

1. Make a smear of material **A**. Submit any one stage for valuation. Identify and draw diagram. (Preparation- 2; Identification and Diagram- 1) **[3 Weightage]**
2. Determine the pH of the solution **B** prepared by mixing ..... ml of ..... molar solution with ..... ml of ..... molar solution. You are supplied with 1molar solution of both. (Preparation- 2; Calculation- 1) **[3 Weightage]**
3. From the given data **C**
   a) Construct Idiogram
   b) Find out Centromeric index
   c) Relative chromosome length
   d) Designation of chromosomes **[3 Weightage]**
4. Work out the problem **D** **[3 Weightage]**
5. In the given map **E**, mark ..... & ..... phytogeographic zones. [**1 Weightage]**
6. Write the botanical name, family and economic importance of **F** and **G**. **[1+ 1 = 2 Weightage]**

PART B (1pm – 4pm)

7. Estimate the Dissolved oxygen in the given water sample H **[3 Weightage]**
8. Demonstrate hybridization between **I** and **J** **[2 Weightage]**
9. Work out the problem **K.** **[5 Weightage]**
10. Work out the problem **L.** **[3 Weightage]**
11. Comment on the Ecological/ Environmental/ Conservational significance of **M** and **N** **[1 + 1 = 2 Weightage]**

Record – 4 Weightage
Submissions – 2 Weightage

Total – 36 Weightage

SCHEME OF VALUATION

PART A (9.30 – 12.30 PM)

1. A – Any suitable flower bud for meiosis
Preparation- 2; Identification – ½ ; Diagram – ½) **3 weightage**

ll. B – 1 molar solution for ph (Preparation – 2; Calculation – 1) **3 weightage**

lll. C – Data is provided **3 weightage**

lV. D – Problem from molecular biology **3 weightage**

V. E – Map of India is provided **1 weightage**

Vl. F and G – Common forest products preferably presented in record/ submission may be given **(1+1 = 2 weightage)**

PART B (1-4 PM)

Vll. H – Water sample may be provided

Vlll. I – and J – Plants suitable for hybridization shall be provided **(2 weightage)**

lX. K – Problem from Linkage **(5 weightage)**

X. L – Problem from biostatistics (Mean/ Median/ Mode/ Standard deviation/ Quartile deviation/ Mean deviation/ Chi-square test/Binomial distribution **(3 weightage)**

Xl. M&N – Photographs/ pictures/ cycles etc. of ecological / environmental/ conservational significance **(1 + 1 = 2 weightage)**

Record- 4 weightage; Submissions – 2 Weightage

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MODEL QUESTION PAPER
M.Sc. BOTANY PRACTICAL EXAMINATION - SEMESTER III
BO03 CP12 – PLANT PHYSIOLOGY, METABOLISM, BIOCHEMISTRY, ANGIOSPERM MORPHOLOGY, TAXONOMY, PLANT RESOURCE UTILIZATION, BIOTECHNOLOGY, COMPUTER APPLICATION AND BIOINFORMATICS

Time: 6 hrs **Max Weightage: 36**

Part A (9.30am -1.30pm)

1a. Separate the chloroplast pigments in the given extract **A** by unidirectional chromatography. Calculate Rf values of the pigments separated. Outline the procedure and leave the chromatogram for evaluation.
(Preparation- 1; Procedure- 1; Calculation of Rf value- 1) **[3 Weightage**]

2a. Estimate the amount of protein present in the given sample **B** using colorimeter / spectrophotometer. You are supplied with a standard solution of protein of .....g/L
(Procedure- 2; Calculation- 1; Result- 1) [**4 Weightage]**

OR

1b. Determine the percentage of seed viability of **A** by NBT / TTC method
(Preparation- 1; Procedure- 1; Tabulation and Calculation- 1) **[3 Weightage]**

2b. Determine the pH optimum of the enzyme **B**
(Procedure- 2; Graph- 1; Result- 1) **[4 Weightage]**

3. Derive the specimen **C** up to species using "The Flora of Presidency of Madras".
(Derivation up to family- 2; Genus- 1; species with author citation- 1) **[4 Weightage]**

4. Derive the specimen **D** up to family using technical terms
(Derivation up to family- 1; Description using technical terms- 1) **[2 Weightage]**

5. Construct the floral diagram, floral formula and draw a labelled diagram of the V.S. of the specimen **E**. (V.S.- 1; Floral Diagram- ½ ; Floral formula- ½) **[2 Weightage]**

6. Demonstrate the inoculation of material **F** into the given culture medium for callus culture. Write down the procedure adopted.
(Procedure- 1; Demonstration- 1) **[2 Weightage]**

7. Comment on **G** and **H.** **[½ + ½ = 1 Weightage**]

PART B (2PM – 4 PM)

8. Construct a taxon card and dichotomous key using the specimens **I, J, K, L** and **M**.
(Taxon card- 2; Indented key- 1) [**3 Weightage]**

9. Give the binomial and family of the source plant **N** and **O**
   (Binomial- ½; Family- ½) **[1 x 2 = 2 Weightage]**
10. Determine the water potential of the given material **P** by tissue weight change method.
    (Preparation- 2; Procedure- 1; Graph & Calculation- 1) **[4 Weightage]**
11. Give the binomial and family of the herbarium specimens **Q** and **R**.
    (Binomial-1; Family- 1) **[1 + 1 = 2 Weightage]**
12. Prepare a line/ bar/ pie diagram or a PPT slide using the given data provided **S**.
    (Preparation- 1) [1 Weightage]

Record: 4 Weightage

Submissions-: 2 Weightage(Herbarium, Field book, tour report**)**

Total: 36 Weightage

SCHEME

A,B- Required material provided from the centre.
C,D, - Plants given by the examiner
E-Flower &bud given by the examiner
G&H- Morphology/bioinformatics(Refer record Book)
N&O-Materials from plant resourses (Refer record Book)
Q & R- Herbarium sheets submitted by the candidate
S-Data provided by the Examiner (line/ bar/ pie diagram)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MODEL QUESTION PAPER
M.Sc. BOTANY PRACTICAL EXAMINATION - SEMESTER IV
BO04EP16: ELECTIVE I – GENETIC ENGINEERING

TIME: 6 HOURS **TOTAL WEIGHTAGE: 36**

PART A (9.30am – 12.30 pm)

1. Isolate DNA from the given plant material **A**.
   (Demonstration- 5; Procedure- 1) **[6 Weightage]**
2. Demonstrate the process of casting gel in **B** using gel mould and comb
   (Demonstration- 1 ½; Procedure- ½) **[2 Weightage]**
3. Demonstrate tube gel preparation and elution using melted agar given in **C**.
   (Demonstration- 2; Procedure- 1) **[3 Weightage]**
4. A DNA fragment of .....kb size **D** having 3 EcoR1 sites E1, E2 and E3. The gap between the restriction site E1 and E2 is ..... kb length. What are the possible ways of generating Restriction Fragment length polymorphisms between restriction sites E1 and E3? Represent each possibility with corresponding RFLPs fragment formed with appropriate fragment length. **[3 Weightage]**
5. How will you read the gel in the given diagram **E** depicting the fragment position in the agarose gel electrophoresis of a DNA fragment? What will be the target sequence?
   (Gel reading- 1; Target sequence- 1) **[2 Weightage]**
6. Identify and write short notes on **F**, **G**, **H** and **I**
   (F-1, G-1, H-1, I-1) **[4 Weightage]**

PART B (2pm – 4pm)

7. From the given nucleotide sequence of non template strand of DNA, **J**, prepare the mRNA strand and the corresponding polypeptide chain formed. Suppose due to a mutation ....., the DNA strand J is changed to .....Write down the mRNA strand and the corresponding polypeptide chain formed and compare polypeptide chains 'a' and 'b'
   (mRNAs and polypeptide chains- 2; Comparison- 1) **[2 Weightage]**
8. By adding initiation and stop codons, construct the coding sequence of the DNA **K** from the given sequence of amino acids using colour beads and the string supplied.
   (mRNA- 1; DNA +colour bead preparation- 1) **[2 Weightage]**
9. Solve the problem **L** related with derivation of restriction map
   (Derivation- 1; Map- 1) **[2 Weightage]**
10. Comment on **M**, **N**, **O** and **P** **[1x4 = 4 Weightage]**

Record – 4 Weightage

Submissions & Tour report – 2 Weightage

Total – 36 Weightage

SCHEME

A. -Plant material and reagent(provided from the centre)
B,C,D –Required data must be given by the examiners.(Refer record Book)
E,F,G,H &I-Diagrams/photographs/instruments/chemicals used/related to genetic engineering
J-Given Data(Examiner may announce the mutation)
K-Amino acid sequence(given)colour beads(from the centre)
L- Problem given
M,N,O,P-Techniques,achievements etc(diagrams,photographs,specimens)

ST. JOSEPH'S COLLEGE (AUTONOMOUS) IRINJALAKUDA
MODEL QUESTION PAPER
M.Sc. BOTANY PRACTICAL EXAMINATION- SEMESTER IV
BO04EP16: ELECTIVE II – PATHOLOGY OF PLANTATION CROPS AND SPICES
TIME: 6 HOURS **TOTAL WEIGHTAGE: 36**

PART A (9.30am – 12.30 pm)

1. Demonstrate the isolation of soil bacteria **A** by serial dilution technique. Write down the procedure for serial dilution, preparation of nutrient medium and enumeration of colonies. (Demonstration- 4; Procedure- 3; Calculation- 1) **[8 weightage]**
2. Identify the disease and the pathogen in the specimen **B** and comment on the symptoms and management. (Identification of disease and pathogen 1/2+1/2=1; symptoms-1; Management-1) **[3 weightage]**
3. Demonstrate the isolation of pathogen from material **C** and write down the procedure for obtaining pure culture of the causal organism. (Demonstration-2; Procedure-2) **[4 weightage]**
4. Write down the trade name/chemical structure, uses, mode of application and mode of action of given chemical **D**. **[2 weightage]**
5. Write critical notes on **E**, **F** and **G**. **[1 x 3=3 weightage]**

PART- B (1pm-4pm)

6. Demonstrate cross inoculation of the given pathogen **H**, on the host supplied. (Demonstration-2; Aim-1) **[3 weightage]**
7. Prepare _____ ml of the pesticide solution **I** of ____ strength. You are supplied with wettable powder of ____ (Purity____ %). (Procedure and calculation-1; preparation-1) **[2 weightage]**
8. Write down the active compounds and uses of the given Botanical **J**. **[1 weightage]**
9. Demonstrate streak plating of the given inoculum **K**. **[2 weightage]**
10. Identify the disease and pathogen of **L** & **M**. **[2 weightage]**

Record: 4 weightage

Submissions: tour report, pathology specimens= 2 weightage **Total: 36 weightage**

SCHEME

1. A- Supply dried and sieved garden soil for the isolation of soil bacteria –from the centre
2 .B- Fungal or bacterial disease,either fresh or dried specimens/herbaria-from the syllabus
3. C- Supply infected plant sample,provide medium poured petriplates
4. D - Any chemical pesticide (insecticide,fungicide,bactericide,nematicide)-based on record submission
5. E, F, G- Diagrams/chemicals/instrument/herbarium may be given
6. H- Pure culture and the host should be provide from the centre.
7. I- Examiner can decide the volume, concentration(ppm / %)of the pesticide solution to be prepared.Centre should provide the wettable powder of known purity.
8. K- Medium and inoculums must be provided from the centre
9. L &M- Pathology sheets submitted by the candidate.