

**Course Name: Proteomics**

**Course Number: BY 517**

**Credit: 3-0-0-3**

**Prerequisites:** - IC 136 - Understanding Biotechnology & its Applications **OR** Consent of Faculty member

**Students intended for:** B. Tech. 3<sup>rd</sup> and 4<sup>th</sup> year, MS/MSc. /M.Tech., Ph.D.

**Elective or Core:** Elective

**Semester:** Even

**Course objective:** This course will introduce the concepts of Proteomics – its principles and techniques which play a significant role in modern systems biology and related areas. Proteomics deals with the qualitative and quantitative analysis of the proteins that express in a biological system. This course introduces the basics of evolution of proteomics as an area, the experimental aspects of tools and techniques in addressing systems level applications. As a result of this course, the students will have strong foundations and first hand scientific understanding of current trends in Proteomics. **It should be cited that the course content mentioned here is from NPTEL online resource - “Proteomics: Principles and Techniques” being offered by Prof. Sanjeeva Srivastava, Department of Biotechnology, IIT Bombay. For more details on NPTEL visit <http://nptel.ac.in/syllabus/102101007>.**

**Course Outline:**

**Module 1 (6 hours):** An introduction to proteomics: Basics of protein structure and function, An overview of systems biology, Evolution from protein chemistry to proteomics;

**Module 2 (6 hours):** Abundance-based proteomics: Sample preparation and prefractionation steps, Gel-based proteomics - two-dimensional gel electrophoresis (2-DE), two-dimensional fluorescence difference in-gel electrophoresis (DIGE), Staining techniques.

**Module 3 (6 hours):** Central role of mass spectrometry: ionization sources, mass analyzers, different types of mass spectrometers;

**Module 4 (6 hours):** Quantitative proteomics - stable isotope labeling by amino acids in cell culture (SILAC), isotope-coded affinity tag (ICAT), isobaric tagging for relative and absolute quantitation (iTRAQ);

**Module 5 (6 hours):** Functional proteomics: Recombinational cloning, Interactomics - techniques to study protein-protein interactions, yeast two-hybrid, immunoprecipitation, protein microarrays, Nucleic Acid Programmable Protein Array (NAPPA), Label-free nanotechnologies in proteomics, Surface Plasmon Resonance (SPR); Modificomics: understanding post-translational modifications;

**Module 6 (6 hours):** Structural proteomics;

**Module 7 (6 hours):** Bioinformatics in proteomics; Challenges and future prospects of proteomics research.

**Text and Reference books**

1. Introduction to Proteomics: Tools for the New Biology, D.C. Liebler, Humana Press, 2002. ISBN 978-1-59259-130-5
2. Principles of Proteomics, R.M. Twyman, Bios Scientific Pub., 2004. ISBN 978-1859962732
3. Proteomics for Biological Discovery, T.D. Veenstra, J.R. Yates III, John-Wiley & Sons, Hoboken, New Jersey, USA; 2006. ISBN 978-0-471-16005-2
4. Protein Biochemistry and Proteomics (The Experimenter Series), R. Hubert, Academic Press, 2006. ISBN 9780120885459
5. Proteomics in Practice: A Guide to Successful Experimental Design, R. Westermeier, T. Naven, H-R. Håkplker, Wiley-VCH, 2008. ISBN 978-3527319411
6. Proteomics: A Cold Spring Harbor Laboratory Course Manual, A.J. Link and J. LaBaer, Cold Spring Harbor Laboratory Press, 2009 ISBN 978-087969787-7

Latest research articles will be advised related to the topic being taught.