SEMESTER – I

PAPER CODE: 23BOTT11: CRYPTOGAMS AND GYMNOSPERMS

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, Economic importance of Algae.

UNIT -II

General account on structure and reproduction of Chlorophyta, Charophyta, Xanthophyta, Bacillariophyta, Phaeophyta, Rhodophyta and;YU.

UNIT III (BRYOPHYTES)

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

UNIT - IV (PTERIDOPHYTES)

General characters and classification of Pteridophytes. Salient features of Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida.
Origin and phylogeny of pteridophytes - Stelar Evolution, Heterospory and seed habit.Economic importance of Pteridophytes.

UNIT - V (GYMNOSPERMS)

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 Wyne.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. BejaminCummings
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

16. Chopra, R.N. &P.K.Kumar, 1988. Biology of Bryophytes.WileyEastern.
17. Arnold, C.A. 1974. An introduction to Paleobotany, NewYork
18. Agashe, S.N. 1995. Palaeobotany.Oxford & IBH, NewDelhi.
19. Bhatnagar, S.P. &AlokMitra 1997. Gymnosperms.New Age Int. (P)Ltd.
20. Charles C. Beck and Charles B. Beck (Ed.). 1988. Origin and Evolution of Gymnosperms. CUP.
21. Kramer, K.U., P. S. Green & Erich Gvtz. 2008. Pteridophytes andGymnosperms.Springer.
22. Sambamurty AVSS. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. Ik International PvtLtd.
23. Vashista, P.C. 2005. Gymnosperms.S. Chand & Co, NewDelhi.
24. Vashista, P.C. 2005. Pteridophyta. Rev. ed. By Sinha&Anil, S. Chand & Co, NewDelhi.
25. Saxena P and Pathak C. 2012. A Text Book of Pteridophyta., Wisdom Press, NewDelhi.
26. Chamberlain, C.J. 1935. Gymnosperms structure and evolution, University of ChicagoPress
27. Coulter, J.M. and Chamberlain, C.J. Morphology of Gymnosperms, Central Book Depot, Allahabad
28. Evans, A.J. 1936. Morphology of Vascular Plants (Lower groups) McGraw Hill Book Company, NewYork
29. Maheswari, P. and Vasil, V. Genetum CSIR (Monographs)
30. Parihar, N.S. 1996. Biology and Morphology of Pteridophytes, Central Book Depot, Allahabad
31. Sporne, K.R. 1962. The Morphology of Pteridophytes, Hutchinson UniversityLibrary

PAPER CODE: 23B0TT12: MICROBIOLOGY

Theory

UNIT – I

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

Cell wall of Bacteria – Gram+ve and Gram-ve bacterial cell walls, cell wall of Fungi.

UNIT –II

Viruses: Structure, Isolation and purification of viruses, Replication and transmission of Viruses.

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

UNIT – III

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

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 viriods and prions.

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UNIT - IV

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

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

UNIT- V.

Economic importence of Bacteria. Fungi in Industry,Medicine,Food&Pest management, Mushroom cultivation. Fungal diseases in plants &Humans

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, NewYork.

6. Aneja KR 2003. **Experiments in Microbiology, Plant pathology and Biotechnology**. New Age International publishers, NewDelhi.

7. Verma HN 2003. **Basics of plant Virology**. IBH publishing co. Pvt. Ltd., NewDelhi.

8. Mehrotra KS and Aneja KR 2003. **An Introduction to Mycology**. New Age International Publishers, NewDelhi.

9. Sullia SB and Shantharam S 2001. **General Microbiology**. Oxford and IBH publishing Co. Pvt. Ltd, NewDelhi.

10. Reddy SM and Ram Reddy S 2000. **Microbiology a Laboratory Manual**. BSC Publishers and Distributors,Hyderabad.

11. Flint SJ, Equist LW, Krug RM, Racaniello VR, Skalka AM 2000. Principles ofVirology Molecular Biology, Pathogenesis and Control. ASM press, WashingtonD.C
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 Wileyand 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, NewYork.
14. Rangaswamy G 1962. **Bacterial Plant disease in India**. Asia Publishing House,Bombay.
Agrios, G.N. 2005. **Plant pathology**. 5th ed. Academicpress.
15. Allen T. Bull.2004. **Microbial diversity and Bioprospecting**. ASM Press,Washington.
Brock, T.D. & Madigan. 1991. **Biology of Microorganisms**.Prentice-Hall.
16. Dube, R.C. & D.K.Maheswari 2005. **Microbiology**. S.Chand & Co. Ltd., NewDelhi.
17. Gilbert, O.L.2000. **Lichens**. Collins NewNaturalist.
18. Ainsworth, G.C. Sparrow, F.K. and Susman, A.S. 1973. **The Fungi-An advancestreatise**, Vol. I toVIB.
19. Alexopoulus, C.J. Mims, C.W. and Blackwel, M. 1996. **Introductory Mycology**, John Wiley & SonsInc.
20. Ananthanarayanan, R. and Dayaram Panikar, C.K. 1998. **A textbook of Microbiology**,VI edition OrientLongman
21. Carpenter, 1977.Microbiology
22. Clifton, A. 1958. **Introduction to the Bacteria**, McGraw-Hill Book Co. NewYork
23. 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.

PAPER CODE: 23B0TT13: 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.

UNIT – II
Non- covalent interactions in relation to function of Nucleic acids and Proteins. Biochemical energetics **:** Laws of thermodynamics as applicable to biological systems.
Cell wall: Structure and functions, Cell wall architecture, Biogenesis and Growth.

UNIT -III
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 - IV
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 - V
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.** 4thEdition. Garland publishers, NewYork.
2. Sharp D, Ploppe G and Sikorski E 2014. **Lewin's Cells.** 3rd Edition. Viva Books, NewDelhi.
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 ofthe Cell.** 5th Edition. Garland publishers, NewYork.
8. Schaffer SW 2007. **Mitochondria: The Dynamic Organelle.** 1st Edition. SpringerVerlag.
9. Wilson J, Hunt T 2007. **Molecular Biology of the Cell** 5th edition**. The Problems Book.** 2nd Edition. Garland publishers, NewYork..

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.

12. Alberts, B. Bray D. Lewis J. Ralf, M.Roberts, K. and Watson, J.D. 1999: Molecular Biology of the Cell, Garland Publishing Inc., NewYork.
13. De, D.N. 2000: Plant Cell Vacuoles. An Introduction. CSIRO Publication. Collingwood, Australia.
14. C.J. Avers 1986: Molecular Cell Biology. Addison Wesley PublishingCompany.
Lodish, Berk A, Zipursky, S.L. Matsdaira P, Baltimore D and Darnell, J. 2000; Molecula

PAPER CODE: 23B0TT14: CYTOLOGY AND CYTOGENETICS

Theory

Unit I:

Nucleus – Structure of nuclear membrane, Nuclear pore complex ; Chromosome structure, Molecular organization of chromatin, centromere and telomeres ; Special types of Chromosomes (lamp brush, polytene) Chromosome identification – Karyotype analysis; Chromosome banding techniques; compute assisted karyotype analysis chromosome Micro-dissection and micro-clonning.

Unit II

Chromosomal structural aberrations I- Origin,meiosis and breeding behavior of duplications, Deficiencies and inversions types of inversions.Robertsonian translocations;Basic concept of Complex translocation heterozygotes.

Unit III:

Chromosomal numerical aberrationsI- Classification of numerical aberrations; Aneuploids-Trisomics(Primary,Secondary,Tertiary),Monosomic and Nullisomics - meiotic behavior and Chromosome mapping.Chromosomal numerical aberrationII: Polyploids – Origin and production of auto and allopolyploids;Meiosis in auto tetraploid;Genome analysis in Tobacco,
and Wheat

Unit IV:

Nuclear DNA content -- C--value paradox, hyperchromacity, cot curves and significance. CellCycle and its regulation - chek points,cyclins and cyclin depended kinases, experimental control
Of cell division.Apoptosis - mechanism and significance.

Unit V: .

Initiation of cacer at cellular level - proto oncogenes and oncogenes;Cytogenetics of sex detemination
Types,genetic basis;Cytogenetics of Apomixis,types,mechanism,genetic control,apomixis and plant breeding.

Text Books

1. C. B. Powar. 1992. Cell Biology. Himalaya Publishers, NewDelhi
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 AmericanElsevier
5. De Robertis E.D.P and E.M.F. De Robertis. Cell and Molecular Biology 2001. CBS Publishers andDistributors

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, NewYork

PAPER CODE: 23BOTP15: CRYPTOGAMS AND GYMNOSPERMS

Suggested Laboratory Exercises

1 Examination of vegetative and reproductive morphology of Chlophyceaemembers.
2 Examination of Thallus structure and reproductive bodies of Xanthophyceae, Bacillariophyceae and Phaeophyceaemembers.
3 Examination of external and internal structure and reproductive organs of Rhodophyceae and Cyanophyceaemembers.
4 Field work to get acquaintance with locally availablealgae.

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, Miadesmia, 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, Triganocarpus, Conostoma, Heterangium,Cordaites

PAPER CODE: 23B0TP16: MICROBIOLOGY

Suggested Laboratory Exercises

1. Microbiological culturetechniques
2. Types of media, Preparation of media andstains
3. Sterilizationmethods
4. Gram staining ofbacteria
5. Morphological study of Stemonitis, Saprolegnia, Mucor, Morchella, Aspergillus, Agaricus, Cyathus, Synchitrium,Helminthosporium

PAPER CODE: 23B0TP17: CELL BIOLOGY OF PLANTS

Suggested Laboratory Exercises

1. Staining techniques – Study of mitosis usingacetocarmine.
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 ofRubisco.
4. 4.Isolation of nuclei and identification of histones by SDS-PAGEtechnique.
5. Fluorescence staining with FDA for cell viability and wall staining withcalcofluor.
6. Immunofluorescence technique –observation ofcytoskeleton.
7. Demonstration Photographs of SEM andTEM.

PAPER CODE: 23B0TP18: CYTOLOGY AND CYTOGENETICS

Suggested Laboratory Exercises

1. Observation and identification of meiotic stages
2. Preparation of karyotypes and construction ofidiograms
3. Observation of slides/photographs showing structural and numerical aberrations and chromosomebanding.

Semester-II

PAPER CODE-23BOTT21: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 F2 progenies; 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;

Unit IV:

Transposable elements in pro-and eukaryotes, Mechanism of transposition; significance of transposable elements

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

Unit-V: .

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. 3rdedition. 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,
2.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.Lewis, R. 1997. Human Genetics: Concepts and Applications, WCB Mc Graw Hill,
5.Malacinski, G.M. and Freifelder, D. 1998. Essentials of Molecular Biology (3rd edition). Jones and Bartlet Publishers Inc. London

PAPER CODE:23 BOTT22 MOLECULAR BIOLOGY OF PLANTS

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.in prokaryotes and Eukaryotes, Rolling circle and Theta mode of replication. Replication of ends of chromosomes

.

UNIT - III

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

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

UNIT – IV

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

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

Unit-V

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 andLondon
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 MolecularBiology.*
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, MarylandUSA
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 Biotechnology, CRC Press, Boc RatonFlorida.
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, NewYork.
11. R F Weaver 1999, Molecular Biology, WCBMcGraw-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 Universitypress, New York,USA

PAPER CODE: 23BOTT23: PLANT DEVELOPMENTAL BIOLOGY AND EMBRYOLOGY

Unit – I

Introduction – Comparison of plant and animal development,Plant cell cycle-Endoreduplication
and Control of plant cell size,Simple and Complex tissues,Epidermis – Stomata, trichomes,secretory cells and tissues.

Unit II:

Theories of Organization of meristems; Root growth and Development: Root apical meristem (RAM); Tissue Differentiation, Root hair and Lateral roots formation. Stem growth and development: organization of the shoot apex; cytological and molecular analysis of shoot apical meristems.

Unit III:

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 ,Genes controlling floral organ differentiation.

Unit IV:

Reproduction and Flower :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 V:

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, Outlines of Exprimental Embryology.

Text Books:

1. Pullaih, T., Naidu, K. C., Lakshminarayana, K. & Hanumantha Rao, B. 2007. Plant Development. Regency Publications, NewDelhi.
2. Fahn, A. 1982. Plant Anatomy (3rdEd.), Pergamon Press,Oxford.
3. Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development, PrenticeHall, NewJersey.
4. Bhojwani, S. S. and Bhatnagar, S.P. 2000. The embryology ofAngiosperms (4th Revised and Enlarged Ed.). Vikas Publishing House, NewDelhi.
5. Pullaiah, T .Lakshiminarayana, 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.

PAPER CODE: 23B0TT24: 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, 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 andimmunity.

UNIT-III

Symptoms, etiology, epidemiology and control measures of Fungal diseases: 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

Symptoms,etiology,epidemiology,and control measures of Bacterial diseases :Citrus canker, Bacterial leaf blight of rice, Angular leaf spot of cotton,
Viral and phytoplasmas diseases :Grassy shoot disease of sugarcane, Little leaf of Brinjal, Rice tungro.

UNIT -V

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, NewDelhi.
05. Rangaswami G 1988. **Disease of Crop Plants in India.** Prentice-Hall ofIndia.
06. Wood RKS 1967.**Physiological PlantPathology.**
07. Kelman A 1967. **Source Book of Laboratory Exercise in PlantPathology.**
08. Mehrotra RS 1994. **PlantPthology.**

09. Mukerji KG and Garg KL 1993. **Bio-control of Plant Diseases.** Vol.I&II CBS Publishers and DistributorsDelhi.
10. Butler EJ 1973. **Fungi and Diseases inPlants.**
11. Roberts RR and Booth Royd LR 1972. **Fundamentals of PlantPathology.**

PAPER CODE: 23B0TP25: 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: 23B0TP26: 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: 23B0TP27: 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, lsobilateral 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 cumin) etc. by Dissections.

PAPER CODE: 23BOTP28: 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

SEMESTER – III

PAPER CODE: 23BOTT31: TAXONOMY OF ANGIOSPERMS AND PLANT RESOURCE UTILIZATION

Theory

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, Nympheaeceae), 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.

Unit IV

Concept of phytogeography: Endemisam,hotspots ,Green revolution: Benfits & adverse consequences Ethnobotany: Introduction , concepts, objectives & scope

Plant Resources Utilization and Diversity

Unit V

Origin, Evolution, Botany and uses of

1.	FoodCrops	:	Rice, Sugarcane, Maize
2	Pulses	:	Red gram, Black gram
3	FibreCrops	:	Cotton, Sunhemp
4.	Medicinal and aromatic crops	:	*Catheranthus, Cymbopogan*
5	Oil yielding crops	:	Groundnut, Castor

Suggested readings and text books

1. Cole, A.J. 1969. Numerical Taxonomy, Academic Pree,London
2. Davis, P.H. and Heywood, V.H. 1973. Principles of Angiosperms Taxonomy. RobertE Kreiger Pub Co NewYork
3. Harrison, H.J. 1971. New concepts in Flowering Plant Taxonomy, HiemanEducational Books Ltd., London

4. Simpson MG. 2006. **Plant Systematics**. Elsevier Academic Press, California,US
5. Nordenstam BEI, Lazily G and Kassas M. 2000. **Plant systematic for 2nd Century.**Portland Press Ltd.,London.
6. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant Systematics (2 nd Edition) McGrawHill Book Co., NewYork

PAPER CODE:23BOTT 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 andhardening.

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,

Unit IV

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 V

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 ofGermplasm.

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, NewDelhi.
3. Bhojwani, S.S. and Razdan, M.K. 1996. Plant tissue culture: Theory and Practice (arevised 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

PAPER CODE:23 BOTT33: ECOLOGY AND PHYTOGEOGRAPHY

Theory

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.

Unit II

Species interactions: Types of interactions, interspecific competition, herbivory, carnivory, prey – predator, parasitism,symbiosis. Ecological pyramids,Niche segregation,nicheoverlap,Characters of niche,Micro climate,Niche phenology

Unit III

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 IV

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 V

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. NewDelhi
5. Purohit, S.S. and Ashok Agrawal. 2007. Ecology andEnvironmental Biology,StudentEdition,Jodhpor
6. Russell, P.J., Wolfe, S.L., Hertz, P.E., Starr, C. and Mc Million B. 2008.Ecology, Cengage Learning India Pvt. Ltd., NewDelhi
7. Ambasht, R.S. and Ambasht, N.K. 1999. A text book of Ecology. CBS Pubi. &Distr.NewDelhi.

Reference Books

1. Campman, J.L. and Reiss, M.J. 1988. Ecology. Principles andApplications, 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 ScientificPublication
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. Freemanand Company. NewYork

PAPER CODE:23BOTT34: PLANT PHYSIOLOGY

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.

Unit II

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,Hydrophonics; root microbe interactions in facilitating nutrient uptake and mechanism ofassimilation.

Unit III

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 seeddormancy.

Unit IV

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 V

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, NewDelhi.
2. Seema Yadav 2014. **Plant Physiology.** SBW publishers, NewDelhi.
3. Heribert H and Kazuo S (eds) 2010. **Plant responses to abiotic stress. Series Topics inCurrent Genetics, Vol 4.** Springer,Berlin.
4. Philip Stewart and Schine Gobig 2011. Plant Physiology. CRCPress.
5. Moore TC. 2011. **Biochemistry and Physiology of Plant Hormones**. Springer, NewYork.
6. Mohr H and Schopfer P. 1995. **Plant Physiology**. Springer-Verlag, NewYork.
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, NewYork.Kocchar and Gujral. 2012. Comprehensive Plant Physiology. McMilanPub
13. Salisbury F. B. & C. W. Ross 1992 *Plant Physiology*. 4 th Edn. Wadsworth Publishing Co., Belmout,
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
17. Devlin, R.M. and Witham, F.H. 1986. PlantPhysiology
18. Davies, P.J. (Ed) 1987. Plant hormones and their role in Plant Growth andDevelopment. Mertinus Nijh off Publishers, TheNetherlands
19. Epstein, E. 1972. Mineral nutrition of plants, Principles and prospectus, John Willey&Sons, INC, NewYork
20. Hooykaas, P.J.J., Hall, M.A. and Libbenga, K.R. (Eds.) 1999. Biochemistry andMolecular Biology of Plant Hormones, Elsevier, Amsterdam, TheNetherlands
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

PAPER CODE:23BOTP 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 availablefamilies
2. Description of various species of a genus: Preparation of key character at genuslevel
3. Preparation of key characters and use of keys at familylevel
4. Field trips: Compilation of field notes and preparation of herbarium wild orcultivated
5. Training in using floras and herbaria for identification of specimens wild and cultivated
6. Taxonomic description of the following cultivatedCrops
    1. Foodcrops : Rice,Maize
    2. Pluses : Red gram, Blackgram
    3. Fibercrops : Cotton,Sunhemp
    4. Oilyielding : Groundnut , Castor,*Brassica*
    5. Medicinal&Aromatic : *Catheranthus,Eucalyptus*

PAPER CODE:23BOTP 36: *IN VITRO* PLANT BIOLOGY

Suggested Laboratory Exercises

1. General out lay of PTClaboratory
2. Preparation of Stock solutions andMedia.
3. Callus induction –Carrot
4. Direct organogenesis and somatic embryogenesis from Tobaccoexplants.
5. Androgenesis and production of haploids from Datura flowerbuds.
6. Embryo culture – Groundnut
7. Establishment of Cell cultures and determination of platingefficiency.
8. Enzymatic isolation and culture ofprotoplasts.
9. Fusion of protoplasts usingPEG.
10. Clonal propagation through meristemculture
11. Preparation of synthetic seeds using sodiumalginate.

PAPER CODE: 23BOTP37: ECOLOGY AND PHYTOGEOGRAPHY

Suggested Laboratory Exercises

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

PAPER CODE:23 BOTP38: PLANT PHYSIOLOGY

Suggested Laboratory Exercises

1. Effects of high and low temperatures on the permeability of the cytoplasmicmembranes
2. Determination of suction force intranspiration
3. Stomatal frequency and Stomatal index ofleaves
4. Rate of transpiration in leaves by Cobalt chloride papermethod
5. Mechanism of opening and closing ofstomata

SEMESTER – IV
PAPER CODE: 23BOTT41: 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

UNIT II
Bacterial transformation, *In-vitro* packaging, Recognition of transformants: Antibiotic resistance, Lac Z gene based selection. Genomic library, cDNA library.
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**)**
UNIT III
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 ; Genetic improvement of industrially important microbes as Biopesticides, Biofertilizers and Antibiotics

Unit IV
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 V
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)
Applications of Bioinformatics in Genetic engineering and their importance. IPR, Patenting,Ethical and Environmental issues

Suggested Readings & Text Books

1. Glick BR, Pasternak JJ and Patten CL. 2010. **Molecular Biotechnology Principlesand**
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 VIIII**. Pearson Prentice Hall, NewJersey.
5. Balasubramanian, D. 2005. Concepts of Biotechnology Newedition.
6. Old andSBPrimrose2002. Principles of Gene Manipulation by Blackwell,Oxford.

PAPER CODE: 23BOTT42: 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.

Unit II

Theories of Evolution: Lamarckism, Darwinism, Natural Selection, Mutation theory, modern synthetic theory, Polygenic inheritance, heritability and its measurements.

Unit III

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 IV

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 Viguor.

Unit V

BioStatisitcal 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; X^2 test;; Basic introduction to Multivariate statistics.

Text Books:

1. Organic Evolution ,Veer BalaRastogi
2. Singh, B.D.: PlantBreeding
3. Genetics M.W. Stickberger, Macmillan Company, NewYork

Reference Books:

1. Alalrd, R.W. 1961: Principles of PlantBreeding
2. Jones & Wilkins – Variation and adaptation in plant species. HeinemannEducational
3. Books Ltd.,Londoan
4. Stebbins, J.L. – Chromosomal evolution in Higher Plants. EdwardArnold
5. Publishers Ltd.,London.

PAPER CODE: 23BOTT43: 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 (CO_2, CH_4, NO_2, CFCS sources trends and role) Ozone layer, Ozone hole and consequences of climate change (CO_2, fertilization, global warming, sea level rise, UV radiation)

Unit II

Composition of soil. Factors affecting soil formation and soil profile (Laterization podosolization, 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.

Unit III

Plant Biodiversity: Concept, levels of biodiversity, Magnitude and distribution, Mega diversity centers.values of biodiversity-anthropocentricand ecocentric.India as a megadiversity center,Agrodiversity –centers of origin,Biodiversity act.

Unit IV

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 domesticatedplants.The Indo Burmese Centre, plant introduction and secondary centers.Concept of land races.

Unit V

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 goal(SDGs/Millennium DevelopmentGoals)

Text Books

1. Mahua Basu and S. Xavier 2017. Fundamental of Environmental Studies. Cambridge publishers
2. Dr. D.K Singh 2006. Environmental Science. S. Chandpublish

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,Jodhpor
5. Russell, P.J., Wolfe, S.L., Hertz, P.E., Starr, C. and Mc Million B. 2008.Ecology, Cengage Learning India Pvt. Ltd., NewDelhi

1. Krishnamurthy, K.V. 2004. Advanced Textbook On Biodiversity: PrinciplesAnd Practice. OxfordLillesand.
2. Sinha, R. K. Biodiversity -Global Concerns.1996. Commonwealth Publishers,New Delhi
3. Negi, S. S. 2005. Biodiversity & Its Conservation in India. Indus PublishingCompany. NewDelhi
4. Ravi Prasad Rao, B. 2005. Remote Sensing and Image Interpretation. 7th ed.Wiley.
5. Basudev Bhatta 2008. Remote Sensing and GIS. Oxford UniversityPress

Reference Books

1. APHA – Standard Methods for the Examination of Water and Waste Water.American Public Health Association, Washington,DC
2. Frankel, OH. Brown, A.H.D. &Burdon, J.J. 1995. The conservation of Plant Diversity, Cambridge University Press, Cambridge,UK
3. Horpes and Row, N.Y; Batra, N.K. & Sharma, K.K. 1990. A Treatise onPlant Ecology. PradeepPublications
4. Molles, M.C. 2005. Ecology-concepts and applications. Mc GrawHill.Boston
5. Magurran, A.E. 1988. Ecological Diversity and its measurement. Chapman andHall, London
6. Chuvieco, E. and Uete, A.H. 2010. Fundamentals of Satellite Remotesensing
7. Gabriel Melchias. 2001. Biodiversity and Conservation. Oxford IBH Publishers, New Delhi
8. Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants. IUCN, the World conservation Union. IUCN, Gland, Switzerland, and Cambridge,U.K.
9. *Kevin J. Gaston & John I. Spicer. 2004. Biodiversity, an introduction. Blackwell* Christian Leveque, Jean-claude Mounolou and Vivien Reuter. 2004. *Biodiversity*. John Wiley
10. *Jensen*, John R. 2007. Remote Sensing *of the Environment: An Earth Resource Perspective.*PHI
11. Heywood, V.M. and Watson, R.T. 1985. Global Biodiversity Assessment, Cambridge Univ. Press,Cambridge

PAPER CODE: 23BOTT44: 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.

Unit II

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

Unit III

Photochemistry and Photosynthesis: General concepts and historical back ground, evolution of photosynthetic apparatus, Redox reactions, photosynthetic pigments and light harvesting complexes, photooxidation 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 IV

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;Cyanide respiration

Unit V

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 Readings & Text Books

1. Bob B. Buchanan, Wilhelm Gruissem, and Russell L. Jones. 2002. Biochemistry and molecular biology ofPlants
2. Devlin, R.M. and Witham, F.H. 1986. PlantPhysiology
3. Frank Boyer Salisbury, Cleon Ross. Plant Physiology,5
4. Hess, D. 1974. PlantPhysiology
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons Including NewYork, USA
6. Hopkins,W.G.2009.IntroductiontoPlantPhysiology.JohnWiley&SonsIncludingNewYork, USA,4Edition.
7. Irwin P. Ting, Plant Physiology, 1982, Addison-Wesley PublishingCompany.
8. Lehninger, A.L. 1982. Principles of Biochemistry, Worth, NewYork
9. Noggle, G.R. and G.J. Fritz. 1991. Introductory plantphysiology (2 edition) Prentice hall of India Limited
10. Postgate John, R. 1975. The physiology and genetics of Nitrogen fixation, Plennum,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

PAPER CODE: 23B0TP45: GENETIC ENGINEERING OF PLANTS AND MICROBES

Suggested Laboratory Exercises

1. Isolation of plasmidDNA
2. Bacterial transformation and identification oftransformation
3. Restriction enzyme digestion and gelelectrophoresis Genetic engineeringassignments

PAPER CODE: 23BOTP46: EVOLUTION AND PLANT BREEDING

Suggested Laboratory Exercises:

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

PAPER CODE: 23BOTP47: ENVIRONMENTAL BIOLOGY AND BIODIVERSITY

Suggested Laboratory Exercises

1. Ombrotherms andClimatograms
2. Analyses of water and soil physico-chemicalcharacteristics
3. Estimation of Chlorophyll content in control and pollutedsites
4. Determination of plant diversity among different forest areas studied
5. Assignments onBiodiversity
6. To estimate rate of Carbon dioxide evolution from different soils using soda lime or alkali absorptionmethod
7. Scientificvisits:
8. 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 milliequivalen