

GOVERNMENT COLLEGE (AUTONOMOUS)

RAJAHMUNDRY

(ESTD: 1853, NAAC Re-Accredited with Grade 'A⁺')

DEPARTMENT OF BOTANY



BOS MEETING PG (BOTANY)

2022-2023

M.Sc., Botany - Course Structure

| Paper Code | Title of the paper | L | T | P | Total (hrs)/ week | Duration Of Exam | Max. Marks | Internal marks | Total Marks | Credits |
|--|--|---|---|---|-------------------|------------------|------------|----------------|-------------|-----------|
| SEMESTER - I | | | | | | | | | | |
| Theory | | | | | | | | | | |
| Core Paper 101 | Biology and Diversity of Algae and Bryophytes | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 102 | Biology and Diversity of Viruses, Bacteria and Fungi | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 103 | Cell Biology of Plants | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 104 | Cytology and Cytogenetics | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Practicals | | | | | | | | | | |
| Practicals 101 | Biology and Diversity of Algae and Bryophytes | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 102 | Biology and Diversity of Viruses, Bacteria and Fungi | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 103 | Cell Biology of Plants | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 104 | Cytology and Cytogenetics | | | | | 3 | 38 | 12 | 50 | 2 |
| Total Marks and Credits for I Semester | | | | | | | | | 600 | 24 |
| SEMESTER - II | | | | | | | | | | |
| Theory | | | | | | | | | | |
| Core Paper 201 | Genetics | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 202 | Molecular Biology of Plants | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 203 | Biology and Diversity of Pteridophytes and Gymnosperms | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 204 | Plant Cell, Tissue and Organ Culture | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Practicals | | | | | | | | | | |
| Practicals 201 | Genetics | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 202 | Molecular Biology of Plants | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 203 | Biology and Diversity of Pteridophytes and Gymnosperms | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 204 | Plant Cell, Tissue and Organ Culture | | | | | 3 | 38 | 12 | 50 | 2 |
| Total Marks and Credits for II Semester | | | | | | | | | 600 | 24 |

| Paper Code | Title of the paper | L | T | P | Total (hrs)/ week | Duration Of Exam(hrs) | Max. Marks | Internal marks | Total Marks | Credits |
|---|--|---|---|---|-------------------|-----------------------|------------|----------------|-------------|------------|
| SEMESTER - III | | | | | | | | | | |
| Theory | | | | | | | | | | |
| Core Paper 301 | Taxonomy of Angiosperms and Plant resource Utilization | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 302 | Plant Development and Reproduction | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 303 | Plant Ecology, Biodiversity and Conservation | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 304 | Plant Physiology | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Practicals | | | | | | | | | | |
| Practicals 301 | Taxonomy of Angiosperms and Plant resource Utilization | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 302 | Plant Development and Reproduction | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 303 | Plant Ecology, Biodiversity and Conservation | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 304 | Plant Physiology | | | | | 3 | 38 | 12 | 50 | 2 |
| Total Marks and Credits for III Semester | | | | | | | | | 600 | 24 |
| SEMESTER - IV | | | | | | | | | | |
| Theory | | | | | | | | | | |
| Core Paper 401 | Genetic Engineering of Plants and Microbes | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 402 | Evolution and Plant Breeding | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 403 | Ecology and Environmental Biology | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Core Paper 404 | Research Methodology And Instrumentation Techniques | 4 | 1 | 3 | 8 | 3 | 60 | 40 | 100 | 4 |
| Practicals | | | | | | | | | | |
| Practicals 401 | Genetic Engineering of Plants and Microbes | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 402 | Evolution and Plant Breeding | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 403 | Ecology and Environmental Biology | | | | | 3 | 38 | 12 | 50 | 2 |
| Practicals 404 | Research Methodology And Instrumentation Techniques | | | | | 3 | 38 | 12 | 50 | 2 |
| Project Presentation | | | | | | | | | 100 | 4 |
| Total Marks and Credits for IV Semesters | | | | | | | | | 700 | 28 |
| Grand Total Marks and Credits for I,II,III & IV Semesters | | | | | | | | | 2500 | 100 |
| L : Lecture hours; T : Tutorial hours; P : Practical hours | | | | | | | | | | |
| Scheme of Examination at the end of each semester | | | | | | | | | | |
| Theory Pass Minimum : 40 % | | | | | | | | | | |
| Practical Pass Minimum : 50 % (External 19 / 38 M & Internal 0 / 12 M = Total marks must be 25) | | | | | | | | | | |
| Aggregate : 50 % | | | | | | | | | | |

**FIRST SEMESTER
PAPER CODE: 101**

BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES

Theory

Algae

UNIT- I

General characters and classification of algae with special reference to Fritsch system of classification. Criteria used for the classification of Algae. Thallus organization in algae. General account of Structure and Reproduction of Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae and Myxophyceae.

UNIT- II

Economic importance of Algae, Single cell protein culture (Spirulina and Chlorella)

Cultivation of economically important seaweeds - *Porphyra*, *Gracillaria*, *Gelidium*.

Bryophytes

UNIT- III

Morphology, Structure, Reproduction, lifehistory , Classification and General account of Marchantiales, Jungermanniales, Anthocerotales.

UNIT- IV

Morphology, structure, reproduction, life history, classification and General account of Sphagnales, Funariales and Polytrichales.

Economic and ecological importance of Bryophytes.

Additional Inputs:

Life histories: *Tetraspora*, *Scenedesmus*, *Ulva* ,*Enteromorpha*,
Cladophora, *Fritchiella*, *Cosmarium*, *Caulerpa*,
Ectocarpus and *Laminaria*

Learning Outcomes:

- The student can learn about various types of algal members and their economic importance.
- Student can know about the role of algae in soil reclamation and pollution control.
- The student can learn about the cultivation of economically useful algal members on industrial scale.
- Student can know about the Bryophytes and their significance in the evolutionary processes and their economic importance.

- Students know about the Biodiversity and also learn about the classification of different Pre forms of life Algae and Bryophytes in environment
- Student can acquire knowledge about the seaweeds like Gelidium, Gracilaria, and Porphyra which are used as industrial products.
- The students know about life history of various species.
- Students gain Knowledge and improve the skills of cultivation methods.
- Students know about the some Algae used as food, medicine, various fields of Industries.

Suggested Laboratory Exercises:

1. Examination of vegetative and reproductive morphology of Chlophyceae members.
2. Examination of Thallus structure and reproductive bodies of Xanthophyceae, Bacillariophyceae and Phaeophyceae members.
3. Examination of external and internal structure and reproductive organs of Rhodophyceae and Cyanophyceae members.
4. Field work to get acquaintance with locally available algae.
5. An examination of the external and internal structure and reproductive organs of the genera, *Riccia*, *Targionia*, *Plagiochasma*, *Marchantia*, *Pellia*, *Porella*, *Anthoceras*, *Notothylus*, *Sphagnum*, *Funaria*, *Polytrichum*.

Suggested Readings & Text Books :

- Lee RW. 2007. **Classification of Algae.**
- Kumar HD. 1988. **Introductory Phycology.** Affiliated East West Press Pvt. Ltd., New Delhi.
- Round FE. 1986. **The Biology of Algae.** Cambridge University Press, New York.
- Bold HC and Wynne MJ. 1978. **Introduction to the Algae.** Prentice-Hall, New Jersey.
- Prescott GW. 1969. **The Algae- a Review.** Houghton Mifflin Company, Boston.
- Morris I. 1967. **An Introduction to the Algae.** Cambridge University Press, UK.
- Chapman VJ. 1962. **The Algae.** Macmillan and Co Ltd., London.
- Lewin RA. 1962. **Physiology and Biochemistry of Algae.** Academic Press, New York.
- Round FE. 1962. **Ecology of Algae.** Cambridge University Press, New York
- Smith GE (ed) 1950. **Fresh Water Algae.** Elsevier Science, USA.
- Fritsch FE. 1945. **The Structure and Reproduction of Algae Vols. 1& II.** Cambridge University Press, New York.
- Chopra RN and Kumra PK. 1988. **Biology of Bryophytes.** New Age International (P) Ltd. Publishers, New Delhi.
- Parihar NS. 1991. **Bryophyta.** Central Book Depot, Allahabad.
- Puri P. 1980. **Bryophytes.** Atmaram and Sons, Delhi.
- Smith GM. 1955. **Cryptogamic Botany Vol.II.** Tata McGraw Hill Publishing Co. Ltd., New Delhi.
- Kashyap S. 1929. **Liverworts of the Western Himalayas and Punjab Plains Part I and Part II.** University of Panjab, Lahore, Pakistan.

PAPER CODE: 101

BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES

Model Question Paper

Time: 3 hrs.

Maximum Marks: 60

Section A

Answer all Questions

4 x 12 = 48M

1. Elaborate on the thallus diversity in Algae
OR
Write about the Criteria used in classification of Algae.
2. Write an essay on Economic Importance of Algae
OR
Write about the Cultivation of Red algae
3. Detail the development of Antheridium, Archegonium in the order Jungermanniales
OR
Give a general account of Anthocerotales
4. Economic Importance and Ecological role of Sphagnum
OR
Write about the Evolution of Sporophyte in Bryophytes

Section B

Answer Any Four of The Following Questions

4x3 = 12M

5. Types of reserve food materials in algae
6. Characteristics of Myxophyceae
7. Seaweeds
8. Algal blooms
9. Thallus types in Marchantiales
10. Pellia capsule
11. Leaf structure in Polytrichum
12. Protonema of Sphagnales and Bryales

PAPER CODE: 101

BIOLOGY AND DIVERSITY OF ALGAE AND BRYOPHYTES

Practical Model Paper

Time:3hrs

Max. Marks:38

1. Take thin section from the given material “A” and write notes leave your preparation for evaluation **10M**
2. Take thin sections of given material “B” & write notes. Leave your preparation for evaluation **10M**
- 3 Identify and write notes for the given spotters **C,D,E,F** **4×21/2=10M**

4. Viva-voce **4M**

5. Record **4M**

FIRST SEMESTER
PAPER CODE: 102
BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

Theory

UNIT – I

General account of archaebacteria, eubacteria and cyanobacteria. Classification of eubacteria. Ultrastructure, nutrition, reproduction and economic importance of bacteria. Morphology and chemical composition of Actinomycetes, Spirochetes, Rickettsiae.

UNIT – II

Ultra structure and Chemistry of viruses, Isolation and purification of viruses, Replication and transmission of Viruses.

Mycoplasma like organisms and their role in carrying plant diseases.

Diseases caused by Plant Viruses.

UNIT - III

Recent trends in Fungal classification, Ultra structure of Fungal cell and Thallus organization in Fungi.

General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.

UNIT - IV

Reproduction in Fungi: Vegetative, Asexual and Sexual.

Heterothallism, Heterokaryosis and Parasexuality.

Nutrition of Fungi: Saprobiotic, biotrophic, and symbiotic.

Fungi in industry, medicine and as food and as biocontrol agents.

Mushroom cultivation

Additional Inputs: Life histories of Mucor, Penicilium, Agaricus, and Puccinia

Learning Outcomes:

- Student can acquire knowledge about the advantages and disadvantages of Microbes.
- Student can distinguish the differences between Autotrophs (Plants) and Heterotrophs (Animals, Parasites)
- Student gain the knowledge about Eco friendly (Useful Microbes), Pathogens, (Disease causing ability) and their control measures.
- Students know about the economic importance of some Bacteria, Fungi and also aware of mushroom cultivation. Students learn the techniques and methods of Mushroom cultivation

Suggested Readings & Text Books

- Kaursethi I and Surinder KW 2011. **Text Book of Fungi and their Allies**. Macmillan publishers, New Delhi, India.
- Ram Reddy S & Reddy SM 2007. **Essentials of Virology**. Scientific publishers, Jodhpur, India.
- Sharma K 2005. **Manual of Microbiology Tools and Techniques**. Ane Book, New Delhi, India.
- Matthew RH 2004. **Plant virology**. 4th edition. Academic press an imprint of Elsevier, California, USA.
- Prescott *et al.* 2003. **Microbiology**. McGraw Hill Education, New York.
- Aneja KR 2003. **Experiments in Microbiology, Plant pathology and Biotechnology**. New Age International publishers, New Delhi.
- Verma HN 2003. **Basics of plant Virology**. IBH publishing co. Pvt. Ltd., New Delhi.
- Mehrotra KS and Aneja KR 2003. **An Introduction to Mycology**. New Age International Publishers, New Delhi.
- Sullia SB and Shantharam S 2001. **General Microbiology**. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
- Reddy SM and Ram Reddy S 2000. **Microbiology a Laboratory Manual**. BSC Publishers and Distributors, Hyderabad.
- Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. **Principles of Virology, Molecular Biology, Pathogenesis and Control**. ASM press, Washington DC.
- Rao AS 1999. **Introduction to Microbiology**. Prentice Hall of India Pvt. Ltd., Delhi.
- Alexopoulos CJ, Mims CW, Blackwell M 1996. **Introductory Mycology**. 4th edition. Replika press, North Delhi.
- Paul S 1995. **Bacteria in Biology, Biotechnology and Medicine**. 5th edition. John Wiley and son Ltd., UK.
- Pelczar, Chan and Krieg 1993. **Microbiology**. 5th edition. McGraw Hill Education, New York.
- *Stainer* RT, Ingraham JL, Wheelis ML and Painter PR 1987. **General Microbiology**. 5th Edition. Macmillan, London.
- Smith KM 1968. **Plant viruses**. Elsevier, New York.
- Rangaswamy G 1962. **Bacterial Plant disease in India**. Asia Publishing House, Bombay.

PAPER CODE: 102
BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI
Practical syllabus

Suggested Laboratory Exercises

1. Tools of microbiology: Care and use of the microscope, Spectrophotometer, PH meter, Autoclave, Centrifuge, Biological safety cabinets, Inoculation needle and loop, Incubator, Colony counter & Lyophilizer.
2. Sterilization methods
3. Preparation of media and stains
4. Gram staining of bacteria
5. Differential staining: Acid fast staining.
6. Isolation of rhizobia from root nodules.
7. Isolation of fungi by Petri plate exposure method.
8. Morphological study of *Stemonitis*, *Saprolegnia*, *Mucor*, *Morchella*, *Aspergillus*, *Agaricus*, *Cyathus*, *Synchytrium* and *Helminthosporium*
9. Symptomatology of some diseased specimens – White rust, Powdery mildew, Green ear of Bajra, Rust of Wheat, Rust of Linseed, Tikka disease of groundnut, Red rot of sugarcane, Blast of rice, Citrus canker, and Tobacco mosaic disease.

PAPER CODE:102
BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI

Model Question Paper

Time: 3 hrs.

Maximum Marks:60

Section -A

Answer all Questions

4 x 12 =48M

1. Explain the general characteristics of Archaeobacteria & Cyanobacteria.

OR

Describe the process of Reproduction in Bacteria

2. What are Mycoplasmas? Write any four plant diseases caused by them with control measures?

OR

Give an account on Transmission of viruses

3. What are the criteria used for fungal classification? Write a brief account of Ainsworth classification.

OR

Write an essay on general characteristics of Mastigomycotina

4. Give a detailed account on Mushroom cultivation.

OR

Discuss on various modes of Asexual and Sexual Reproduction in Fungi

Section - B

Answer any Four of the Following

4 x 3 =12M

5. Growth of bacteria
6. Nutritional types in bacteria
7. Isolation of viruses
8. Tobacco mosaic virus
9. Ultra structure of fungal cell
10. Important characteristics of Basidiomycotina
11. Heterothallism
12. Phylogenetic trends in Fungi

PAPER CODE: 102
BIOLOGY AND DIVERSITY OF VIRUSES, BACTERIA AND FUNGI
Practical Model Paper

Time:3Hrs

Max. Marks: 38

- | | |
|---|--------------------|
| 1. Take thin sections of given material “A” and write notes, leave your preparation for valuation | 12M |
| 2. Write the Procedure of given experiment | 8M |
| 3. Identify and write notes for the given spotters B,C,D&E | 4×2 1/2=10M |
| 4. Viva-voce | 4M |
| 5. Record | 4M |

FIRST SEMESTER
PAPER CODE:103
CELL BIOLOGY OF PLANTS

UNIT – I
Theory

The Cell Theory: Origin and development of cell biology as a separate branch. Structure and organization of Prokaryotic and Eukaryotic cells. Specialized cell types.

Chemical Foundation: Macromolecules - Structure, shape and information. Non-covalent interactions in relation to function of Nucleic acids and Proteins.

Bio Energetics: Laws of thermodynamics as applicable to biological systems.

UNIT – II

Cell wall: Structure and functions, Cell wall architecture, Biogenesis and Growth.

Plasmodesmata: Structure and function, Plasmodesmata in comparison with gap junctions of animal cells.

Plasma membrane: Structure, models and functions, ATPases, Receptors, Carriers, Channels and Pumps. Vacuole structure and function, Vacuolar ATPases, Transporters.

Cytoskeleton: Microtubules and Microfilaments, their role in cell division and motility; Intermediate filaments role in providing strength.

UNIT - III

Chloroplast and Mitochondria: Structure and function, Genome organization, Nucleo-cytoplasmic interactions, RNA editing.

Other organelles: Structure and functions of Endoplasmic reticulum, Golgi apparatus, Lysosomes, Ribosomes, Microbodies and Peroxisomes.

UNIT - IV

Tools in cell Biology-I - Microscopy: Working principles of Light Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, STEM. Preparation of specimens for Microscopy, Freeze fracture and Freeze etching techniques.

Tools in Cell Biology-II Subcellular fractionation, Principles of centrifugation. Spectroscopic techniques: Principles and applications of UV- visible, ESR, Nuclear Magnetic Resonance, Spectrofluorometry, Circular Dichroism(CD).

Additional Inputs:

Centrifugation and Electrophoretic techniques

Learning Outcomes:

- In this course student know the history, origin and foundation of cell biology.
- Students acquire knowledge about the macromolecules(DNA & RNA).
- Student can able to understand inheritance of genes from one generation to another generation.
- Student gain knowledge about various cell organelles of plant body and their biological activities such as Photosynthesis, Respiration, Transpiration etc.
- It deals with microscopic techniques, students get skilled in the instrumentation handling and microscopic techniques.

Suggested Laboratory Exercises

1. Staining techniques – Study of mitosis using acetocarmine.
2. Isolation of mitochondria and the activity of its marker enzyme, Succinate dehydrogenase(SDM).
3. Isolation of chloroplasts and photographs SDS – PAGE technique and photographs - profile of proteins to demonstrate (2) the two subunits of RUBISCO.
4. Isolation of nuclei and identification of histones by SDS-PAGE technique.
5. Fluorescence staining with FDA for cell viability and wall staining with calcofluor.
6. Immunofluorescence technique –observation of cytoskeleton.
7. Demonstration Photographs of SEM and TEM.

Suggested Readings & Text Books

- Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. **Essential Cell Biology**. 4th Edition. Garland publishers, New York.
- Sharp D, Ploppe G and Sikorski E 2014. **Elwin's Cells**. 3rd Edition. Viva Books, New Delhi.
- Cooper GM, Hausman RE 2013. **The Cell – A Molecular Approach**. 6th Edition. Sinauer Associates, Incorporated, USA.
- Karp G 2013. **Cell and Molecular Biology – Concepts and Experiments**. 7th Edition. Wiley Global Education, USA
- Cowling G, Allen T 2011. **The Cell. A very Short Introduction**. Oxford University Press, USA.
- Schaffer SW 2007. **Mitochondria: The Dynamic Organelle**. 1st Edition. Springer Verlag.
- Celis JE (ed) 2006. **Cell Biology–A Laboratory Hand Book**. 3rd Edition. Elsevier, USA.
- Lodish H, Berk A, Kaiser CA, Kreiger M, Scott P M, Bretcher A, Ploegh H, Matsudaira P. 2004. **Molecular Cell Biology**. 5th edition. W. H. Freeman and Company, New York.
- De DN 2000. **Plant Cell Vacuoles. An Introduction**. CSIRO Publication. Collingwood, Australia.
- Krishna Murthy KV 2000. **Methods in Cell Wall Cytochemistry**. CPC Press, Boca Raton, Florida.
- Kleinsmith LJ and Kish VM 1995. **Principles of Cell and Molecular Biology**. 2nd Edition. Harper Collins College Publishes, New York, USA.

PAPER CODE:103
CELL BIOLOGY OF PLANTS

Model Question Paper

Time:3 hours

Maximum Marks:60

Answer all Questions

4x12= 48M

1. Describe the Non covalent interactions in relation to function of Nucleic acids and Proteins
OR
Write about the structure and organization of Prokaryotic Cells
2. Give an account of different models of Plasma membrane, which model is more appropriate and why?
OR
What is cytoskeleton? Explain in detail about the role of microtubules in motility and cell division.
3. Write in detail about Genome organization in mitochondria and its function.
OR
Give an account on structure and functions of Golgi apparatus.
4. Write in detail about principles, methodology and application of ESR and NMR.
OR
Explain the working principles of Transmission Electron Microscopy (TEM).

Section – B

Answer any Four of the Following

4x 3 =12M

5. Specialized Cell types
6. Laws of Thermodynamics as applicable to biological systems
7. Structure and function of Plasmodesmata
8. Vacuole structure and function
9. Lysosomes
10. RNA editing
11. Freeze fracture Technique
12. Circular Dichroism

PAPER CODE: 103
CELL BIOLOGY OF PLANTS
Practical Model Paper

Time:3hrs

Max. Marks:38M

- | | |
|--|-----------------|
| 1. Writetheprincipleandprocedureofgivenroottipsandidentifyanytwostages | 12 M |
| 2. Identify and write notes for the given spotters A,B,C,D,E &F | 6×3= 18M |
| 3. Viva-voce | 4M |
| 4. Record | 4M |

FIRST SEMESTER
PAPER CODE: 104
CYTOLOGY AND CYTOGENETICS

Theory

UNIT - I

Nucleus: Structure of nuclear membrane, Nuclear pore complex; Chromosome structure, molecular organization of chromatin, centromeres and telomeres; Special types of chromosomes (lampbrush, Polytene)

Chromosome identification - Karyotype analysis; Flow cytometry and confocal microscopy in karyotype analysis; computer assisted karyotype analysis – chromosome micro-dissection and micro-cloning. Chromosome banding techniques.

UNIT - II

Chromosomal aberrations-I

Structural aberrations – Origin, Types, meiosis and breeding behavior of duplications, deficiencies, inversions and interchanges; Robertsonian translocations; Basic concept of Complex translocation heterozygotes.

UNIT – III

Chromosomal aberrations-II

Numerical aberrations-I – Classification of numerical aberrations; Aneuploids– Trisomics (Primary, Secondary, Tertiary), Monosomic and nullisomics – meiotic behavior and chromosome mapping

Numerical aberration II – Polyploids – Origin and production of auto and allopolyploids; Meiosis in autotetraploids; Genome analysis in *Tobacco*, wheat and *Arabidopsis*

UNIT – IV

Nuclear DNA content, C-value paradox, hyperchromicity, Cot-curves and their significance, Molecular organization of nuclear genome

Cell Cycle and its regulation – check points, cyclins and cyclin dependent kinases, experimental control of cell division

Apoptosis - mechanism and significance; Initiation of cancer at cellular level – proto oncogenes and oncogenes

Additional inputs:Molecular Markers and Physical mapping.

Learning outcomes:

- Students are able to understand the Cell cycle regulation and genetical diseases & abnormalities in living organisms.
- Students can understand the genome analysis, chromosome structure, number and organisation in various species
- Students can able make karyotype and Ideogram.
- Students can evaluate genetic variations like mutations.

Suggested Laboratory Exercises

1. **Observation and identification of meiotic stages.**
2. **Preparation of karyotypes and construction of idiograms**
3. **Observation of slides/photographs showing structural and numerical aberrations and chromosome banding.**

Suggested Readings & Text Books

- Singh RJ. 2014. **Plant Cytogenetics**. 2nd Edition. CRC Press, India
- David M. Prescott. **Cells**. 1988. Jones and Bartlett Publ. Boston.
- Gupta, P.K. 1995. **Cytogenetics**. Rastogi & Company, Meerut.
- Pierce BA. 2013. **Genetics: A Conceptual Approach**. 5th Edition. W.H. Freeman, California.
- Swanson, Merz and Young. **Cytogenetics**. Prentice Hall. India.
- Ajoy Paul. 2015. **Text Book of Cell and Molecular Biology**. Books and Allied Pvt, Ltd
- De Robertis E.D.P and E.M.F. De Robertis. **Cell and Molecular Biology** 2001. CBS Publisher and Distributors.
- Darnell, Lodish and Baltimore: **Molecular Biology**, Scientific American Books, New York
- Bass H and Birchler J. 2011. **Plant cytogenetics: Genome structure and chromosome Function** Springer, New York

PAPER CODE: 104

CYTOLOGY AND CYTOGENETICS

Model Question Paper

Time:3 hours

Maximum Marks:60M

Answer all Questions

4x12=48M

1. Explain the molecular organization of centromeres and telomeres
OR
Give an account of chromosome banding and its applications
2. Give a brief account of chromosomal structural aberrations and explain their meiotic behavior
OR
Elaborate on Aneuploids and their significance in human genetics.
3. Give a brief account of the origin and production of autopolyploids
OR
Give an account on molecular organization of nuclear genome
4. Write briefly about cell cycle and its regulation
OR
Write about the mechanism of apoptosis giving its significance.

Section B

Answer any four Questions

4x3=12M

5. Karyotype
6. Polytene chromosome
7. Robertsonian translocation
8. Trisomics
9. C-value paradox
10. Arabidopsis
11. Cyclins and CDKS
12. Differentiate Proto-oncogenes and Oncogene

PAPER CODE: 104
CYTOLOGY AND CYTOGENETICS

Practical Model Paper

Time:3hrs

Max. Marks:38M

1. Write the principle and procedure of given flower buds and identify any two stages of meiosis. **12M**
2. Construction of ideogram and preparation of karyotype **8M**
3. Identify and write notes for the given spotters **C,D,E&F** **4×2½=10M**
4. Viva-voce **4M**
5. Record **4M**

SECOND SEMESTER

PAPER CODE: 201

GENETICS

Theory

UNIT - I

Concept of Genetic markers and their types, application of probability Laws to Mendelian principles. **Chi-square testing for goodness of fit.**

Allelic and gene interactions; Co-dominance and incomplete dominance, Multipleallelism – Penetrance and expressivity – Pleiotropism, pseudoalleles, phenocopies.

UNIT - II

Linkage and crossing over: **Gene mapping methods based on test-cross and F2 progenies; LOD score analysis; Tetrad analysis** and its significance; somatic cell genetics and its use in mapping; Correlation between genetic and physical maps; QTL mapping.

Sex-linked inheritance, sex-influenced and sex- limited characters Polygenic inheritance: heritability and its measurement. Recombination and its molecular mechanism, Holliday's model; role of rec A,B,C,Denzymes.

UNIT - III

Mutations – types – molecular basis; site-directed mutagenesis – DNA damage and repair mechanisms; examples of inherited defects in DNA repair.

Multigene families and their organization and significance; Transposable elements in pro-and eukaryotes, Mechanism of transposition; significance of transposable elements.

UNIT - IV

Mapping in bacteria and phages – methods using conjugation; Transformation and transduction; Fine structure analysis of gene - Benzer's work; concept of gene; Nature and variant forms of eukaryotic genes.

Maternal inheritance – Distinction between nuclear and cytoplasmic types of inheritances, Distinction between Genetics of mitochondrial and chloroplast characters; Male sterility types and significance

Additional inputs:Genetics of *Neurospora*

Learning outcomes:

- Students can understand about the transmission of characters from one generation to another generation.
- Students are able to understand the consequence of genetic disorders.
- One can acquire knowledge about the chromosomal mapping techniques.

Suggested Laboratory Exercises

1. **Observation of types of chlorophyll mutants.**
2. **Problems on Mendelian Genetics, Probability Laws and Chi-Square test**
3. **Problems on Gene interactions.**
4. **Problems on Linkage and Crossing over**
5. **Chromosome Mapping and Tetrad Analysis**

Suggested Readings & Text Books

- Lewis B. 2000. **Gene VII**. Oxford University Press, New York, USA.
- Snustad DP. and Simons MJ 2000. **Principles of Genetics**. 2nd Edition. John Wiley and Sons Inc., USA.
- Atherly AG, Girton JR and McDonald JF. 1999. **The Science of Genetics**. Saunders College Publishing, Fort Worth, USA.
- Karp G. 1999. **Cells and Molecular Biology: concepts and Experiments**. Hohn Wiley and Sons Inc., USA.
- Hartl DL and Jones EW. 1998. **Genetics: Principles and Analysis**. 4th Edition. Jones and Bartlett Publishers, Massachusetts, USA.
- Malacinski GM and Freifelder D. 1998. **Essentials of Molecular Biology**. 3rd Edition. Jones and Bartlet Publishers Inc., London.
- Russel PJ. 1998. **Genetics**. 5th Edition. The Benjamin/ Cummings Publishing Company Inc., USA.
- Lewis R. 1997. **Human Genetics: Concepts and Applications**. 2nd Edition. WCB McGraw Hill, USA.
- Griffiths RCL, Anthony JF, Miller JH and Suzuki DT. 1996. **Genetic analysis**. 6th Edition. W. H. Freeman and Co., New York.

PAPER CODE: 201
GENETICS
Model Question Paper

Time:3hrs.

Maximum Marks:60M

Answer all the following questions

4X12=48M

1. What are genetic markers and elaborate on their types
OR
Explain multiple allelic inheritance and its significance
2. Write about tetrad analysis and its significance
OR
What is Recombination and its molecular mechanism.
3. Discuss the DNA damage and repair mechanisms
OR
Describe the organization and importance of Multi gene families
4. Describe the genetic basis of mitochondrial and chloroplast related characters.
OR
What are the different methods of gene mapping in bacteriophages

Section B

Answer any four Questions

4x3=12M

5. Chi square test
6. Penetrance and Expressivity
7. Three point testcross
8. Holliday model
9. Site directed Mutagenesis
10. Transposons
11. Maternal inheritance
12. Male-sterility

PAPER CODE: 201
GENETICS
Practical model paper

Time:3hrs

Max. Marks:38M

- | | |
|--|-------------------|
| 1. Write the solutions for the given problems of dihybrid cross | 10M |
| 2. Write the solutions for the given problems A,B,C | 3x5=15M |
| 3. Identify and write notes for the given spotters D,E | 2x2 1/2=5M |
| 4. Viva-voce | 4M |
| 5. Record | 4M |

SECOND SEMESTER
PAPER CODE: 202
MOLECULAR BIOLOGY OF PLANTS

Theory

UNIT - I

Composition and structure of Biomolecules: Carbohydrates, Lipids and Proteins (Ramachandran plot, domains, motifs and folds).

Nucleic acids, DNA structure and duplex model. A, B and Z forms of DNA. Types of small RNAs - Si RNA, micro RNA and catalytic RNA

UNIT - II

DNA replication, Semi-conservative, Semi-discontinuous mode of replication. RNA Priming, Enzymes for DNA replication Helicases, SSBs, Topoisomerases and Polymerases. Mechanism of DNA replication. Rolling circle and Theta mode of replication. Replication of ends of chromosomes

Transcription Promoters, Activators, Transcription factors and Mechanism of Transcription in Prokaryotes and Eukaryotes. Post Transcriptional modifications.

UNIT – III

Translation: Structure of tRNA, Ribosome as a Translation factory, Genetic code, Mechanism of Translation - Initiation, elongation and termination. Post translational modifications

Protein sorting and targeting of proteins into Chloroplasts, Mitochondria, Vacuoles and Peroxisomes. Protein trafficking.

UNIT – IV

Regulation of gene expression in Prokaryotes. Basic models, Lac-Operon, Arabinose and Trp-operons, Positive and Negative controls, Regulation in Viruses: Lytic and Lysogenic cycle.

Regulation of gene expression in Eukaryotes. Britten Davidson model. Role of chromatin in gene expression. DNA methylation. Temporal and spatial regulation.

Gene silencing

Additional inputs: Chromatography Techniques.

Learning outcomes:

- Student can acquire the knowledge about Bio macromolecules.
- To know about the structure and organisation of carbohydrates, proteins and lipids.
- Creates knowledge about replication of DNA in cells.
- It improves knowledge about the Transcription and synthesis of proteins..
- To know about the protein targeting (destination) of various biological activities.

Suggested Laboratory Exercises

1. **Isolation of DNA from Onion bulbs/Banana**
2. **Isolation of DNA using CTAB method**
3. **Biochemical Tests of Carbohydrates, Proteins and Fats in the plant cells**
4. **Assignments on problems related to DNA replication, Transcription, Translation and Gene regulation**
5. **Electrophoresis of seed proteins**

Suggested Readings & Text Books

- Snustad P, Simmons MJ. 2003. **Principles of Genetics**. 3rd Edition. John Wiley and Sons, Inc, USA.
- Buchaman BB, Gruissem,W and Jones R. 2000. **Biochemistry and Molecular Biology of plants**: American Societies of plant physiologists, John Wiley and Sons Ltd., Maryland, U.S.A.
- Lewin B. 2000. **Genes IX**, Oxford University Press, New York.
- Lodish BA, Zipursky SL, Matsdaira P, Baltimore D and Darnell J. 2000. **Molecular Cell Biology**. 4th Edition. W.H. Freeman and Co., New York.
- Alberts B, Bray D, Lewis J, Ralf M, Roberts K and Watson JD.1999. **Molecular Biology of the Cell**. Garland publishing Inc., New York.
- Weaver RF. 1999. **Molecular Biology**. WCB /McGraw-Hill,.
- Shaw CH. 1998. **Plant Molecular Biology. A practical approach**, IRL Press, Oxford.
- Glick BR and Thompson JE. 1992. **Methods in Plant Molecular Biology and Biotechnology**, CRC Press, Boc Raton Florida.

PAPER CODE: 202
MOLECULAR BIOLOGY OF PLANTS
Model question Paper

Time: 3hours.

Max. Marks: 60 M

Answer all the following questions

4X12=48M

1. Describe the composition and structure of Proteins

OR

Give detailed account on composition and structure of DNA

2. Describe the mechanism of DNA replication

OR

Explain the process and enzymes involved in Transcription and post transcription activities

3. Describe the mechanism of Translation

OR

What is meant by Protein sorting? Discuss the process of targeting of proteins into chloroplasts

4. Give a critical account on regulation of gene expression in Eukaryotes

OR

Write an essay on regulation of gene expression with special reference to Lac-operon.

Section B

Answer any Four of the Following questions:

4x3=12M

5. Ramachandran plot

6. Micro RNA

7. Okazaki fragments

8. Replication of ends of Chromosomes

9. Structure of tRNA

10. Protein trafficking

11. Gene silencing

12. Lytic and Lysogenic cycle

PAPER CODE: 202
MOLECULAR BIOLOGY OF PLANTS
Practical model question paper

Time:3hrs

Max. Marks:38M

1. Write the principle and procedure of DNA isolation from banana and leave your preparation for evaluation **12M**

2. Write the solutions for the given problems **A,B,C** **3x3=9M**

3. Identify and write notes for the given spotters **D,E&F** **3x3= 9M**

4. Viva-voce **4M**

5. Record **4M**

SECOND SEMISTER

PAPER CODE: 203

BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Theory

UNIT - I

Pteridophytes

General characters and classification of Pteridophytes.

Salient features and classification of Psilophytosida (*Rhynia*), Psilotopsida (*Psilotum*), Lycopsidea, (*Lycopodium*) Sphenopsida (*Equisetum*) and Pteropsida (*Pteris*).

UNIT - II

Origin and phylogeny of pteridophytes - Telome theory, Stear Evolution, Heterospory and seed habit. Economic importance of Pteridophytes.

Gymnosperms UNIT – III

General account and classification of Gymnosperms Geological periods, fossil formation and their types

General account of Pteridospermales, Bennettitales, Pentoxylales, Cordaitales.

UNIT - IV

Structure and Reproduction of living Gymnosperms: Cycadales, Coniferales and Gnetales; their economic importance.

Additional Inputs: *Marselia*, *Salvinia*, *Azolla*

Learning outcomes:

- This paper improves the knowledge about the pteridophytes occurrence and organisation.
- Gives knowledge about the origin of pteridophytes and evolutionary tendencies in stele.
- Get the knowledge of economic importance of pteridophytes
- After completion of course student have a knowledge about of Gymnosperms , geological periods and fossil formation types etc.

Suggested Laboratory Exercises Pteridophytes

1. Examination of the external features, anatomy and reproductive structures of *Psilotum*, *Lycopodium*, *Selaginella*, *Isoetes*, *Equisetum*, *Adiantum*, *Salvinia* and *Azolla*.
2. Observations of the slides of the following fossil plants: *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Miadesmia*, *Sphenophyllum*, *Calamites*.

Gymnosperms

1. Examination of the external features, anatomy (TS, TLS & RLS) and reproductive structures of *Ginkgo*, *Pinus*, *Cupressus*, *Cryptomeria*, *Araucaria*, *Ephedra* & *Gnetum*.
2. Study of fossil gymnosperms from prepared slides. *Lyginopteris*, *Lagenostoma*, *Medullosa*, *Trigianocarpus*, *Conostoma*, *Heterangium*, *Cordaites*

Suggested Readings & Text Books

- Saxena P and Pathak C. 2012. **A Text Book of Pteridophyta.**, Wisdom Press, New Delhi.
- Sharma OP. 2006. **Pteridophyta.** MacMillan India Ltd., New Delhi.
- Parihar NS. 1996. **Biology and Morphology of Pteridophytes.** Central Book Depot, Allahabad.
- Smith GM. 1995. **Cryptogamic Botany. Vol. II.** McGraw Hill Book Company, New York.
- Sporne KR. 1962. **The Morphology of Pteridophytes.** Hutchinson University Library, London.
- Evans AJ. 1936. **Morphology of Vascular Plants (Lower groups).** McGraw Hill Book Company, New York.
- Biswas C and Johri BM. 1997. **The Gymnosperms.** Narosa Publishing House, New Delhi.
- Bhatnagar SP and Moitra A. 1996. **Gymnosperms.** New Age International Private Limited, New Delhi.
- Sharma OP. 1996. **Gymnosperms.** Pragati Prakashan, Meerut.
- Stewart WN and Rothwell GW. 1993. **Paleobotany and the Evolution of Plants.** Cambridge University Press, USA.
- Singh H. 1978. **Embryology of Gymnosperms.** Gebrudev Bortraeger, Berlin.
- Arnold CA. 1974. **An introduction to Paleobotany.** McGraw Hill Book Co., Inc., New York.
- Sporne KR. 1967. **The Morphology of Gymnosperms.** Hutchinson University Library, London.
- Chamberlain CJ. 1935. **Gymnosperms structure and evolution.** University of Chicago Press, USA.

PAPER CODE: 203

BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND GYMNOSPERMS

Model question Paper

Time: 3 hrs.

Max. Marks:60M

Section -A

Answer all the following questions

4x12 =48M

1. Describe salient features and classification of Pteridophyta

OR

Differentiate between Lycopsidea and Sphenopsida

2. Discuss the significance of Heterospory and seed habit

OR

Give an account of Evolutionary trends in Pteridophyta

3. Discuss the significance of Geological Time Scale

OR

Give an account of Pteridospermales

4. Describe the structure and reproduction in Gnetales

OR

Give economic importance of Gymnosperms

Section –B

Write short notes on Four of the following

4x3=12M

5. Rhynia

6. Pteropsida

7. Telome theory

8. Lepidocarpon

9. Lyginopteris

10. Types of fossilization

11. Ephedra

12. Ovule in Gymnosperms

PAPER CODE: 203

**BIOLOGY AND DIVERSITY OF PTERIDOPHYTES AND
GYMNOSPERMS**

Practical model question paper

Time:3hrs

Max. Marks:38

1. Prepare the section of the given material 'A'. Identify and leave your preparation for evaluation. **9M**
2. Prepare the section (TS, TLS & RLS) of the given material 'B'. Identify and leave your preparation for evaluation. **9M**
3. Identify and write notes for the given spotters **C,D,E&F** **4×3=12M**
4. Viva-voce **4M**
5. Record **4M**

SECOND SEMESTER

PAPER CODE: 204

PLANT CELL, TISSUE AND ORGAN CULTURE

Theory

UNIT - I

Plant Cell Tissue and organ culture: Introduction, history, scope, Basic concepts of tissue culture: Tissue culture cycle, types of cultures. Concept of cellular differentiation, totipotency.

Culture media – composition and effects of media components; Phytohormones – effects in tissue culture; **sterilization methods.**

UNIT - II

Pathways of regeneration – biochemical and molecular aspects of tissue culture cycle. **Organogenesis and adventive embryogenesis,** Fundamental aspects of morphogenesis, somatic embryogenesis. **Methods of androgenic and gynogenic haploid production,** diploids and applications in agriculture, **embryo rescue technique.**

UNIT - III

Cell culture: Establishment, plating efficiency, induction and selection of mutants. **Production of secondary metabolites/natural products.** **Somatic hybridization:** protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements, limitations, merits and demerits and protoplasts in genetic transformation.

UNIT - IV

Applications of Plant tissue culture: Clonal propagation, artificial seeds production and its applications, Soma clonal variation and its applications. **Techniques and applications of Cryopreservation and Germplasm storage.**

Additional inputs:Banana culture

Learning outcomes:

- It improves knowledge about the cells .tissues and organs.
- To get the knowledge of preparation of medias
- To know about the staining and sterilization methods
- Learn about the handling of tissue culture instruments like incubator hot air oven laminar air flow.
- To acquire the knowledge of basic concept of tissue culture techniques.
- Learn about the cryopreservation techniques and germplasm storage.
- To get the knowledge of protoplast isolation fusion and somatic embryogenesis.

Suggested Laboratory Exercises

1. **General out lay of PTCLaboratory**
2. **Preparation ofmedia**
3. **Callus induction – Carrot**
4. **Clonal propagation through meristemcultures**
5. **Embryo culture – Groundnut**
6. **Anther culture – Datura/Tobacco**
7. **Establishment of cell cultures and determination of growthpattern**
8. **Determination of Plating efficiencies of cellculture**
9. **Protoplast isolation and culture**
10. **Protoplastfusion**
11. **Observationofdifferentdevelopmentalstagesofsomatic embryo inembryogenic callus**
12. **Artificial seedpreparation**

Suggested Readings & Text Books

- Collin HA and Edwards S. 1998. **Plant Cell Culture**. Bioscientific Publishers, Oxford, UK.
- Callow JA, Ford-Lloyd BV and Newbury HJ. 1997. **Biotechnology and Plant Genetic Resources: Conservation and Use**. CAB International, UK.
- Raghavan V. 1997. **Molecular Biology of Flowering plants**. Cambridge University press, New York, USA.
- Bhojwani SS and Razdan MK. 1996. **Plant tissue culture: Theory and Practice**. (A revised edition). Elsevier Science Publishers, New York, USA.
- Jain SM, Sopory SK and Velleux RE. 1996. **In Vitro Haploid production in Higher Plants. Volumes 1-5**. Fundamental aspects and Methods Kluwer Academic Publishers, Dordrecht, Netherlands.
- Vasil IK and Thorpe TA. 1994. **Plant Cell and Tissue Culture**. Kluwer Academic Publishers, Dordrecht, Netherlands.
- Bhojwani SS. 1990. **Plant Tissue Culture: Applications and Limitations**. Elsevier Science Publishers, New York, USA.
- Raghavan V. 1986. **Embryogenesis in Angiosperms: A Developmental and Experimental Study**. Cambridge University Press, New York, USA.
- Kartha KK. 1985. **Cryopreservation of Plant Cells and Organs**. CRC Press, Boca Raton, Florida, USA.

PAPER CODE: 204
PLANT CELL, TISSUE AND ORGAN CULTURE

Model question Paper

Time:3 hrs.

Max.Marks:60 M

Section-A

Answer all the following questions

4x12 =48M

1. Give an account on various Phytohormones and their role in plant growth and development

OR

Write in detail about Tissue culture cycle and add a note on composition and effects of media components

2. Describe biochemical and molecular aspects of tissue culture cycle

OR

Describe the methods of Androgenic & Gynogenic haploid production

3. What are secondary metabolites? Enumerate these secondary metabolites of plant origin and state their importance

OR

What is Somatic hybridisation? Give its achievements and limitations

4. Give an account of Somaclonal variations and its applications

OR

Elucidate the method of Clonal Propagation and give its importance

Section -B

Write short notes on Four of the following

4x3=12M

5. Totipotency
6. Cellular differentiation
7. Haploid production
8. Morphogenesis
9. Synthetic seeds
10. Cybrids
11. Germplasm storage
12. Cryopreservation

PAPER CODE: 204

PLANT CELL, TISSUE AND ORGAN CULTURE

Practical model question paper

Time:3hrs

Max. Marks:38M

-
1. Writetheprocedureofthegivenexperiment 'A'. Illustratewiththediagramsand demonstrate. 11M
 2. Write the procedure of the givenexperiment 'B'. 7M
 3. Identify and write notes for the given spottersC,D,E. 3×4=12M
 4. Viva-voce 4M
 5. Record 4M

THIRD SEMESTER, PAPER CODE: 301
TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES
UTILIZATION AND CONSERVATION

UNIT -I

Taxonomy and Systematics. Species concept. Taxonomic hierarchy, Origin and evolution of Angiosperms. **Plant identification.** Plant nomenclature and ICBN rules.

Plant collection and documentation.

Brief analysis of the features and evolutionary tendencies noticed in the following groups: Ranales, Rosales, Centrospermae, Tubiflorae, Amentiferae, Helobiales, Liliiflorae and Glumiflorae.

UNIT-II

Taxonomic evidences: embryology, cytology and phytochemistry. **Taxonomic tools:** herbaria, floras, botanical gardens, biochemical and molecular techniques, computers and GIS (Geo Information Systems). Cladistics in taxonomy. Numerical taxonomy and sero-taxonomy

Systems of Angiosperm classification: Phenetic versus Phylogenetic systems. Relative merits and demerits of major systems of classification: Takhtajan, Cronquist and Thorne. Angiosperm Phylogeny Group (APG-IV) classification system, Relevance of Taxonomy to conservation, sustainable utilization of bio resources and ecosystem research.

UNIT-III

World centers of primary diversity of domesticated plants. The Indo-Burma Centre, Plant Introductions and Secondary centers. Plant explorations. Origin of agriculture.

Origin, evolution, Botany, cultivation and uses of :

- | | | |
|----------------------------------|---|---|
| 1. Food Crops | : | Wheat, Rice |
| 2. Forage Crops | : | <i>Sorghum</i> , Redgram |
| 3. Fibre Crops | : | Cotton, Jute |
| 4. Oily yielding crops | : | Groundnut, Coconut |
| 5. Medicinal and aromatic crops: | | <i>Catharanthus</i> , <i>Withania</i> , <i>Cymbopogon</i> |

UNIT-IV

Green Revolution: benefits and adverse consequences. Plant biodiversity: Concept, status in India, utilization and concerns, conservation of wild biodiversity.

Principles of conservation: **Strategies for conservation**, *In-situ* conservation: protected areas in India- reserves, wetlands, mangroves, *Ex-situ* conservation: principles and practices. Botanical gardens. BSI, ICAR and CSIR.

Additional inputs: Attribution of ranks

Learning outcomes:

- Student can acquire knowledge about the plant identification.
- Students can aware about the principles of ICBN
- Students can understand the process of plant classification.
- Students know about the economically useful plants.

Exhibits/ Experiments/ Suggested Laboratory Exercises :

1. Description of a specimen from representative and locally available families
2. Description of a species based on various specimens to study intraspecific variation: A collective exercise.
3. Description of various species of a genus: location of key character and preparation of keys at genetic level.
4. Location of key characters and use of keys at family level.
5. Field trips within and around the campus; compilation of field notes and preparation of herbarium sheets of such plants, wild or cultivated, as are abundant.
6. Training in using floras and herbaria for identification of specimens described in the class.
7. Demonstration of the utility of secondary metabolites in the taxonomy of some appropriate genera.
8. Comparison of different species of a genus and different genera of a family to calculate similarity coefficients and preparations of dendrograms

Plant Resources Utilization and Conservation

Laboratory work:

1. Foodcrops : Wheat, Rice
2. Forage/foddercrops : Sorghum, Redgram
3. Fibercrops : Cotton, Jute
4. Oilyielding : Groundnut, Coconut
5. Medicinal and Aromatic plants : *Catharanthus*, *Withania*, *Cymbopogon*

Scientific visits:

The students should be taken to one of the following:

A protected areas or Biosphere reserve or national park or sanctuary, wetland and Mangrove.

NBPGR (National Bureau of Plant Genetic Resources – New Delhi). BSI. CSIR Laboratory. FRI, Tropical Botanical Gardens.

Reference Books:

Taxonomy of Angiosperms

- Mondal AK. 2011. **Advanced Plant Taxonomy**. New Central Book Agency Pvt. Ltd., Kolkata.
- Simpson MG. 2006. **Plant Systematics**. Elsevier Academic Press, California, USA.
- Nordenstam BEI, Lazily G and Kassas M. 2000. **Plant systematics for 2nd Century**. Portland Press Ltd., London.
- Takhtajan AL. 1997. **Diversity and classification of Flowering Plants**. Columbia University Press, New York.
- Zomlefer WB. 1994. **A Guide to flowering plant families**. University of California Press, USA.
- Woodland DW. 1991. **Contemporary Plant Systematics**. Prentice Hall, New Jersey.
- Stace CA. 1989. **Plant Taxonomy and Biosystematics** .2ndEdition. Edward Arnold Ltd., London.
- Jones SB Jr. and Luchsinger AE. 1986. **Plant Systematics**. 2ndEdition. McGraw Hill Book Co., New York.
- Radford AE. 1986. **Fundamentals of Plant Systematics**. Harper and Row Publications, USA.
- Heywood VH and Moore DM. 1984. **Current concepts in Plant Taxonomy**. Academic Press, London.
- Davis PH and Heywoos VH. 1973. **Principles of Angiosperms Taxonomy**. Robert E Kreiger Pub. Co., New York.
- Harrison HJ. 1971. **New concepts in Flowering Plant Taxonomy**. Hieman Educational Books Ltd., London.
- Jones AD and Wilbins AD. 1971. **Variations and Adaptations in Plant species**. Hiemen and Co., Educational Books Ltd., London.
- Grant V. 1971. **Plant Biosystematics**. Academic press, London.
- Solbrig OT. 1970. **Principles and Methods of Plant Biosystematics**. Macmillan, London.
- Heslop-Harrison J. 1967. **Plant Taxonomy**. English language Books Soc. and Edward Arnold Pub. Ltd., U.K.

Plant Resource Utilization and Conservation:

- Sambamurthy AVSS and Subramanyam NS. 2000. **Economic Botany of Crop Plants**. Asiatech Publishers, Inc., New Delhi.
- Conway G. 1999. **The Doubly Green Revolution: Food for All in the 21st Century**. Comstock Publishing Associates, New York.
- Pinstrup – Anderson P. et al. 1999. **World Food Prospects: Critical Issues for the Early 21st Century**. International Food Policy Research Institute, Washington DC, USA.

- Kocchar SL. 1998. **Economic Botany of the Tropics**. 2nd Edition. Mac Millan India Ltd., Delhi.
- Plant Wealth of India 1997. Special Issue of Proceedings Indian National Science Academy B-63.
- Sharma OP. 1996. **Hills Economic Botany**. (Late Dr. A.F. Hill, adapted by O.P. Sharms). Tata McGraw Hill Co., Ltd., New Delhi.
- Frankel OH, Brown AHD and Burdon JJ. 1995. **The conservation of Plant Diversity**. Cambridge University Press, Cambridge, UK.
- Paroda RS and Arora RK. 1991. **Plant Genetic Resources Conservation and Management**. IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi.
- Swaminathan MS and Kocchar SL (ed). 1989. **Plants and Society**. Mac Millan Publication Ltd., London.
- Thakur RS, Puri HS and Hussain A. 1989. **Major Medicinal Plants of India. Central Institute of Medicinal and Aromatic Plants**. CSIR, Lucknow.
- Council of Scientific & Industrial Research 1986. **The useful plants of India. Publications and Information Directorate**. CSIR, New Delhi.
- Baker HG. 1978. **Plants and Civilization**. 3rd Edition. C.A. Wadsworth, Belmont.
- Chrispeels MJ and Sadava D. 1977. **Plants, Food and People**. W.H. Freeman and Co., San Francisco, USA.
- Schery RW. 1972. **Plants for Man**. 2nd Edition. Englewood Cliffs, New Jersey.

PAPER CODE: 301

**TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCES
UTILIZATION AND CONSERVATION**

Model Question Paper

Time: 3hrs

Max. Marks:60

Answer all the following questions

4X12=48

1. Discuss the different Species Concept .
(Or)
Give an account of International Code of Nomenclature
2. What is APG System of classification. Discuss about its significance
(Or)
Discuss Cronquist's system of classification and mention its merits and demerits
3. Elaborate on the evolutionary tendencies in Tubiflorae
(Or)
Discuss on the role of Phytochemistry in Taxonomy
4. Explain the origin, evolution and cultivation of Rice
(Or)
Give an account of cultivation practices in oil yielding crops with an example

Section B

Answer any Four questions

4x3=12

5. Taxonomic hierarchies
6. Nomenclature
7. Cladistic analysis
8. α Taxonomy
9. Amentiferae
10. Microanatomy
11. Indian Cotton
12. Withania

PAPER CODE: 302

PLANT DEVELOPMENT AND REPRODUCTION

Theory

UNIT-I

Tissues: Simple and complex tissues. Epidermis – stomata, trichomes. Secretory cells and tissues. Vascular tissue: development and structure of the primary and secondary xylem, and phloem. Root shoot transition.

Shoot development: organization of the shoot apical meristem (SAM), cytological and molecular analysis of SAM.

Leaf growth and differentiation: differentiation of epidermis and mesophyll. Structure of foliage leaves and modified leaves.

UNIT-II

Root development: organization of root apical meristem (RAM), cell fates and lineages, tissue differentiation. Lateral roots, root hairs, root microbe interactions.

Cambium: Structure, cell types, development of vascular cambium, cork cambium – structure of its derivatives, bark. Anomalous secondary growth in dicot and monocot stems.

UNIT-III

Male gametophyte: structure of anther, microsporogenesis, types and role of tapetum, pollen development, sperm dimorphism, pollen embryo sacs and compound pollen grains. Pollen allergy.

Female gametophyte: Ovule types and development, Megasporogenesis, types and development of embryo sacs, Organization of the embryo sac – ultra structure of the embryo sac cells.

Pollination: Pollination types, vectors and pollination mechanism. Pollen-pistil interaction – structure of the pistil.

Self-incompatibility: Sporophytic and gametophytic self incompatibility, different methods to overcome self-incompatibility.

Fertilization: Pollen germination, pollen tube growth and guidance, entry of pollen tube into the embryo sac, and pollen discharge. Syngamy and triple fusion, polyspermy and heterofertilization.

UNIT-IV

Post-fertilization events: Endosperm – development, types, functions, endosperm-embryo relationship.

Embryo development and Types, Polyembryony; apomixis; parthenocarpy. Storage proteins of endosperm and Embryo – LEA proteins. Seed dormancy, and **methods to overcome seed dormancy.**

Additional inputs:Anomalous secondary growth in Yucca.

Learning outcomes:

- Student can understand about the anatomy of plants
- Can understand about the process of secondary growth and anomalous secondary growth in monocot plants
- Can understand about the process of fertilization, fruit development.
- Embryo development and Endosperm development.

Suggested Laboratory Exercises

Plant Development

1. Microscopic examination of transverse sections of leaves such as *Nerium* and maize
2. To understand the internal structure of leaf tissues and trichomes, glands etc. Study of the C3 and C4 anatomy of plants
3. Study of epidermal peels of different kinds of leaves to study the development and nature stomata, computing stomatal index.
4. Study of elements of wood from macerations and sections taken in three planes T.S., T.L.S. and R.L.S
5. Study of the anomalous structure of the stems of *Aristolochia*, *Achyranthes*, *Bignonia*, *Boerhaavia*, *Leptadenia* and *Dracaena*.

Plant Reproduction

1. Study of microsporogenesis and gametogenesis in sections of anthers.
2. Tests for pollen viability using stains and *in-vitro* germination.
3. Embryo sac development through examination of permanent, stained serial sections.
4. Study of nuclear and cellular endosperm through dissections and staining.
5. Isolation of different stages of embryo development from suitable seeds.

Reference Books :

Plant Development

- Pullaiah T, Naidu KC, Lakshminarayana K and Hanumantha Rao B. 2007. **Plant Development**. Regency Publications, New Delhi.
- Fosket DE. 2004. **Plant Growth and Development. A Molecular approach**. Academic Press, San Diego.
- Howell SH. 1998. **Molecular Genetics of Plant Development**. Cambridge University Press,
- Waisel Y, Eshel A and Kafkaki V (ed) 1996. **Plant Roots: the Hidden Hall**. 2nd edition. Marcel Dekker, New York.
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- Salisbury FB and Ross CW. 1992. **Plant Physiology**. 4th Edition. Wordsworth Publishing, Belmont, California.
- Lyndon RF. 1990. **Plant Development. The Cellular Basis**. Unnin Hyman, London.
- Steeves TA and Susses IM. 1989. **Patterns in Plant Development**. 2nd Edition. Cambridge University Press, Cambridge.
- Mauseth JD. 1988. **Plant Anatomy**. Benjamin Cummings, California
- Fahn A. 1982. **Plant Anatomy**. 3rd edition. Pergamon Press, Oxford

Plant Reproduction

- Pulliah T, Lakshminarayana K and Hanumantha Rao B. 2008. **Plant Reproduction**. Scientific Publishers, Jodhpur, India.
- Bhojwani SS and Bhatnagar SP. 2000. **The Embryology of Angiosperms**. 4th revised and enlarged edition. Vikas Publishing House, New Delhi.
- Raghavan V. 1999. **Developmental Biology of Flowering Plants**. Springer – Verlag, New York.
- Raghavan V. 1997. **Molecular Embryology of Flowering Plants**. Cambridge

University Press, Cambridge.

- Shivanna KR and Swahney VK. (ed.) 1997. **Pollen Biotechnology for Crop Production and Improvement**. Cambridge University Press, Cambridge.
- The Plant Cell. Special Issue on Reproductive Biology of plants, Vol.5 (10) 1993. The American Society of Plant Physiologists, Rockville, Maryland, USA.
- Shivanna KR and Rangaswamy NS. 1992. **Pollen Biology, A Laboratory Manual**. Springer-Verlag, Berlin.
- Sedgely M and Griffin AR. 1989. **Sexual Reproduction of Tree Crops**. Academic Press, London
- Sedgely, M. and Griffin, A.R. 1989. Sexual Reproduction of Tree Crops, Academic Press, London.
- Leins P, Tucker SC and Endress PK. 1988. **Aspects of Floral Development**. J. Cramer, Germany.
- Shivanna KR and Johri BM.1985. **The Angiosperm Pollen Structure and Function**. Wiley Eastern Ltd., New Delhi.
- Procter M and Yeo P. 1973. **The Pollination of Flowers**. William Collins Sons, London.

PAPER CODE: 302

PLANT DEVELOPMENT AND REPRODUCTION

Model question paper

Time: 3 hrs.

Max.Marks:60

Section A

Answer all the following questions

4 x 12 =48

1. Describe in brief about Complex tissues with neat labeled diagrams.

OR

Give a concise account of Leaf growth & differentiation.

2. Write about the anomalous secondary growth in dicots with suitable examples.

OR

Describe the structural variations met within the secondary phloem in dicots.

3. Write an essay on the ultrastructure of tapetum and its functions

OR

Give an illustrated account of the different types of Tetrasporic Embryo sacs you have studied

4. Write in detail about the process of Fertilization

OR

Give an account on development of embryo as per Johansen's system.

Section B

Answer any four questions

4X3=12 M

5. Secretory cells

6. SAM

7. Bark.

8. Root microbe interactions

9. Pollen Embryo sacs.

10. Pollen, Pistil interactions.

11. Polyembryony.

12. Seed dormancy.

PAPER CODE: 303
PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION

Theory

Unit-I

Ecology – A synthetic approach: Ecological factors (Biotic and Abiotic), Plant succession, Major biomes and bio geographical regions of the World. Major Vegetational and Soil types of India.

UNIT-II

Community ecology: Characteristics of plant communities: qualitative and Quantitative study of plant communities.

Synthetic characters of plant Communities: Similarity Index.

General account of classification of communities

Population Ecology: Population structure, characteristics of population; population density, Natality, Mortality, Age distribution, Biotic potential, Population growth forms and population growth curves. Population fluctuations and population dispersal.

UNIT-III

Plant Biodiversity: Concept, Status in India, Utilization and concerns, World Centers of primary diversity of domesticated plants. The Indo Burmese Centre, plant introduction and secondary centers.

Biogeography: Major terrestrial biomes, theory of island biogeography, bio geographical zones of India

UNIT - IV

Principles of Conservation: Strategies for conservation, *in situ* conservation, protected areas in India-Biosphere reserves, wetlands, mangroves, conservation of wild biodiversity, strategies for conservation – *ex situ* conservation. Principles and practices. Importance of Botanical gardens, BSI, ICAR and CSIR in biodiversity conservation.

Additional inputs: Ecological succession, Ramsar convention

Learning outcomes:

- Student can gain knowledge about the biological interactions
- Students can understand about the role of biodiversity in our daily life
- Students can understand the process of conservation strategies.

Suggested Laboratory Exercises

1. **study vegetation in the botanical gardens**
2. **To prepare life forms of local botanical gardens and prepare a biological spectrum**
3. **To determine the minimal size and number of quadrates required for reliable estimate of biomass in grassland**
4. **Quantitative analysis of vegetation: relative frequency, density, relative density, basal area and IVI**
5. **To estimate rate of Carbon dioxide evolution from different soils using sodalime or alkali absorption method**
6. **Estimation of Carbon footprint in the campus**
7. **Determination of leaf area index**
8. **To determine the water holding capacity of soil moisture content**

Scientific visits:

A protected areas or Biosphere reserve or national park or sanctuary

A wetland, Mangrove, NBPGR (National Bureau of Plant Genetic Resources – New Delhi) BSI, CSIR Laboratories, FRI and Tropical Botanical Gardens

Suggested readings:

- American Public Health Association American Water Works Association. 2013. **Standard Methods for the Examination of Water and Waste Water**. General Books LLC, USA.
- Sharma PD. 2007. **Ecology and Environment**. Rastogi Publications, Meerut.
- Sharma PD. 2001. **Ecology and Environment**. Rastogi Publications, Meerut.
- Smith RL. 1996. **Ecology and field Biology**. Harper Collins, New York.
- Sokal RR and Rohit FJ. 1995. **Biometry**. W.H. Freeman and Co., New York.
- Batra NK. 1992. **Treatise on Plant Ecology**. Pradeep Publications, Delhi.
- CJ. 1989. **Ecological Methodology**. Harper and Row, New York, USA.
- Ludwig JA and Reynolds JF. 1988. **Statistical Ecology**. Wiley, New York.
- Magurran AE. 1988. **Ecological Diversity and its measurement**. Croom Helm, UK.
- Moore PD and Chapman SB. 1986. **Methods in Plant Ecology**. Blackwell Scientific, Oxford, UK.
- Pielow EC. 1984. **The interpretation of Ecological Data**. John and Wiley Sons, USA.
- Muller – Dombois D and Ellenberg H. 1974. **Aims and Methods of Vegetation Ecology**. Blackburn Press, New Jersey.
- Odum PE. 1971. **Fundamentals of Ecology**. 3rd Edition. W. B. Saunders, Philadelphia.
- Dansemmire RF. 1968. **Plant Communities**. Horpes and Row, New York.
- Misra R. 1968. **Ecology Work Book**. Oxford and IBH Publishing Co., New Delhi.
- Ambasht RS and Ambasht NK. **A Text Book Plant Ecology**. CBS Publishers and distributors, New Delhi.

PAPER CODE: 303

PLANT ECOLOGY, BIODIVERSITY AND CONSERVATION

Model Question Paper

Time: 3hrs.

Max. Marks:60

Section-A

Answer all the following Questions

4x12=48

1. Write an account on Bio geographical regions of the World
Or
Discuss the different methods employed to study a plant community
2. What are different quantitative characters used to characterize a plant community
Or
Detail the Population structure and characteristics
3. Define biodiversity and discuss on the importance of its studies
Or
Discuss about the World centers of domesticated plants
4. Distinguish between the different strategies of Conservation
Or
What are the principles and practices of Botanical Gardens and ICAR

Section-B

Answer any four of the following questions

4x3=12M

5. Soil types
6. Biological spectrum
7. Clements' classification of community
8. Population Age structure
9. Secondary centers
10. Growth curves
11. Biosphere reserves
12. CSIR

PAPER CODE: 304
PLANT PHYSIOLOGY

Theory

UNIT-I

1. **Plant water relations:** Free energy and chemical potential, osmotic potential, water potential and its determination, active and passive absorption of water, Stomatal physiology and mechanisms of stomatal opening and closing, Soil-plant-atmosphere- continuum concept (SPAC), mechanism of water transport.
2. **Mineral nutrition:** Passive and active uptake of ions, translocation of minerals in plants, essential elements, their functions and symptoms of mineral deficiency, importance of foliar nutrition and use of chelates in agriculture, root microbe interactions in facilitating nutrient uptake, mechanism of assimilate translocation.

UNIT_II

- 1 **The flowering process:** Phytochrome structure, photochemical and biochemical properties, role in photomorphogenesis. Photoperiodism and its significance, mechanisms of floral induction. Vernalization. Morphological, biochemical and metabolic changes accompanying seed germination.
- 2 **Plant growth regulators and elicitors:** biosynthesis, physiological effects and mechanism of action of auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid. Role of plant growth regulators in agri-horticulture.

UNIT_III

1. **Fundamentals of Enzymology:** General aspects, allosteric mechanism, regulatory and activesites, isozymes, kinetics of enzymatic catalysis, Michaelis-Menten equation and its significance, Mechanism of enzyme action.
2. **Photochemistry and Photosynthesis:** General concepts and historical background, evolution of photosynthetic apparatus, Redox reactions, photosynthetic

pigments and light harvesting complexes, photo-oxidation of water, mechanisms of electron and proton transport, structure, synthesis and function of ATP, carbon assimilation -the Calvin's cycle, photorespiration and its significance, the C4 cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations.

UNIT_IV

1. **Respiration and Lipid metabolism** : Plant respiration, glycolysis, the TCA cycle, electron transport and ATP synthesis, pentose phosphate pathway, glyoxylate cycle, alternative oxidase system, structure and function of lipids, fatty acid biosynthesis of membrane lipids, structural lipids and storage lipids and their catabolism.
2. **Stress Physiology**: Plant responses to biotic and abiotic stress, mechanisms of biotic and abiotic stress tolerance, water deficit and drought resistance, salinity stress, metal toxicity, heat stress and oxidative stress.

Additional inputs:

Nitrogen fixation and nitrogen metabolism: Biological nitrogen fixation, nodule formation and nod-factors, biosynthesis of amino acids and proteins, mechanism of nitrate uptake and reduction.

Learning outcomes:

- Students can understand the importance of mineral nutrients in plant growth and metabolism.
- Students can understand about the process of photosynthesis and respiration.

Suggested Laboratory Exercises

1. Determination of osmotic potential.
2. Determination of water potential.
3. Demonstration of osmosis.
4. Determination of root pressure.
5. Effects of high and low temperatures upon the permeability of the cytoplasmic membranes.
6. Determination of suction force due to transpiration.
7. Stomatal frequency and stomatal index of leaves.
8. Rate of transpiration in leaves by cobalt chloride paper method.
9. Determination of amylase activity
10. Extraction and separation of chloroplast pigments by paper chromatographic method
11. Determine chlorophyll a / chlorophyll b contents in C₃ and C₄ plants by spectrophotometric method
12. Determination of Hill reaction
13. Determination of rate of Aerobic respiration by continuous current method
14. Determination of rate of Anaerobic respiration by continuous current method
15. Determination of catalase activity
16. Demonstration of Polyphenol oxidase
17. Determination of reducing sugars
18. Estimation of free acids in Bryophyllum in terms of milliequivalent of NaOH
19. Extraction and estimation of seed proteins depending upon the solubility
20. SDS – PAGE for soluble proteins extracted from the given plant materials
21. Separation of isozymes esterase, peroxidase by native polyacrylamide gel electrophoresis
22. Effect of Light quality on the rate of Photosynthesis
23. Effect of CO₂ concentration on the rate of Photosynthesis
24. Estimation of Starch by gravimetric method
25. Demonstration of Starch hydrolysis
26. Separation of Chloroplast pigments by chemical method
27. Separation of amino acids and carbohydrates through two dimensional chromatographic method

Suggested books:

- **Principles of Plant nutrition** 4th Edition by Mengel K. and E.A. Kirby International Institute of Polesh Switzerland 1987.
- **Mineral nutrition of crop plants.** H. Marshener academic Press 1986.
- **Plant Physiology.** L. Taiz and E. Zeiger. 1999. Sinava Associates Inc. Publishers Sunderland MA
- **Plant Physiology.** Frank B. Salisbury and Cleon W. Ross. 4th edition. 1992. Words worth Publication Co., Belmont. California
- **Growth and differentiation in plants** by Wareing and Phillips, Pergamon press.
- **Plants Cell structure and metabolism.** J.L. Hall, Flower and Roberts, ELBS, Longman.
- **Advanced Plant Physiology** by M.B. Wilkinson, ELBS, Longman
- **Introduction to Plant Physiology** by G.R. Noggle and G.J. Fritz, Printice Hall Press
- **Plant Physiology** by R.N. Devlin and F.H. Witham, CBS 1986
- **Introduction to plant physiology** W.G. Hopkins and Norman P.A. Huner
- **Photosynthesis and crop productivity in different environments.** J. Cooper, Cambridge
- **Photosynthesis: A comprehensive treatise** (1998) Ed. A.S. Raghavendra Cambridge University Press,
- **Introduction to Plant Physiology** by W.G. Hopkins 2nd Ed. John Wiley, NY.
- **Advances in Plant Physiology. Vol.2.** A. Hemantarajan.
- J.R. Gallow and A.E. Chaplin (1987) **An introduction to Nitrogen fixation.** Cassel Education Limited.
- F.O' GARA; S. MNNIANA, J.J.DREEVON (eds.) (1988) **Physiological limitations and Genetic improvement of symbiotic Nitrogen fixation.** Kluwer Academic Pub.
- J.R. Postgate (1982) **The fundamentals of nitrogen fixation,** Cambridge Univ Press, Cambridge, U.K.
- **Encyclopedia Plant Physiology.** New Series. 12 ABCD Plant Physiology Ecology 1983. Springer Verlag Berlin
- **Stress Physiology.** D.P. Singh

PAPER CODE: 304

PLANT PHYSIOLOGY

Model Question Paper

Time:3hrs

Max.Marks :75

Answer all the following questions

4x15=60

1. Define water potential? Describe its components and Interrelationships in plant cell

OR

Describe the microelements and their function and symptoms of mineral deficiency

2. What is phytochrome structure? Write photochemical and Biochemical properties

OR

What is Auxins? Discuss the Biosynthetic pathway of Auxins

3. Write a note on Enzyme Kinetics

OR

Write detail account on C₃ Pathway

4. Mention the Biosynthesis and Catabolism of storage Lipids

OR

B. Write essay on explain the Water Stress

Write any Five questions

5x3=15

5. SPAC Concept
6. Root Microbe Interaction
7. Photo morphogenesis
8. ABA
9. Iso-enzymes
10. ATP-Synthase
11. Nod factors
12. Heat Stress

PAPER CODE:401
GENETIC ENGINEERING OF PLANTS AND MICROBES

Theory

UNIT – I

Basics of rDNA technology: Restriction enzymes, types, nomenclature, mechanism of action.

Tools used in rDNA molecule synthesis: Poly linkers, Vectors- Features and types: Cloning vectors - Plasmids, Phagemids, Cosmids, - Bacterial and Yeast artificial chromosomes (BACs and YACs); Expression vectors. Bacterial transformation, *In-vitro* packaging, Selection of transformants: Antibiotic resistance, Lac Z gene based selection. Genomic library, cDNA library

UNIT - II

Blotting techniques: Southern, Northern and Western blotting, Properties of radio isotopes. Carbon, Phosphorus and Sulphur: *In-situ* Hybridization: Radioactive and non-radioactive probes: Enzyme and fluorescence detection methods (FISH), Types and Applications of PCR technique.

DNA sequencing: Basic principle of Sanger's method, sequencing genomes Automated DNA sequencing, High throughput DNA sequencing; Sequencing genomes: Whole genome, Shot gun sequencing.

UNIT - III

DNA fingerprinting: molecular markers RFLP;RAPD,AFLP; Chromosome mapping, Restriction maps and Genetic markers, QTL mapping analysis; Introgression of useful traits using DNA markers. Microarray and its applications

Methods of gene transfer in plants: Physical and Biological methods.

Agrobacterium mediated: Binary and co integrative vector based. Chloroplast transformation.

UNIT - IV

Transgenic plants: Fungal, Bacterial, Viral and Insect tolerant (BT and proteinase inhibitors) transgenics. Herbicide tolerate, Abiotic stress tolerate, Male sterility: Barnase- Barstar.

Quality improvement: Golden rice, Late ripening tomatoes (Flavr-Savr)

Genetic improvement of industrially important microbes as Bio-pesticides, Bio-fertilizers and Antibiotics

Applications of Bioinformatics in Genetic engineering and their importance. IPRs, Ethical and Environmental issues.

Additional inputs: Genomics and Proteomics.

Learning outcomes:

- Student can understand the process of recombinant DNA technology and also obtain knowledge about the genetically modified plants.
- Students can acquire knowledge about the importance of genetically modified crops.
- One can acquire skilled knowledge in the field of genetic engineering.

Suggested Laboratory Exercises

1. Isolation of plasmid DNA
2. Bacterial transformation and identification of transformation Restriction enzyme digestion and gel electrophoresis
3. Genetic engineering assignments

Suggested Readings & Text Books

- Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principles and Applications of rDNA**. ASM Press, USA.
- Attwood TK, Smith DJP and Phukan S. 2009. **Introduction to Bioinformatics**. Pearson Education Ltd., UK.
- Sateesh MK. 2008. **Bioethics and Biosafety**. I K International Pvt. Ltd., Bangalore.
- Channarayappa. 2007. **Molecular Biotechnology Principles and practices**. Taylor and Francis, UK.
- Watson JD. 2007. **Recombinant DNA: Genes and Genomes: A short course**. W. H. Freeman, USA.
- Primrose SB and Twyman RM. 2006. **Principles of Genome Analysis and Genomics**. Blackwell publishers, USA.
- Lewin B. 2004. **Genes VIII**. Pearson Prentice Hall, New Jersey.
- Chawla HS. 2002. **Introduction to Plant Biotechnology**. Oxford and I B H Publishers, USA.

PAPER CODE 401:
GENETIC ENGINEERING OF PLANTS AND MICROBES

Model Question Paper

Time :3hrs

Max.Marks:60

SectionA

Answer all the following Questions

4X12=48

1. What are Restriction enzymes? What is their role in rDNA technology?

OR

What is Bacterial transformation? Discuss how to recognize transformation.

2. Distinguish between Northern and Southern blotting techniques.

OR

Write down the types and applications of PCR techniques.

3. What is Microarray Technique? Explain the principles and applications.

OR

Describe the methods of Gene transfer in plants.

4. What are Transgenic plants? Discuss the Fungal and Insect tolerant transgenic.

OR

Give an account of applications of Bioinformatics in Genetic Engineering and their importance.

Section – B

Answer any Four questions

4 x 3 = 12M

5. BACs
6. cDNA library
7. FISH
8. Basic principle of Sanger's method
9. RFLP
10. Chloroplast transformation.
11. Barnase – Barstar
12. Golden Rice

PAPER CODE 401:
GENETIC ENGINEERING OF PLANTS AND MICROBES

Practical Model Question Paper

Time :3hrs

Max.Marks:60

SectionA

PAPER CODE: 402

EVOLUTION AND PLANT BREEDING

Theory

UNIT - I

Origin of life and Unicellular evolution – Origin of basic biological molecules – abiotic synthesis of monomers and polymers – Concept of Oparin and Haldane, Evolution of prokaryotes and eukaryotes.

Theories of organic evolution – Darwinism, Synthetic theory, Phyletic gradualism, Punctuated equilibrium;

UNIT – II

Molecular evolution – Concepts of neutral evolution, molecular divergence and molecular clocks – protein and nucleotide sequence analysis; gene duplication and divergence, Natural Selection; Reproductive isolation – types and species concept; Hardy Weinberg equilibrium and applications

Polygenic inheritance, heritability and its measurements

UNIT - III

Origin of cultivated plants; evolution of wheat and maize; Plant introduction, primary centers of origin, Burma center of origin and secondary centers of origin Germplasm banks.

Methods of breeding self and cross pollinated plants; breeding of vegetatively propagated crops; Heterosis and Hybrid Vigour – genetic basis and significance.

Breeding for disease resistance.

UNIT - IV

Biostatistical Methods: Basic concept of Parametric and non-parametric methods; - Graphical representation, measures of central tendency and dispersion; Probability distributions (Binomial, Poisson and Normal distributions); types of error, levels of significance, t-test, X^2 – test, ANOVA.

Additional inputs: Mean, Median and Student test.

Learning outcomes:

- Students can acquire knowledge in the field of plant breeding.
- One can produce new hybrid varieties in crop plants as he gets knowledge and skills regarding how to create new ones
- One can understand the process of transmission of characters from one generation to another generation by studying biostatistics

Suggested Laboratory Exercises

1. Assignment containing problems on topics mentioned in the theory syllabus
2. Floral biology
3. Pollination mechanisms
4. Breeding techniques of Rice, Maize, Sorghum, Bajra, Brassica, Chilli and Solanum

Suggested Readings & Text Books

- Singh BD. 2012. **Plant Breeding: Principles and Methods**. Kalyani Publishers, Delhi.
- Stickberger MW. 1985. **Genetics**. McMillan, New York.
- Frey KJ. 1981. **Plant Breeding II**. Iowa State University Press, Oxford.
- Jones DA and Wilkins DA. 1971. **Variation and adaptation in plant species**. Heinemann Educational Books Ltd., London.
- Stebbins GL. 1971. **Chromosomal evolution in Higher Plants**. Edward Arnold Publishers Ltd., London.
- Poehlman JM and Borthakur D. 1969. **Breeding Asian field crops: With Special Reference to Crops of India**. Oxford and IBH Pub. Co., Delhi.
- Briggs FN and Knowles PF. 1967. **Introduction to Plant Breeding**. Reinhold Pub. Corp., New York.
- Brewbaker JL. 1964. **Agricultural Genetics**. Prentice-Hall, New Jersey, USA.
- Allard RW. 1961. **Principles of Plant Breeding**. 2nd Edition. John Wiley and Sons Inc., New York.

PAPER CODE 402:
EVOLUTION AND PLANT BREEDING
Model question paper

Time :3hrs

Max. Marks: 60

Section- A

Answer all the following Questions

4X12=48 M

1. Explain molecular evolution

Or

Discuss the evolution of Prokaryotes and Eukaryotes

2. What is Natural selection? Discuss in detail.

Or

Describe Polygenic Inheritance

3. Give an account of origin of cultivated plants

Or

Discuss in detail Heterosis and Hybrid Vigour

4. Differentiate between Binomial and Normal distribution with sample data

OR

Explain Regression and Correlation in detail

Section B

Answer any Four questions

4x3=12M

5. Oparin and Handaneconcept

6. Neutralevolution

7. Hardy – Weinberglaw

8. HeritabilityMeasurement

9. Germplasm banks

10. PlantIntroduction

11. Measures of Central tendency

12. ANOVA

PAPER CODE 402:
EVOLUTION AND PLANT BREEDING
Practical Model question paper

Time : 3hrs

Max. Marks: 38M

- | | |
|---|-----|
| 1. Write the solutions for the given problems. A & B | 10M |
| 2. Identify and write notes for the given spotters. C & D. | 10M |
| 3. Demonstrate emasculation technique and artificial pollination. | 10M |
| 4. Viva-Voce | 04M |
| 5. Record | 04M |

PAPER CODE-403
ECOLOGY AND ENVIRONMENTAL BIOLOGY

Theory

UNIT – I

Ecosystem organization: Structure and functions of Ecosystem, Management, Stability, Complexity, Dynamics, Homeostasis (Forest, Grassland, Freshwater, Ecosystems) Ecological efficiencies, Energy Dynamics, Trophic organization, Energy flow pathways. Litter fall and decomposition (mechanism, substrate quality and climate factors). Global biogeochemical cycles of C, N, P, S and H₂O.

UNIT – II

Biodiversity: The role of biodiversity in Ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns of terrestrial bio-diversity.

Pollution: Air, Water and Soil pollution; sources, quality parameters, effects on plants and ecosystems.

UNIT-III

Ecosystem stability: Concept (resistance and resilience) ecological perturbations (Material and anthropogenic) and their impact on plants and ecosystems .Environmental impact assessments. Ecosystem restoration. Primary production and destination.

UNIT – IV

Climate change: Greenhouse gases (CO₂, CH₄, NO₂, CFCS sources trends and role) Ozone layer, Ozone hole and consequences of climate change (CO₂, fertilization, global warming, sea level rise, UV radiation)

Composition of soil, factors affecting soil formation and soil profile(Laterization, Podsolization, Glaciations, Mineralization and soil classification, soil water and soil solution, soil organic matter or humus and soil organisms.

Additional inputs: Estimation of primary productivity, Earth summit and Climate change

Learning outcomes:

- Students can acquire knowledge about the structure and functions of ecosystem.
- One can understand about the various types of biomes in the world and vegetation types.
- Students can understand about the various causes of pollution and their prevention methods

Suggested Laboratory Exercises:

1. **Estimation of Carbon footprint in the campus**
2. **Estimation of biomass of crop plants**
3. **Estimation of Chlorophyll**
4. **Determination of leaf area index**
5. **To determine the water holding capacity of soil moisture content**

Suggested Readings & Text Books :

- American Public Health Association American Water Works Association. 2013. **Standard Methods for the Examination of Water and Waste Water.** General Books LLC, USA.
- Sharma PD. 2007. **Ecology and Environment.** Rastogi Publications, Meerut.
- Sharma PD. 2001. **Ecology and Environment.** Rastogi Publications, Meerut.
- Smith RL. 1996. **Ecology and field Biology.** Harper Collins, New York.
- Sokal RR and Rohit FJ. 1995. **Biometry.** W.H. Freeman and Co., New York.
- Batra NK. 1992. **Treatise on Plant Ecology.** Pradeep Publications, Delhi.
- CJ. 1989. **Ecological Methodology.** Harper and Row, New York, USA.
- Ludwig JA and Reynolds JF. 1988. **Statistical Ecology.** Wiley, New York.
- Magurran AE. 1988. **Ecological Diversity and its measurement.** Croom Helm, UK.
- Moore PD and Chapman SB. 1986. **Methods in Plant Ecology.** Blackwell Scientific, Oxford, UK.
- Pielow EC. 1984. **The interpretation of Ecological Data.** John and Wiley Sons, USA.
- Muller – Dombois D and Ellenberg H. 1974. **Aims and Methods of Vegetation Ecology.** Blackburn Press, New Jersey.
- Odum PE. 1971. **Fundamentals of Ecology.** 3rd Edition. W. B. Saunders, Philadelphia.
- Dansemmire RF. 1968. **Plant Communities.** Horpes and Row, New York.
- Misra R. 1968. **Ecology Work Book.** Oxford and IBH Publishing Co., New Delhi.
- Ambasht RS and Ambasht NK. **A Text Book Plant Ecology.** CBS Publishers and distributors, New Delhi.

Model question paper

Time :3hrs

Max.Marks:60

Section -A

Answer all the following questions

4X12=48

1. Give a brief account of structure and function of an Ecosystem

Or

Discuss the importance of Bio-geochemical cycles

2. Describe the role of biodiversity in function and stability of Ecosystem

Or

Enumerate the types and sources of Pollution and its effect on Ecosystem

3. Discuss on the impact of Ecological perturbations on plants and ecosystem,

Or

What are the different methods employed to estimate Primary Productivity

4. Importance of Green house gases in Climate change

Or

Elaborate on the factors affecting soil formation

Section B

Answer any four of the following

4x3=12

5. Homeostasis
6. Litter fall & decomposition
7. IUCN Categories of threat
8. Air Pollution
9. Ecosystem Restoration
10. Environmental Impact Assessment
11. CO₂ fertilization
12. Humus

PAPER CODE: 404
INSTRUMENTATION TECHNIQUES AND RESEARCH METHODOLOGY

Theory

INSTRUMENTATION TECHNIQUES

UNIT – I

Microscopic techniques: Microscopy- basic principles and applications of Light microscope, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fluorescence Microscopy, Scanning Tunneling Electron Microscopy- (STM), Automated Fluorescence Microscopy.

Centrifugation- Differential and density gradient centrifugation, construction of preparative and analytical ultracentrifuge, Svedberg's constant, sedimentation velocity and sedimentation equilibrium.

UNIT – II

Separation techniques- Principles, methods and applications of chromatography – Paper, thin layer, and HPLC

Spectroscopic techniques- Principles of colorimeter, spectrophotometer, fluorimeter. Beer-Lambert's Law and its limitations.

Electrophoretic techniques- Agarose gel electrophoresis, isoelectric focusing, pulsed field electrophoresis. Separation of proteins, lipoproteins and nucleic acids. Visualizing separated components; staining, fluorescence, PAS staining.

RESEARCH METHODOLOGY

UNIT – III

Foundations of Research: Meaning, Objectives, Motivation, types of research and significance.

Research methods: Process of research, criteria of good research.

Research Design: Concept and Importance in Research; Features of a good research design, Different research designs and Basic principles of Experimental designs.

Concept, types and uses of Exploratory Research Design, Concept of Independent & dependent variables.

UNIT – IV

Sampling: Sample, Sampling Frame, Sampling Error, Sample Size. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling.

Data Analysis: Data Preparation – Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis – Cross tabulations and Chi-square test including testing hypothesis of association

Interpretation of Data and Paper Writing – Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, Ethical issues related to publishing, Plagiarism and Self-Plagiarism.

Additional inputs: Sequential review literature, bibliometric analysis, paper writing skills, citation and journal selection.

Learning outcomes:

- Students can able to handle various instruments used in molecular studies.
- Students acquire knowledge about the use of instruments like Centrifuge, Spectrophotometer and Electrophoretic instruments.
- Students are able to think in a scientific way to solve the biological problems.
- One can understand the process of research and various methods used in research design and paper presentation.

Suggested Readings & Text Books

- Wilson & Walker. Principles and Techniques in Practical Biochemistry. 5thed. Cambridge Univ. Press,2000.
- West & Todd. Biochemistry. 4thed. Oxford and IBH.
- Horst Friebolin. Basic One and Two-dimensional spectroscopy. VCH Publ,1991.
- Murphy D.B. Fundamental of Light Microscopy & Electron Imaging. 1sted. Wiley- Liss, 2001.
- Biochemical techniques theory and practice john f. Robyt and Bernard j. White
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PAPER CODE: 404
INSTRUMENTATION TECHNIQUES AND RESEARCH METHODOLOGY

Model question paper

Time :3hrs

Max.Marks: 60

Section A

Answer all questions

4x12=48

1. Define Research? What are the main objective of good Research?

OR

Write any essay on basic principles of research Design.

2. Describe the data interpretation, what are the ethical issues included paper publication.

OR

Write an essay on Microscopic techniques?

3. Describe the concept of independent and dependent variables.

OR

What is Sampling? Explain about Statistical Concepts of sampling.

4. Write an essay on Agarose gel electrophoretic instrument utilization.

OR

Write an Essay on Principles and procedure of separation technique.

Section –B

Answer any four Questions

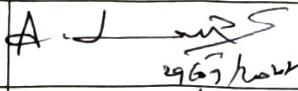
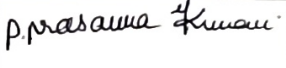
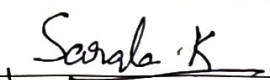

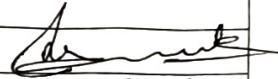
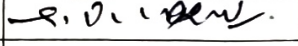
4x3=12


5. Data Collection
6. Descriptive research
7. Research concept and scope
8. Centrifugation
9. Chromatography
10. Beer –combats law
11. PAS-Staining
12. Plagiarism

**GOVERNMENT COLLEGE (AUTONOMOUS), RAJAHMUNDRY
DEPARTMENT OF BOTANY**

BOARD OF STUDIES MEETING FOR M.Sc., (BOTANY): 2022-23 A.Y.

The Board Of Studies Meeting for the courses of M.Sc., (BOTANY) is convened at Department of Botany, G.C. (A), Rajahmundry on **29-07-2022** by **02:00 PM** under the Chairmanship of Dr. A. Srinivasa Rao with the following members.

| S.No. | Designation | Name | Signature |
|-------|---------------------------|--|---|
| 1. | Chairman | Dr. A. Srinivasa Rao Lecturer in-Charge, Department of Botany |  |
| 2. | University Nominee | Dr. P. Prasanna Kumari, DNR College (A), Bhimavaram |  |
| 3. | Subject Expert | Dr. K. Sarala, Principal Scientist, C.T.R.I., Rajahmundry |  |
| 4. | Subject Expert | Dr. P. Prayaga Murthy, Lecturer in Botany, G.D.C., Yeleswaram |  |
| 5. | Industrial Nominee | Dr. P. Rama Krishna, Director, Sri Satyadeva Nursery, Kadiapulanka. | |
| 6. | Faculty Member | Y. Baby, Lecturer in Botany |  |
| 7. | Faculty Member | G. Vijay Kumar, Lecturer in Botany |  |
| 8. | Student Nominee | K. Supriya, M.Sc. (Botany) -Final | |
| 9. | Student Nominee | Y. Mary Susanna, M.Sc. (Botany) -Final | |


**CHAIRMAN,
BOARD OF STUDIES
Lecturer in-Charge
DEPARTMENT OF BOTANY
GOVERNMENT COLLEGE (A)
RAJAMAHENDRAVARAM-533 103.**

BOARD OF STUDIES MEETING FOR M. Sc., (BOTANY): 2022-23 A.Y.

The Board Of Studies Meeting for the courses of M. Sc., (BOTANY) is convened at Department of Botany, G.C. (A), Rajahmundry on **29-07-2022** by **02:00 PM** under the Chairmanship of Dr. A. Srinivasa Rao, Lecturer In-Charge of the department.

Agenda:

1. Program wise Curriculum Design for all the Semesters
2. Designing of Course Outcomes and Course Objectives
3. Identification of unit wise assignment questions and relevant model question paper.
4. Identifying /inclusion of components of Skill Development, Employability and Entrepreneurship in the course content and specific activity proposed.
5. Additional inputs into the curriculum
6. Designing Model Question Papers and identifying potential paper setters
7. Innovative Teaching - Learning Methodology (Learner Centric)
8. Academic activities of the Department such as seminars, fieldworks etc.
9. Any other proposal with the permission of the chair

Minutes of the Meeting:

Agenda point 1: Program wise Curriculum Design for all the Semesters

Discussion: The members discussed the curricular design of the M.Sc., (Botany) programme in each semester to teach inclusive experiences in the domain area.

Resolution: The design of the programme as well as courses offered in all the semesters (I to IV) are totally approved by all the members of the BOS concerned.

Agenda point 2: Designing of Course Outcomes and Course Objectives



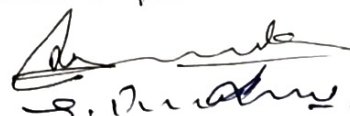
Discussion: The members who attended the meeting have gone through the course outcomes and course objectives related to the Botany courses pertaining to all the semesters and discussed in detail.

Resolution: The outcomes and objectives written as per the Bloom's taxonomy are well appreciated and accepted unanimously.

Agenda point 3: Identification of unit wise assignment questions and relevant model question paper.

Discussion: Members who attended the meeting have read the assignment questions and discussed their relevance to the course curriculum with the teachers dealing with the said core courses.

Resolution: The assignment questions given for each course are accepted by the BOS members.


Sarala K

P. Prasanna Kumar

S. Srinivasa Rao

Agenda point 4: Identifying /inclusion of components of Skill Development, Employability and Entrepreneurship in the course content and specific activity proposed.

Discussion: The members of BOS discussed about the modules related to vertical mobility, employment and entrepreneurship in the core course (Botany). A need is felt on giving coaching for CSIR (NET)/APSET and employment. Further opined of laborious practical training for modules of entrepreneurship.

Resolution: The committee unanimously resolved to train the students by inviting experts in the applied fields related to domain subject and by conducting skill based trainings and field visits to different ecosystems and research organizations in public and private sectors.

Agenda point 5: Additional inputs into the curriculum

Discussion: The additional inputs kept in the curriculum in the form of co-curricular and outreach programmes are well prized by all the members of BOS.

Resolution: All the additional inputs related to core subject are unanimously admitted by the BOS members.

Agenda point 6: Designing Model Question Papers and identifying potential paper setters

Discussion: The members of BOS gone through the model question papers of all the courses and proposed names of question papers setters and evaluators and discussed the relevance and competencies.

Resolution: The model question papers, names of question paper setters and evaluators are unanimously accepted by the members of BOS.

Agenda point 7: Innovative Teaching - Learning Methodology (Learner Centric)

Discussion: All the members of BOS discussed various pedagogical methods for effective learning process by the students. A need is felt to have more number of student centric activities at their residence and also in the college to inculcate in depth knowledge in the subject. The members opined to use ICT tools for effective teaching-learning process. BOS members opined to give case studies and field based student study projects for students to get experiential learning and to get basic knowledge of research.

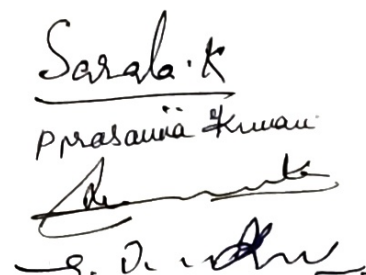
Resolution: It is unanimously resolved to conduct more number of student-centric activities and to teach good number of modules using ICT tools. It is further resolved to assign student study projects to hone the students towards research in thrust areas of the subject.

Agenda point 8: Academic activities of the Department such as seminars, fieldworks etc.

Discussion: The members who have attended the BOS meeting discussed the annual action plan prepared by the department and the activities planned. The members felt the importance of botanical tours, visits to research institutes and industries of plant based products to get an experience recent developments in the domain area.

Resolution: It is unanimously resolved to conduct one botanical tour/field trip or visit to research institute/industry in each of the two semesters of an Academic Year.




Sarala K
Prasad