

SYLLABUS FOR Ph.D. COURSE WORK



**DEPARTMENT OF PLANT MOLECULAR BIOLOGY
FACULTY OF INTERDISCIPLINARY & APPLIED SCIENCES
UNIVERSITY OF DELHI, SOUTH CAMPUS
NEW DELHI – 110 001
INDIA**

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The department offers two papers (PMB I and PMB II) for Ph.D. course work. These two papers are also open for students from other departments under FIAS. Each paper will be of 4 credits and the credit assigned to Ph.D. course work shall be a minimum of 8 credits and a maximum of 16 credits. The Ph.D. students of Department of Plant Molecular Biology can also opt for courses in allied subjects being offered by other departments affiliated to FIAS. A student shall be required to complete the coursework within initial one or two semesters. A paper on 'Research Methodology' is compulsory. The courses to be opted by students in each semester should be in consultation with the Research Advisory Committee and with concurrence of the Departmental Research Committee (DRC).

Details of Papers:

The research methodology paper is based on literature survey, instrumentation, core techniques in molecular biology, computer application, data search, and presentation and writing skills. The other course is aimed at introducing the students to advances in the field of plant molecular biology and plant biotechnology.

S. No.	Code of the Paper	Name of the Paper
1.	PMB I	Research Methodology
2.	PMB II	Advances in Plant Molecular Biology and Biotechnology

Evaluation Criteria:

The papers will have components of end-of-semester examination and continuous evaluation or internal assessment. The criteria for internal assessment shall be decided by the Coordinator and the teachers involved in teaching the respective courses. Students shall be required to attend a minimum of two-third of the lectures delivered in individual papers. The maximum marks for each paper are 100 and a student must score at least 55 marks to pass a paper. The distribution of marks is as follows:

Code of the Paper	Offered in Semester	Maximum Marks (100)	
		End-of-semester Examination	Internal Assessment
PMB I	Semester I (July-Nov)	70	30
PMB II	Semester II (Jan-May)	70	30

PMB I: RESEARCH METHODOLOGY

1. **Instrumentation** -- Basic techniques in Microscopy, Spectroscopy, Spectrometry, Centrifugation, Electrophoresis (gel and chip), Biacore, Gene gun (biolistic), related topics. *8 lectures*
2. **Core Techniques of Molecular Biology** -- Cloning vectors, Cloning methodologies, PCR and its modifications, Gene expression studies, Bimolecular interaction studies, Next Generation Sequencing (NGS) methodologies, Protein sequencing, related topics. *12 lectures*
3. **Literature Survey** -- Reading and interpretation of research papers, Critical analyses of research problems, Research design, Sampling, Patent search, related topics. *3 lectures*
4. **Computer Applications** -- Basics of Computer Operating System: basics of UNIX and Linux commands, Using Windows, Directory structures, Command structure (Document preparation, EXCEL, Power Point Presentation), Scientific editing tools, related topics. *6 lectures*
5. **Database Search & their Utilities** -- Data mining and analysis, preparation and interpretation. *2 lectures*
6. **Introduction to Biostatistics** -- Univariate analysis (frequency tables, bar charts, pie charts, percentages), Bivariate analysis, Cross tabulations, t-test, Chi-square test, correlation, SPSS, p-value, ANOVA (analysis of variance), cluster analysis, related topics. *8 lectures*
7. **Presentation Skills** -- Oral and written presentations, Hand-outs and Brochures, Paper and grant writing skills, Thesis writing tutorials, Project work (drafting a research paper or a project work), related topics. *4 lectures*
8. **Ethics in Science** -- Copyright, Royalty, Intellectual property rights and Patent laws, Reproduction of published material, Plagiarism, Citation and acknowledgements, Reproducibility and accountability, Conflict of Interest, related topics. *5 lectures*
9. **Research Seminars on Related Topics** *14 lectures*

PMB II: ADVANCES IN PLANT MOLECULAR BIOLOGY AND BIOTECHNOLOGY

1. **Unifying Concepts in Light and Hormone Signal Transduction in Plants** -- Diversity of sensory receptors and their evolutionary significance; Two-component sensor-regulator system; Light- and hormone-regulated signaling. *5 lectures*
2. **Forefronts of Calcium Signal Transduction in Plants** -- Calcium as “Hub and Nodal point” in multiple signaling (biotic and abiotic stress); Development of calcium signaling networks with advanced tools and techniques. *5 lectures*
3. **Plant Development** -- Model systems; Developmental differences between animals and plants; Early plant embryogenesis. Patterning and molecular mechanisms of differentiation. *5 lectures*
4. **Gene Regulatory Networks Controlling Flower Development** -- ABCDE model of flower development; Floral initiation and meristem specification; Male and female reproductive development. *5 lectures*
5. **Bioinformatics** -- Biological Databases; Sequence alignment, phylogenetic analysis; Generation and analysis of whole genome data, Whole genome annotation taking examples of major plant genomes. *5 lectures*
6. **Small RNA-mediated Gene Regulation** – Types of non-coding RNAs: Sequencing, detection and validation, Mechanism of action and biological roles; Artificial microRNA (amiR) and siRNA technology. *5 lectures*
7. **Plant Biotechnology and Production of Transgenics for Resistance to Varied Abiotic Stresses** -- Conventional plant breeding, molecular breeding and transgenic science; Tools and techniques for production of transgenic plants; Developing transgenic plants for resistance/tolerance to abiotic stresses. *5 lectures*
8. **Interaction of Plants with Viruses** -- Organization, functions and dynamics of viral genes; Viral promoters; RNA-interference and viral infections; Viral suppressors and their role in pathogenesis; Virus-induced gene silencing; Development of transgenic virus resistance in crops. *5 lectures*
9. **Regulation of Fruit Ripening and Quality Addition and Role of Plants as Bioreactors** -- Role of ethylene; Genes manipulated for delayed ripening; Improvement of folate, lycopene and flavor compounds. Strategies for high-level expression, down-stream processing; Humanization of plant expressed products, few success stories. *5 lectures*
10. **Molecular Breeding and IPR-related Issues** -- Molecular markers; Marker-assisted breeding (MAB) and molecular-assisted selection (MAS); IPR-related issues, trade marks, copy rights, patents, geographical indicators. *5 lectures*
11. **Research Seminars on Related Topics** *14 lectures*