

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

**July 2016 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 3rd February, 2016**

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 three papers for Ph.D. course work:

Paper I (BIOCHEM P-I): RESEARCH METHODOLOGY

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

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

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 all the three papers in one academic year (two semesters) to successfully complete the Ph.D. course work.

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

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

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

# RESEARCH METHODOLOGY

## (BIOCHEM P-I)

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

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; Plagiarism; Reproduction of published material, Citation and acknowledgement; Guidelines for Ph.D. thesis.

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

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**

Experimental designs to address the research problem; Pros and cons of the experiments; 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**

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; Importance of effective Communication.

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.

### **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- I (BIOCHEM P-II)

## **Unit 1. Biochemical Reagents and Solutions**

Preparation of solutions; Concepts of solution strength (concentration); Sterilization of solutions; Buffer preparation - Concept of pKa and Henderson-Hasselbach equation, Concept of conjugate acid and base.

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

Principle, instrumentation and applications of absorbance, fluorescence and circular dichroism spectroscopic techniques; Mass spectrometry and its applications including 2D PAGE and basic proteomics. Estimation of biomolecules.

## **Unit 3. Recombinant DNA**

Amplification of DNA using PCR; Design of primers; Use of Restriction and modification enzymes in cloning, Plasmid vector, Ligation, Transformation and Plasmid isolation, 8. Basic DNA sequencing methods, Sanger's chain termination method, and automated DNA sequencing, Base calling and sequencing accuracy, Introduction to next generation sequencing (NGS).

## **Unit 4. Genomics**

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.

## **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. An Introduction to Practical Biochemistry (1998) 3<sup>rd</sup> ed., Plummer D. T., Tata McGraw Hill Education Pvt. Ltd. (New Delhi), ISBN:13: 978-0-07-099487-4 / ISBN:10: 0-07-099487-0.
3. 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.

## **TOOLS AND TECHNIQUES IN BIOCHEMISTRY- II (BIOCHEM P-III)**

### **Unit 1. Growth and Maintenance of Mammalian cells**

Classification of cell culture; Preparation of primary culture from tissues or organs; Requirements for *in vitro* cell culture, determination of doubling time, live cell staining and counting, freezing, thawing and synchronization of mammalian cells.

### **Unit 2. Characterization and Genetic engineering of animal cells in culture**

Various ways of overexpressing and silencing genes in mammalian cells; Generation of transient and stable lines. Application of FACS for detection of cell surface markers, apoptotic cells and cell cycle phases. Analysis of cell signaling pathways by Western blotting, Immunoprecipitation and Pull down assays; Use of radioisotopes in cell biology.

### **Unit 3. Cell Fractionation and Cell-cell Interaction Methods**

Cell fractionation; Centrifugation; Isolation and purification of membrane proteins and lipids; Various methods to study cell-cell and cell-virus fusion, Electrophoresis.

### **Unit 4. Animal Handling**

Handling and maintenance of animals, cages, feed, animal house; Life cycle of mouse; Dissection and anatomy. Immunization of animals, various routes of injection, blood collection and euthanasiation.

### **Unit 5. Purification, Characterization of proteins and Drug discovery**

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. Animal Cell Culture & Technology (2004) 1<sup>st</sup> ed., Butler, M., Taylor & Francis Publishers (UK), ISBN-1: 859960499.
2. 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.
3. 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.
4. R. Burgess, M. P. Deutcher. 2009. Guide to Protein Purification, Academic Press, San Diego, USA.