GENERIC ELECTIVES (GE-6)
VI. 4.3. Genomics and Proteomics

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Prerequisite of the course (if any)	Dept. offering the course
		Lecture	Tutorial	Practical/ Practice			
Genomics and Proteomics GE-6, VI.4.3	4	2	0	2	12th Pass	Basic knowledge of biological sciences	Chemistry / Biology Faculty of CIC

Learning Objectives

This module is designed to:

- Introduce students to basic RDT techniques
- Introduce students to basic tools of genomics and proteomics
- Introduce students to building and analyzing networks involving complex biological data.

Learning outcomes

After studying this course, the students will be able to:

- Design primers for PCR
- Well-versed in gene cloning techniques
- Will develop skills in understanding the advancement of the genomic and proteomics branches of Sciences and their importance in manipulating genome and proteome.

SYLLABUS

Unit I: Basics of gene cloning (8 Hours)

Introduction to Recombinant DNA technology, Isolation of DNA, PCR amplification, Types of PCR, Restriction digestion, Cloning and expression vectors, Cloning, Expression, Purification of expressed proteins, DNA libraries and Screening

Unit II: Genome analysis (8 Hours)

Genome sequences and database, Discovery of new genes and function, Early DNA sequencing efforts: Maxam & Gilbert Method, Sanger Di-deoxy method, Fluorescence method, shot-gun approach, NGS: different methods and principles, Genome libraries, expressed sequenced tags (ESTs)

Unit III: Applied Genomics (8 Hours)

Genotyping tools: DNA Chips, Diagnostic assays, Diagnostic services. Functional genomic studies with model systems such as Drosophila, Yeast and C. elegans, Interference RNA, RNA silencing, SiRNA: Applications in Functional genomics, Medicine and Gene Knockdown. Gene Editing - Crispr Cas9

Unit IV: Applied Proteomics (6 Hours)

Large-scale preparation of proteins and peptides, Synthesis of peptides, Use of peptides as probes Two-hybrid interaction screens, Mass-spec based analysis of protein expression. "Protein Chip" - interactions and detection techniques, Two-dimensional PAGE for proteome analysis, Detection of proteins on SDS gels, Protein cleavage, Edman protein micro-sequencing, Automation in proteomics, Applications of proteome analysis to drug development and toxicology, Phage antibodies as tools for proteomics.

Practicals- **(60 Hours)**

- Isolation and analysis of plasmids
- Expression of proteins as inclusion bodies
- Isolation and refolding of the inclusion bodies
- Agarose Gel Electrophoresis
- SDS PAGE analysis
- Primer design
- Polymerase Chain Reaction (PCR)
- Restriction Digestion
- Cloning Strategy (Introductory Gene Cloning)

Essential Readings

- Principles and Techniques of Biochemistry and Molecular Biology, Wilson & Walker, Cambridge University Press, 2010
- Principles of Gene Manipulation and Genomics, Primrose and Twyman, Wiley-Blackwell 2013