



Name :

Roll No. :

Invigilator's Signature :

CS/B.Tech (BT)/SEM-4/BT-403/2011

2011

MOLECULAR BIOLOGY & rDNA TECHNOLOGY

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : 10 × 1 = 10

i) You have obtained a sample of DNA and you transcribe mRNA from this DNA and purify it. Then you separate the two strands of the DNA and analyze the base composition of each strand and of the mRNA. You obtain the data shown in the table to the right. Which strand of the DNA is the coding strand, serving as a template for mRNA synthesis ?

	A	T	G	C	U
DNA strand # 1	19.1	26.0	31.0	23.9	0
DNA strand # 2	24.2	30.8	25.7	19.3	0
mRNA	19	25.9	30.8	0	24.3

- a) Strand 1 b) Strand 2
c) Both strands 1 and 2 d) Neither strand 1 nor 2.



- ii) What is added to the 3'-end of many eukaryotic *mRNAs* after transcription ?
- a) introns
 - b) a poly A tail
 - c) a cap structure, consisting of a modified G nucleotide
 - d) the trinucleotide 5'-CCA.
- iii) Which of the following tools of recombinant DNA technology is *incorrectly* paired with one of its uses ?
- a) restriction endonuclease — production of DNA fragments for gene cloning
 - b) DNA ligase — enzyme that cuts DNA, creating sticky ends
 - c) DNA polymerase — copies DNA sequences in the polymerase chain reaction
 - d) reverse transcriptase — production of cDNA from *mRNA*.
- iv) Which of the following is *not* a feature of eukaryotic gene expression ?
- a) many genes are interrupted by noncoding DNA sequences
 - b) RNA synthesis and protein synthesis are coupled as in prokaryotes
 - c) *mRNA* is often extensively modified before translation
 - d) multiple copies of nuclear genes and pseudogenes can occur.

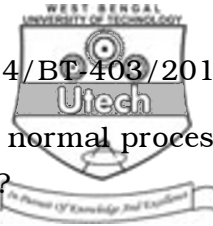


- v) The "Southern" technique involves
- a) the detection of DNA fragments on membranes by a radioactive DNA probe
 - b) the detection of proteins on membranes by using a radioactive DNA probe
 - c) the detection of proteins on membranes by using specific radioactive antibodies
 - d) the detection of DNA fragments on membranes by specific radioactive antibodies.
- vi) The primary RNA transcript of the chicken ovalbumin gene is 7700 nucleotides long, but the mature *mRNA* that is translated on the ribosome is 1872 nucleotides long. This size difference occurs primarily as a result of
- a) splicing
 - b) cleavage of polycistronic *mRNA*
 - c) removal of poly A tails
 - d) reverse transcription.
- vii) For transcription to occur in the lactose operon, an inducer must be present so that
- a) the repressor can bind to the operator
 - b) the repressor does not bind to the operator
 - c) the inducer can bind to the operator
 - d) the inducer does not bind to the operator.



viii) In the lactose operon, what is the function of *lac Z* gene product ?

- a) binds to an inducer
 - b) binds to the *lac* operator
 - c) binds to the *lac* promoter
 - d) splits lactose into glucose and galactose.
- ix) "Gene library" is a term used to describe
- a) a computerized listing of known DNA sequences
 - b) bacteria with plasmids containing DNA fragments representing the majority of the genetic information from a plant or animal
 - c) a store that specializes in the sale of Levis
 - d) a compilation of the amino acid sequences of protein coding genes.
- x) One of the most significant discoveries which allowed the development of recombinant DNA technology was
- a) the discovery of antibiotics used for selecting transformed bacteria
 - b) the identification and isolation of restriction endonucleases permitting specific DNA cutting
 - c) the discovery of DNA and RNA polymerase allowing workers to synthesize any DNA sequence
 - d) the southern technique for separation and identification of DNA sequences.



xi) Which of the following is not part of the normal process of cloning recombinant DNA in bacteria ?

- a) Restriction endonuclease digestion of cellular and plasmid DNAs
- b) Separation of recombinant DNAs by electrophoresis using the southern technique to determine where the desired recombinant migrates
- c) Transformation of bacteria by the recombinant DNA plasmids and selection using ampicillin
- d) Probing blots of bacteria clones with radioactive DNA complementary to desired gene.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

- 2. What is insertional inactivation ? Explain with an example. $2 + 3$
- 3. What is Wobble hypothesis ? How does it explain the ease of interaction between *mRNA* and *tRNA* ? Which amino acid except methionine has only one genetic code ? $4 + 1$
- 4. Which vector is best suited for cloning a fragment of 40 Kbp ? Describe the function of *dam* methylase. $1 + 4$
- 5. Discuss the synthesis of aminoacyl *tRNA*. State the differences between genomic DNA library & cDNA library. $2 + 3$
- 6. What is the role of *Ara C* protein as repressor and activator of arabinose operon ? 5



GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are – 10 and – 35 sequences ?
- b) Define the role of Σ (sigma) factor in transcription.
- c) Describe rho dependent termination in transcription.
- d) Describe the mode of function of rifampicin and tetracycline. $2 + 2 + 2 + 4 + 2\frac{1}{2} + 2\frac{1}{2}$
8. a) What is a polycistronic *mRNA* ?
- b) Describe the different types of 5' cap structures of *mRNA*.
- c) Explain with diagram how a cDNA library has been constructed.
- d) What are *cis* acting and *trans* acting elements ? $1 + 4 + 6 + 2 + 2$
9. a) In prokaryotes, transcription and translation are coupled process. Explain.
- b) State the mechanism of recycling of EF-Tu during bacterial protein synthesis.



- c) What are HRE ?
- d) Where are the receptors for steroid hormones and nonsteroid hormones found in a cell ?
- e) How has Human Genome project been helpful to mankind ? $2 + 4 + 2\frac{1}{2} + 2\frac{1}{2} + 4$
10. a) Write short notes on the following :
- i) Alpha complementation
- ii) Cloverleaf structure of *t*RNA
- b) Describe the process of production of recombinant human insulin in *E.coli*.
- c) State the function of polynucleotide kinase in *r*DNA technology. $(2 \times 4) + 5 + 2$
11. a) Explain antisense RNA technology with example.
- b) What is ribozyme ? How are they used in gene therapy ?
- c) Describe the procedure for generating a mutant by site directed mutagenesis. $5 + 5 + 5$