



RAJARSHI SHAHU MAHAVIDYALAYA, LATUR
(AUTONOMOUS)

AFFILIATED TO

**SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY,
NANDED**

M. Sc. SECOND YEAR (GENERAL SEMESTER PATTERN) (CBCS)

BOTANY – CURRICULUM

(MCQ + THEORY PATTERN)

w. e. f. JUNE, 2019

SEMESTER III

BO 3.1 Angiosperms Systematics

Credits: 4

Lectures: 60

Objectives:

1. To understand the complex optical devices, key concept and application.
 3. To obtain most conclusive results.
 4. To provide platform to develop computational biological methods.
 5. Provide training in scientific and transferable skills through modular lecture courses.
 6. Provide knowledge to distinguish species on morphology and anatomy basis.
 7. They will be able to perform sectioning of various ovules.
 9. Able to develop approach for embryology study.
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Credit - I: Modern Trends in Taxonomy: (15L)

1. Aims, principles and practices in taxonomy. Botanical Nomenclature: Brief history, Scientific names, ICN, Principles, typification, Principle of priority, effective and valid publication, rank of taxa.
2. Tools of taxonomy: Floras, monographs, revisions, websites. Herbarium and botanical gardens, their role in teaching, research and conservation, important herbaria and botanical gardens of the World. Botanical Survey of India.
3. Floristics: Need and significance. History of botanical exploration in India and recent work with special emphasis on Maharashtra.
4. Morphological features used in identification. Artificial dichotomous keys.
5. Biodiversity, types, importance and methods of conservation.
6. Taxonomic Structure: Taxonomic hierarchy, The species concept, Categories and ranks Principles & methods of taxonomy:
7. Taxonomy in relation to morphology and anatomy.

Credit- II: Classification System: (15L)

1. Importance and need for classification. Criteria used for classification;

Phases of plant classification. Overview of pre- and post-Darwinian systems of classification.

2. Artificial systems of classification - Theophrastus, Linnaeus.

3. Natural system of classification - Bentham and Hooker.

4. Phylogenetic systems of classification – Takhtajan.

5. APG system of classification, contributors, A.P. web.

6. Plant Speciation: Allopathic / Abrupt / Sympatric / Hybrid / Apomictic speciation, Isolating mechanisms.

Credit- III: Study of Families-I-Dicotyledons (Polypetalae & Gamopetalae): (15L)

(Systematic position, general characters, distinguishing features, floral formula, floral diagram and economic importance).

A) Polypetalae:

1. Ranales – Magnoliaceae,

2. Parietales – Papaveraceae.

3. Malvales- Tiliaceae.

4. Geraniales-, Rutaceae.

B) Gamopetalae:

1. Rubiales – Rubiaceae,.

2. Asterales – Asteraceae.

3. Personales- ,Bignoniaceae.

4. Lamiales –Verbenaceae

Credit - IV: Study of Families-II: Dicotyledons (Apetalae) & Monocotyledons: (15L)

(Systematic position, general characters, distinguishing features, floral formula, floral diagram and economic importance).

A) Apetalae:

1. Curvembryae – Amarantaceae.

2. Micrombryae – Piperaceae.

3. Unisexuales –Casuarinaceae.

B) Monocotyledonae:

1. Microspermae- Orchidaceae.
2. Epigynae – Scitamineae.
3. Coronarieae –Commelinaceae.
4. Nudiflorae – Typhaceae.
5. Cyperales - Cyperaceae .

Reference Books:

1. Agashe, S.N. 1995. Paleobotany, Oxford and IBH Publ. Co. Pvt. Ltd, New Delhi.
2. Bhojwani, S.S. and Bhatnagar, S.P. 1984. Embryology of Angiosperms. Vikas Publ. House, New Delhi.
3. Briggs, David. 2009. Plant microevolution and Conservation in Human-influenced Ecosystems. Cambridge University Press.
4. Cooke, T. 1903-1908. The Flora of Presidency of Bombay, Vol. I-III.
5. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
6. Cronquist, A. 1988. The Evolution and Classification of Flowering Plants (2nd ed.) Allen Press, U.S.A.
7. Davis, P. H. and V. H. Heywood 1991. Principles of Angiosperm Taxonomy. Today and Tomorrow Publications, New Delhi.
8. Eames A.J. 1961. Morphology of Angiosperms, McGraw Hill Book Co.
9. Erdtman, G. 1966. Pollen Morphology and Plant Taxonomy of Angiosperms (An introduction to Palynology I), Hafner Pub. Co. London.
10. Fahn, A. 1979. Plant Anatomy, Pergamon Press, London.
11. Hickey, M. and King, C. 2000. The Cambridge Illustrated Glossary of Botanical Terms. Cambridge University Press, UK.
12. Hutchinson, J. 1959. Families of Flowering plants. Clarendon Press, Oxford.
13. Jain S.K. and Rao R.R. 1976. Handbook of Field and Herbarium Methods, Today and Tomorrow Publishers, New Delhi.
14. Johri, B. M. 1984. Comparative embryology of Angiosperms. Ind. Nat. Sc. Acad. New Delhi.

15. Jones, S. B. and Luchinger A.E. 1986. Plant Systematics 2nd edn, McGraw Hill Book Co.
16. Judd Walter S., Campbell, C. S., Kellogg, E. A., Stevens, P.F. and M. J. Donoghue. 2008. Plant Systematics- A Phylogenetic Approach. Sinauer Associates, INC, Publishers. Sunderland, Massachusetts, USA.
17. Kubitzki, K. 1977. Flowering Plants Evolution and Classification of Higher Categories. Plant Systematics – Evolution Supplement I.
18. Kuijt J. 1969. The biology of parasitic flowering plants. California University Press.
19. Lawrence, G. H. M. 1951. Taxonomy of Vascular Plants. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi.
20. Mabberly, T. J. 1997. The Plant Book 2nd edn Cambridge University Press, Cambridge.
21. Maheshwari, P. 1985. An Introduction to Embryology of Angiosperms. Tata McGraw Hill, New Delhi.
22. Manilal, K. S. and M. S. Muktesh Kumar [ed.] 1998. A Handbook of Taxonomic Training. DST, New Delhi.
23. Naik, V. N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill, New Delhi.
24. Nair, P.K.K. 1966. Pollen morphology of Angiosperms. Periodical Expert Book Agency, New Delhi.
25. Paech, K. and M.V. Tracey. 1956. Modern Methods of Plant Analysis. Vol-I & II. Springer-Verlag.
26. Quicke, Donald L. J. 1993. Principles and Techniques of Contemporary Taxonomy. Blakie Academic & Professional, London.
27. Radford A.E. 1986. Fundamentals of Plant Systematics, Harper and Row N Y.
28. Sharma A.K. and A. Sharma. 1980. Chromosome Technique: Theory and Practices (3rd ed.) Butterworths, London.
29. Shivanna, K.R. and N.S. Rangaswamy. 1992. Pollen Biology- A Laboratory Manual. Springer – Verlag.
30. Simpson, M.G. 2010. Plant Systematics. Elsevier, Amsterdam.
31. Singh G. 2004. Plant Systematics, 2nd edn, Oxford and IBH, New Delhi.
32. Sivarajan, V.V. 1984. Introduction to Principles of Plant Taxonomy, Oxford and IBH, New Delhi.

33. Smith, P. M. 1976. The Chemotaxonomy of Plants, Edward Arnold Pub.Ltd.
34. Sporne, K. R. 1974. Morphology of Angiosperms, Hutchinson UniversityLibrary,London.

B.O 3.2 Molecular Biology

Credits: 4

Lectures: 60

OBJECTIVES:

1. To acquire good knowledge about molecular biology
 2. To acquire good knowledge about chemistry of active constituents of medicinal plants.
 3. To know the techniques of Molecular biology.
 4. Develop understanding about inheritance Biology.
 5. Solve problems independently on Genetic disorder.
 6. To understand Gene related diseases & its control.
 7. To prepare karyotype and Idiogram and their significance.
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Credit- I: DNA structures & topology(15L)

1. DNA structure Types of base pairing, unusual structures, topology, split gene. pseudogene, overlapping gene, cryptic gene Jumping gene (transposons).
2. Melting and reassociation of DNA, Cot curves and kinetic complexity of DNA. Organization of genomes (from whole genome sequences), repetitive and unique sequences, C-value paradox.
3. Chromosome organization, centromeres, telomeres, specialized chromosomes.
4. Initiation, elongation and termination of DNA replication, molecular machinery of DNA replication in Prokaryotes.
5. DNA damage and repair.

Credit- II : RNA structure and processing: (15L)

1. RNA structure – Modified bases, pairing, secondary structure.
2. Transcription units, RNA polymerases, initiation, elongation and termination of transcription in eukaryotes, proof reading.
3. RNA processing – Processing of tRNA, rRNA and mRNA and mRNA localization.
4. Non-coding RNAs, ribozymes and riboswitches.

Credit- III : ProteinSynthesis: (15L)

1. Protein synthesis – The genetic code ,t-RNA charging, ribosomal organisation. Initiation, elongation and termination of protein synthesis in prokaryotes. Antibiotics used in inhibition of protein synthesis.

Proof reading.

2. Post-translational processing of proteins, protein modifications. Chaperones and protein folding.

3. Proteases. Ubiquitination and degradation of proteins by proteasomes.

Credit - IV Regulation of gene expression: (15L)

1. Regulation of transcription – i)Operons, repressors and inducers(Catabolic and Anabolic)
ii)positive and negative control.
iii) regulation of lytic and lysogenic cycles in phages.

2. Regulation of gene expression at translational and post-translational level.

Reference books:

1. Genes IX– Benjamin Lewin, Jones and Bartlett, 2008
2. Genes X– Benjamin Lewin, Jones and Bartlett, 2011
3. Molecular Biology of the Cell – Alberts, B, Bray, D, Raff, M, Roberts, K and Watson JD, Garland Publishers, 1999.
5. Principles of Biochemistry – Lehninger, W.H. Freeman and Company, 2005
6. E.J. Dupraw – 1970: Cell and Molecular Biology; Academic Press, London
7. De Robertis and De Robertis – 1997 : Cell and Molecular Biology (VIII); B.I.
8. Waverly Pvt. Ltd., New DelhiC. P. Swanson, T. Merz, and W.J. Young – 1982 : Cytogenetics ; Prentice – Hall of India Pvt. Ltd., New DelhiP.C.L. John (Ed.) – 1981 : The cell cycle; Cambridge University press
9. Benjamin Lewin : Genes – VI, VII and VIII ; Oxford Press.
10. R. A. Chapoldi 1977: Membrane proteins and their interactions with lipids;
11. Marcel Dekker, inc. N. York
12. A. N. Mortonosi (Ed.) – 1985: The enzymes of Biological Membranes Vol. I, II
13. and III;Plenum press, New York
14. Watson and others – 2004: Molecular Biology of the gene (V); pearseEducations, Inc India

BO.3.3 Immunology, Plant Nanotechnology and Forensic Botany

Credits: 4

Lectures: 60

OBJECTIVES:

1. Understand and appreciate the scope of forensic biology.
 2. Understand and appreciate the scope, diversity and utility of a variety of DNA typing techniques.
 3. Perform the primary technique used in Forensic DNA analysis: PCR.
 4. To study Perform post-PCR Processing.
 5. After studying this paper the students will know –. The significance of forensic science to human society.
 6. To Study the fundamental principles and functions of forensic science.
 7. TO know the divisions in a forensic science laboratory.
 8. To know the working of the forensic establishments in India and abroad
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Credit- I: Plant Nanotechnology and Its Concepts: (15L)

1. Plant Nanotechnology: An Overview on Concepts, Strategies, and Tools
2. Physical and Chemical Nature of Nanoparticles.
3. Effects of Nanoparticles on Plant Growth and Development
4. Agri-Nanotechniques for Plant Availability of Nutrients
5. Utilization of Nanoparticles for Plant Protection
6. Nanotechnology in Soil-Plant System

Credit- II: Introduction to Forensic Botany: (15L)

1. Introduction to forensic botany. Botanical evidence on legal investigations .Legal plant definition. Botanical evidence in legal investigations
2. The Use of Botanical Evidence in Criminal Investigations.
3. Evidence collection and analysis:
 - i. Documentation of botanical evidence
 - ii. Collection information needed for each botanical sample

iii. How to have botanical evidence analyzed

iv. Evidence analysis

v. Laboratory report

4. Fundamentals of wildlife forensic. Significance of wildlife forensic.

Credit- III: Immunology-I (15L)

1. Cells and molecules involved in innate and adaptive immunity,
2. antigens, antigenicity and immunogenicity
3. B and T cell epitope, structure and function of antibody molecules.
4. Generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen antibody interaction MHC molecules.
5. Antigen processing and presentation, activation and differentiation of B and T cells.

Credit- IV: Immunology-II (15L)

1. B and T cell receptors, humoral and cell mediated immune responses, primary and secondary immune responses,
2. The complement system.
3. Toll-like receptors, cell mediated effector functions, inflammation, hypersensitivity and autoimmunity,
4. Immune response during bacterial (tuberculosis), Parasitic (malaria) and viral (HIV) infections congenital and acquired immunodeficiencies,
5. Vaccines.

Reference Books:

1. L. Stryer, Biochemistry, 3rd Edition, W.H. Freeman and Company, New York (1988).
2. R.K. Murray, D.K. Granner, P.A. Mayes and V.W. Rodwell, Harper's Biochemistry,
3. APPLETON & Lange, Norwalk (1993).
4. S. Chowdhuri, Forensic Biology, BPRD, New Delhi (1971).
5. R. Saferstein, Forensic Science Handbook, Vol. III, Prentice Hall, New Jersey (1993).
6. G.T. Duncan and M.I. Tracey, Serology and DNA typing in, Introduction to Forensic
7. Sciences, 2nd Edition, W.G. Eckert (Ed.), CRC Press, Boca Raton (1997).
8. Edlestein A.S and Cammarata RC, Nano materials synthesis, properties and applications:
9. Michael Kohler, Wolfgang Fritzsche, Michael Kohler, Wolfgang Fritzsche,
10. Nanotechnology-An Introduction to Nano structuring Techniques Wiley (Practical)

11. Brian Robinson, Self-Assembly, IOS Press
12. Tai Ran – Hsu, MEMS and Microsystems, Design, Manufacture and Nanoscale
13. Engineering, John Wiley & Sons, 2008.
14. M. Gentili, C. Giovannella, S. Selci, Nanolithography: A Borderland between STM, EB, IB
15. and X-Ray Lithographies (NATO ASI Series), Kluwer Academic Publishers, 1994.
16. Nicholas A. Kotov, Nanoparticle Assemblies and Superstructures, CRC, (2006).
17. Guozhong Cao, Nanostructures & Nanomaterials Synthesis, Properties G; Z, Applications,
18. World Scientific Publishing Pvy. Ltd., Singapore 2004
19. Zheng Cui, Nanofabrication, Principles, Capabilities and Limits, Springer Science +
20. business media, New York (2008).
21. Kostya (Ken) Ostrikov and Shuyan Xu, Plasma-Aided Nanofabrication: From Plasma
22. Sources to Nanoassembly, WILEY-VCH Verlag GmbH & Co. KGaA (Weinheim) (2007)
23. H. Baltimore, WH Freeman, Cell & Molecular Biology
24. Kimball T.W., Cell Biology, Wesley Pub
25. Geoffrey M. Cooper, The Cell A Molecular Approach; 2nd Edition, ASM press, Sinauer
26. Associates, Inc., Washington, (2000)
27. Harvey Lodish, Arnold Berk, S.L Zipursky, Paul Matsudaira, David Baltimore and James
28. Daniel, Molecular Cell Biology; 4th Ed., W.H Freeman and company, (2000).
29. E.D.P. De Robertis, and E.M.F De Robertis, —Cell and Molecular Biology. 8th Ed,
30. Lippincott Williams and Wilkins, (2001).
31. Albert Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts and Peter
32. Walter, C. Bre'chignac P. Houdy M. Lahmani, Nanomaterials and Nanochemistry, Springer.
33. Heidelberg, Germany (2006).
34. Kenneth J. Klabunde, Nanscale materials in chemistry, Wiley Interscience Publications
- (2001).
35. Hans Lautenshlager, Emulsions, Kosmetik International, (2002).
36. Roque Hidalgo-Alvarez, Structure and Functional properties of Colloids, CRC Pre

B.O.3.4 Plant Pathology-I

Credit: 4

Lecture: 60

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Objectives:

1. To awaken the students about microbial world and the nature of diseases of plants.
 2. To understand the principles and concept in plant pathology.
 3. To understand the relationships between pathogens and plants.
 4. To become familiar with terms and references used to diagnose plant disease.
 5. To develop the awareness about the importance of plant disease in human life.
 6. To learn the basic biology of major groups of plant pathogens.
 7. To explain the concept of plant disease and disease pyramid.
 8. To describe main modes of plant disease transmission.
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Credit- I: Introduction to Plant Pathology:

1. Scope and Importance of Plant Pathology; Contributions of E.F .Smith E. C.S Takman, S. D. Garrett, E. J. Butler, K. C. Mehta, M. J .Thirumalachar, in the field of plant pathology.
2. Development of Plant Pathology as a Profession, Careers in Plant Pathology, The Practice and Practitioners of Plant Pathology. Certification of Professional Plant Pathologists .Plant Pathology as a Part of Plant Medicine; the Doctor of Plant Medicine Program.
3. Aerobiology: Scope and applications of aerobiology. Airborne pathogens, Methods for detection of Aerospora.
4. Methods in plant pathology.
5. Biopesticides.

Credit - II: Diseases of crop plants – I:

History, symptomology, causal organism, etiology and management of:

1. Rice: - Blast disease.
2. Jowar :- Leaf Spot
3. Rice:- Bacterial blight
4. Pigeon pea :- Leaf Spot
5. Tomato: - Early Blight.
6. Bhendi :- Powdery Mildew
7. Brinjal: - Leaf Spot.
8. Chilly: - Anthracnose.
9. Bean Mosaic
10. Soybean: - Rust.
11. Brinjal: - Little leaf.
12. Cotton: Stenosis

Credit- III: Disease of crop plants – II:

(History, symptomology, causal organism, etiology and management of)

1. Banana: - Panama disease.
2. Grapes: - Powdery Mildew.
3. Green gram: - Leaf spot
4. Citrus: - Greening disease.
5. Sugarcane: - Grassy Shoot.
6. Cotton: - Root rot.
7. Sunflower: - Rust.
8. Groundnut :- Rust
9. Sesamum :- Blight, Leaf Spot
10. Green gram: - Powdery mildew.
11. Sesamum: phyllody

Credit- IV: Host resistance, Disease management and control of diseases:

1. Plant defenses: Non-host and host resistance.
2. Pre-existing and induced structural and chemical defenses.
3. Defense signaling network: R genes, role MAPK cascade, Transcription factors and PRPs.
4. Pathogenicity genes, avirulence genes, effector molecules.

5. Diagnostic methods for detecting pathogens.
6. Control of disease using fungicides and other chemicals.
7. Biocontrol agents for controlling disease.
8. Disease control using biological and chemical activators of resistance.

Reference Books:

1. Agrios, G. N. 2006: Plant Pathology, 5th Edition
2. Aneja, K. R. 1993. : Experiments in Microbiology, plant pathology and Tissue culture
3. Cooke, A. A. 1981. Diseases of Tropical and Subtropical field, Fiber and oil plants
4. Gangopadhyay , S. 2004: Clinical Plant Pathology
5. Kuijit, J. 1969: The Biology of parasitic flowering plants.
6. Mahadevan, A. and R. Shridhar, 1982. Methods in physiological plant pathology
7. Agarwal A. and Mehrotra, R. S. 2012: Plant Pathology
8. Nyvall, R. F. 1979 : Field Crop Diseases Handbook
9. Paul Khurama, S. M. 1998: Pathological Problems of Economic crop plants and their management
10. Planke, J. E. ander, 1968: Disease Resistance in plants.
11. Planke, J. E. Vander. 1963: Plant Diseases Epidemics and control
12. Rangaswami, G. 1979: Diseases of crop plants in India
13. Singh, R. S. 2009: Plant Diseases, 9th Edition
14. Current and back – Volumes of following periodicals:
 - I. Journal of phytopathology
 - II. Indian journal of phytopathology
 - III. Journal of Mycology and plant pathology
 - IV. Annual review of plant pathology.

PRACTICAL

Lab course IX: Based on theory paper BO 3.1(Angiosperms Systematics)

- 1-8. Study of at least 16 locally available families of flowering plants of genus and species family.
 9. Identification of genus and species of locally available wild plants.
 10. Comparative account of karyotypic analysis.
 11. To study of pollen morphophytes of different family.
 12. Study of fossil angiosperms of India with the help of slides and specimens.
 - 13-16. Study of floral biology, visitations by pollinators, pollen viability, self and crosspollination, seed set of any two species.
 17. At least two short excursion of one two days each and one long excursion of five days.
- (N.B. Each short excursion corresponds to two practicals and one long excursion 6 practicals).

(Any Ten Practical)

N.B: 1) Any ten Practical

2) Several Short Excursions and at least one Long Excursion

Lab course X: Based on theory paper BO 3.2(Molecular Biology)

1. Isolation of plasmid DNA and quantification
2. Electrophoretic separation of plasmid isoforms
3. Restriction digestion of plasmid DNA, electrophoresis and molecular weight determination of DNA fragments.
4. Isolation of plant genomic DNA and quantification
5. Effect of temperature and alkali on absorbance of DNA – hyperchromicity
6. Separation of SSP from leguminous seed & quantitation of each fraction
7. SDS-PAGE separation of seed storage proteins from legumes.
8. Determination of molecular sizes of the globulin subunits.
9. Isolation of DNA from plants and Estimation by DPA method
10. Isolation of RNA and Estimation of RNA by orcinol method
11. Visit to Biotechnology Research center.

12. solation of DNA from various sources
13. Determination of Electrical conduction of DNA
14. Isolation and separation of cell organelles
15. 2D- Electrophoresis technique for separation of proteins
16. Synthesis of Gold Nanoparticles by biogenic methods
17. Synthesis of Silver Nanoparticles by biogenic methods
18. Isolation of enzymes involved in biosynthesis of nanomaterials

(Any Ten Practicals)

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

Lab course –XI (Practicals based on theory paper BO 3.3)

1. Immunodiffusion test.
2. Determination of blood groups.
3. Determination of clotting time.
4. Determination of bleeding time.
5. Differential count of RBC/Leucocytes.
6. Widal test.
7. ELISA Tests.
8. Western blots.
9. RPR Test.
10. Preparation of thiolated silver nanoparticles
11. Zinc Selenide quantum dot preparation.
12. Synthesis of Iron Oxide Nanoparticle
13. Synthesis of Nickel metal nanoparticle by urea decomposition method
14. Synthesis of Zinc Oxide nanoparticle
15. To carry out microscopic examination of pollen grains.
16. To carry out microscopic examination of diatoms.
17. To cite a crime case in which diatoms have served as forensic evidence.

(Any Ten Practicals) N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

Lab course –XII (Practicals based on theory paper BO 3.4)

(Practicals: Based on theory paper BO 3.4)

1. Study of different equipments for sterilization (Autoclave, Laminar air flow, Incubator and Oven).
- 2-4. To study different staining methods.
- 5-18. . Symptomology, histopathology of disease given in theory
- 19-20. Estimation of chlorophylls, sugars and polyphenols from healthy and infected leaves.
21. Isolation and identification of plant pathogens from air over infected field

22. Use of Aerobiological technique to study fungal flora of different localities by Tilak air Sampler
23. Study of rhizosphere mycoflora from different soil samples of infected and healthy plants by serial dilution technique
24. Effect of temperature on growth of plant pathogenic fungi
25. Effect of pH on growth of plant pathogenic fungi
26. Study of Phyllosphere mycoflora of infected and healthy plants by leaf print method.

(Any Ten Practicals) N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

BO 4.1: Cytogenetics and Plant Breeding

Credits: 4

Lectures: 60

Objectives:

1. To understand the cell structure, function and different aspects of cytogenetical studies.
 2. To study importance of plants and inculcate the importance of farming based
 3. To reveal the different aspects of plant breeding.
 4. To provide platform to develop the investigation abilities by using biological tools.
 5. To provide training in scientific and transferable skills through modular lecture courses.
 6. To provide basic knowledge to be able to sustain in upcoming green revolution.
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Credit: I Cytogenetics-I (15L)

1. Cell division: Mitosis and Meiosis.
2. Concept of Gene: Allele, Multiple allele, Pseudoallele, Complementation test.
3. Mendelian Principles: Dominance, Segregation and Independent assortment.
4. Extensions of Mendelian Principles: Codominance, Incomplete dominance,
5. Gene interactions (Epistatic and Non Epistatic)
6. Pleiotropy, Genomic imprinting, Penetrance, Expressivity and Phenocopy.

Credit II: Cytogenetics-II (15L)

1. Microbial genetics: Mapping of bacterial genome by interrupted mating.
3. Linkage and mapping in eukaryotes: Linkage and crossing over, Sex linkage, Sex limited and sex influenced characters.
3. Recombination: homologous and non-homologous including transposition,
4. Linkage maps, Lod score for linkage testing, Mapping by 3 point test cross,
5. Mapping by tetrad analysis in Yeast and Neurospora, mapping with molecular Markers.

Credit III: Cytogenetics-III (15L)

1. Extra chromosomal inheritance: Inheritance of mitochondria and chloroplast genes, Maternal inheritance and its effect.
2. Quantitative genetics- Introduction to complex traits, Polygenic inheritance. Heritability & its measurement, QTL Mapping.

3. Karyotypes and genetic disorders.
4. Structural alterations of chromosomes: Deletion, Duplication, Inversion, Translocation, Complex translocation heterozygotes, Robertsonian translocations, BA translocations and their genetic implications.
5. Numerical alterations of chromosomes: Euploidy and aneuploidy and their genetic implications.

Credit IV: Plant Breeding-

1. Plant Breeding- Introduction , Defination, History (phases), Objectives.
2. Hybridization methods in plants.
3. Mutation breeding: Types, Mutagens: Physical and chemical mutagens, Mutant types, Role of mutation in breeding.
4. Induction of polyploidy, in plant.
5. Methods of Breeding for Biotic stress (Disease resistance) and abiotic stress resistance (drought resistance).
6. Procedure for of new variety.

Selected Readings:

1. Atherly, A.G., Girton, J.R. and Mcdonald, J. F. (1999) The science of genetics. Saunders College Pub. Fort Worth USA.
2. Burnham, C.R.(1962) Discussions in cytogenetics. Burgess Pub. Co., Minnesota.
3. Hartl, D.L., Jones E.W.(2001). Genetics: Principle and analysis (4th edn) Jones and Barlett Pub., USA.
4. Khush, G S (1973) Cytogenetics of Aneuploids. Academic press New York, London.
5. Lewin, B. Genes VIII. Oxford, University press. New York, USA.
6. Russel, P.J. 1998. Genetics (5th edn).The Benjamin/ Cummins Pub. Co., Inc. USA.
7. Snustad, D.P. and Simmons, M.J. 2000. Principles of genetics (4th edn). John Wiley and Sons, Inc., USA.
8. Freifelder, D. (1987) Microbial Genetics.
9. Strickberger, M.W: Genetics (4th edn). Mcmillan Publishing company, New York.
10. Griffiths, A.J.F. and Gilbert, W.M (2nd edn). Modern genetic analysis. W.H. Freeman and Company, New york.

11. Singh, B.D.(2005). Plant breeding: principles and methods. 7th edn.
12. Allard, R.W.(1960). Principles of plant breeding. John Wiley and sons, Inc., New York.
13. Chopra, V.L. (2000) Plant breeding: Theory and practice 2nd edn. Oxford & IBH Pub., Co., Ltd. New Delhi.
14. Jain, H.K. and Kharwal, M.C.(2003) Plant breeding: Mendelian to molecular Approaches. Navrosa Publishing House Pvt. Ltd., New Delhi.
15. Mandal, A.K. Ganguli, P.K., Banergee, S.P. (1991). Advances in Plant breeding. Vol 1 and 2, CBS Pub.& distributors.
16. Sharma, J.R. 1994. Principles and practices of plant breeding. Tata Mcgraw Hill. Pub. Co. Ltd. New Delhi.
17. Simmonds, N.W. 1979 Principles of crop improvement. Longman, London and New York.

BO 4.2: Plant Biotechnology & Genetic Engineering

Credits: 4

Lectures: 60

Objectives

1. To know the molecular aspect.
 2. To study Agrobacterium mediated gene transfer.
 3. To know the DNA sequencing.
 4. To know the tissue culture techniques.
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Credit I: Plant tissue culture: (15L)

1. History of plant tissue culture.
2. Laboratory condition requirement.
3. Tools and techniques for tissue culture.
4. Culture media and their constituents
5. Types of culture (Anther, callus, Micropropagation) and application of tissue culture.
6. Somaclonal variation and its significance.
7. Protoplast culture and somatic hybridization.
8. Cryopreservation.

Credit II: Recombinant DNA technology and gene cloning (15L)

1. Introduction to recombinant DNA technology.
2. Enzymes used in recombinant DNA technology.
3. Recombinant technology and gene cloning.
4. Use of vectors in cloning- Plasmids, cosmids, BACs and YACs.
5. DNA Sequencing methods (Maxam Gillbert, Sangers, Pyrosequencing and Next generation sequencing).

Credit III: Gene libraries and Screening of recombinants (15L)

1. Genomic and cDNA libraries – choice of vectors and construction.
2. RNA Interference mechanism, synthesis and its application. Virus Induced Gene Silencing(VIGS).

3. Concept of genomics and proteomics.
4. Concept of Human genome Project (HGP).

Credit IV: Genetic transformation of plan (15L)

1. Agrobacterium: Ti and Ri plasmids, transfer of DNA into host by Agrobacterium, mechanism of integration of DNA into plant genomes, vectors for chloroplast transformation, vectors for marker-free selection.
2. Transformation technique -Agrobacterium-mediated transformation, Factors affecting on Agrobacterium-mediated transformation.
3. Molecular markers and their applications.

References:

1. Recombinant DNA – Principles and Methodologies. Greene JJ and Rao VS, Marcel Dekker, New York, 1998.
2. Principles of gene manipulation. Primrose SB, Twyman RM and Old RW, 6th Edition, Blackwell Science, Oxford, 2001
3. Differentially expressed gene in plants. Hansen and Harper, Taylor and Francis Ltd. London, 1997.
4. Engineering plants for commercial products and applications. Eds. Collins GB and Shepherd RJ, NY Acad. Of Science Publishers 1996.
5. DNA markers. Eds. Caetano-Anolles and Gresshoff, Wiley-VCH Publishers, NY, 1998
6. Introduction to Bioinformatics. Attwood, T.K., Parry-Smith, DJ, Addison Wesley Longman, Harlow, Essex, 1999.
7. Bioinformatics. Westhead, DR, Parish JH and Twyman, RM, BIOS Scientific Publishers Ltd., Oxford, 2003
8. Bioinformatics – Sequence and genome analysis. D.W. Mount, CBS Publishers, NewDelhi, 2003

9. Collins GB and Shepherd RJ Eds., 1996, Engineering plants for commercial products and application. , NY Acad. Of Science Publishers
10. Senson CW Edt, 2002, Essentials of Genomics and Bioinformatics,. Wiley-VCH Publishers, NY,
11. Charlwood B.V. and Rhodes MV Edt. 1999, Secondary products from plant tissue culture. Clarendon Press, Oxford.
12. Dicosmo F and Misawa M, Edt 1996, Plant cell culture: Secondary metabolism towards industrial application, CRC press, Boca Raton ,N.Y.
13. Ramawat K G and Merillon J M, Edt.,1999 Biotechnology: Secondary metabolites, Oxford IBH Publishing Co., New Delhi
14. Buchanan BB, Grussem Wand Jones RL ,2000 , Biochemistry and molecular biology of plants , IK International Pvt Ltd. New Delhi

B.O.4.3: Plant Pathology-II

Credits: 4

Lectures: 60

Objectives:

1. To awaken the students about microbial world and the nature of diseases of plants.
 2. To understand the principles and concept in plant pathology.
 3. To understand the relationships between pathogens and plants.
 4. To become familiar with terms and references used to diagnose plant disease.
 5. To develop the awareness about the importance of plant disease in human life.
 6. To learn the basic biology of major groups of plant pathogens.
 7. To explain the concept of plant disease and disease pyramid.
 8. To describe main modes of plant disease transmission.
-

Credit I: Introduction to Plant Pathology (15L)

1. History: Beginning of modern plant pathology; Contribution of Anton De Bray; Benedict Prevost; J.C. Kuhn; Paul Neergaard, P.H. Geregory. History of the development of plant pathology in India; plant disease clinics.
2. Disease inciting agents:
 - i) Biotic agents: Bacteria, viruses, fungi, Mycoplasma, nematodes.
 - ii) Abiotic agents: Air pollution; mineral elements, temperature, toxic effects of improperly used chemicals.
3. Symptoms of plant diseases: Symptoms caused by Fungi, Bacteria, Viruses, Mycoplasma and Nematodes.
- 4 Dissemination of plant pathogen: Dissemination by Air, Water, Buds, Insects, Man and transmission of plant viruses.
- 5 Economic importance of plant diseases.

Credit-II: Diseases of crop plants I(15L)

Symptomology, causal organism, etiology and control measures of:-

- 1) Wheat: Stem rust.

- 2) Jowar: Head smut.
- 4) Arhar: Wilt.
- 5) Potato: Leaf spot (Cercospora).
- 6) Groundnut: Tikka.
- 7) Gram: Blight Disease.
- 8) Tomato: Broom rape (Orobanche).
- 9) Radish :Mosaic.
- 10) Citrus: Canker

Credit IV: Diseases of crop plants II (15L)

Symptomology, causal organism, etiology and control measures of

- 1) Mango: Anthracnose.
- 2) Pea: Rust.
- 3) Sugarcane: Wilt.
- 4) Sugarcane :Whip Smut
- 5) Chilly: Leaf curl.
- 6) Mustard: White Rust
- 7) Crucifers: Black rot.
- 8) Cucurbits: Fruit rot.
- 9) Sugarcane: Gummosis.
- 10) Giant mistletoes (Loranthus) – Mango

Credit- IV: Epidemiology and forecasting of plant diseases (15L)

1. Epidemiology and forms of epidemics:
 - i) Compound interest diseases, simple interest, diseases slow and rapid epiphytotic.
 - ii) Essential conditions of epidemics, decline of epidemics.
 - iii) Disease measurement, disease severity, analysis of epidemics.
2. Disease assessment and forecasting.
3. Pathogenesis: Penetration and entry by plant pathogen; Pre-penetration; Entry through
 - natural opening; Direct penetration; Entry through wounds, root hairs and buds.
4. Survival of plant pathogen.
5. Effects of infection on the host:
 - i) Tissue disintegration.
 - ii) Effect on growth of host.

- iii) Effect on reproduction
- iv) Effect on uptake and translocation of water and nutrients
- v) Effect on respiration of host.

Suggested readings

1. Agrios, G.N. (1969) Plant Pathology, Academic Press, New York.
2. Rangaswami, G. and A. Mahadevan (2001) Disease of crop plants in India, Printic Hall of India, Pvt. Ltd., New Delhi.
3. Gupta, V.K. and V.S. Paul (2001) Disease of vegetable crops. Kalyani Publ. Ludhiana,
4. Gupta, V.K. and S.K. Sharma (2000) Disease of fruit crops, Malyani Publ. Ludhiana.
5. Raychaudhari, S.P. and T.K. Nariani (1977), Virus and Mycoplasma disease of plants in India. Oxford and IBK Publ. Corp., New Delhi.
6. Bos L. (1999), Plant viruses, unique and intriguing pathogens. Backhugs Publ. Leiden.
7. Rangaswami, G. and S. Rajagopalan (1973), Bacterial plant pathology, T.N. Agri. Uni.Coimbatore.

B.O.4.4: Plant Pathology-III

Credits: 4

Lectures: 60

Objectives:

1. To awaken the students about microbial world and the nature of diseases of plants.
2. To understand the principles and concept in plant pathology.
3. To understand the relationships between pathogens and plants.
4. To become familiar with terms and references used to diagnose plant disease.
5. To develop the awareness about the importance of plant disease in human life.
6. To learn the basic biology of major groups of plant pathogens.
7. To explain the concept of plant disease and disease pyramid.
8. To describe main modes of plant disease transmission.

Credit I: Effect of environment on pathogenesis:(15L)

1. Effect of environment, temperature, moisture, humidity, shade, wind, light, pH, O₂ and CO₂ concentration.
2. Role of Toxins in Plant pathogenesis: Pathotoxins, Vivo toxins and Phyto toxins.
3. Effect of toxins on plant tissues: Selective and non-selective toxins.
4. Seed Pathology: Scope and importance; seed health testing; methods and procedures; detection of seed borne-fungi, Bacteria and viruses. Seed bio deterioration: Biochemical changes, Morphological abnormalities, loss in germinability. Mycotoxins, fusarium toxin and aflatoxin. Control of Post-harvest spoilage of grains.

Credit- II:Diseases of crop plants-I:(15L)

Symptomology, causal organism and control measures of:

- 1) Sorghum: Long Smut.
- 2) Chilly: Die back.
- 3) Soyabean: Charcoal rot.
- 4) Potato: Stem canker.
- 5) Tomato: Fusarium Wilt
- 6) Wheat: Loose Smut
- 7) Sugarcane: Red Rot
- 8) Papaya: Leaf Curl
- 9) Potato: Black Heart.
- 10) Potato/Flax: Dodder or Cuscuta.

Credit III:Diseases of crop plants II:(15L)

Symptomology, causal organism and control measures of:

- 1) Crucifers: Black spot.
- 2) Sorghum: Loose smut.
- 3) Bean: Rust

- 4)Wheat: Brown Rust.
- 5) Cucurbits:Powdery mildew.
- 6)Grapes: Downy mildew.
- 7) Potato: Late Blight
- 8) Wheat: Ear cockles.
- 9) Sugarcane: Mosaic
- 10) Sandal: Spike.

Credit IV: Genetic Variability:(15L)

1. Genetic Variability in plant pathogen:

- i) Genetic Variability in viruses
- ii) Genetic Variability in Fungi
- iii) Level of variability in pathogen
- iv) Loss of virulence

2. Genetics and molecular basis of host parasite interaction:

- i) Evolution of parasitism.
- ii) Genetics of host parasite interaction.
- iii) Gene for gene relationship.
- iv) Criteria for gene for gene relationship.
- v) Molecular basis of host parasitic interaction.

3. Physiologic specialization: General accounts.

Suggested readings

1. Chandnivala, M. (1955). Recent advances in plant pathology, Amol Publication, Pvt. Ltd.,
2. Nurenburg, H.W. (1985) Pollution and their ecotoxicological significance, John Wiley and Sons, New York.
3. Mehrotra, R.S. Plant Pathology, Tata McGraw Hill Publication Co., Ltd., New Delhi.
4. Agrisos, G.N. Plant Pathology, Academic Press, New York and London.
5. Bilgrami, K.S. and H.C. Dubey, A text book of Modern plant pathology, Vikas Publishing House, New Delhi.

6. Nene, Y. and P.N. Thaphyal Fungicides in plant disease control II lidiv Oxford and IBH Publishing Co., New Delhi
7. Vyas, S.C. Systemic fungicides, Vol. 1 - 3, Tata Mc(Jrnw Hill Publishing Co., Ltd., New Delhi.
8. Dekker, J. and S.G. Georgopoulos (Ed), Fungicides Resistance in plnnl Protection, CARD Publications,
9. Gangawane, L.V. and JayashreeDeshpande. Pesticides and crop plnntn in India, Ajay Prakashan, Aurangabad.
10. Holton, C.S., Fischr, C.N. Fulton, R.W., Hart, H. and S.K.A.Macallan. Plant Pathology: Problems and progress (1908 - 1958), The University of Wisconsin, USA.

RACTICALS:

Lab course -XIII Based on theory paper BO 4.1& 4.2

- 1.Preparation of stains, Fixatives, preservatives and pretreatments to plant material .
- 2.Problems on determination of blood grouping
- 3.Problems based on Multiple alleles.
- 4.Problems based on Gene mapping.
- 5.Problems based on linkage.
- 6.Study of meiotic configuration from suitable plant material.
- 7.Study of chromosomal aberrations in irradiated plant material .
- 8.Study of Polygenic inheritance.
- 9.Problems of Mendelian inheritance and estimation of gene frequencies and heterozygotic frequencies, population genetics and Linkage.
- 10.Neurospora tetrad analysis.
- 11.Linear differentiation of chromosomes through banding techniques such as C-Banding,G-Banding and Q-Banding.

12. Floral Biology, study of Pollen Viability, germination in vitro and staining of any two major crops.
13. Study of monohybrid and dihybrid crosses and interactions.
14. Study of quality traits in rice, cotton/wheat/soybean/Brassica.
15. Use of Colchicine for induction of polyploidy in appropriate plant material.
16. Demonstration of techniques of hybridization .
17. Effect of physical or chemical mutagens on crop plants of M1 and M2 population.
18. Visit to research institutes / Biotechnology/ Tissue culture laboratories / Agriculture Universities.

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

Plant Biotechnology & Genetic Engineering

1. Sterilization Techniques.
2. Preparation of stock solutions.
3. Preparation of Media MS Medium.
4. Surface sterilization of explants.
5. Characterization of Callus.
6. Protoplast isolation.
7. Preparation of Synthetic seeds.
8. Growth characteristics of E.coli using plating & turbidimetric method.
9. To detect mutants variant of a given plating techniques.
10. Isolation of plasmid from E.coli by enzymatic method.
11. Effect of temperature and alkali on absorption of DNA: hyperchromicity
12. Isolation of RNA and its quantification.
13. Visit to Plant tissue culture laboratory.

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

Lab course – XIV (Based on theory paper BO 4.3 and BO 4.4)

Practicals Based on theory paper BO 4.3 Plant Pathology-II

1. Extraction and estimation of pigments in healthy and diseased plants.
2. Detection of sugars from healthy and infected leaves by paper chromatography.
3. Production and assay of macerating enzymes.
4. Production and assay of polygalacturonase, cellulolytic enzymes, amylase.
5. Estimation of plant pigment from diseased and healthy plants
6. Detection of sugars from healthy and diseased leaves by paper chromatography.
7. Estimation of total phenol from diseased plant part.
8. Extraction and separation of alpha toxins

9-25.Symptomology, histopathology of disease given in theory.

26. Visits to fields for study of diseases.

Practicals: Based on theory paper BO 4.4 Plant Pathology-III

1. Detection of seed borne-fungi and Bacteria.

2. Evaluation of fungicide against plant pathogenic fungi.

3. Evaluation of Bioagents against plant pathogenic fungi

4. Evaluation of antibiotics against pathogenic bacteria.

5. Extraction and estimation of pigments in healthy and diseased plants.

6. Isolation of plant pathogen from infected plant parts.

7. Preparation of nutrient agar medium and PDA.

8. Study of common effect of pollutants –SO₂, NO and NH₃ on leaves of common crop plants.

9. Estimation of protein from infected seeds.

10-25. Symptomology, histopathology of disease given in theory.

26. Visits to fields for study of diseases.

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

SKELETON OF QUESTION PAPER
M.Sc. I and II Year

Semester – I, II, III & IV

Time: 2.30 hours

Maximum Marks: 60

Note: (i) Attempt all questions
(ii) All questions carry equal marks
(iii) Draw neat and well labeled diagrams wherever necessary

Q1. Long answer type question. **15**

Or

a) Short answer type question **07**

b) Short answer type question **08**

Q2. Long answer type question. **15**

Or

a) Short answer type question **07**

b) Short answer type question **08**

Q3. Long answer type question. **15**

Or

a) Short answer type question **07**

b) Short answer type question **08**

Q4. Long answer type question. **15**

Or

a) Short answer type question **07**

b) Short answer type question **08**

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR

(Autonomous)

M.Sc. I and II

PRACTICAL EXAMINATION IN BOTANY

SEE WINTER/SUMMER



Time: Four Hours

Maximum Marks: 60

Note: - (i) Attempt all questions.

(ii) Draw neat and well labeled diagrams wherever necessary

Q.1) a) Long answer type question.	15
b) Long answer type question.	
Q.2) a) Short answer type question	10
b) Short answer type question	
Q.3) Viva-voce.	05