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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: IV - THEORY EXAMINATION (2023 - 2024)

Subject: Structural and Computational Biology

Time: 3 Hours   **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* **three Sections -A, B, & C.** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

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SECTION A   **20**

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1. Attempt all parts:-

1-a.   Which one contains Imino group? (CO1)   1

           (a) Arginine

           (b) Serine

           (c) Proline

           (d) Asparagine

1-b.   All amino acids contain α-chiral carbon except.................. (CO1)   1

           (a) Alanine

           (b) Glycine

           (c) Valine

           (d) Selenocystiene

1-c.   The Protein Data Bank (PDB) is a database for the..............structural data of large biological molecules? (CO2)   1

           (a) two-dimensional

           (b) three-dimensional

(c) both (a) and (b)

(d) none

1-d. Amount of volume required during the NMR sample preparation is………… 1
(CO2)

(a) ~6μl

(b) ~60μl

(c) ~600μl

(d) ~6000μl

1-e. Undulator magnet is used in which techniques? (CO3) 1

(a) FRET

(b) EPR

(c) Cryo-EM

(d) XFEL

1-f. Steady-state fluorescence is an analytical technique that studies the long term 1
average fluorescence of a sample with……………………. (CO3)

(a) UV or visible

(b) Visible or near IR light

(c) UV or near IR light

(d) UV, visible or near IR light

1-g. Macromolecule chitin is………………. (CO4) 1

(a) Simple polysaccharides

(b) Sulphur containing polysaccharides

(c) Phosphorus containing polysaccharides

(d) Nitrogen containing polysaccharides

1-h. Target recognition and binding involve three-dimensional structure, 1
hydrophobic interactions as well as ………………………………., base-stacking, and
intercalation. (CO4)

(a) Shape Dependent Interactions

(b) Two Dimensional Structure

(c) Hydrophilic Interactions

(d) All

1-i. Which is not a solution methods to measure the kinetics of RNA-protein 1
interactions? (CO5)

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        (a) Fluorescence anisotropy

        (b) Single Molecule Fluorescence

        (c) Fluorescence quenching

        (d) Surface Plasmon Resonance

1-j.	Which is not the specific biophysical techniques? (CO5)	1

        (a) Electrophysiology

        (b) Spectroscopy

        (c) MD simulation

        (d) Single Molecule Technique

2. Attempt all parts:-

2.a.	Define the term dehydration reaction, give example in support of your answer. (CO1)	2
2.b.	Write the full form of BMRB and also write the type of data maintained on this platform? (CO2)	2
2.c.	Define steady state fluorescence and it is useful? (CO3)	2
2.d.	Define the terms interchain and intrachain. How they are different? (CO4)	2
2.e.	Write various simulation systems that are used in structural biology. (CO5)	2

SECTION B   **30**

3. Answer any <u>five</u> of the following:-

3-a.	Explain how protein domains are different from protein motifs? Give example in support of your answer. (CO1)	6
3-b.	Calculate the alignment score for the sequence TAG vs TTG? Increase the match value by 2, decrease the value by 2 for mismatch, and assign 0 (zero) for gap. (CO1)	6
3-c.	Explain how differential centrifugation is useful for the separation of soluble and membrane proteins. Give example in support of your answer. (CO2)	6
3-d.	Explain the effects of salting-in and salting-out on protein solution? Give your explanation with proper graphical representation. (CO2)	6
3.e.	Describe the working principal of X-ray crystallography. Enlist the applications of X-ray crystallography? (CO3)	6
3.f.	Write down various types of RNA and also explain their function? (CO4)	6
3.g.	Write a note on protein dynamics studies by molecular dynamic simulations. (CO5)	6

SECTION C   **50**

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4. Answer any <u>one</u> of the following:-

4-a. Enlist and explain the importance of domain in protein structure? Give example in support of your answer. (CO1)   10

4-b. Describe the different basis by which proteins are classified into different groups. (CO1)   10

5. Answer any <u>one</u> of the following:-

5-a. Write down different approach that are used to validate the target proteins? Give example in support of your answer. (CO2)   10

5-b. Define the term phase diagram. Enlist various difficulties that we usually encountered after changing the solution conditions? Also, explain the solubility curve. (CO2)   10

6. Answer any <u>one</u> of the following:-

6-a. Write a short note on the following: (a) XFEL (b) Circular Dichroism (c) Single particle Cryo-EM (d) FRET (e) EPR (CO3)   10

6-b. Explain anisotropy use of Circular Dichroism. Enlist various applications of Circular Dichroism in structural biology? How can we use this technique for the function prediction of novel protein? (CO3)   10

7. Answer any <u>one</u> of the following:-

7-a. Write a note on RNA secondary structure prediction. Enlist various database and tools that are used for the prediction of secondary structure of RNA. (CO4)   10

7-b. What do you understand by isomer, epimer and anomer? Explain with suitable examples. (CO4)   10

8. Answer any <u>one</u> of the following:-

8-a. Imagine If a police officer finds a kid lost during the fair visit from their parents and three parents come to claim the parent of that kid. As a biotechnologist, what you will suggest to the police to identify the real parent of the kid? Explain with the help of an example or use neat and clean diagram. (CO5)   10

8-b. Explain the enzymatic approaches and solution methods to measure the kinetics of RNA-protein interactions. (CO5)   10