

D. Cystic fibrosis	iv. swelling of hands and feet, delayed growth, frequent infections
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	A	B	C	D
a)	i	ii	iii	iv
b)	iv	iii	ii	i
c)	iv	iii	ii	i
d)	i	iii	ii	iv

5. **Assertion (A):** DNA looping is responsible for coordinating multiple proteins binding to various genetic elements which are regulating gene expression in eukaryotes. CO3 [K4]

Reason (R): In eukaryotes, genes expression is controlled by many genetic elements such as promoter, enhancer etc.

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|---|---|
| a) Both a and R are correct, R is the correct explanation for A | b) Both a and R are correct, R is NOT the correct explanation for A |
| c) A is correct R is false | d) R is correct A is false |

6. A student was working on human gene expression in *E.coli* expression system. He sequenced his genomic clone and found to be 3500 bases. He has constructed cDNA of the gene and the number of bases is 2585. Predict the size of the recombinant protein. CO3 [K5]

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|---------------|---------------|
| a) 85.040 kDa | b) 65.040 kDa |
| c) 95.040 kDa | d) 55.040 kDa |

7. Choose the **MOST** suitable ligand for a biotinylated recombinant protein. CO4 [K4]

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|----------------|------------|
| a) Glutathione | b) Nickle |
| c) Avidin | d) His Tag |

8. **Assertion (A):** Mutations on mitochondrial genome affects energy production capacity of the cells. CO6 [K3]

Reason (R): Mitochondrial genomes are inherited from fathers.

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|---|---|
| a) Both A and R are correct, R is the correct explanation for A | b) Both A and R are correct, R is NOT the correct explanation for A |
| c) A is true, R is false | d) A is false, R is true |

9. Which one of the following molecular diagnosis methods is most suitable for dengue virus infection? CO6 [K3]

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|---------------------|-----------------------------|
| a) Western blotting | b) cDNA microarray analysis |
| c) PCR | d) Southern blotting |

PART C (10 x 5 = 50 Marks)

21. Bacteria are exposed to various environmental stresses and one such stress is osmotic stress. Under high and low osmolarity conditions, how do bacteria regulate its gene expression to survive in the surroundings. CO1 [K₄]
22. In a particular experiment, *E.coli* culture was grown in media containing both glucose and lactose. What is your prediction with respect to carbon source utilization by the *E.coli* culture? How does catabolite repression work for preferential utilization of glucose over other carbon sources like lactose in a growth medium? CO1 [K₄]
23. How does codon-deoptimization help to silence the gene expression in any system and explain it with a suitable example. CO2 [K₃]
24. How is microRNA synthesized? and Correlate the mechanism of action of microRNA with gene expression regulation. CO3 [K₃]
25. Describe the components of a cell free system for protein synthesis and how is superior to conventional cell culture (*in vivo*) system. CO4 [K₂]
26. Below are the common challenges faced, while expressing recombinant proteins in *E.coli*. Based on your understanding of the prokaryotic expression system (*E.coli*) provide suitable solutions for each of the challenges. CO4 [K₄]

Challenges
i. Formation of inclusion bodies
ii. Over glycosylation of recombinant proteins
iii. Under expression of the foreign gene
iv. Degradation of proteins

27. Explain the steps involved in fabrication of DNA chip using photolithography with suitable illustrations. CO5 [K₂]
28. How does DNA methylation regulate gene expression? CO5 [K₂]
29. Elaborate the symptoms, causes, diagnosis and treatments options for Huntington's disease. CO6 [K₃]
30. Draw typical steps in detection of specific proteins in a protein sample using Western blotting. CO6 [K₂]

**Answer any TWO Questions
PART D (2 x 10 = 20 Marks)**

31. *E.coli* strains were grown in media containing initially tryptophan rich media for 24 hours and later it was shifted to media without tryptophan. Analyze the status of "trp" operon under both conditions and provide suitable explanation. CO1 [K₃]
32. Human growth hormone gene was cloned in expression vector containing "His" tag. Design your steps in purifying the recombinant human growth hormone fusion protein using suitable column. CO4 [K₃]

33. In a research project involving finding targets for treatment of colon cancer, cDNA microarray-based differential gene expression profiling was done from control as well as cancer cells. Below are the experimental results in terms of number of spots detected in control and cancer cells. Write the experimental protocol for cDNA microarray-based gene expression profiling and comment on the results towards finalizing potential drug targets for diagnosis and treatment.

CO6 [K₅]

Spot Colour	Control Cells	Cancer Cells
Green	12500	-
Red	-	25
Yellow	9765	2431
Black	100	100
