Register Number:……..

KUMARAGURU
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B.TECH DEGREE EXAMINATIONS: MAY 2017

(Regulation 2014)

Sixth Semester

BIOTECHNOLOGY

U14BTT602: Protein Structure and Engineering

COURSE OUTCOMES

CO1: Explain and analyze the secondary and supersecondary structural features

CO2: Discuss and distinguish the tertiary structure with quaternary structure of proteins

CO3: Demonstrate the protein – non-protein interactions

CO4: Understand the basics and steps involved in protein engineering

CO5: Describe the protein engineering design to construct various proteins

Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-

PART A (10 x 1 = 10 Marks)

1. Match the following groups. CO3 [K_2]

List I	List II
A. Zinc fingers	i. GCN4
B. POU regions	ii. Octylglucoside
C. Detergent	iii. TFIIIA
D. Leucine zipper	iv. Oct-1

	A	B	C	D
a)	iv	iii	ii	i
b)	iii	iv	ii	i
c)	ii	iv	iii	i
d)	ii	iii	iv	i

2. The major function of transcription factor TFIIE is to_____. CO3 [K_2]

a) Recruit TFIIH to the preinitiation complex

b) Help in binding of TBP to TATA-box

c) Provide helicase and ATPase activity

d) Stabilize the binding affinity of RNA polymerase II

3. Which of the following statements are true about the enzyme lipases? CO4 [K3]

i) Lipases catalyze the hydrolysis of triacylglycerols to glycerol and free fatty acids.

ii) Lipases gets inactivated when adsorbed to an oil–water interface.

iii) Lipases display little activity in aqueous solutions containing soluble substrates.

a) i & ii only b) ii & iii only

c) i & iii only d) i, ii & iii

4. Which one of the following protein is made up of large proportion of β sheets and is devoid of α helices? CO1 [K_2]

a) Hemoglobin b) Myoglobin

c) Triose phosphate isomerase d) Concanavalin A

5. **Assertion (A):** Amino acids with acidic side chains carry a net negative charge at physiologic pH. CO1 [K3]

Reason (R): Asparagine has a side chain containing a carboxylic acid and has a net negative charge at physiological pH.

a) Both A and R are Individually true and R is the correct explanation of A b) Both A and R are Individually true but R is not the correct explanation of A

c) A is true but R is false d) A is false but R is true

6. During protein folding, the rate of cis-trans isomerization of proline peptides could be enhanced by _____? CO2 [K4]

a) Retinal b) Cyclophilin

c) GroEL/GroES complex d) Proly peptides Isomerase

7. Identify the correct sequence of steps followed in X-ray diffraction analysis CO5 [K3]

1. Diffraction collection, 2. Purification of protein molecules, 3. Protein crystallization, 4. Refining the structure, 5. Validating the structure, 6. Electron density map calculation.

a) 3-1-2-4-5-6 b) 3-1-2-6-4-5

c) 2-3-1-4-5-6 d) 2-3-1-6-4-5

8. The portions of a transmembrane protein that cross the lipid bilayer usually consist of which structures? CO2 [K2]

a) β sheet with mostly polar side chains b) β sheet with mostly nonpolar side chains

c) α helix with mostly polar side chains d) α helix with mostly nonpolar side chains

9. **Assertion (A):** Error prone PCR is the method of choice for inducing random mutation by altering the nucleotide concentration. CO4 [K3]

Reason (R): For inducing mutations using error prone PCR method, Pfu enzymes can be used as an alternative for Taq polymerases.

a) Both A and R are Individually true and R is the correct explanation of A
b) Both A and R are Individually true but R is not the correct explanation of A
c) A is true but R is false
d) A is false but R is true

10. Which of the following Ras genes in humans are the most common oncogenes found in wide varieties of cancer? CO5 [K2]

a) HRas, KRas, and MRas
b) MRas, KRas, and NRas
c) HRas, MRas, and NRas
d) HRas, KRas, NRas and MRas

PART B (10 x 2 = 20 Marks)
(Answer not more than 40 words)

11. Differentiate between π helix and 3_{10} helix. CO1 [K3]
12. Write the significance of directed evolution in protein engineering. CO4 [K_2]
13. List the molecules involved in the formation of pre-initiation complex during eukaryotic transcription. CO3 [K_2]
14. Draw the structure of jelly roll barrel. CO2 [K_2]
15. State the significance of Hydropathy plot. CO2 [K_3]
16. Write the importance of hydrogen and hydrophobic bonds in regulating protein the conformation CO1 [K_2]
17. Differentiate between homology modeling and Threading. CO5 [K_3]
18. Define nucleotide analogues and their role as prodrug. CO4 [K_3]
19. Define Alanine-shaving. CO5 [K2]
20. State the role of various subunits in photosynthetic reaction center. CO3 [K_2]

Answer any FIVE Questions:-
PART C (5 x 14 = 70 Marks)
(Answer not more than 300 words)

Q.No. 21 is Compulsory

21. Comment on the mechanism involved in recognition and regulation of DNA by prokaryotic transcription factors with suitable examples. CO3 [K2]

22.	Explain the following tertiary structures: i) Coiled to coil structure ii) Up and down β barrels	(7) (7)	CO2	[K_2]
23.	i) Discuss the various classes of transmembrane proteins with suitable examples. ii) Comment on the nature and importance of nonspecific protein-DNA interactions	(8) (6)	CO3	[K_2]
24.	Write the various methods of creation of site directed mutagenesis with suitable examples.		CO4	[K3]
25.	Explain de novo and rational designing of proteins with suitable examples.		CO4	[K_2]
26.	Discuss the principle and design methodology involved in stabilization of T4 phage lysozyme by engineering disulfide bonds.		CO5	[K_3]
27.	What are fibrous proteins? Explain the structure of any two fibrous proteins. Write short note on super secondary structures.	(10) (4)	CO1	[K_2]

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