**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.

1. **Text book [T]**

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

1. **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.

1. **Course Plan / Schedule:**

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| **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 |

1. **Evaluation scheme:**

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| --- | --- | --- | --- | --- | --- |
| 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# |
| 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 | | | | | |

1. **Chamber Consultation Hour**: To be announced in the class. ***(Google-meet link will be created and meet link will be shared)***
2. **Contact Email IDs**: (I/C) [shuvadeep@hyderabad.bits-pilani.ac.in](mailto:shuvadeep@hyderabad.bits-pilani.ac.in)
3. **Notices:** All notices and study materials concerning this course will be displayed/uploaded on CMS or via emails depending on the convenience.
4. **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.
5. **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.
6. **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