Printed Page:- 04 **Subject Code:- ABT0403**

Roll. No:

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.*

SECTION-A 20

1. Attempt all parts:-

1-a. Which among these codon codes for the arginine? (CO1) 1

(a) AGU
(b) AGC
(c) AGA
(d) AAC

1-b. β-mercaptoethanol is responsible to disrupt the protein structure by……..? (CO1) 1

(a) removing the amino acid
(b) breaking the disulphide bridge
(c) by dissociating the H-bond
(d) All

1-c. The data in PDB is usually stored in 3 different file formats except…… (CO2) 1

(a) PDB file format
(b) PDBQT file format
(c) mmCIF format
(d) PDBML file format

1-d. If the homogenized cells are centrifuged at 205g for 180 minutes, then which among these will be available in precipitate? (CO2) 1

(a) Nucleus
(b) Mitochondria
(c) Lysosome
(d) Ribosome

1-e. Interacting molecules for the FRET should not be ……apart. (CO3) 1

(a) <10000 nm
(b) <1000 nm
(c) <100 nm
(d) <10 nm

1-f. ….....technique is used to investigate the molecular structure through the growth of solid crystals? (CO3) 1

(a) Computed Tomography
(b) X-ray crystallography
(c) Fluoroscopy
(d) Radiotherapy

1-g. In reverse hoogsteen base pair involves flipping one of the bases 180° with respect to the other at position…..... (CO4) 1

(a) N7-O4
(b) N7-O2
(c) N6-N3
(d) N6-N4

1-h. Aptamer term is taken from latin words "aptus" meaning….....and "meros" meaning…..... (CO4) 1

(a) part & to fit
(b) to fit & part
(c) small & to fit
(d) to fit & small

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

(a) Fluorescence anisotropy
(b) Single Molecule Fluorescence
(c) Fluorescence quenching
(d) Surface Plasmon Resonance

1-j. Binding of a guide RNA (gRNA) to the Cas9 protein modulates the conformation of Cas9 protein and activates its …..... activity on the targeted DNA sequences. (CO5) 1

(a) endonuclease
(b) ribonuclease
(c) both (a) & (b)

(d) neither (a) nor (b)

2. Attempt all parts:-

2.a.	Why we use R and S configuration in stereochemistry? (CO1)	2
2.b.	Define the term Cryo-EM and how it is useful? (CO2)	2
2.c.	Define steady state fluorescence and it is useful? (CO3)	2
2.d.	Examine and explain the structure of D-glucose using Fischer projection. (CO4)	2
2.e.	Explain the classification of approaches used to measure the dynamics of RNA-protein interactions in cells based on RNAs bound to proteins. (CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Why it is important to align biological sequences for the study? What type of information you will get after aligning the sequences?(CO1)	6
3-b.	Explain the major difference between active sites and binding sites in the protein structure? (CO1)	6
3-c.	What is NMR? Describe the method to prepare sample for NMR Spectroscopy? (CO2)	6
3-d.	Explain various zones that are present in supersaturated region during protein solubility. Also, draw the graphical plot between protein concentration and precipitation. (CO2)	6
3.e.	Explain various approaches that are used to reconstruct a 3D object from 2D projection image? (CO3)	6
3.f.	Define the term carbohydrates. Also, distinguish between amylose and amylopectin with their structure. (CO4)	6
3.g.	Write notes on (a) Optical and Magnetic Tweezers (b) Single Molecule Fluorescence (c) Fluorescence Resonance Energy Transfer (d) Surface Plasmon Resonance (CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	If a novel protein is identified by a researcher in the lab, then explain various approaches that he/she should follow to get the information especially the suitable group for that protein? (CO1)	10
4-b.	How diastereomers differ from enantiomers? Explain with the help of example. (CO1)	10

5. Answer any one of the following:-

5-a.	How phase diagram studies are important for protein crystallization? Explain with the help of an example. (CO2)	10
5-b.	A student was asked to separate membrane bound proteins from soluble proteins. According to your opinion which method will best to separate these proteins. Explain with the help of an example. (CO2)	10

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

6-a.	Whether X-Ray Free-Electron Laser is different from X-ray crystallography? If yes then explain in detail. (CO3)	10
6-b.	Enlist, how X-ray crystallography is different from NMR? Also, explain the advantages and disadvantages of these techniques. (CO3)	10

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

7-a.	Draw Fischer projection of D-glucose and answer the following: (a) Number each carbon from 1 to 6. What number is the anomeric carbon? (b) Circle the -OH group that determines whether it is a D- or L-sugar. (c) Sketch the structure of L-glucose for comparison. Are the two versions of glucose enantiomers of one another or diastereomers? (d) sketch the structure of D-glucose for comparison. Are D-galactose and D-glucose enantiomers or diastereomers? (CO4)	10
7-b.	Define the term aptamers. Explain why aptamers require denaturing prior to use? Give example in support of your answer. (CO4)	10

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

8-a.	Write a short notes on the following: (a) Molecular dynamic simulations (b) DNA fingerprinting (c) Single Molecule Fluorescence (d) Fluorescence anisotropy (e) Fluorescence quenching. (CO5)	10
8-b.	Explain the enzymatic approaches and solution methods to measure the kinetics of RNA-protein interactions. (CO5)	10