

DEPARTMENT OF BOTANY
MPHIL/PHD COURSEWORK SYLLABUS

Code	Title	Credits
BOT-RS-C101	Research Methodology	04
BOT-RS-C102	Research Proposal	04
BOT-RS-O103	Recent advances in Plant Physiology	
BOT-RS-O104	Recent advances in Mycology and Plant Pathology	
BOT-RS-O105	Taxonomy, Biodiversity & Conservation	
BOT-RS-O106	Recent advances in Ecology	
BOT-RS-O107	Trends in Biotechnology	04

BOT-RS-C101: RESEARCH METHODOLOGY IN PLANT SCIENCES

Unit I: Research Methodology

Experimental design - Basic principles of experiment: Experimental unit, sampling unit, Experimental error, replication, Generalization and randomization, control; Fundamentals of research- characteristics of research, classification of research (pure research, applied research, descriptive, experimental, historical etc); Research process - Steps and elements, selection, analysis and statement of the problem. Literature collection and citation, bibliography. Writing skills - Preparation of research report, presentations, writing grant proposals.

Unit II: Statistical Methods

Data analysis - variables, numerical, categorical Central measures (mean, median, mode); Dispersion measures (range, standard deviation), probability, co- relation and regression, Binomial position and normal distribution, parametric and non parametric tests t-test, f-test, chi-square test, ANOVA.

Unit III: Analytical Methods

Microscopic Techniques: Light microscope: Resolving power and magnification, Phase Microscope, Fluorescence Microscope, Confocal Microscope, Micrometry. Electron Microscope: Transmission and scanning techniques for E.M. Spectrophotometry: Electromagnetic spectrum, construction of calorimeter and spectrophotometer, Applications. Analytical techniques: GC-MS, HPLC, FT-IR, Maldi, Raman, Etc.

Unit IV: Techniques in Plant Sciences

Algal cell culture - Algal culture, Fungal culture - Fungal culture media, Protoplast and Spore culture, Plant cell Culture- Cellular totipotency, cytodifferentiation, Somatic embryogenesis, Preservation techniques- Histochemical and cytochemical preservation, Herbarium, Molecular biological Techniques- Gene amplification and PCR, Molecular Probes, DNA fingerprinting

References:

1. P.N. Arora and P.K. Malhan (1998). Biostatistics. Himalaya Publishing Bombay.
2. P.S.G. Kumar (2004). Research methods and statistical techniques. B.R. publishing Academy, Udaypur.
3. G.B.N. Chainy, G. Mishra and P.K. Mohanty (2004) Basic Biostatistics. Kalyani Publisher.
4. N. Gurumani (2006). Research Methodology for Biological Sciences. MJP Publishing, Chennai.
5. C.R. Kothari (2004). Research Methodology- Methods and Techniques, New Age Publ. Wiley Eastern, 1985.
6. Dawson, Catherina (2002). Practical Res. Methods. New Delhi. UBS Publ.
7. Kumar Ranjit (2005). Res. Methodology. A step by step Guide for Beginners. Singapore, Pearson Education.

BOT-RS-C102: RESEARCH PROPOSAL AND PREPARATION

Objective: To learn the preparation of Research Proposal through review of literature in the chosen field of research, identification of gaps in the knowledge and preparation of specific objectives to bridge the gaps with realistic budget requirement.

Activities:

- Sources of research material, literature survey, compiling records.
- Collection of source documents- research papers, review paper, book reviews, theses, and conference and project reports.
- Preparation of submission of proposal.
- Develop communication skills for presentation of proposal and justification of budget.
- To understand follow ethical issues in research.

BOT-RS-O103: RECENT ADVANCES IN PLANT PHYSIOLOGY**Unit I: Lipids and Amino Acids Biosynthesis**

Lipids- structural and storage lipids and their functions; Amino acid biosynthesis and assimilation in plants

Unit II: Secondary Metabolites

Secondary metabolites- Role of natural products in plant defense, pharmaceuticals and cosmetics; Development of transgenic plants for abiotic stress tolerance; Phytoremediation Stress Proteins in plants- HSP, osmotin, PR, BSIPS, salt-, cold- and UV light- induced proteins.

Unit III: Stress physiology

Biotic and Abiotic stress; Physiological and Biochemical responses of plants to environmental stress; Plant responses to salinity and chilling stress; Abiotic stress and secondary metabolite production.

Unit IV: Hormones & Signal Transduction

Hormonal regulation of plant growth and development, signal Transduction, Role of PGR in agriculture and horticulture, Status of Plant Physiology Research in India.

References:

1. L. Taiz and E. Zeiger (2002) Plant Physiology (Second Edition) Simauer Associates Inc Publishers Sunderlands, Massachusetts
2. H.W. Heldt (1997) Plant Biochemistry and Molecular Biology Oxford University Press
3. W.G. Hopkins (1985) Introduction to Plant Physiology John Wiley and Sons, Inc. New York
4. Methods in Enzymology Colowick and Caplan Academic Press, New York
5. Coombs, Hall, Long and Scurlik (1985) Techniques in Bioproductivity and Photosynthesis, Pergmon Press, Oxford
6. Hall, Scurlik, Bolhar, NordenKamf, Leagood and Long (1993) Photosynthesis and production in a Changing Environment. A Field and Laboratory Manual, Chapman and Hall Publication
7. Buchnan, B.B., Gruissem, W. and Jones, R.L. (2000) Biochemistry and Molecular Biology of Plants. I.K. International Pvt. Ltd., New Delhi.

Journals

- a) Annual Review of Plant Physiology and Molecular Biology
- b) Trends of Plant Sciences
- c) Plant Physiology
- d) Physiologia Plantarum
- e) Journal of Experimental Botany
- f) Indian Journal of Plant Physiology

BOT-RS-O104: RECENT ADVANCES IN MYCOLOGY AND PLANT PATHOLOGY

Unit I: Introduction to Mycology

Current scenario of Mycology and Plant Pathology in India; Role of Fungi in Biotechnology: Selection, Production formulation and Commercial use of fungi in biocontrol of plant diseases, insect and weeds. Ganomedicines.

Unit II: Plant Diseases

Molecular techniques for Identification and classification of fungi; Seed pathology: Major seed borne plant pathogens of fungal, bacterial and viral origin. Techniques involved in identification of seed borne pathogens.

Unit III: Plant Defense

Recent concept of plant defence: Mechanism of sensing pathogenecity, Systemic Acquired Resistance (SAR), Biochemical defence, Regulation of lignification in defence.

Unit IV: Fungal Biotechnology

Fungal protoplast: Isolation, mycolytic enzymes, hyphal organization and protoplast formation, PEG induced and electrofusion of protoplast, Application and feature prospect of protoplast, Chemical management of plant pathogens.

Reference Books:

1. Dennis, E.S. et al, 1992 Plant Gene Research: Basic knowledge and Application. Springer-Verlag Wien Publ. New York.
2. Gengopadhyay, S 1984 Clinical plant pathology, Kalyani Publ. New Delhi
3. Nane Y.1 and Thapliyal 1979, Fungicides in plant disease control. Oxford IBH, Publ. New Delhi.
4. Smith, J.E and D.R. Berry. 1978. The filamentous fungi. Vol-I Industrial mycology. Vol-II Development Mycology, Edward Arnold Publ. London
5. Taiz, I, and E. Zeiger. 1998. Plant physiology, Sinauer Assoc Inc. Publ. New York.
6. Trehan. K.1994. Biotechnology, Wiley Eastern Ltd, New Delhi.
7. Vaidya, J.G 1995 Biology of the fungi, Satyajeet Prakashan, Pune.
8. Vyas, S.C.1992. Hand Book of Systemic fungicides, Vol-I, II, III, Tata McGraw Hill, New Delhi.
9. Whipps, J.M. and R.D. Lumsden. 1989. Biotechnology of Fungi for Improving plant Growth. Cambridge Univ. Press, New York.

Journals

- a) Indian Phytopathology
- b) Annual Review of Plant pathology
- c) Index of Fungi
- d) Phytopathology
- e) Kavaka

BOT-RS-O105: TAXONOMY, BIODIVERSITY AND CONSERVATION

Unit I: Taxonomy and Biodiversity

The principles and practices of Taxonomy. The role of Taxonomy. Global biodiversity, measures of biodiversity, diversity indices, biodiversity values, use and importance of biodiversity, threatened biodiversity, major causes of biodiversity loss. Biodiversity of India. RET species. The role of Taxonomist in conservation.

Unit II: Variation, Biosystematics, Population Genetics and Evolution

Key concepts in plant evolution. Developmental, experimental and genetic variations, breeding systems, apomixism, population genetics, evolution

Unit III: Plant Classifications

Phenetic methods, molecular systematics, cladistic methods, phylogenetic analysis, APG classification. Diagnostic features, systematic position and affinities of major groups of flowering plants recognized in APG classification: Basal angiosperms, Magnoliids, Monocots, Commelinids, Eudicots, Core Eudicots-II.

Unit IV: Taxonomy and conservation

Needs, politics, Economics, issues, plant diversity. Biotechnology and biodiversity conservation, In-situ and ex-situ conservation. Climate change and Biodiversity. Biodiversity and Forest Acts.

Environment Impact Assessment. Role of Botanical Gardens in plant conservation. Concept of Lead Botanical Gardens and Biodiversity Parks. National Programmes on plant conservation.

Reference books:

1. Ray Samit and A.K. Ray (ed.) 2006. Biodiversity and Biotechnology. New Central Book Agency Ltd. Kolkata.
2. Singh Gurucharan 2010. Plant systematic: An Integrated approach. Science Publisher. USA.
3. Judd, W.S., Campbell, C.S., Kollogg, E.A., Stevens, P.F. and Donoghue M.J.2008.
4. Plant systematic: Phylogenetic approach. Sinauer Associates, Inc.
5. Futuyma D.J. 2009. Evolution. Sinauer Associates, Inc. Publishers, Sunderland.
6. Groom, M.J., Meffe, G.K. and Carroll, C.R.2006. Principles of conservation biology. Sinauer Associates, Inc.
7. Etelka leadlay and Stephen jury (ed.) 2006 Taxonomy and plant conservation. Cambridge University Press. UK.
8. David Briggs 2009. Plant microevolution and conservation in human influenced ecosystems. Cambridge University Press. UK.

Journals

- a. **Kew Bulletin**
- b. **Journal of Taxonomic & Economic Botany**
- c. **Plant Ecology**
- d. **Biodiversity and Conservation**

BOT-RS-O106: ADVANCES IN PLANT ECOLOGY

Unit I: Ecology and Globalization

Phytogeography of Indian Subcontinent; Ecology in a global Economy, Image of Ecology Economics, Globalization as a global opening concept of sustainable development

Unit II: Ecological System

Plant habitat relationship: Allelopathy, Mechanism of self regulation in ecological systems.

Unit III: Conservation Ecology

Understanding rarity and monitoring rare plants population. Use of IUCN guidelines. Population Size: Conservation Dilemma. Concept of minimum viable population size. Concept of maximum tolerance population size.

Unit IV: Restoration Ecology

Restoration of degraded lands: Habitat restoration for afforestation with any suitable example Ecotoxicology with respect to contamination of food chains. Ecofriendly approach, Bioremediation, Green products.

Reference books:

1. Davy, A.S. Hutchings, M.S. and Watkinson, A.R. (1988). Plant population Ecology, 28th Symposium of the British Ecological Society.

2. Krebs, C.J.(1994). Ecology (IV ed.) the experimental analysis of Distribution and abundance, Hamper Collins.
3. Osborne, P.L.(2000). Tropical ecosystems and ecological concepts. Cambridge University Press.
4. Synge, H. (1981). The Biological aspects of rare plant conservations. John Wiley and Sons.
5. Brij Gopal, P.S. Pathak, K.G. Saxena (1998). Ecology Today- an anthology of Contemporary Ecological research. International Scientific Publication

Journals:

- a) Nature and Biosphere
- b) Nature, Environment and Pollution technology
- c) Ecology, Environment and conservation
- d) Indian Journal of Environment and Ecoplanning
- e) Journal of Tropical Ecology

BOT-RS-O107: TRENDS IN BIOTECHNOLOGY

Unit I: Techniques in Biotechnology

Application of Tissue culture and achievements in plant biotechnology, Techniques in biotechnology: Molecular diagnostics- Immunological, DNA diagnostic systems, Molecular diagnostics of genetic diseases, Array based markers (SFPs, DArT), Transgenic crops: Crop productivity and nutritional quality.

Unit II: Molecular Biotechnology

Construction of synthetic vectors and their uses in r-DNA technology, An overview of gene silencing and its applications, DNA barcoding in plants.

Unit III: Biotechnology and Biosafety

Objectives, risk assessment, regulation, Biosafety during industrial, Production, Biosafety guidelines in India, Guidelines and regulation Biotechnology for environment: Bioenergy, Biofuel, Bioremediation and Climate change.

Unit IV: Genomics, Proteomics and Bioinformatics

Sequencing of whole genome, functional and comparative genomics, (Rice, Arabidopsis, Soyabean), Proteomics and Proteome analysis, Bioinformatics and data mining (In silico Biology).

References:

1. Agarwal, S.K. (2007) Bioinformatics. APH Publishing Corporation, New Delhi.
2. Glick, B.R. and Pasternak, J.J. (1994) Molecular Biotechnology: Principles and Application of r- RNA Press, Washington.
3. Gupta, P.K. (2006) Cell and Molecular Biology, Third edition. Rastogi Publications, Meerut.
4. Kumar, S. and Flading M. (2005) Molecular Genetics and Breeding of Forest Trees. International Book Distributers, Lucknow.
5. Mandal, A.K. and Gibson, G.L. (2008) Forest Genetics and Tree Breeding. CBS Publishers and Distributers, New Delhi.

6. Russell, P. (2010) Genetics- A Molecular Approach, Third edition. Pearson Benjamin Cummings, San Francisco.
7. Sharma, Munjal and Shankar (2008) A Textbook of Bioinformatics. Rastogi Publications, Meerut.
8. Singh, B.D. (2009) Biotechnology: Expanding Horizons, Kalyani Publishers.

Journals:

1. Applied Microbiology & Biotechnology
2. Biotechnology Letters
3. Biotechnology Techniques
4. Indian Journal of Biotechnology
5. Biotechnology Journal
6. British Biotechnology Journal
7. BMC Plant Biology