

# **COURSES OFFERED FOR Ph.D. CURRICULUM**

**July 2023 onwards**



**Department of Biochemistry  
Faculty of Interdisciplinary and Applied Sciences  
University of Delhi South Campus  
Benito Juarez Road New Delhi-110021**

**Passed in DRC held on 17<sup>th</sup> July 2023**

The courses offered for the Ph.D. curriculum aim to provide the students with excellent knowledge in various Tools, Techniques and Research methodologies in Biochemistry emphasizing on solid background of basic concepts as well as rapid advancement in the field, providing them an initiation into their respective research fields. The department will offer the following two papers for Ph.D. course work:

Paper I (BIOCHEM P-I): RESEARCH METHODOLOGY

Paper II (BIOCHEM P-II): TOOLS AND TECHNIQUES IN BIOCHEMISTRY

These courses are also open for Ph.D. students from other departments in FIAS. The Ph.D. students of the biochemistry department are also free to choose from Ph.D. courses offered by the other departments. A student has to pass both the papers in one academic year (two semesters) to successfully complete the Ph.D. course work.

**Evaluation:** All the papers will have components of continuous evaluation and end semester examination. 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:

| Paper        | Continuous evaluation | End-semester evaluation | Total Marks |
|--------------|-----------------------|-------------------------|-------------|
| BIOCHEM P-I  | 50                    | 50                      | 100         |
| BIOCHEM P-II | 30                    | 70                      | 100         |

Both the courses will be offered in the July to December semester.

## **RESEARCH METHODOLOGY (BIOCHEM P- I)**

**CREDITS- 4**

**Total Hours: 64**

### **Unit 1. Biosafety and Bioethics in Research\***

**No. of Hours: 8**

Guidelines for Biosafety and Bioethics; Safety practices and Bio-waste in the laboratory; Radioactivity and safety; Fire hazards and safety; Institutional Biosafety, Ethics and Animal Ethics compliance and concerns; Genetically modified organisms; Patents and Intellectual property rights; Guidelines for Ph.D. thesis.

### **Unit 2. Defining the Research Problem**

**No. of Hours: 34**

Identification of broad area of research; Review of literature using appropriate sources – reviews, patents, research papers, books; Utilization of tools for literature source – web and libraries; Defining a research problem

### **Unit 3. Experimental Approaches and Methodology**

**No. of Hours: 12**

Experimental designs to address the research problem; Alternative plans for experimental design; Tools and techniques to execute experiments; Means to validate and analyze data; Methods of record keeping.

### **Unit 4. The art of Presentation**

**No. of Hours: 10**

Development of writing skills – Plan of research, Research project, Research report, Research article and review, Term paper; Bibliography, referencing and footnotes; Creation of reference libraries; Plagiarism check; Development of Oral presentation skills – Planning, Preparation, Practice, Oration; Use of visual aids and software like MS Word, MS PowerPoint, MS Excel, EndNote.

Students are expected to undertake the following assignments, exercises and evaluations.

1. Identify the broad area of research in consultation with Ph.D. supervisor.
2. Review literature, collate information, identify scope of research, formulate a research plan and prepare and submit a term paper including references.
3. Present and defend their research plan orally.
4. Evaluation will be based on term paper and oral presentation.

\*Students are also encouraged to attend 1-2 days workshops / seminars / lectures on IPR / Bioethics / Biosafety. This can count towards the hours assigned for the module.

## **SUGGESTED READINGS**

1. Research Methodology - Methods and Techniques (2004) 2<sup>nd</sup> ed., Kothari C.R., New Age International Publishers.
2. Research Methodology: A Step-by-Step Guide for Beginners (2005) 2<sup>nd</sup> ed., Kumar R., Pearson Education.

## TOOLS AND TECHNIQUES IN BIOCHEMISTRY (BIOCHEM II)

**CREDITS- 4**

**Total Hours: 64**

### **Unit 1. Genomics**

**No. of Hours: 11**

Global expression profiling; Whole genome analysis of mRNA and protein expression; Real time PCR to monitor changes in expression levels; Concept of microarrays and its applications for DNA, RNA and proteins.

### **Unit 2. Spectroscopy and Spectrometry**

**No. of Hours: 11**

General principles of spectroscopy and spectrometry, theory and applications of various spectroscopic techniques; Mass spectrometry and its biological applications.

### **Unit 3. Recombinant DNA Technology**

**No. of Hours: 10**

Use of Restriction and modification enzymes in cloning, Plasmid/Phagemid vector, Ligation, Transformation and Plasmid isolation, Design of primers; PCR: Standard PCR, Hot Start PCR, Allele-Specific PCR, Colony PCR, Nested PCR, Applications of PCR in research, Basic DNA sequencing methods. Sanger's chain termination method, and automated DNA sequencing, Introduction to next generation sequencing (NGS) methods including base calling, sequence alignment, and variant calling.

### **Unit 4. Growth, Maintenance and Genetic engineering of Mammalian cells**

**No. of Hours: 11**

Basic requirements for *in vitro* cell culture, live cell staining and counting. Synchronization of mammalian cells and cell cycle analysis. Various ways of overexpressing and silencing genes in mammalian cells; Generation of transient and stable lines. Use of radioisotopes in cell biology.

### **Unit 5. Concepts of vaccine development**

**No. of hours- 10**

Vaccine development history, Vaccine generations and types, Vaccines and immunological memory, adjuvants, mechanism and need of adjuvant, vaccine engineering, antigen and antigenicity, Immune epitope database (IEDB), epitope mapping, vaccine preparation and protein expressions, vaccine testing and clinical trials.

### **Unit 6. Purification and Characterization of proteins and Drug discovery**

**No. of Hours: 11**

Expression vectors; Expression, isolation and purification of heterologous proteins; Chromatography techniques for protein purification; Mapping of protein interactions: two hybrid, Protein fragment complementation, Concepts of drug discovery and development.

## SUGGESTED READINGS

1. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2<sup>nd</sup> ed., Freifelder, D., W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 / ISBN:0-7167-1444-2.
2. Molecular Cloning: A laboratory Manual (2012) Vol. 1-3, 4<sup>th</sup> ed., Green M.R. and Sambrook J., Cold Spring Harbour Laboratory Press (New York). ISBN: 978-1-936113-41-5 / ISBN: 978-1-936113-42-2.
3. Animal Cell Culture & Technology (2004) 1<sup>st</sup> ed., Butler, M., Taylor & Francis Publishers (UK), ISBN-1: 859960499.
4. Principles and Techniques of Biochemistry and Molecular Biology (2010) 7<sup>th</sup>ed, Keith Wilson and John Walker, Cambridge University Press India Pvt. Ltd., ISBN-13: 978-0-521-17874-7 / ISBN:10: 0-07-099487-0.
5. R. Burgess, M. P. Deutcher. 2009. Guide to Protein Purification, Academic Press, San Diego, USA.
6. System vaccinology: The history, the translational challenge and the future (2022); Academic Press Inc; ISBN-10: 0323859410.
7. Vaccine Design: Methods and Protocols, Volume 3. Resources for Vaccine Development: 2412 (Methods in Molecular Biology); Springer-Verlag New York Inc.; 2nd ed. 2022 edition; ISBN-101071618946 :