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Question Paper Code: R4C05

B.E./B.Tech. DEGREE EXAMINATION, APRIL / MAY 2025

Fourth Semester

Biotechnology

R21UBT405 - MOLECULAR BIOLOGY AND GENETICS

(Regulations R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What is chromosomal basis of heredity? CO2-App
2. Given a case of two mutant strains that fail to produce a functional protein, determine whether complementation occurs and justify your answer CO2-App
3. What is the significance of the 3',5'-phosphodiester bond in DNA? CO1-U
4. Describe Chargaff's rule and its significance in DNA structure. CO1-U
5. Mention the beneficial effects of poly adenylation. CO1-U
6. What is the role of Rho factor in Transcription? CO1-U
7. What do you mean by translocation? CO1-U
8. Write a note on Operator genes. CO1-U
9. Mention the function of corepressor. CO1-U
10. Write a note on feedback inhibition. CO1-U

PART – B (5 x 16= 80 Marks)

11. (a) Differentiate between sex-linked, sex-limited, and sex-influenced inheritance with suitable examples. CO1-U (16)

Or

- (b) Describe the concept of gene interaction. Elaborate on epistasis and complementary gene action with suitable examples. CO1-U (16)
12. (a) Describe the structural and physicochemical differences between DNA and RNA. Discuss the biological significance of these differences. CO1-U (16)
- Or
- (b) Describe the Watson and Crick model of DNA structure. How do Chargaff's rules support the double-helix model? CO1-U (16)
13. (a) Explain self-splicing introns. How do class I introns differ from class II introns. CO1-U (16)
- Or
- (b) Give a detailed account on prokaryotic transcription initiation, elongation and termination mechanisms with suitable diagram and factors involved in it. CO1-U (16)
14. (a) Given a bacterial protein that loses its function after translation, suggest possible post-translational modifications that could restore its activity and justify your choices CO2-App (16)
- Or
- (b) Describe about the factors involved in prokaryotic transcriptional process and give its role in each step of the process. CO2-App (16)
15. (a) If you were designing a genetically engineered strain of *E. coli* that continuously synthesizes tryptophan regardless of external supply, how would you modify the Trp Operon regulation? CO2-App (16)
- Or
- (b) If a bacterial strain has a mutation in one of the structural genes of the lac operon, predict its effect on lactose metabolism and suggest a possible solution to restore function. CO2-App (16)