

BOARD OF STUDIES IN M.Sc. BOTANY
2022-2023

DEPARTMENT OF BOTANY

SYLLABUS FOR M.Sc. BOTANY



PITHAPUR RAJAH'S GOVERNMENT COLLEGE
Autonomous and Accredited with 'A' Grade by NAAC (3.17 CGPA)
KAKINADA – 533 001, Kakinada Dist., ANDHRA PRADESH

Theory

UNIT – I

Basics of rDNA technology: Restriction enzymes: Types, Nomenclature, Mechanism of action: Methodology of rDNA molecule synthesis: Polylinkers. Vectors: Features and types: Cloning vectors - Plasmids, Viral DNA, Cosmids, Artificial chromosomes - Bacterial and Yeast artificial chromosomes (BAC's and YAC's); Expression vectors
Bacterial transformation, In-vitro packaging, Recognition 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: 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

SUGGESTED LABORATORY EXERCISES

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

SUGGESTED READINGS & TEXT BOOKS

1. Glick BR, Pasternak JJ and Patten CL. 2010. Molecular Biotechnology Principles and Applications of rDNA. ASM Press, USA.
2. Attwood TK, Smith DJP and Phukan S. 2009. Introduction to Bioinformatics. Pearson Education Ltd., UK.
3. Watson JD. 2007. Recombinant DNA: Genes and Genomes: A short course. W. H. Freeman, USA.
4. Lewin B. 2004. Genes VIII. Pearson Prentice Hall, New Jersey.
5. Balasubramanian, D. 2005. Concepts of Biotechnology New edition.
6. Old and S.B. Primrose. 2002. Principles of Gene Manipulation by Blackwell, Oxford.
7. Brown, T.A. 2002. Gene cloning – DNA Analysis – Blackwell, London.
8. Davies, J.A. and WS Reznikoff. 1992. Milestones in Biotechnology.
9. Glick and Pasternock 2002. Molecular Biotechnology, Panima
10. Mickloss, D.A. and GA Freyer 1990. DNA Science. A first Course in Recombinant Technology, Cold Spring Harbor Laboratory Press, New York.
11. Primrose, S.B. 1994. Molecular Biotechnology (2nd Edn), Blackwell Scietific Pub. Oxford.
12. Sambrook, J., E. Frisch and T. Maniatis 2000. Molecular Cloning: Laboratory manual, Cold Spring Harbor Laboratory Press New York.
13. Satyanarayana U. 2005 Biotechnology.
14. Glick BR, Pasternak JJ and Patten CL. 2010. Molecular Biotechnology Principles and Applications of rDNA. ASM Press, USA
15. Benjamin Lewin, Genes X 2004 Pearson Prentice Hall International Edition
16. Channarayappa, Molecular Biotechnology Principles and practices 2006 University
17. Chawla, H S. 2002. Introduction to Plant Biotechnology Oxford and I B H Publlishers
18. Primrose, S B and RM Twyman 2006. Principles of Genome Analysis and genomics Blackwell publishers
19. Sateesh, M K. 2008. Bioethics and Biosafety I K International

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – IV
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; Molecular evolution – Concepts of neutral evolution, molecular divergence and molecular clocks – protein and nucleotide sequence analysis; gene duplication and divergence

UNIT – II

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, Germplasm banks. Methods of breeding self and cross pollinated plants; breeding of vegetatively propagated crops; Heterosis and Hybrid Vigor – genetic basis and significance

UNIT – IV

Bio statistical 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, X² – test, ANOVA.

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

1. Allard, R.W. 1961: Principles of Plant Breeding
2. Briggs and Knowles, Introduction to Plant Breeding
3. Jones & Wilkins – Variation and adaptation in plant species. Heinemann Educational Books Ltd., London
4. James L Brew Baker, Agricultural Genetics, Foundation of Modern Genetics Series
5. Kenneth J Frey, Breeding, Univ. Press, Ames, Iowa
6. Poehiman and Borthakur, 1981. Breeding Asian field crops
7. Stebbins, J.L. – Chromosomal evolution in Higher Plants. Edward Arnold Publishers Ltd., London
8. Singh, B.D.: Plant Breeding
9. Stickberger, M.W., Genetics, Macmillan Company, New York

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – IV
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 falls and decomposition (mechanism, substrate quality and climate factors). Global biogeochemical cycles of C, N, P, S and H₂O.

UNIT – II

The role of biodiversity in Ecosystem functions and stability, speciation and extinction, IUCN categories of threat, distribution and global patterns of terrestrial bio-diversity
Air, Water and Soil pollution; kinds, 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 estimation.

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, gleization, mineralization and soil classification, soil water, soil solution). Soil organic matter or humus and soil organisms

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

1. Cunningham, W.P. & M.A.Cunningham 2007. Principles of Environmental Science Inquiry and applications. Tata Mc GrawHill Pub.New Delhi
2. Dash, M.C.2009. Fundamentals of Ecology. Tata Mc GrawHill Pub.New Delhi
3. Horpes and Row, N.Y; Batra, N.K. & Sharma, K.K. 1990. A Treatise on Plant Ecology. Pradeep Publications
4. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
5. Odum.E.P. & Gary W.Barrett. 2005. Ecology.Tomson Brooks/Cole, Singapore
6. Misra, K. C. D.N. Rao, R.S; Ambasht and Mukherjee. Ecology study of ecosystems
7. Odum, E.P. 1971. Fundamentals of Ecology (3rd Edition), Saunders & Co., Philadelphia
8. Sharma, P.D. 2001. Ecology and Environment
9. Sharma, P.D. 2nd Edition, Environmental Ecology

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – IV
PAPER CODE: 404: PLANT METABOLISM

Theory

UNIT – I

Fundamental of Enzymology: General aspects, allosteric mechanism, regulatory and active sites, isozymes, mechanism of enzyme action, kinetics of enzymatic catalysis, Michaelis Menten Equation and its significance

Signal transduction: Receptors and G protein, Phospholipid signaling, role of cyclic nucleotides, Calcium-calmodulin cascade, diversity in protein kinases and phosphatases, Two-component sensor- regulator system in bacteria and plants, source sensing mechanism

UNIT – II

Photochemistry and Photosynthesis: General concepts and historical back ground, 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 cycle, photorespiration and its significance, C4 cycle and CAM pathway, biosynthesis of starch and sucrose, physiological and ecological considerations

UNIT – III

Respiration and Lipid metabolism : Plant respiration, glycolysis, 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

UNIT – IV

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, ammonium assimilation, sulphate uptake, transport and assimilation

SUGGESTED LABORATORY EXERCISES

1. Determination of amylase activity ✓
2. Extraction and separation of chloroplast pigments by paper chromatographic method ✓
3. Determine chlorophyll a / chlorophyll b contents in C3 and C4 plants by spectrophotometric method ✓
4. Determination of catalase activity ✓
5. Demonstration of Polyphenol oxidase ✓
6. Determination of reducing sugars ✓
7. Estimation of free acids in Bryophyllum in terms of milliequivalents of NaOH
8. Extraction and estimation of seed proteins depending upon the solubility
9. SDS – PAGE for soluble proteins extracted from the given plant materials
10. Separation of amino acids and carbohydrates through two dimensional chromatographic method ✓

SUGGESTED READINGS & TEXT BOOKS

1. Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones. 2002. Biochemistry and molecular biology of Plants
2. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology
3. Frank Boyer Salisbury, Cleon Ross. Plant Physiology, 5th Edition.
4. Hess, D. 1974. Plant Physiology
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA
6. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA, 4th Edition.
7. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.
8. Lehninger, A.L. 1982. Principles of Biochemistry, Worth, New York
9. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2nd edition) Prentice hall of India Limited
10. Postgate John, R. 1975. The physiology and genetics of Nitrogen fixation, Plenum, Press, London
11. Postgate John, R. 1982. the fundamentals of Nitrogen fixation, Cambridge Univ., Press, Cambridge.
12. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th edition). Wordsworth Publishing Company, California, USA
13. Subba Rao, N.S. 1979. recent Advances in Biological Nitrogen Fixation, Pub., Oxford & IBH publishing Co., New Delhi
14. Stryer, L. 1995. Biochemistry 4th Edition, W.H. Freeman, New York
15. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2nd edition). Sinauer Associates including Publishers, Massachusetts, USA
16. Stumft, P.K. and Conn, E.E. 1980. Biochemistry of Plants. Lipids, Vol-4, Acad., Press, New York.
17. Wilkins, M.D. 1987. Advanced Plant Physiology. English Language Book Society, Longman
18. Wisthoff, P. 1998. Molecular Plant Development from Gene to Plant. Oxford University Press, Oxford, UK
19. Govindjee, ed. 1982-83. Photosynthesis. Vol. I & II. Academic Press Inc. New York
20. Dennis, D.T. D. B. Layzell, D. D. Lefebvre & D. Turpin. 1997. Plant Metabolism. 2nd Ed. Addison- Wesley Pub Co. New York.