

**DEPARTMENT OF GENETICS  
FACULTY OF INTERDISCIPLINARY & APPLIED SCIENCES  
UNIVERSITY OF DELHI SOUTH CAMPUS**

**Syllabus for Ph.D course work**

The department offers the following three papers for Ph. D course work

**Paper I (PGEN01): Advances in Genetics – I**

**Paper II (PGEN02): Advances in Genetics –II**

**Paper II (PGEN03): Research Methodology**

**PGEN01** and **PGEN02** are aimed at introducing to the students the salient features of several model systems, highlighting their utility in genetics and genomics research. They will also be updated on the advances in both basic and applied aspects of contemporarily significant areas in genetics, genomics and biotechnology research across life sciences.

**PGEN03** is aimed at teaching the essentials to fresh Ph.D students to train them in the appropriate methods that they should inculcate early on in their scientific pursuit. It is proposed to teach this course in an interactive mode and taking in-house examples. It is projected to follow mainly a continuous evaluation mode for this paper based on assignments and presentations.

These courses are also open for students from other departments. The students of the department are also free to choose papers from Ph.D courses offered by other departments. A student has to pass three papers in one year (two semesters), including one on research methodology to have successfully completed the Ph.D. course work.

Evaluation: All three papers will have components of end semester examination and continuing evaluation. The total marks for each paper will be 100. A student has to score 50 marks to pass a paper. The distribution of marks will be as follows:

<b>Paper</b>	<b>Total marks (100)</b>	
	<b>End semester examination</b>	<b>Continuing Assessment</b>
PGEN01	70	30
PGEN02	70	30
PGEN03	50	50

All three courses will be offered in the July to December semester.

## PGEN01: Advances in Genetics - I

- **Revisiting concepts in genetics:** variations, segregation, independent assortment, gene interactions, linkage, recombination and genetic maps  
18 lectures
- ***Saccharomyces cerevisiae*:** A hotbed for discovery of basic biological processes in eukaryotic cells; Metabolic switching and adaptation as a connection between yeast and cancer formation; A tool to study longevity; Discover platform for numerous genomic technologies, A model for studying pathogenic yeast  
12 lectures
- ***Dictyostelium discoideum*:** Classical experiments; Genome organization; Starvation-induced development - morphogenesis, cell movement, chemotaxis, cell differentiation and pattern formation; Signaling molecules and its influence on cell differentiation; A model for various cellular processes and in understanding the shared pathological mechanism of disease (human neurodegenerative diseases and intracellular bacterial pathogens)  
12 lectures
- ***Drosophila melanogaster*:** Tools for genetic analyses, studying developmental processes and cell signaling, disease modeling and analyses  
12 lectures
- **Microbial pathogenomics:** Genome organization of plant pathogens; genomic tools to understand evolution of pathogenesis in plant microbes; Evolution of virulence determinants- gene duplication, horizontal gene transfer and genome reduction  
12 lectures

## PGEN02: Advances in Genetics – II

- **Plant genetics and breeding:** Natural breeding systems; Concept of gene pool; Haploidy and polyploidy and their implications in breeding; Breeding methods; Genetic basis of heterosis and their exploitation in development of hybrid varieties; Molecular plant breeding - molecular markers in genome and gene mapping, QTL analysis, marker assisted breeding, map-based cloning of genes  
18 lectures
- **Biotechnological approaches for crop improvement:** Plant cell and tissue culture techniques and their applications in agriculture; Gene transfer in plants; Transgenic plants for crop improvement; Biofortification; Biopharming; RNA silencing and its applications in plants  
18 lectures
- **Medical genomics:** Genetic variation (Chromosomal, SNPs, Indels, CNVs) in health and disease; Human Genome Project; Human Genome mapping methods - Physical mapping (Chromosomal banding through Next Generation sequencing) and Genetic mapping (Linkage analysis using RFLP/MS/SNP markers); Applications of mapping-linkage/association mapping for disease gene identification in monogenic and complex disorders; Diagnostic genetics, Genetic counseling; Functional genomics  
14 lectures
- **Cancer biology:** Genetic and epigenetic basis of cancer; Methods and models in cancer research; Updates on cancer therapy  
14 lectures

## PGEN03: Research Methodology

- **Identifying a broad research area:** Basic versus applied; Narrowing down to a sub-area  
2 lectures
- **Relevant scientific literature search:** Importance and methods (including choice of key words); Learning to distinguish between original work, repetitive work and validation study  
2 lectures
- **Framing a research question:** Identification of lacunae in the research area of interest; Hypothesis generation; Defining the aims/objectives; Revising objectives at a later date  
2 lectures
- **Designing a realistic research strategy including alternate strategy;** Study design, Importance of - inclusion of negative and positive experimental controls, biological and technical replicates, single and double blind studies, coding/anonymisation of samples, statistics based sample size determination prior to finalization of study design  
6 lectures
- **Recording observations:** Importance; Methods of transparent and systematic record keeping; Maintenance of laboratory work books – hard and soft copies; Storage of data including taking regular backups  
4 lectures
- **Organization and analysis of observational/experimental data:** Hypothesis testing, hypothesis generation, unbiased analysis, importance of looking beyond the obvious, serendipitous findings, independent cross-validation of data; Interpretation of data  
6 lectures
- **Presentation of data:** Raw and analyzed data; Methods- Graphic, pictorial, tabular, oral, poster  
16 lectures
- **Scientific writing:** Abstract, synopsis, concept note, full length research proposal, research paper, research thesis; Importance and styles of citing references  
16 lectures
- **Safety in research:** Handling of biohazardous substances, disposal of biohazardous waste; Biosafety issues- Chemical, radiation, recombinant DNA, biological material  
2 lectures

- **Research ethics:** Honesty, acknowledgement of contributions, authorship issues, plagiarism, fraud  
2 lectures
- **Regulatory bodies in research:** Institutional ethics committee, Institutional biosafety committee, Animal ethics committee  
2 lectures
- **Debatable issues in applied research:** Genetically modified foods; Ethical, legal and social issues in biomedical research  
2 lectures
- **IPR issues in research**  
2 lectures