[This question paper contains 4 printed pages.]

**Sr. No. of Question Paper : 2377** **F-4** **Your Roll No.....**

Unique Paper Code : 2491402

Name of the Course : **B.Sc. (Hons) Biochemistry**

Name of the Paper : Gene Expression and Regulation

Semester : IV

Duration : 3 Hours Maximum Marks : 75

**Instructions for Candidates**

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. Answer **five** questions in all including Question No. **1** which is compulsory.

1. (a) Comment on the following:

(i) Inspite of a single codon for methionine, the ribosome is able to differentiate between initial and internal methionine in prokaryotes.

(ii) The aminoacyl tRNA synthetase has a proofreading function that ensures the fidelity of the aminoacyl reaction, but histidine tRNA synthetase lacks such proof reading activity.

(iii) Promotor efficiency tends to decrease with the incorporation of GC base pair at -10 region.

(iv) Poly A Polymerase function differs from DNA dependent RNA polymerase.

(v) Unusual amino acid like Selenocysteine gets incorporated in peptides using termination codon.

(vi) DNA methylation and histone modification influence gene silencing in eukaryotes.

*P.T.O.*

(b) 5'-GGCAUGCAUUACGGCAUCACACUAGGGAUC-3' mRNA Transcript What is the sequence of the template and coding strands of the DNA that encodes this RNA.

(c) Write the contributions of the following scientists:

(i) Nirenberg

(ii) Khorana

(iii) Pribnow

(iv) Jacques Monod

(v) Charles Yanofsky (12,2,5)

2. (a) Explain self-splicing introns. How do Class I introns differ from Class II introns ?

(b) Write down the mechanism of action for the following inhibitors

(i) Actinomycin D

(ii) Puromycin

(iii) Diphtheria toxin

(iv) Cyclohexiimide

(v) α Amanitin

(c) Explain the basis and significance of wobble hypothesis with a diagram. (5,5,4)

3. (a) Explain with example how a gene can be under positive as well as negative regulation.

(b) How is protein synthesis accuracy ensured without proof reading enzyme?

(c) Indicate the role of CAP protein and CCA sequence at 3' end of the tRNA.

(6,6,2)

4. (a) Describe the role of Class II transcription factors in eukaryotic transcription.

(b) Give brief summary of Polyadenylation and capping of mRNA in eukaryotes and why this is not seen in prokaryotes.

(c) Give the reaction for the synthesis of amino-acyl tRNA (5,6,3)

5. (a) Justify the following statements:

(i) Sigma factor plays an important role in transcription initiation. Draw a diagram showing the different regions of sigma factor binding to the DNA template.

(ii) Silencing in eukaryotes is mediated by de-acetylation and methylation of histones

(b) Describe briefly Rho-dependent and Rho- independent mechanism of transcription termination (10,4)

6. (a) Protein translation initiation requires more factors in eukaryotes than prokaryotes. Explain briefly.

(b) Attenuation is an important process to regulate gene expression in prokaryotes but not in eukaryotes. Explain.

(c) What are the cis-acting and trans-acting regulatory elements in eukaryotes. Explain with examples. (4,5,5)

7. (a) Comment on the following

(i) Transcription is a sequence-dependent process.

(ii) Spliceosomes recognize correct splicing sites

(iii) Suppressor mutations can reside in the same or a different gene. Explain

(b) A researcher isolated mutant variants of the bacterial translation factor IF2, EF-2 and EF-G. In each case the mutation allows proper folding of the protein and the binding of GTP, but does not allow GTP hydrolysis. At what stage would translation be blocked by each mutant protein.

(c) What signals trigger ubiquitinylation of proteins? (6,4,4)

8. (a) Write short notes on the following

(i) RNA editing

(ii) Release factors in translation

(iii) DNA Binding protein motif

(iv) Gene silencing by RNA interference

(b) Explain the principal and application of DNase I footprinting. (12,2)