

**Title: Advanced Structural Biology [3-0-0-6]**

**Content :**

Structural Biology by NMR spectroscopy: Basic principle of NMR, NMR instrumentation, NMR sample preparation, particle aspects of data acquisition, Multi-dimensional NMR, protein structure determination from NMR data, Protein-protein interactions and Protein-ligand interaction by NMR.

Practice session: Setting on 2D experiments on peptide and data analysis.

Protein crystallography: Protein crystallization, Crystal geometry, X-ray diffraction, Instrumentation and diffraction data collection, Diffraction data to electron density, Solving phase problem, Isomorphous replacement method, Molecular replacement method, Model building and refinement, Structure validation and deposition

Practice sessions: (1) Protein Crystallization, (ii) Diffraction data collection and (iii) Structure solution

Refinement Cryo-EM for structure determination of biological molecules: Basics of Electron Microscopy, direct detector camera, Image formation, Contrast Transfer Function, Dose limitation, Data Collections Strategies, 2D to 3D reconstruction, resolution assessment, cryo- EM map interpretation and modelling.

Practical/ hands on experience Session: Sample preparation with room temperature and freezing methods, docking into cryo-EM map and modelling

**Texts / References:**

1. Structural Biology Particle NMR applications by Quincy Teng Springer
2. NMR of proteins and Nucleic acids 1st Edition by K. Wuthrich
3. Protein NMR spectroscopy edited by John Cavanagh 2nd edition
4. "Biomolecular Crystallography: Principles, Practice, and Application to Structural Biology; by Bernhard Rupp: Garland Science, Taylor & Francis Group LLC., 1st edition, 2010.
5. Crystallography Made Crystal Clear: A Guide for Users of Macromolecular Models; by Gale Rhodes: Elsevier Inc., 3rd edition, 2006.
6. Principles of Protein X-Ray Crystallography; by Jan Drenth: Springer Science + Business Media LLC., 3rd edition, 2007.
7. Three-Dimensional Electron Microscopy of Macromolecular Assemblies: Visualization of Biological Molecules in Their Native State, 2nd Edition, (2006) Joachim Frank, Oxford University Press.
8. Computational Methods for Three-Dimensional Microscopy Reconstruction, (2014), Gabor T. Herman and Joachim Frank, Springer.
9. Cheng, Yifan et al. "A primer to single-particle cryo-electron microscopy." Cell vol. 161,3 (2015): 438-449.