

**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI**  
**INSTRUCTION DIVISION**  
**First Semester 2021-2022**  
**Course Handout (Part – II)**

**Date: 20-08-2021**

In addition to Part I (General Handout for all courses appended to the Time Table) this portion further specific details regarding the course.

**Course No.** : BIOT F345  
**Course Title** : Proteomics  
**Instructor-in-charge** : Dr. Shuvadeep Maity  
**Course Instructor** : Dr. Shuvadeep Maity

**1. Scope and Objective of the Course:**

This course is designed to impart knowledge of proteomics which is one of the emerging fields of biology that ensure large scale analysis of proteins. It is organized to make the student understand various tools used in structural and functional proteomics and to analyze current and newly emerging mass spectrometry-based technologies and approaches in protein and proteome analysis with regard to their applications in biology, biotechnology, medicine and systems biology. This course also allows to make foundation of the proteomics technique and help them to transition in company where proteomics-based technologies are used frequently.

**2. Text book [T]**

T1: Proteomics for Biological Discovery, Timothy D. Veenstra, John R. Yates, Publishers: Wiley & Blackwell Edition: 2nd edition

**3. Reference book(s) [R]:**

**R1:** Principles of Proteomics (Advanced Texts) 1st Edition by Richard M. Twyman, PhD

**R2:** Introduction to Proteomics Tools for the New Biology by Daniel c. Liebler, PhD, Foreword by John r. Yates, III, PhD, Humana Press Totowa, NJ

**R3:** Proteomics from protein sequence to function edited by S R Pennington MJ Dunn.

**4. Course Plan / Schedule:**

Lec. No	Topics to be covered	Learning objectives	Chapter in the Text Book
1-2	Proteomics and Experimental Biology	Introduction and overview of proteomics, Why do we study, Challenges	Class Lectures, R1:1
3-7	Protein separation methods	Overview-Qualitative Vs Quantitative Proteomics approaches, Protein fractionation, chromatography and electrophoresis techniques, isoelectric-focusing, two dimensional-SDS-PAGE, protein visualization	T1: 1, R1: 2, Class Lectures
8-11	Principles of Mass Spectrometry	Understand the principles of mass spectrometers used for proteome analysis, Mass spectrometry, ionization methods, types of mass analyzers	T1: 6, R1: 3, Class

			Lectures
12-14	Determining protein sequence	Edman degradation, mass fingerprinting, Protein Microarray and de novo sequencing using b and y ion series	T1: 2, R1: 3, Class Lectures
15-17	Quantitative proteomics	Overview of Data dependent and independent methods of quantification, Isotope labeling, incorporation of labeled amino acids, TMT, DIA	R1: 4, Class Lectures
18-20	Proteome analysis	Concept of protein identification and sequencing by mass-spectrometry and basic data analysis	R1:5, Class Lectures
21-22	Post translational modifications	Phosphorylation, Acetylation, Hydroxylation, Methylation, Glycosylation, Ubiquitination, SUMOylation, Deamidation etc.	T1: 11, 12, 13, R1:8 Class Lectures
23-24	Systematic analysis of protein modifications by mass spectrometry	Understand the principles and limitations of mass spectrometric methods for the analysis of PTMs, Phospho proteome analysis	T1: 4, R1:8 Class Lectures
25-27	Characterization of protein complexes	Protein complexes, RNases, RNA polymerase, ribosomes assembly	T1: 6 Class Lectures
27-30	Structural Proteomics	Overview of Nuclear magnetic resonance (NMR), and X-ray crystallography, Structural Analysis of Protein Complexes by Cross-Linking	T1: 7 R1: 6 Class Lectures
31-34	Functional proteomics	Characterization of physical and cellular organization through protein-protein interaction, Protein-protein interaction principal and strategies, protein chips, plant biotechnology and proteomics	T1: 5,8,10, R1: 7, 9, Class Lectures
36-37	Clinical Proteomics	Application of proteomics in diagnosis and biomarker discovery, biomarkers, medical statistics to assess diagnostic performance of biomarkers, disease diagnosis, clinical compound development, Drug protein interaction (chemo proteomics)	T1:3 R1: 10 Class Lectures
38-39	Bioinformatic resources for mass spectrometry-based proteomics	Understanding the computational resources for mass spectrometry-based proteomics, and their use that are publicly accessible and commercial software.	Class Lectures
40	Application	Discussion with some landmark proteomics study	Research articles

## 5. Evaluation scheme:

EC No.	Evaluation Component	Duration	Weightage %	Date, Time & Venue	Nature of Component
1	4 Announced Quizzes*	Variable	35% (70M =15M+20M+15M+20M)	To be announced	OB <sup>#</sup>
2	Mid-Sem	90 Min.	30% (60M)	23/10/2021 9.00 - 10.30AM	OB
3	Comprehensive	2 Hrs.	35% (70M)	27/12 AN	OB
*Quizzes will be conducted during lecture hours; two before the mid-semester and two after. All four quizzes will be considered. # OB- Open Book Only prescribed text book/Reference book(s), slides and hand written notes are permitted					

6. **Chamber Consultation Hour:** To be announced in the class. (*Google-meet link will be created and meet link will be shared*)
7. **Contact Email IDs:** (I/C) [shuvadeep@hyderabad.bits-pilani.ac.in](mailto:shuvadeep@hyderabad.bits-pilani.ac.in)
8. **Notices:** All notices and study materials concerning this course will be displayed/uploaded on CMS or via emails depending on the convenience.
9. **Make-up policy:** Make-up will be granted for Mid-semester and Comprehensive exam only in case of medical emergency requiring submission of proof in form of doctors' note/prescription. No makeup for quizzes.
10. **Grading policy:** A student will be likely to get "NC", if he / she doesn't appear / appear for the sake of appearing for the evaluation components / scoring zero in pre-compre total. Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, student's regularity in attending classes, and instructor's assessment of the student.
11. **Academic Honesty and Integrity Policy:** Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

**Instructor-in-Charge**  
BIOT F345