



BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, Hyderabad Campus
SECOND SEMESTER 2022-2023
Course Handout (Part II)

Date: 16/01/2023

In addition to part-I (General Handout for all courses appended to the timetable) this portion gives further specific details regarding the course.

Course No. : **BIO F215**
Course Title : **BIOPHYSICS**
Instructor-In-Charge : **DEBASHREE BANDYOPADHYAY**
Instructors: Syeda Lubna, Kirtimaan Syal, Debashree Bandyopadhyay

1. SCOPES AND OBJECTIVE:

The objective of the course is to introduce the students to the concepts of physical principles in the biological and biomimetic molecular systems. Properties and conformations of biomolecules like amino acids, proteins, nucleotides, nucleic acids as well as biomimetic systems like monolayers and bilayers are to be discussed. Related physical phenomena in these systems like structural transitions, protein folding, membrane equilibrium are to be discussed. Emphasis will also be given to understand the principles of major experimental techniques applied to understand these physical problems.

2. Text Book (TB): "Introduction to Molecular Biophysics", J. A. Tuszynski and M. Kurzynski, Published by CRC Press (Indian Edition), Chennai

3. Reference Book (RF) : 1. "Biophysical Chemistry, Part I, Part II and Part III", Charles R Cantor and Paul R. Schimmel, W.H. Freeman and Co., New York.
2. "Principal of Physical Biochemistry" Kensal E. van Holde, W. C. Johnson and P.S. Ho John, 2nd Edi. Pearson Prentice Hall

4. Course Plan

| Lec. No. | Learning Objectives | Topics to be covered | Ref |
|----------|----------------------------|--|--|
| | Self study | Basics of thermodynamics, bondings, interactions, basics of biomolecules, Biochemistry | Chapter-2 of RF-2, Physical Chemistry Text Book |
| 1 | Overall idea of the course | Overview of subjects | Chapter-1 of TB |
| 2 | Biological Macromolecules | Macromolecules, configuration and conformation, symmetry | Chapter-1 of RF-2 |
| 3-4 | | Weak interactions: Intermolecular interaction, H-bonding, hydrophobic interaction | Chapter-2 of TB, Chapter-1 of RF-2 |
| 5-8 | Biological Macromolecules | Protein structure: Primary, Secondary, Tertiary and Quaternary structure of proteins | Chapter-2 of TB, Chapter-1 of RF-2, Chapter-2 of |



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|-------|---|--|---|
| | | | RF-1 |
| 9-11 | Biological Macromolecules | The Structure of nucleic acids | Chapter-2 of TB, Chapter-1 of RF-2, Chapter-3 of RF-1 |
| 12-13 | Biological Macromolecules | Lipids and Membrane equilibria | Chapter-2 of TB, Chapter-25 of RF-1 |
| 14-15 | Physics of macromolecules | Conformation dependent properties of polymeric systems | Chapter-3 of TB, Chapter-4 of RF-2 |
| 16-18 | Helix coil transitions in biomolecules | In proteins and nucleic acids (DNA, RNA) | Chapter-4 of RF 2 |
| 19-20 | Molecular Thermodynamics | Protein folding | Chapter-3 of TB, Chapter-4 of RF-2, Chapter-21 of RF-1 |
| 21-25 | Simulating macromolecule structures | Energy minimization, Molecular dynamics | Chapter-3 of RF-2 |
| 26-28 | Crystallographic techniques to determine the molecular structures | X-ray crystallography | Chapter 13 and 9 of RF-1 (Part-II), Chapter-6 of RF-2 |
| 29-32 | Magnetic Resonance method | Basic principle of NMR | Chapter-12 of RF-2 |
| 33 | Spectroscopic techniques | Absorption spectroscopy | Chapter-9 of RF-2 |
| 34-35 | Single Molecule Techniques | Circular Dichroism (CD) | Chapter-10 of RF-2 |
| 36-38 | | Fluorescent Spectroscopy | Chapter-11 of RF-2 |
| 39-40 | | Atomic force microscopy | Chapter-16 of RF-2 |



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5. Evaluation Scheme:

| Component | Duration | Weightage% | Date & Time | Remarks |
|---|--|------------|------------------------|-----------------|
| Midsem | 90 Mins | 30% | 16/03 4:00PM to 5:30PM | CB |
| Seminar/Open assignment/literature survey | Throughout the semester distributed in class as well as in tutorial hour | 30% | TBA | 15%CB + 15% OB |
| Compre. Exam. | 3 hrs. | 40% | 16/05 AN | 20% OB + 20% CB |

6. Chamber Consultation Hours: To be announced.

7. Notices: Notices, if any, concerning the course will be displayed on the Notice Board of Biological Sciences notice board or on BITS CMS.

8. Make up Policy: Make up will be given on genuine grounds as determined by the Instructor-in-charge.

9. Academic Honesty and Integrity Policy:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor In Charge
BIO F215