MBTCR 9252T/P:
Structural Biology (T) and Protein folding & structure (P)

Theory: CIA: 10 Marks; End-Sem: 60 Marks
Structural Biology (70 Marks) (4 classes/Week)

No. of Credits	6
Theory/Composite	Composite
No. of periods assigned	4 Theory + 2 Practical

Course description/objective:

The course is designed to provide a comprehensive overview on the structure determination techniques by x-ray crystallography, cryo-EM microscopy and SAXS. Students will also be aware of the structure function relationship of biological macromolecules.
In practical module students will learn the protein crystallization techniques and will measure ΔG to understand the stability of protein. They will also be exposed to the software required for structure determination techniques.

Syllabus:

UNIT I: Protein crystallography: Principle of crystallizations and crystal growth, X-ray scattering by atoms and UNIT cells of crystals, Review of Fourier transforms, Bragg's Law, Point groups, Bravais lattices, indexing of lattice planes, space groups, Phasing- Isomorphous replacement, Molecular replacement, Difference electron density maps-2Fo-Fc, Fo-Fc, omit maps, Refinement, model accuracy.
UNIT II: Small and Wide-Angle X-ray Scattering SAXS & WAXS: Brief overview on principles and applications.
UNIT III: Cryo-electron microscopy of biological macromolecules and complexes: Introduction to electron microscopy and structural biology, The electron microscope and image formation process, Negative staining and cryo-electron microscopy, sample preparation, image reconstructions and available software.
UNIT IV: Structure – function Paradigm: Recent development

Practical: (30 Marks) (2 classes/Week)
Protein folding & Structure

1. Hands on experiments on crystallization, freezing and mounting.
2. Software handling for data collections and refinements.
3. Calculation of ΔG of a protein by fluorimetric measurements.
4. The fundamentals of protein folding, Spectral properties (absorbance, fluorescence, CD), Molecular chaperone.
5. SAXS for protein folding.

Texts & Reading/Reference Lists:

1. Crystallography made crystal clear by Gale Rhodes: Chapter 1-7
2. Atomic and Nuclear Physics by SN Ghoshal: Chapter- X-rays
3. Crystallization of Nucleic Acids and Proteins: A Practical Approach by Arnaud Ducruix and

Richard Giegé: Chapters: Crystallization of protein.

4. Relevant Research Papers
5. Proteins: Structures and Molecular Properties by Thomas E. Creighton
6. Relevant Research Papers

Q. Paper Structure for End SemTheory

Compulsory objective questions of 15 marks with choice;
3 questions of 15 marks (Any 3 from 5).