

BTPE3012 PROTEIN ENGINEERING (3-0-0)

Module - I: (08 Hours)

Primary structure, secondary structure, tertiary structure, quaternary structure, Ramachandran, Post-translational modifications, Protein folding and misfolding, Structural bioinformatics tools.

Module - II: (08 Hours)

Strategies for the design of novel proteins, strategies for the design of structure and function, computer methods in protein modeling, Docking and molecular dynamics simulation.

Module - III: (08 Hours)

Site and strategies for heterologous expressions, methods for expressing recombinant proteins in yeast, in vitro mutagenesis, Protein purification techniques, High throughput screening techniques.

Module - IV: (08 Hours)

NMR spectroscopy, crystallography, spectroscopic and calorimetric methods, cryo electron microscopy, Protein stability analysis.

Module - V: (08 Hours)

Design of polymeric biomaterials, nicotinic acetylcholine receptors as a model for a super family of ligand - gated ion channel proteins, Protein Engineering for therapeutics, Synthetic biology applications.

Course outcomes (Cos)

1. Explain the structure-function relationship of proteins and their engineering potential.
2. Apply principles of rational and directed evolution techniques to modify protein functions.
3. Analyze sequence and structural data for designing improved or novel proteins.
4. Evaluate different methods of protein expression, purification, and characterization in protein engineering.
5. Design experimental strategies for improving enzyme stability, specificity, or therapeutic properties.

Program outcomes (Pos)-

1. Apply knowledge of mathematics, science, and engineering to biotechnology problems
2. Identify, formulate, and analyze protein-based challenges and develop solutions
3. Design protein-based processes or products with consideration for desired properties.
4. Conduct experiments in protein engineering using tools like mutagenesis and screening.
5. Use modern techniques such as molecular modeling, protein expression systems, and analytics.

Program Specific Outcomes (PSOS)-

1. Apply protein engineering strategies to develop enzymes, therapeutic proteins, and industrial biocatalysts
2. Utilize bioinformatics and molecular biology tools for rational design and expression of engineered proteins.

Books:

1. Paul R. Carey Protein engineering and design, Academic Press
2. David Whitford, Proteins: Structure and Function, Wiley
3. Sheena E. Radford, Protein Folding, Misfolding, and Design, Academic Press
4. Roger L. Lundblad, Protein Engineering and Design, CRC Press
5. James C. Sampson, Ian M. Fearnley, Analytical Techniques for Protein Stability and Dynamics, Springer