[This question paper contains 4 printed pages]

Your Roll No

5807 **J**

B.Sc. (Hons.)/III

BIO-CHEMISTRY—Paper XII

(Molecular Biology-II – Gene Expression and Recombinant DNA Technology)

(Admissions of 2000 and onwards)

Time 3 *Hours* *Maximum Marks* 60

(Write your Roll No on the top immediately on receipt of this question paper)

Attempt **Five** *questions in all, including Q No* **1** *which is compulsory*

1 (a) Study the following statements and justify whether True or False $1\frac{1}{2} \times 6 = 9$

(i) In λ phage both DNA strands are antisense strands for different sets of genes

(ii) Patients of SLE (systemic lupus erythematosus) have impaired splicing

(iii) Use of cordycepin as an inhibitor of transcription proves that RNA is synthesised in a $3' \rightarrow 5'$ direction

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(iv) Translational accuracy has to be better than transcriptional fidelity

(v) The major criteria to be used while selecting a Restriction enzyme is whether it is a blunt or staggered cutter

(vi) RNA synthesis whether in procaryotes or encaryotes is entirely processive

(b) Indicate the role of the following enzymes $1\times4 = 4$

(i) *t*-RNA nucleotidyl transferase

(ii) Polynucleotide phosphoryllase

(iii) 50s ribosomal sub-unit

(iv) Alkaline phosphatase

(c) Each of the following statements is a description of a phenomenon observed in Gene expression Indicate the phenomenon in each case $1\times3 = 3$

(i) The rate of *r*-RNA synthesis is proportional to the rate of ribosomal protein synthesis

(ii) His deletion mutants increasing his operon expression

(iii) In the presence of lactose and glucose, β-galactosidase is poorly expressed

2 Explain

(i) In both procaryotes and encaryotes selection of the

initiating amino acid in translation is not only by codon-anticodon based 6

(ii) What is the wobble hypothesis and what role does it play in translation? 3

(iii) Strong promoters are not always good for recombinant gene expression 2

3 (i) With the aid of a schematic diagram indicate how a c-DNA library is made In what ways is it better than a genomic DNA library ? 5 + 2

(ii) What is the mechanism behind blue-white selection of recombinants ? 4

4 Give reasons to explain the following

(i) Alternate splicing gives rise to different proteins with the same N-terminus 3

(ii) Selenocysteine has no designated codon but is considered the 21st proteinaceous amino acid 3

(iii) RF-2 is a structural mimic of *t*-RNA 2

(iv) Puromycin inhibits procaryotic and encaryotic translation 3

5 (i) Transcriptional initiation in encaryotes is far more complex than in procaryotes Briefly with a diagram indicate initiation at a protein encoding gene and highlight three reasons for the complexity over procaryotic genes 4 + 3

(ii) *m*-RNA transcripts in encaryotes are poly adenylated

Why ? How do histone genes get translated inspite of no poly adenylation 4

6 (i) Explain two different mechanisms of encaryotic translational control 3×2 = 6

(ii) Why is translational control rare in procaryotes ? Indicate any one translational control observed in procaryotes 1+2

(iii) In the expression of the lac operon, the ratio of the proteins β-galactosidase lactose permease transacetylase is 10 5 : 2 Why ? 2

7 (i) How do aminoacyl *t*-RNA synthetases recognise their cognate *t*-RNAs Indicate if these enzymes can proof-read with an example to support your claim 5+3

(ii) Why are cell free systems derived from reticulocytes used in translation studies ? If in such a study involving translation of *m*-RNA of globin a brief pulse of ^{3}H labelled leucine was given followed by a chase with unlabelled leucine, what would be the distribution of radioactivity in the completed haemoglobin chains ? 3

8 Write short notes on the following

(i) λ-switch 4

(ii) DNA-binding protein motifs 3

(iii) RNA interference 4