BOARD OF STUDIES IN M.Sc BOTANY
2023-2024

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, E G Dist., ANDHRA PRADESH

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – II,
PAPER CODE: 201: GENETICS

Theory

UNIT – I

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

Allelic and gene interactions; Multiple allelism – Penetrance and expressivity – Pleiotropism, pseudo alleles, phenocopies

UNIT – II

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 of genetic and

physical maps; Sex-linked inheritance, sex-influenced and sex- limited characters

Recombination and its molecular mechanism; role of rec A, B, C, D enzymes; Holliday's model

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 - Genetics of mitochondrial and chloroplast characters; Male sterility, types and significance

SUGGESTED LABORATORY EXERCISES

1. Observation of types of chlorophyll mutants.
2. Problems in Mendelian Genetics, Gene interactions and Epistasis, Probability Laws and Chi-Square test
3. Chromosome Mapping and Tetrad Analysis

SUGGESTED READINGS & TEXT BOOKS

1. William K, Cummings S, Spencer MR and Charlotte A. 2013. Essentials of Genetics. Pearson Books, Delhi.
2. Griffiths, A.J.F., Miller, H.T., Suzuki, Lewontin, Gelbart Intd. Genetic analysis, H.F. Freeman and Co.
3. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th edition) Jones and Bartlett Publishers, Massachusetts, USA.
4. Karp, G. 1999. Cells and Molecular Biology: concepts and Experiments. Hohn Wiley & Sons Inc. USA.
5. Lewin, B. 2000. Gene VII. Oxford University Press, New York, USA.
6. Lewis, R. 1997. Human Genetics: Concepts and Applications, WCB Mc Graw Hill, USA.
7. Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition). Jones and Bartlet Publishers Inc. London.
8. Russel PJ. 2009. Genetics–A Molecular Approach. 3rd Edition. Pearson Benjamin Cummings, San Francisco, USA.
9. Snustad, D.P. and Simons, M.J., 2000. Principles of Genetics John Wiley and Sons Inc., USA.
10. Brooker R. 2008. Genetics, Analysis and Principles. 3rdedition. McGraw Hill Science.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – II,
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 and uni and bi directional 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, Arabinose and Trypoperons.

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

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

1. Alberts, B, D. Bray, J. Lewis, M. Raff, K. Roberts and J.D.Watson. 2004. Molecular Biology of the Cell Garland Publishing, New York and London
2. Fritsch, E.F. and J. Sambrook. 1992.Molecular cloning: Laboratory Manual. Maniatis, Cold Spring Harber Laboratory, New York).
3. George M. Malacinski & D.Freifeilder 2005. Essentials of Molecular Biology.
4. Schecleif, R.F. and P.C. Wensik 1991. Practical Methods in Molecular Biology Springer-Verlag.
5. Walker, J. and W. Castra. 1992. Techniques in Molecular Biology. Goom Helns, London.
6. Buchaman B.B., Gruissem, W ans Jones R.I. 2000. Biochemistry and Molecular Biology of plants: American Societies of plant physiologists, Maryland, U.S.A.
7. Gupta, P.K. 2002. Cell and Molecular Biology, 3rd Edition, Rastogi Publications, Shivaji Road, Meerut, India.
8. Glick, B.R. and Thompson J.E. 1932. Methods in Plant Molecular Biology and
9. Biotechnology, CRC Press, Boc Raton Florida.
10. Lodish, B.A, Zipursky S.L, Matsdaira P, Baltimore D. and Darnell J. 2000. Molecular Cell Biology (4th edition). W.H. Freeman & co. New York, USA.
11. Lewin B, 2000. Genes VII Oxford University Press, New York.
12. Shaw, C.H. 1998. Plant Molecular Biology. A practical approach, IRL Press, Oxford.
13. R F Weaver 1999, Molecular Biology, WCB McGraw-Hill.
14. Raghavan V. 1997. Molecular Biology of Flowering plants. Cambridge University press, New York, USA.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – II,
PAPER CODE: 203: CELL BIOLOGY OF PLANTS

Theory

UNIT – I

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. Biochemical 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, Micro bodies 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, Spectrofluorimetry, Circular Dichroism (CD).

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

1. Alberts B, Breyer D, Hopkin K, Johnson AD, Lewis J, Raff M, Roberts K and Watter P 2014. Essential Cell Biology. 4thEdition. Garland publishers, New York.
2. Sharp D, Ploppe G and Sikorski E 2014. Lewin's Cells. 3rd Edition. Viva Books, New Delhi.
3. Cooper GM, Hausman RE 2013. The Cell – A Molecular Approach. 6th Edition. Sinauer Associates, Incorporated, USA.
4. Karp G 2013. Cell and Molecular Biology – Concepts and Experiments. 7th Edition. Wiley Global Education, USA
5. McLennan A, Bates A, Turner P, White M 2013. Bios Instant Notes in Molecular Biology. 4th Edition. Garland publishers, New York.
6. Cowling G, Allen T 2011. The Cell. A very Short Introduction. Oxford University Press, USA.
7. Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walker P 2007. Molecular Biology of the Cell. 5th Edition. Garland publishers, New York.
8. Schaffer SW 2007. Mitochondria: The Dynamic Organelle. 1st Edition. Springer Verlag.
9. Wilson J, Hunt T 2007. Molecular Biology of the Cell 5th edition. The Problems Book. 2nd Edition. Garland publishers, New York.
10. Celis JE (ed) 2006. Cell Biology–A Laboratory Hand Book. 3rd Edition. Elsevier, USA.
11. 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. Freemanand Company, New York.
12. Alberts, B. Bray D. Lewis J. Ralf, M.Roberts, K. and Watson, J.D. 1999: Molecular Biology of the Cell, Garland Publishing Inc., New York.
13. De, D.N. 2000: Plant Cell Vacuoles. An Introduction. CSIRO Publication. Collingwood, Australia.
14. C.J. Avers 1986: Molecular Cell Biology. Addison Wesley Publishing Company.
15. Lodish, Berk A, Zipursky, S.L. Matsdaira P, Baltimore D and Darnell, J. 2000; Molecular Ce11 Biology (4th Edition) W.H. Freeman and Co., New York, USA.
16. Krishna Murthy, K.V. 2000: Methods in cell wall cytochemistry CPC Press, Boca Raton, Florida.
17. Kleinsmith, L.J. and Kish, V.M. 1995: Principles of Cell and Molecular Biology (2nd Edition) Harper Collins College Publishes, New York, USA.

PITHAPUR RAJAH'S GOVERNMENT COLLEGE (AUTONOMOUS), KAKINADA
M.Sc – BOTANY, SEMESTER – II,
PAPER CODE: 204: PLANT CELL, TISSUE AND ORGAN CULTURE

Theory

UNIT – I

Plant Cell and Tissue culture: Introduction, history, scope, Basic concepts of tissue culture: Tissue Culture Apparatus Tissue culture cycle, types of cultures: Embryo culture, Anther culture, Ovary culture, Callus Culture. 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-dihaploids and application in agriculture embryo rescue.

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 and its applications, Soma clonal variation and its applications.

Technique and applications of Cryopreservation and Germplasm storage.

SUGGESTED LABORATORY EXERCISES

1. General out lay of PTC laboratory
2. Preparation of media
3. Callus induction – Carrot
4. Clonal propagation through meristem cultures
5. Embryo culture – Ground nut
6. Anther culture – Datura/ Tobacco
7. Establishment of cell cultures and determination of growth pattern
8. Determination of Plating efficiencies of cell culture
9. Protoplast isolation and culture
10. Protoplast fusion
11. Observation of different developmental stages of somatic embryo in embryogenic callus
12. Artificial seed preparation

SUGGESTED READINGS & TEXT BOOKS

1. Vasil IK and Thorpe TA. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers, Dordrecht, Netherlands.
2. Kalyan Kumar De. 1997. Plant Tissue Culture. NCB Agency, Kolkata.
3. Pullaiah, T. 2009. Plant Tissue Culture. Scientific Publishers, Jodhpur.
4. Razdan, M.K. 2003. An Introduction to Plant Tissue Culture. Oxford & IBH, New Delhi
5. Bhojwani, S.S. and Razdan, M.K. 1996. Plant tissue culture: Theory and Practice (a revised edition) Elsevier Science Publishers, New York, USA
6. Bhojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier Science Publishers, New York, USA.
7. Callow, J.A. Ford-Lloyd, B.V. and Newbury, H.J. 1997. Biotechnology and Plant Genetic Resources: Conservation and use. CAB International, UK, Oxon
8. Collin, H.A. and Edwards, S. 1998. Plant Cell Culture, Bio scientific Publishers, Oxford, UK
9. Jain, S.M. Sopory, S.K. and Velleux, R.E. 1996. In Vitro Haploid production in Higher Plants, Volumes 1-5. Fundamental aspects and Methods Kluwer Publishers, Dordrechi, the Netherlands.
10. Kartha, K.K. 1985. Cryopreservation of Plant Cells and Organs CRC Press, Boca Roton, Florida, USA
11. Raghavan, V. 1986. Embryogenesis in Angiosperms: A Developmental and Experimental Study. Cambridge University Press, New York, USA
12. Raghavan, V. 1997. Molecular Biology of Flowering plants, Cambridge University press, New York, USA
13. Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers. The Netherlands