

Course contents for Protein Engineering

1. **Faculty:** FLSB
2. **Course Code:**
3. **Course Title:** Protein Engineering
4. **Number of Credits:** Two
5. **Course objectives:**

Protein engineering is a valuable tool for the creation of novel or improved proteins for practical and therapeutic usage and provides new insights into protein structure and function. In this course, expression of proteins in Bacteria, Yeast, Mammalian cell lines, Insect cell and Xenopus oocytes will be discussed which will be followed by various advanced methodologies for the creation of gene library and high-throughput screening. Students will also learn the concepts and strategies of Directed laboratory evolution and Rational protein designing to understand the protein's structure-function correlation and for therapeutic applications.

6. Minimum prerequisites for taking this course, if any:

Basic knowledge of Biochemistry, Molecular genetics, Molecular biology and Genetic engineering would be assumed.

7. Course structure with units, if applicable:

Unit 1: Introduction to Protein Engineering, Expression of Proteins in Bacteria, Expression of Heterologous Gene Products in Yeast, Expression of Engineered Proteins in Mammalian Cell Culture, Insect Cell Expression Technology, Protein Expression in Xenopus Oocytes and Cell free protein expression.

Unit 2: Methods of Mutagenesis and Library creation: Random Mutagenesis, Targeted Mutagenesis and Gene Shuffling.

Unit 3: High-throughput Screening Methodologies: Bacteriophage display, Bacterial cell surface display, Yeast display, m-RNA display, Ribosome display, Cis-display, DNA-display and water-in-oil emulsions.

Unit 4: Directed Laboratory Evolution and Rational Protein Designing: Concepts, strategies and applications.

8. Reading suggestions:

- a. Protein Engineering: Principles and Practice by Jeffrey L. Cleland and Charles S. Craik, publisher-Wiley-Liss-A John Wiley & Sons, INC.
- b. Protein Design: Methods and Applications by Raphael Guerois and Manuela Lopez de la Paz, publisher- Humana Press
- c. Protein Engineering and Design by Sheldon J. Park and Jennifer R. Cochran, Publisher-CRC press.
- d. Protein Purification: Principle and Practice by Robert K. Scopes, Publisher- Springer.
- e. Protein Engineering: Handbook, Volume 1 and 2 by Stefan Lutz and Uwe Théo Bornscheuer, Publisher- Wiley-VCH.

9. Evaluation:

Theory: Mid-semester Written Examination	: 40% Marks
End-semester Written Examination	: 40% Marks
Quiz / Assignment/Presentation (oral / poster)/other	: 20% Marks