

SEMESTER – I

PAPER CODE: 19BOYY11: CRYPTOGRAMS AND GYMNASPERMS

Theory

UNIT I (ALGAE)

General account, Criteria employed in Classification. Classification given by Fritsch, Bold and Wynne. Thallus organization, reproduction and life cycles in algae. General account on structure and reproduction of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta and Cyanophyta, Economic importance of Algae.

UNIT II (BRYOPHYTES)

General account, Classification of Bryophytes, Classification, general characters, range of thallus organization and reproduction in Hepaticopsida, Anthocerotopsida and Bryopsida. Evolutionary trends in gametophytes and sporophytes of Bryophytes, Ecological and Economic importance.

UNIT - III (PTERIDOPHYTES)

General characters and classification of Pteridophytes. Salient features of Psilophytopsida, Psilotopsida, Lycopsidea, Sphenopsida and Pteropsida.

Origin and phylogeny of pteridophytes - Stellar Evolution, Heterospory and seed habit. Economic importance of Pteridophytes.

UNIT - IV (GYMNASPERMS)

General account and classification of Gymnosperms Geological periods, fossil formation and their types. General account of Pteridospermales, Bennettitales, Pentoxylales, Cordaitales. Structure and Reproduction of living Gymnosperms: Cycadales, Coniferales and Gnetales; their economic importance.

Suggested Readings & Text Books

1. Bold, H.C and Wynne.M.J. 1978. Introduction to thealgae
2. Chapman, V.J.1962. TheAlgae
3. Graham, J.E, Lee W. Wilcox &L.E.Graham 2008. Algae. 2nd ed. BenjaminCummings
4. Britsch,F.E.1945. The structure and reproduction of Algae Vols. 1& II. Cambridge University Press,London
5. Kumar, H.D.1988.IntroductoryPhycology
6. Kashyap, S. 1929. Liverworts of the Western Himalayas and Punjab Plains Part I and PartII.
7. Lewin,R.A. 1962. Physiology and Biochemistry ofAlgae
8. Morris, I 1967. An Introduction to theAlgae
9. Presscot, G.W. 1969. The Algae- areview
10. Bernard Goffinet&A. Jonathan Shaw. 2008. Bryophyte Biology. 2nd ed.Cambridge
11. Parihar, N.S. 1991.Bryophyta
12. Puri,P. 1980.Bryophytes
13. Round, E.E. 1986. The Biology ofAlgae
14. Round, E.E. 1962. Ecology ofalgae
15. Smith, G.M. 1955. Cryptogamic Botany Vol.II

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PAPER CODE: 19B0TT12: MICROBIOLOGY

Theory

UNIT – I

Introduction: Discovery and Evolution of microbiology as a discipline. A brief idea of microbial diversity. General account of Archaeobacteria, Eubacteria, Cyanobacteria, Fungi. Fungal classification and phylogeny.

Cell wall of Bacteria – Gram+ve and Gram-ve bacterial cell walls, cell wall of Fungi. Viruses: Structure, Isolation and purification of viruses, Replication and transmission of Viruses.

UNIT – II

Nutritional requirements of microorganisms: types (autotrophs and heterotrophs), requirements, uptake of nutrients and types of nutrient media. Nutrition of Fungi : Saprobic, biotrophic, and symbiotic.

Microbial growth: Principles of growth, Kinetics of growth methods of measuring growth, Batch and continuous growth, Synchronous culture and Diauxic growth.

UNIT - III

Genetics of Bacteria: An overview of genetic recombination; Mechanism of transformation, conjugation and transduction in bacteria. Lytic cycle in T even phages and lysogenic cycle in lambda phage. A brief account on virioids and prions.

Reproduction in Fungi : Vegetative, Asexual and Sexual. Heterothallism, Heterokaryosis and Parasexuality.

UNIT - IV

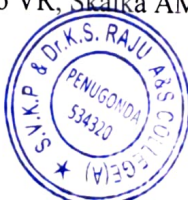
Microbial ecology, Denitrification, free living nitrogen fixation, symbiotic nitrogen fixation, plant-microbe interactions, mycorrhizae.

Basic design of a Fermentor, Biosensors, Bioremediation. Mushroom cultivation. Economic importance of Microbes.

Suggested Readings & Text Books

1. Kaursethi I and Surinder KW 2011. **Text Book of Fungi and their Allies**. Macmillan publishers, New Delhi, India.
2. Ram Reddy S & Reddy SM 2007. **Essentials of Virology**. Scientific publishers, Jodhpur, India.
3. Sharma K 2005. **Manual of Microbiology Tools and Techniques**. Ane Book, New Delhi, India.
4. Matthew RH 2004. **Plant virology**. 4th edition. Academic press an imprint of Elsevier, California, USA.
5. Prescott et al. 2003. **Microbiology**. McGraw Hill Education, New York.
6. Aneja KR 2003. **Experiments in Microbiology, Plant pathology and Biotechnology**. New Age International publishers, New Delhi.
7. Verma HN 2003. **Basics of plant Virology**. IBH publishing co. Pvt. Ltd., New Delhi.
8. Mehrotra KS and Aneja KR 2003. **An Introduction to Mycology**. New Age International Publishers, New Delhi.
9. Sullia SB and Shantharam S 2001. **General Microbiology**. Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10. Reddy SM and Ram Reddy S 2000. **Microbiology a Laboratory Manual**. BSC Publishers and Distributors, Hyderabad.
11. Flint SJ, Enquist LW, Krug RM, Racaniello VR, Skalka AM 2000. Principles of Virology

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- Rao AS 1999. **Introduction to Microbiology**. Prentice Hall of India Pvt. Ltd., Delhi.
- 12 Paul S 1995. **Bacteria in Biology**, Biotechnology and Medicine. 5th edition. John Wiley and son Ltd., UK.
13. Pelczar, Chan and Krieg 1993. **Microbiology**. 5th edition. McGraw Hill Education, New York.
14. Stainer RT, Ingraham JL, Wheelis ML and Painter PR 1987. **General Microbiology**. 5th Edition. Macmillan, London.
- Smith KM 1968. **Plant viruses**. Elsevier, New York.
15. Rangaswamy G 1962. **Bacterial Plant disease in India**. Asia Publishing House, Bombay.
- Agrios, G.N. 2005. **Plant pathology**. 5th ed. Academic press.
16. Allen T. Bull. 2004. **Microbial diversity and Bioprospecting**. ASM Press, Washington.
- Brock, T.D. & Madigan. 1991. **Biology of Microorganisms**. Prentice-Hall.
17. Dube, R.C. & D.K. Maheswari 2005. **Microbiology**. S.Chand & Co. Ltd., New Delhi.
18. Gilbert, O.L. 2000. **Lichens**. Collins New Naturalist.
19. Ainsworth, G.C. Sparrow, F.K. and Susman, A.S. 1973. **The Fungi-An advanced treatise**, Vol. I to VIB.
20. Alexopoulos, C.J. Mims, C.W. and Blackwell, M. 1996. **Introductory Mycology**, John Wiley & Sons Inc.
21. Ananthanarayanan, R. and Dayaram Panikar, C.K. 1998. **A textbook of Microbiology**, VI edition Orient Longman
22. Carpenter, 1977. **Microbiology**
23. Clifton, A. 1958. **Introduction to the Bacteria**, McGraw-Hill Book Co. New York
24. Landecker, E.M. 1972. **Fundamentals of the Fungi** Mehrota, R.S. and Aneja, R.S. 1998. **An introduction to microbiology**, Prentice Hall of India Pvt.Ltd., New Delhi.

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PAPER CODE: 19B0TT13: 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, 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, Spectrofluorimetry, Circular Dichroism (CD).

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**. 4th Edition. 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.

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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.
- Lodish, Berk A, Zipursky, S.L. Matsdaira P, Baltimore D and Darnell, J. 2000; Molecular

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PAPER CODE: 19B0TT14: 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; Chromosome banding techniques; Flow cytometry and confocal microscopy in karyotype analysis; computer assisted karyotype analysis – chromosome micro-dissection and micro-cloning

Unit II:

Chromosomal structural aberrations: Origin, meiosis and breeding behavior of duplications, deficiencies and inversions and interchanges; types of inversions. Robertsonian translocations; Basic concept of Complex translocation heterozygotes. Chromosomal numerical aberrations I – Classification of numerical aberrations; Aneuploids–Trisomics (Primary, Secondary, Tertiary), Monosomic and nullisomics – meiotic behavior and chromosome mapping

Unit III:

Chromosomal numerical aberration II: Polyploids – Origin and production of auto and allopolyploids; Meiosis in autotetraploid; Genome analysis in *Tobacco*, wheat and *Arabidopsis*. Nuclear DNA content – C-value paradox, hyperchromicity, Cot curves and significance- Molecular organization of nuclear genome

Unit IV:

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

Text Books

1. C. B. Powar. 1992. Cell Biology. Himalaya Publishers, New Delhi
2. Gupta, P.K. 1995. Cytogenetics. Rastogi & Company, Meerut
3. Swanson, Merz and Young. Cytogenetics. Prentice Hall. India
4. Sybenga, J. 1973. General Cytogenetics. North Hall and American Elsevier
5. De Robertis E.D.P and E.M.F. De Robertis. Cell and Molecular Biology 2001. CBS Publishers and Distributors

Reference Books

1. David M. Prescott. Cells. 1988. Jones and Bartlett Publ. Boston
2. Pierce BA. 2013. Genetics: A Conceptual Approach. 5th Edition. W. H. Freeman, California.
3. Darnell, Lodish and Baltimore: Molecular Biology, Scientific American Books, New York
4. Bass H and Birchler J. 2011. Plant cytogenetics: Genome structure and chromosome Function. Springer, New York

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PAPER CODE: 19BOTP15: CRYPTOGRAMS AND GYMNASPERMS

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.

Bryophytes

1. 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.

Pteridophytes

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

Gymnosperms

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

PAPER CODE: 19BOTP16: MICROBIOLOGY

Suggested Laboratory Exercises

1. Microbiological culture techniques
2. Types of media, Preparation of media and stains
3. Sterilization methods
4. Gram staining of bacteria
5. Morphological study of Stemonitis, Saprolegnia, Mucor, Morchella, Aspergillus, Agaricus, Cyathus, Synchitrium, Helminthosporium

PAPER CODE: 19BOTP17: CELL BIOLOGY OF PLANTS

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. 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.




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PAPER CODE: 19B0TP18: CYTOLOGY AND CYTOGENETICS

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.

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Semester-II

PAPER CODE-19BOTT21: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, pseudoalleles, phenocopies

Unit II:

Gene mapping methods based on test-cross and F_2 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

Text Books

1. Strickberger, Genetics, Prentice Hall
2. Lewin, B. 2008. Gene IX. Jones and Barlette publishers, London
3. Brooker R. 2008. Genetics, Analysis and Principles. 3rd edition. McGraw Hill science
4. Snustad, D.P. and Simons, M.J., 2000. Principles of Genetics John Wiley and Sons Inc., USA
5. Russel PJ. 2009. Genetics–A Molecular Approach. 3rd Edition. Pearson Benjamin Cummings, San Francisco, USA
6. William K, Cummings S, Spencer MR and Charlotte A. 2013. Essentials of Genetics. Pearson Books, Delhi
7. P.S. Verma and V.K. Agarwal, 2005. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company Ltd, New Delhi
8. Pierce BA. 2013. Genetics: A Conceptual Approach. 5th Edition. W. H. Freeman, California

Reference Books

1. Griffiths, A.J.F., Miller, H.T., Suzuki, Lewontin, Gelbart Intd. Genetic analysis, H.F. Freeman and Co.
2. Hartl, D.L. and Jones, E.W. 1998. Genetics: Principles and Analysis (4th edition) Jones and Bartlett Publishers, Massachusetts, USA
3. Lewis, R. 1997. Human Genetics: Concepts and Applications, WCB Mc Graw Hill,
4. Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition). Jones and Bartlet Publishers Inc. London

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PENUGONDA-534320, W.G.D.T.A.P

PAPER CODE:19BOTT22 MOLECULAR BIOLOGY OF PLANTS

Theory

UNIT - I

Composition and structure of Biomolecules: Carbohydrates, Lipids and Proteins (Ramachandran plot, secondary structures, 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 Tryp 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

Suggested Readings & Text Books

1. Alberts B, D. R. 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 Harbor 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 and Jones R.I. 2000. *Biochemistry and Molecular Biology of Plants: American Societies of plant Physiologists*, Maryland USA
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. 1992. *Methods in Plant Molecular Biology and Biotechnology*, CRC Press, Boc Raton Florida.
9. 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.
10. Lewin B, 2000. *Genes VII* Oxford University Press, New York.
11. R F Weaver 1999, *Molecular Biology*, WCB McGraw-Hill.
12. Shaw, C.H. 1998. *Plant Molecular Biology. A practical approach*, IRL Press, Oxford.
13. Raghavan V. 1997. **Molecular Biology of Flowering plants**. Cambridge University press, New York, USA.

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PAPER CODE: 19BOTT23: PLANT DEVELOPMENTAL BIOLOGY AND EMBRYOLOGY

Unit I:

Introduction- comparison of Plant and animal development, Plant Cell Division and Expansion, Plant cell cycle- Endoreduplication and control of plant cell size, Plant Architecture, Theories of Organization of meristems; Root growth and Development: Root apical meristem (RAM); Tissue Differentiation, Root hair and Lateral roots formation.

Unit II:

Stem growth and development: organization of the shoot apex; cytological and molecular analysis of shoot apical meristems. Leaf and flower development: Development of leaf and Phyllotaxy, specialized cells and tissue differentiation. Development and Anatomy of flower, including transition to Flowering and reproductive shoot apex.

Unit III:

Reproduction and Flower: Vegetative options and reproduction; Genes controlling floral organ Differentiation. Male Gametophyte: Structure of Anther, Microsporogenesis, Role of Tapetum; Pollen development, Pollen germination, Pollen tube growth and Guidance; Pollen storage. Female Gametophyte: Ovule- Structure and development; Megasporogenesis; Development and Organization of the mature Embryo sac; Structure of the Embryo sac cells; Embryo sac haustoria.

Unit IV:

Fertilization, Seed and Fruit Development: Pollination mechanisms and Vectors; Structure of the Pistil; Pollen- Stigma Interactions, Sporophytic and Gametophytic Self-Incompatibility; Double Fertilization. Endosperm development; Types of Endosperm; Functions; Embryogenesis-Dicot types; Monocot embryo; Polyembryony; Apomixis; Parthenocarpy, Dynamics of Fruit growth and Seed Development. Outlines of Experimental Embryology.

Text Books:

1. Pullai, T., Naidu, K. C., Lakshminarayana, K. & Hanumantha Rao, B. 2007. Plant Development. Regency Publications, New Delhi.
2. Fahn, A. 1982. Plant Anatomy (3rdEd.), Pergamon Press, Oxford.
3. Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development, Prentice Hall, New Jersey.
4. Bhojwani, S. S. and Bhatnagar, S.P. 2000. The embryology of Angiosperms (4th Revised and Enlarged Ed.). Vikas Publishing House, New Delhi.
5. Pullaiah, T. Lakshminarayana, K. & Hanumantha Rao, B. 2008. plant reproduction. Scientific publishers, Jodhpur.

Reference Books:

1. Biochemistry & Molecular Biology of Plants by Bob Buchanan, Gruissen W and Jones RL
2. Howell, S.H. 1998. Molecular Genetics of Plant Development, Cambridge Univ. Press, Cambridge.
3. The plant cell. Special issue on Reproductive Biology of Plants, Vol. 5. 1993. The American Society of plant physiologist, Rockville, Maryland, USA.
4. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology, A Laboratory Manual. Springer-Verlag, Berlin

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PAPER CODE: 19B0TT24: MOLECULAR PLANT PATHOLOGY

Theory

UNIT-I

An overview on plant diseases. A brief history, terminology involved. Flor's hypothesis, Koch postulates. Causal agents- Bacteria, Viruses, Fungi, phytoplasmas.

Colonization of pathogen in host – Different stages: Inoculum, Penetration, infection, invasion, Reproduction, Spread and survival of pathogens.

UNIT-II

Plant Defense mechanisms: performed, induced, biochemical and physiological responses. Host-pathogen interactions, disease signaling, pathogen recognition and signal transduction. Physiological changes in diseased plants.

Molecular determinants of pathogenicity, virulence, effectors, elicitors, defensins, phytoalexins, common phenolics, plant cell wall degrading enzymes, host specific toxins, host non-specific toxins, hormones and their role in cell signaling and immunity.

UNIT-III

Symptoms, etiology, epidemiology and control measures of certain plant diseases: Citrus canker, Bacterial leaf blight of rice, Angular leaf spot of cotton, Grassy shoot disease of sugarcane, Little leaf of Brinjal, Rice tungro, Club root of Crucifers, Damping off of seedlings, Whip smut of Sugarcane, Coffee rust, Bean rust, Wilt of Cotton, Leaf spot of Turmeric.

UNIT-IV

Plant Disease management: Plant Quarantine, Cultural practices, Chemical control, Biological control, Integrated Pest Management (IPM). Plant Disease resistance, classes of resistance genes. Transgenic and genetic manipulation approaches, molecular marker to tag disease resistance and avirulence genes. Use of databases and application of bioinformatics in plant pathology.

Suggested Readings & Text Books

01. Agrios GN 2001. **Plant Pathology**. Academic Press, London.
02. Richard N Strange 2003. **Introduction to Plant Pathology**. Springer.
03. Lucas 2001. **Host Pathogen Interactions**. Blackwell.
04. Bilgrami KS and Dube HC 2000. **A Text Book of Modern Plant Pathology**. Vikas Publications, New Delhi.
05. Rangaswami G 1988. **Disease of Crop Plants in India**. Prentice-Hall of India.
06. Wood RKS 1967. **Physiological Plant Pathology**.
07. Kelman A 1967. **Source Book of Laboratory Exercise in Plant Pathology**.
08. Mehrotra RS 1994. **Plant Pathology**.
09. Mukerji KG and Garg KL 1993. **Bio-control of Plant Diseases**. Vol.I&II CBS Publishers and Distributors Delhi.
10. Butler EJ 1973. **Fungi and Diseases in Plants**.
11. Roberts RR and Booth Royd LR 1972. **Fundamentals of Plant Pathology**.



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PAPER CODE: 19B0TP25: GENETICS

Suggested Laboratory Exercises

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

PAPER CODE: 19B0TP26: MOLECULAR BIOLOGY OF PLANTS

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
6. Diagrams/Photographs display related to all units

PAPER CODE: 19B0TP27: PLANT DEVELOPMENTAL BIOLOGY AND EMBRYOLOGY

Suggested Laboratory Exercises

Plant Development

1. Representative types of roots -Diarch, Triarch, and Polyarch types — transverse sections with double staining, ex. *Vicia*, *Ficus*, *Tinospora* (aerial root), *Vanda* (velamen root).
2. Types of Stems: For transverse sections with double staining methods — showing Primary and Abnormal Secondary Growth. Ex. *Aristolochia*, *Bignonia*, *Amaranthus*, *Achyranthus*, *Boerhaavia*, *Dracaena*.
3. Maceration of wood: For observation of Individual Xylem elements with single staining.
4. Leaf types: Dorsiventral leaf, Isobilateral leaf, Xeromorphic leaves - *Nerium*, *Casuarina*, *Ficus* leaves, *Nymphaea*, leaves. *Sorghum* and *Saccharum* leaves for C4 anatomy.

Plant Reproduction

1. Examination of Modes of Anther Dehiscence and collection of Pollen grains for microscopic examination (Maize, Grasses, *Cannabis sativa*, *Crotalaria*, *Tradescantia*, *Brassica*, *Petunia*, *Solanum melongena* etc).
2. Tests for Pollen Viability using stains and in vitro Germination. Pollen Germination using Hanging drop and Sitting drop cultures, Suspension culture and Surface culture.
3. Estimation of Percentage and Average Pollen tube Growth *in vitro*.
4. Field study of several types of flowers with different pollination mechanisms (Wind Pollination, Thrips pollination, Bee / Butterfly Pollination, Bird Pollination).
5. Study of Nuclear and Cellular endosperm through dissections and staining.
6. Isolation of Zygotic Globular, Heart-shaped, Torpedo stage and mature embryos from suitable seeds.
7. Polyembryony in Citrus, Jamun (*Syzygium cumini*) etc. by Dissections.

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PAPER CODE: 19BOTP28: MOLECULAR PLANT PATHOLOGY

Suggested Laboratory Exercises:

1. Acquaintance with general techniques used in phytopathological work.
2. Study of symptoms, microscopic examination of diseased parts and identification of the pathogens involved in different plant diseases included in the theory part of syllabus.
3. Isolation and Identification of pathogens

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SEMESTER – III

PAPER CODE:19 BOTT31: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCE UTILIZATION

Theory

Taxonomy of Angiosperms

UNIT-I

Taxonomic hierarchy, species, genus, family and other categories; Principles used in assessing relationship delimitation(Delete) of taxa and attribution of rank; Species concepts Nomenclature and ICN Rules

UNIT - II

Systems of angiosperm classification: Phenetic versus phylogenetic system in Chronological order; Cladistics in taxonomy; relative merits and demerits of major systems of classification Takhtajan, Cronquist, Thorne and Dahlgren, APG system-IV

UNIT – III

Brief analysis of evolutionary tendencies: Ranales (Magnoliaceae, Nymphaeaceae), Rosales (Fabaceae, Apiaceae), Centrospermae(Caryophyllaceae, Nyctaginaceae) Tubiflorae (Asteraceae, Lamiaceae) Amentiferae (Casuarinaceae,), Helobiales (Najadaceae, Anismataceae), Liliflorae (Liliaceae, Amaryllidaceae), Glumiflorae(Poaceae, Cyperaceae).

Modern trends in Taxonomy: Embryology, Palynology, Microanatomy, Cytology, and Phytochemistry.

Plant Resources Utilization and Diversity

UNIT - IV

Origin, Evolution, Botany and uses of

- | | | | |
|----|------------------------------|---|---|
| 1. | Food Crops | : | Rice, Sugarcane, Maize |
| 2. | Pulses | : | Red gram, Black gram |
| 3. | Fibre Crops | : | Cotton, Sunhemp, Flax |
| 4. | Medicinal and aromatic crops | : | <i>Catheranthus</i> , <i>Withania</i> , <i>Cymbopogon</i> |
| 5. | Oil yielding crops | : | Groundnut, Castor, <i>Brassica</i> |

Suggested Readings & Text Books

Taxonomy of Angiosperms

1. Cole, A.J. 1969. Numerical Taxonomy, Academic Pree, London
2. Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. Robert E Kreiger Pub Co New York
3. Harrison, H.J. 1971. New concepts in Flowering Plant Taxonomy, Hieman Educational Books Ltd., London
4. Simpson MG. 2006. **Plant Systematics**. Elsevier Academic Press, California, USA
5. Heywood, V.H. and Moore, D.M. 1984. Current concepts in Plant Taxonomy, Academic Press, London
6. Nordenstam BEI, Lazily G and Kassas M. 2000. **Plant systematic for 2nd Century**. Portland Press Ltd., London.
7. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2 nd Edition) McGraw Hill Book Co., New York
8. Angiosperm Phylogeny Group website. 2012. consult www.apgweb.
9. Heywood, V.H., RK Brummitt, A. Culham, O. Seberg 2007. *Flowering Plant Families of the World*. Firefly books Ltd. New York.
10. Judd, W.S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Chrispeels, M.J. and Sadava, D. 1977. *Plants, Food and People*. W.H. Freeman and Co., San Francisco



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PLANT RESOURCE UTILIZATION AND DIVERSITY

1. Cinway, G. 1999. The Doubly Green Revolution. Food for All in the 21st Century, Penguin Books.
2. Council of Scientific & Industrial Research 1986. The useful plants of India. Publications and Information Directorate. CSIR, New Delhi
3. Council of scientific and industrial research (1948-1976). The wealth of India. A dictionary of Indian Raw materials and industrial products, New Delhi, Raw materials I-XII revised Vol.I-III (1985-1992) supplement (2000)
4. Pinstrip – Anderson P et al. 1999. World Food Prospects: Critical Issues for the early 21st Century. International food policy Research Institute, Washington, DC, USA
5. Paroda, R.S. and Arora, R.K. 1991. Plant Genetic Resources Conservation and Management. IPGRI (Publication) South Asia Office, C/o. NBPGR Pusa Campus, New Delhi

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PAPER CODE:19BOTT 32: *IN VITRO* PLANT BIOLOGY

Theory

Unit I:

Plant Tissue Culture: Historical developments and landmarks in plant tissue culture, Basic concepts in plant tissue culture, Concept of totipotency. Molecular basis of totipotency, Formulation of media for plant tissue culture, Plant growth regulators – Involvement in differentiation and morphogenesis, Methods of Sterilization, Inoculation, Incubation and hardening.

Unit II:

Fundamental aspects of Morphogenesis, Organogenesis – process, inducing factors, molecular basis of Organogenesis; Somatic Embryogenesis – Induction, Controlling factors, cytological and molecular changes; Production of haploids and its Significance in Crop improvement (Androgenic and Gynogenic haploid production) Double haploids and its applications in agriculture, embryo rescue.

Unit III:

Cell Culture and Cell cloning – Isolation of cells, preparation of pure culture, cell cloning techniques and its applications, plating efficiency. Secondary metabolite production through Cell and Organ cultures-Hairy roots,

Somatic hybridization: Protoplast isolation, Fusion and culture, Hybrid selection and characterization of hybrids, Symmetric, Asymmetric hybrids and Cybrids, significant achievements and limitations of Protoplast research.

Unit IV:

Applications of Plant Tissue culture: Modes, stages and Application of Micro propagation, synthetic seeds production and uses, Origin, Molecular basis and application of Somaclonal variation, Cryopreservation methods and *in vitro* conservation of Germplasm.

Text Books:

1. Kalyan Kumar De. 1997. *Plant Tissue Culture*. NCB Agency, Kolkata.
2. Razdan, M.K. 2003. *An Introduction to Plant Tissue Culture*. Oxford & IBH, New Delhi.
3. Bhojwani, S.S. and Razdan, M.K. 1996. *Plant tissue culture: Theory and Practice* (a revised edition) Elsevier Science Publishers, New York, USA.

Reference Books:

1. Vasil IK and Thorpe TA. 1994. *Plant Cell Tissue Culture*. Kluwer Academic Publishers, Dordrecht, Netherlands.
2. Callow, J.A. Ford-Lloyd, B.V. and Newbury, H.J. 1997. *Biotechnology and Plant Genetic Resources: Conservation and use*. CAB International, UK, Oxon.
3. Collin, H.A. and Edwards, S. 1998. *Plant Cell Culture*, Bioscientific Publishers, Oxford, UK.

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Theory

PAPER CODE BOTT33: ECOLOGY AND PHYTOGEOGRAPHY

Unit I:

Ecology – Concepts and levels of organization. Population Ecology: Population structure, characteristics of population; population density, Natality, Mortality, Age distribution, Biotic potential, Population growth forms and curves. Population fluctuation and population dispersal. Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, prey – predator, parasitism, symbiosis

Unit II

Community ecology: Methods of study of plant communities, qualitative study of plants communities. Stratification of Life forms and physiognomy; normal biological spectrum. Quantitative study of plant communities, distribution pattern frequency, density, canopy, basal area and cover. Synthetic characters of Community: Similarity Index, Simpson Index; clemensian classification of communities

Unit III

Ecosystem organization: Structure and functions; primary production (methods of measurement, global pattern, controlling factors); energy dynamics (trophic organization, energy flow pathways, ecological efficiencies); Litter fall and decomposition; comparative account of nutrient cycles- C, N, P, S and H₂O; Homeostasis and self regulation

Unit IV

Phytogeography: Basic Principles, Age and Area Theory, Good's Principles. Phytogeographical regions of the world, biogeography theory, continental drift, continuous and discontinuous distribution, endemic distribution - floristic regions of India. Major Biomes of the World; Forest types of Andhra Pradesh.

Text Books

1. Odum, E.P. 1983. Basic Ecology. Saunders, Philadelphia
2. Odum, E.P. & Gary W. Barrett. 2005. Ecology. Tomson Brooks/Cole, Singapore
3. Sharma, P.D. 2016. Ecology and Environment, Rastogi Publications, Meerut
4. Kormondy, E.J. 1996. Concepts of Ecology. Prentice-Hall of India Pvt. Ltd. New Delhi
5. Purohit, S.S. and Ashok Agrawal. 2007. Ecology and Environmental Biology, Student Edition, Jodhpur
6. Russell, P.J., Wolfe, S.L., Hertz, P.E., Starr, C. and McMillion B. 2008. Ecology, Cengage Learning India Pvt. Ltd., New Delhi
7. Ambasht, R.S. and Ambasht, N.K. 1999. A text book of Ecology. CBS Pub. & Distr. New Delhi.

Reference Books

1. Campman, J.L. and Reiss, M.J. 1988. Ecology. Principles and Applications, Cambridge University Press, U.K
2. Krebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA
3. Moore, P.W. and Chapman, S.B. 1986. Methods in Plant Ecology Blackwell Scientific Publication
4. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill. Boston
5. Ricklefs, R.E. & Gary L. Miller. 2000. Ecology. 4th ed. W.H. Freeman and Company. New York

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Theory

Unit-I

Plant water Relations: Thermodynamic concepts of plant water relations, free energy and chemical, osmotic and water potential, active and passive absorption of water, stomatal physiology and stomatal opening and closing, Soil-plant-atmosphere-continuum concept (SPAC) and mechanism of water transport

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, Hydroponics; root microbe interactions in facilitating nutrient uptake and mechanism of assimilation

UNIT - II

The physiology of flowering: Phytochrome structure, photochemical and biochemical properties and role in photomorphogenesis, photoperiodism and its significance, mechanisms of floral induction, role of vernalization, morphological, biochemical and metabolic changes accompanying seed germination, causes and methods of breaking seed dormancy

UNIT - III

Plant growth regulators and Elicitors: Biosynthesis, physiological effects and mechanism of action auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, polyamines, jasmonic acid and salicylic acid, role in agri-horticulture, and hormone receptors

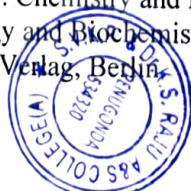
UNIT - IV

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

Suggested Readings & Text Books

1. Sinha SK 2014. **A text book of Plant Physiology**. Centrum Press, New Delhi.
2. Seema Yadav 2014. **Plant Physiology**. SBW publishers, New Delhi.
3. Heribert H and Kazuo S (eds) 2010. **Plant responses to abiotic stress. Series Topics in Current Genetics, Vol 4**. Springer, Berlin.
4. Philip Stewart and Schine Gobig 2011. **Plant Physiology**. CRC Press.
5. Moore TC. 2011. **Biochemistry and Physiology of Plant Hormones**. Springer, New York.
6. Mohr H and Schopfer P. 1995. **Plant Physiology**. Springer-Verlag, New York.
7. Witham FH and Devlin RM. 1986. **Plant Physiology**. CBS Publishers and Distributors, Bangalore.
8. Wilkins MD. 1987. **Advanced Plant Physiology**. English Language Book Society, Longman Scientific and Technical, Harlow, UK.
9. Ting IP. 1982. **Plant Physiology**. Addison-Wesley, Reading, MA.
10. Murthy HNK. 1981. **Plant growth substances including applications in Agriculture**. Tata McGraw Hill Publishing Company Ltd., New Delhi.
11. Kramer PM and Kozlowski TT. 1980. **Physiology of Woody Plants**. Academic Press, New York.
12. Hillman WS. 1963. **Physiology of Flowering**. Holt, Reinhart and Winston, New York. Kocchar and Gujral. 2012. **Comprehensive Plant Physiology**. McMillan Pub
13. Salisbury F. B. & C. W. Ross 1992 *Plant Physiology*. 4 th Edn. Wadsworth Publishing Co., Belmont,
14. Wiltmer, C.M. & M. Fricker. 1996. *Stomata*. 2nd Ed. Chapman Hall. U. K.
15. Audus, L.J. 1972. *Plant Growth Substances*, Volume 1. Chemistry and Physiology. Leonard
16. Hill, UK. Bewley, J.D. and Black, M. 1982. *Physiology and Biochemistry of seed in relation to germination and dormancy*. Volume 1 & 2, Springer – Verlag, Berlin.

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17. Devlin, R.M. and Witham, F.H. 1986. Plant Physiology
18. Davies, P.J. (Ed) 1987. Plant hormones and their role in Plant Growth and Development. Mertinus Nijhoff Publishers, The Netherlands
19. Epstein, E. 1972. Mineral nutrition of plants, Principles and prospectus, John Willey & Sons, INC, New York
20. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (Eds.) 1999. Biochemistry and Molecular Biology of Plant Hormones, Elsevier, Amsterdam, The Netherlands
21. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including New York, USA
22. Hopkins, W.G. 2009. Introduction to Plant Physiology. John Wiley & Sons Including New York, US, 4 Edition.
23. Konrad Mengel, Ernest A. Kirkby, Harald Kosegarten, Thomas Appel. Principles of Plant Nutrition, 5 Edition
24. Khan, A.A. 1982. The Physiology and Biochemistry of Seed Development, Dormancy and Germination. Elsevier, Amsterdam, The Netherlands
25. H.N. Krishna Murthy. 1981. Plant growth substances including applications in Agriculture. Tata McGraw – Hill Publishing Company Ltd
26. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley Publishing Company.
27. Leopold, A.C. 1964. Plant growth and development. Mc Graw Hill Book Company, Inc, New York.
28. Meyer, A.M. and A. Poljakoff Mayber. 1975. The germination of Seeds
29. Noggle, G.R. and G.J. Fritz. 1991. Introductory plant physiology (2 edition) Prentice hall of India Limited
30. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology
31. Slayter, R.O. 1967. Plant Water Relationships. Academic Press, New York
32. Sutcliffe, J.F. 1962. Mineral salts absorption in plants, Bergamen, Press, Oxford, London
33. Taiz, L. and Zeiger, E. 1998. Plant Physiology (2 edition). Sinauer Associates including Publishers, Massachusetts, USA

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**PAPER CODE: BOTP 35: TAXONOMY OF ANGIOSPERMS AND PLANT
RESOURCE UTILIZATION**

Suggested Laboratory Exercises

Taxonomy of Angiosperms & Plant Resources Utilization and Diversity

1. Description of a Taxa /Species from representative and locally available families
2. Description of various species of a genus: Preparation of key character at genus level
3. Preparation of key characters and use of keys at family level
4. Field trips: Compilation of field notes and preparation of herbarium wild or cultivated
5. Training in using floras and herbaria for identification of specimens wild and cultivated
6. Taxonomic description of the following cultivated Crops
 1. Food crops : Rice, Maize
 2. Pluses : Red gram, Black gram
 3. Fiber crops : Cotton, Sunhemp
 4. Oil yielding : Groundnut, Castor, *Brassica*
 5. Medicinal & Aromatic : *Catheranthus*, *Eucalyptus*

PAPER CODE: BOTP 36: IN VITRO PLANT BIOLOGY

Suggested Laboratory Exercises

1. General out lay of PTC laboratory
2. Preparation of Stock solutions and Media.
3. Callus induction – Carrot
4. Direct organogenesis and somatic embryogenesis from Tobacco explants.
5. Androgenesis and production of haploids from *Datura* flower buds.
6. Embryo culture – Ground nut
7. Establishment of Cell cultures and determination of plating efficiency.
8. Enzymatic isolation and culture of protoplasts.
9. Fusion of protoplasts using PEG.
10. Clonal propagation through meristem culture
11. Preparation of synthetic seeds using sodium alginate.

PAPER CODE 3BOTP7: ECOLOGY AND PHYTOGEOGRAPHY

Suggested Laboratory Exercises

1. Study of vegetation in the local forest
2. To classify the vegetation into different life forms and prepare a biological spectrum
3. To determine the minimal size and number of quadrates required for quantitative study of the plant community
4. Quantitative analysis of vegetation: relative frequency, density, relativedensity, basal area and IVI
5. Ecological adaptations of plants: hydrophytes, xerophytes and succulents

PAPER CODE: BOTP38: PLANT PHYSIOLOGY

Suggested Laboratory Exercises

1. Effects of high and low temperatures on the permeability of the cytoplasmic membranes
2. Determination of suction force in transpiration
3. Stomatal frequency and Stomatal index of leaves
4. Rate of transpiration in leaves by Cobalt chloride paper method
5. Mechanism of opening and closing of stomata



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SEMESTER – IV
PAPER CODE:19BOTT 41: GENETIC ENGINEERING OF PLANTS AND MICROBES

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(BACs and YACs); 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 Biopesticides, Biofertilizers and Antibiotics

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

Suggested Readings & Text Books

1. Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principles and**
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 SBPrimrose 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
Mickloss, D.A. and GA Freyer 1990. *DNA Science. A first Course in Recombinant Technology*,
10. Cold Spring Harbor Laboratory Press, New York
11. Primrose, S.B. 1994. *Molecular Biotechnology* (2nd Edn), Blackwell Scietific Pub. Oxford.

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Sambrook, J., E. Fritsch and T. Maniatis 2000. *Molecular Cloning: Laboratory manual*, Cold

12. 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 Publishers
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

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PAPER CODE:19BOTT 42: EVOLUTION AND PLANT BREEDING

Theory

Unit I:

Origin of cells and unicellular evolution; Origin of basic biological molecules; Abiotic synthesis of organic monomers and polymers; Concept of Oparin and Haldane; Experiment of Miller (1953); The first cell; Evolution of prokaryotes; Origin of eukaryotic cells.
Theories of Evolution: Lamarckism, Darwinism, Natural Selection, Mutation theory, modern synthetic theory, Polygenic inheritance, heritability and its measurements.

Unit II:

The Mechanisms: Population Genetics – Populations, Gene pool, Gene frequency; Hardy-Weinberg Law; concepts and rate of change in gene frequency through natural selection, migration and random genetic drift; Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Sexual selection; Co-evolution.

Unit III:

Molecular Evolution: Concepts of neutral evolution, molecular divergence and molecular clocks; Molecular tools in phylogeny, classification and identification; Protein and nucleotide sequence analysis; origin of new genes and proteins; Gene duplication and divergence.
Plant breeding: Introduction and scope, Pure line selection - Mass selection, pedigree method, Bulk method, Back cross method and Clonal selection and hybridization, Heterosis and Hybrid Vigor.

Unit IV:

BioStatistical Methods: Measures of central tendency and dispersal; probability distributions (Binomial, Poisson and normal); Sampling distribution; Difference between parametric and non-parametric statistics; Confidence Interval; Errors; Levels of significance; Regression and Correlation; t-test; Analysis of variance; χ^2 test; Basic introduction to Multivariate statistics.

Text Books:

1. Organic Evolution, Veer Bala Rastogi
2. Singh, B.D.: Plant Breeding
3. Genetics M.W. Stickberger, Macmillan Company, New York

Reference Books:

1. Alalrd, R.W. 1961: Principles of Plant Breeding
2. Jones & Wilkins – Variation and adaptation in plant species. Heinemann Educational Books Ltd., Londoan
3. Stebbins, J.L. – Chromosomal evolution in Higher Plants. Edward Arnold Publishers Ltd., London.

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PAPER CODE:19BOTT 43: ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

Theory

Unit I

Ecosystem stability: Concept (resistance and resilience) ecological perturbations (Material and anthropogenic) and their impact on plants and ecosystems
Environmental impact assessments. Ecosystem restoration
Climate: Koppen – Thorntwait's classification of climate
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)

Unit II

Composition of soil. Factors affecting soil formation and soil profile (Laterization podsolization, gleixation, mineralization and soil classification, soil water, soil solution). Soil organic matter or humus and soil organisms, Soil types of India and Andhra Pradesh
Pollution: Air, Water and Soil, kinds, sources, quality parameters, effects on plants and ecosystems.
Plant Biodiversity: Concept, levels of biodiversity, Magnitude and distribution, Mega diversity centers, Status of BD in India.

Unit III

The role of biodiversity in Ecosystem functions and stability, speciation and extinction, global patterns of terrestrial bio-diversity
Hotspots, Keystone species, Umbrella and Indicator species.
Threats to Biodiversity, Utilization and concerns, IUCN categories of threat.
World Centers of primary diversity of domesticated plants. The Indo Burmese Centre, plant introduction and secondary centers. Concept of land races

Unit IV

Principles of Conservation: Strategies for conservation, *in situ* conservation, protected areas network, Biosphere reserves, wetlands, mangroves strategies for conservation – *ex situ* conservation. Principles and practices. Botanical gardens, BSI, ICAR and CSIR.
Remote Sensing Applications in biodiversity conservation: Remote sensing-Concept, Principles, Applications and Role in study and Identification of Phyto Diversity and Natural Resources using GIS.
Sustainable development: concept and strategies; SD goals (SDGs/Millennium Development Goals)

Text Books

1. Mahua Basu and S. Xavier 2017. Fundamental of Environmental Studies. Cambridge publishers
2. Dr. D.K Singh 2006. Environmental Science. S. Chand publish
3. Sharma, P.D. 2016. Ecology and Environment, Rastogi Publications, Meerut
4. Purohit, S.S. and Ashok Agrawal. 2007. Ecology and Environmental Biology, Student Edition, Jodhpur
5. Russell, P.J., Wolfe, S.L., Hertz, P.E., Starr, C. and Mc Million B. 2008. Ecology, Cengage Learning India Pvt. Ltd., New Delhi
6. Odum.E.P. & Gary W.Barrett. 2005. *Ecology*. Tomson Brooks/Cole, Singapore
7. Erach Barucha 2002. Biodiversity of India. Mapin publishing in association with TATA Power company Pvt. Ltd



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PAPER CODE: 19B0TP45: GENETIC ENGINEERING OF PLANTS AND MICROBES

Suggested Laboratory Exercises

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

PAPER CODE: 19BOTP46: EVOLUTION AND PLANT BREEDING
Suggested Laboratory Exercises:

1. Assignment containing problems on topics mentioned in the theory syllabus.
2. Floral biology
3. Pollination mechanisms
4. Vegetative propagation techniques
 - a) Cutting b) Layering c) Budding d) Grafting
5. Breeding techniques of Rice, Maize, Sorghum, Bajra, Brassica, Chilli and Solanum

PAPER CODE: 19BOTP47: ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

Suggested Laboratory Exercises

1. Ombrotherms and Climatograms
2. Analyses of water and soil physico-chemical characteristics
3. Estimation of Chlorophyll content in control and polluted sites
4. Determination of plant diversity among different forest areas studied
5. Assignments on Biodiversity
6. To estimate rate of Carbon dioxide evolution from different soils using soda lime or alkali absorption method
7. 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

PAPER CODE: 19BOTP48: PLANT METABOLISM

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

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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

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