



Department of Biotechnology		LP: BT18001 Rev. No: 00 Date: 10/07/2023
B.Tech	: Biotechnology	
Regulation	: 2018A	
PG Specialisation	: NA	
Sub. Code / Sub. Name	: <b>BT18001 - Biophysics &amp; Structural Biology</b>	
Unit	: <b>I</b>	

**Unit Syllabus: MOLECULAR STRUCTURE OF BIOLOGICAL SYSTEMS****(9)****Objective: To analyze the various forces responsible for biological molecular structure**

Session No *	Topics to be covered	Ref	Teaching Aids
01	Intramolecular bonds in biological systems	TB1 (Pp. 05-15) TB3 (Pp. 01-03)	PPT, ICT Tools & BB
02	Covalent bonds in biological systems	TB1 (Pp. 16-22) TB3 (Pp. 05-07)	PPT, ICT Tools & BB
03	Ionic bonds in biological systems	TB1 (Pp. 05-59) TB3 (Pp. 08-10)	PPT, ICT Tools & BB
04	Hydrogen bonds in biological systems	TB3 (Pp. 08-10)	PPT, ICT Tools & BB
05	Biological structures and their general features	TB2 (Pp. 63-48) TB3 (Pp. 37-53)	PPT, ICT Tools & BB
06	Water structure, Hydration	TB2 (Pp. 45-48) TB3 (Pp. 14-17)	PPT, ICT Tools & BB
07	Interfacial phenomena and membranes	TB3 (Pp. 194-208)	PPT, ICT Tools & BB
08	Self-assembly of membranes	TB2 (Pp. 488-520) TB3 (Pp. 194-208) RF1 - 235	PPT, ICT Tools & BB
09	Molecular structure of membranes	TB2 (Pp. 494-528) TB3 (Pp. 194-208) TB4 Pp. 109	PPT, ICT Tools & BB

**Content beyond syllabus covered (if any):**

Factors involved in the biomolecular structural maintenance and disturbance

**Sub. Code / Sub. Name: BT18001 - Biophysics & Structural Biology**

Unit : II

**Unit Syllabus : CONFORMATION OF NUCLEIC ACIDS****(9)****Objective : To model the conformation in nucleic acid in biological molecules**

Session No *	Topics to be covered	Ref	Teaching Aids
10	Primary structure of the bases and sugars	TB2 (Pp. 196-228) TB4 (Pp. 36-48)	PPT, ICT Tools & BB
11	Phosphodiester bonds and double helical structure	TB2 (Pp. 383-384) TB4 (Pp. 36-48)	PPT, ICT Tools & BB
12	Conformational changes in DNA molecules – a, b and z forms	TB2 (Pp. 37-40) TB3 (Pp. 148-154)	PPT, ICT Tools & BB
13	Torsional angles in proteins	TB2 (Pp. 203-207) TB4 (Pp. 55-60)	PPT, ICT Tools & BB
14	Properties of circular DNA	TB2 (Pp. 1119-1126) TB4 (Pp. 60-68)	PPT, ICT Tools & BB
15	Topology, polymorphism and flexibility of DNA	TB3 (Pp. 151-154) TB4 (Pp. 349-368)	PPT, ICT Tools & BB
16	Structure of ribonucleic acids	TB2 (Pp. 197-206) TB3 (Pp. 151-154) RF1 -184	PPT, ICT Tools & BB
17	Hydration of nucleic acids	TB3 (Pp. 38-41) RF2 - 82	PPT, ICT Tools & BB
18	Advanced methodologies in the analysis of nucleic acid confirmations	TB3 (Pp. 24-130) TB4 (Pp. 346-392)	PPT, ICT Tools & BB

**Content beyond syllabus covered (if any):**

DNA Structural and functional analysis.

\* Session duration: 50 mins

**Sub. Code / Sub. Name: BT18001 - Biophysics & Structural Biology**

Unit : III

**Unit Syllabus : CONFORMATION OF PROTEINS****Objective : To Analyse the relationships between protein stability and its conformation (9)**

Session No *	Topics to be covered	Ref	Teaching Aids
19	Function of proteins	TB2 (Pp. 63-79) TB3 (Pp. 161-164) TB4 (Pp. 431-450)	PPT, ICT Tools & BB
20	Hierarchical structure of proteins	TB3 (Pp. 161-164) TB4 (Pp. 431-450)	PPT, ICT Tools & BB
21	Super secondary structure and importance	TB3 (Pp. 161-164) RF1 - 253	PPT, ICT Tools & BB
22	Torsional angles in proteins	TB2 (Pp. 1121-1122) RF1 - 254	PPT, ICT Tools & BB
23	Characterization of Secondary structure using CD	TB3 (Pp. 73-84) TB4 (Pp. 445-450)	PPT, ICT Tools & BB
24	Protein stability	TB2 (Pp. 112-122) RF1 - 144	PPT, ICT Tools & BB
25	Protein folding	TB2 (Pp. 119-125) TB3 (Pp. 133-140) TB4 (Pp. 444-450)	PPT, ICT Tools & BB
26	Levinthal Paradox	IS - 1 RF1 - 305	PPT, ICT Tools & BB
27	Bohr effect	IS - 2 IS - 3	PPT, ICT Tools & BB

**Content beyond syllabus covered (if any):**

Protein Structural and functional analysis.

\* Session duration: 50 mins



**Sub. Code / Sub. Name: BT18001 - Biophysics & Structural Biology**

Unit : IV

**Unit Syllabus : CELLULAR PERMEABILITY AND ION – TRANSPORT (9)**

**Objective : Classify the various ion transport across the biological membrane based on cellular permeability**

Session No *	Topics to be covered	Ref	Teaching Aids
28	Introduction to molecular transportation across biological system	RF2 (Pp. 744 -771) TB2 (Pp. 52-59)	PPT, ICT Tools & BB
29	Ionic conductivity and their role in metabolism	RF2 (Pp. 768 -771) TB2 (Pp. 540-559)	PPT, ICT Tools & BB
30	Iron transport across ion channels	RF2 (Pp. 768 -771) TB2 (Pp. 540-559)	PPT, ICT Tools & BB
31	Mechanism of ion pumps	TB2 (Pp. 69-73) TB3 (Pp. 228-237)	PPT, ICT Tools & BB
32	Proton transfer	TB2 (Pp. 753-762) TB3 (Pp. 228-237)	PPT, ICT Tools & BB
33	Nerve conduction	RF1 (Pp. 771 – 773) TB2 (Pp. 1321-762) TB3 (Pp. 232-237)	PPT, ICT Tools & BB
34	Patch and Voltage clamp method	TB2 (Pp. 541-543) TB3 (Pp. 232-237)	PPT, ICT Tools & BB
35	Nernst and GHK equation	TB3 (Pp. 229-235)	PPT, ICT Tools & BB
36	Recent developments in cell permeability and molecular transfer across membranes research	IS 4	PPT, ICT Tools & BB

**Content beyond syllabus covered (if any):**

Targeted ion channels and overcoming certain disease.



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Unit : V

**Unit Syllabus : ENERGETICS & DYNAMICS OF BIOLOGICAL SYSTEMS (9)**

**Objective : To Analyse biological processes using the principles of thermodynamics to quantify the associated energetics and kinetics**

Session No *	Topics to be covered	Ref	Teaching Aids
37	Concepts in thermodynamics	RF2 (Pp. 52-61) TB2 (Pp. 52 -54)	PPT, ICT Tools & BB
38	Kinetics and thermodynamics of protein folding	RF2 (Pp. 278-290) TB2 (Pp. 52 -54)	PPT, ICT Tools & BB
39	Kinetics and thermodynamics of protein forces and motions	RF2 (Pp. 323-330) TB2 (Pp. 512 -517)	PPT, ICT Tools & BB
40	Entropy and stability	TB2 (Pp. 529 -530) RF2 (Pp. 323-330)	PPT, ICT Tools & BB
41	Analyses of fluxes	TB2 (Pp. 619 -620) TB4 (Pp. 473 -475)	PPT, ICT Tools & BB
42	diffusion potential	TB3 (Pp. 223 – 224)	PPT, ICT Tools & BB
43	Basic properties of fluids	TB3 (Pp. 228 – 234)	PPT, ICT Tools & BB
44	Basic properties of biomaterials	RF1 - 339	PPT, ICT Tools & BB
45	Laminar and turbulent flows	IS 5	PPT, ICT Tools & BB

**Content beyond syllabus covered (if any):**

Signal transduction mechanism to induce immune response.  
Functions of body fluids and their flow pattern

\* Session duration: 50 mins



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**TEXT BOOKS (TB)**

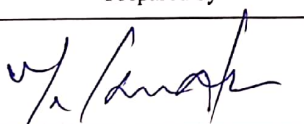

1. Glaser, R., "Biophysics", Springer Verlag, 2000.
2. Biochemistry. 5th edition. Berg JM, Tymoczko JL, Stryer L. New York: W H Freeman; 2002
3. Vasantha, P. and Gautham, N., "Biophysics", Kluwer Academic Publishers, 2002.
4. Prescott, D. M. (Ed.). (2016). Methods in Cell Physiology: Volume I (Vol. 1). Elsevier.
5. Primrose, S. B., & Twyman, R. (2006). Principles of gene manipulation and genomics. John Wiley & Sons.
6. Pollard, Thomas D., et al. Cell biology E-book. Elsevier Health Sciences, 2022.

**REFERENCES (RF)**

1. Charles, C.R. and Schimmel P.R., "Biophysical Chemistry", W.H. Freeman & Co., 1980.
2. Donald, V. and Judith, G. V., "Biochemistry", 4<sup>th</sup> Edition., John Wiley and Sons, 2010.

**INTERNET SOURCES (IS)**

1. <https://pubs.acs.org/doi/10.1021/ed300302h>.
2. <https://www.ncbi.nlm.nih.gov/books/NBK526028/>
3. <https://derangedphysiology.com/main/cicm-primary-exam/required-reading/respiratory-system/Chapter%201143/bohr-effect>
4. <https://pubmed.ncbi.nlm.nih.gov/25826483/>
5. <https://resources.system-analysis.cadence.com/blog/msa2022-the-differences-between-laminar-vs-turbulent-flow>

	Prepared by	Approved by
Signature		
Name	Dr M Nareshkumar	Dr E Nakkeeran
Designation	Assistant Professor	Professor and HOD
Date	10.07.2023	10.07.2023
Remarks *:	This is new lesson plan prepared for this course and not followed from previous lesson plans.	
Remarks *:	This lesson plan provides insight into the basics and advancements of biophysics and structural biology field.	

\* If the same lesson plan is followed in the subsequent semester/year it should be mentioned and signed by the Faculty and the HOD