CS/B.TECH (BT-NEW)/SEM-4/BT-403/09

1. .....
Signature of Invigilator

2. .....
Signature of the Officer-in-Charge

Reg. No. | | | | | | | | | | | | | | |

Roll No. of the Candidate | | | | | | | | | | | | | | |

CS/B.TECH (BT-NEW)/SEM-4/BT-403/09

ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

MOLECULAR BIOLOGY AND *r*-DNA TECHNOLOGY (SEMESTER - 4)

Time : 3 Hours] [Full Marks : 70

INSTRUCTIONS TO THE CANDIDATES :

1. This Booklet is a Question-cum-Answer Booklet. The Booklet consists of **32 pages**. The questions of this concerned subject commence from Page No. 3.
2. a) In **Group – A**, Questions are of Multiple Choice type. You have to write the correct choice in the box provided **against each question.**
   b) For **Groups – B** & **C** you have to answer the questions in the space provided marked 'Answer Sheet'. Questions of **Group – B** are Short answer type. Questions of **Group – C** are Long answer type. Write on both sides of the paper.
3. **Fill in your Roll No. in the box** provided as in your Admit Card before answering the questions.
4. Read the instructions given inside carefully before answering.
5. You should not forget to write the corresponding question numbers while answering.
6. Do not write your name or put any special mark in the booklet that may disclose your identity, which will render you liable to disqualification. Any candidate found copying will be subject to Disciplinary Action under the relevant rules.
7. **Use of Mobile Phone and Programmable Calculator is totally prohibited in the examination hall.**
8. You should return the booklet to the invigilator at the end of the examination and should not take any page of this booklet with you outside the examination hall, **which will lead to disqualification**.
9. Rough work, if necessary is to be done in this booklet only and cross it through.

No additional sheets are to be used and no loose paper will be provided

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Marks Obtained

	Group – A										Group – B			Group – C				
Question Number																	***Total Marks***	***Examiner's Signature***
Marks Obtained																		

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Head-Examiner/Co-Ordinator/Scrutineer

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ENGINEERING & MANAGEMENT EXAMINATIONS, JUNE – 2009

MOLECULAR BIOLOGY AND *r*-DNA TECHNOLOGY

SEMESTER – 4

Time : 3 Hours] [Full Marks : 70

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

i) Polycistronic *m*RNA is found in

a) prokaryotes b) plants

c) lower eukaryotes d) all living cells. ☐

ii) The factor(s) responsible for initiation and termination of transcription in *E.coli* is/are

a) σ and ρ respectively b) ρ and σ respectively

c) σ only d) ρ only. ☐

iii) Repressor molecule binds to the site of DNA called

a) Operator b) TATA box

c) Pribnow box d) CAP binding site. ☐

iv) Restriction enzyme which cuts the double stranded DNA inside its recognition site is

a) Type-I b) Type-II

c) Type-III d) Type-IV. ☐

v) Enzyme used in 5' end labelling of DNA is

a) Alkaline phosphatase b) Polynucleotide kinase

c) DNA polymerase d) Terminal transferase. ☐

vi) Of the sequences shown below, which would be the most likely target sequence for a restriction endonuclease ?

a) TATAAT b) CATTAC

c) GCCTGC d) GAUUAC. ☐

vii) Which plasmid of the following would be the best cloning vector ?

a) pHA 1 : 12 restriction sites for *Eco*R1 and 2 for *Pst*I; amp^R; *ori*

b) pHA 2 : 1 restriction site for *Eco*R1, *Pst*I; *Bam*H1; *ori*

c) pHA 3 : 1 restriction site for *Eco*R1, *Pst*I and *Bam*H1; *ori*, tet^R

d) pHA 4 : no restriction sites; *ori*; amp^R and tet^R. ☐

viii) Which type of vector can be transformed into both bacterial and yeast cells ?

a) Cosmid b) YAC

c) Shuttle vector d) Expression vector. ☐

ix) In a cell with a $lacO^c$ mutation, the operon genes will

a) only be expressed in the presence of lactose

b) not be expressed in the presence of lactose

c) not be expressed in the absence of lactose

d) be expressed in the presence or absence of lactose. ☐

x) An enhancer element is

a) a specific upstream nucleotide sequence of a gene

b) a regulatory protein

c) an *m*RNA degrading enzyme

d) an *m*RNA transcript. ☐

xi) The transcriptional start site and translational start site are

a) same b) different

c) not specified d) none of these. ☐

xii) If the template strand of a segment of a gene has the nucleotide sequence 5'CGAATCG3', the sequence present in the RNA transcript will be

a) 5'CGAUUCG3' b) 3'GCUUAGC5'

c) 5'CGAAUCG3' d) 3'GCUAAGC5'.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following questions. 3 × 5 = 15

2. Write the reaction and only one use of each of the following enzymes in *r*-DNA technology :

i) Klenow fragment

ii) Bacterial alkaline phosphatase

iii) Terminal deoxynucleotide kinase

iv) T4 DNA ligase

v) Poly nucleotide kinase.

3. Write short note on any *one* of the following :

i) 5' Capping of eukaryotic *m*RNA

ii) *m*RNA splicing

iii) 3' poly adenylation.

4. Write short note on any *one* of the following :

i) pBR322

ii) pUC18

iii) Cosmid.

5. a) The restriction endonuclease EcoRI recognizes the sequence GAATTC. If a 40·96 kb genomic DNA with random sequence digested with EcoRI, theoretically how many fragments will be produced ? (presume that 50% GC content in the genomic DNA)

b) What are HRE ? Where are the receptors for steroid hormones and non-steroid hormones found in a cell ? $2\frac{1}{2} \times 2$

6. Write a short note on Wobble hypothesis. State how occurrence of at least three *t*RNAs can account for six codons for Serine. 4 + 1

GROUP – C

(Long Answer Type Questions)

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

7. a) What is *c*DNA library ? What is the difference between *c*DNA library and genomic library ?

b) If you know the protein product of a eukaryotic gene, then schematically draw a method for cloning and selection of the full length *c*DNA molecules of the corresponding gene.

c) A vector is used to clone 20 kb DNA fragments from human genome (3×10^9 bp). Let you wish to isolate a gene containing completely on that 20 kb fragment. To have a 99% chance of isolating the gene from recombinant genomic library, how many independent clone must be examined ? 3 + 7 + 5

8. a) What is operon ?

b) Explain with diagram the mode of operation of lac operon

i) in absence of lactose,

ii) in presence of lactose.

c) Explain how the regulatory protein Ara *C* acts as a repressor and activators of arabinose operon.

d) Write one application of lac operon in *r*-DNA technology. 1 + 8 + 4 + 2

9. a) What are the features for good cloning vector ?

b) What are the features of a good host ?

c) Describe the cloning procedure by which a foreign DNA fragment can be cloned into a Cosmid vector (with diagram only).

d) Starting with 600 template DNA molecules, after 25 cycles of PCR, how many molecules of DNA will be produced ? 3 + 3 + 5 + 4

10. Describe the Cloverleaf structure of *t*RNA. How is a particular *t*RNA charged ? What are meant by Gln-*t*RNA^{gln} and Glu-*t*RNA^{gln} ? How can they be interchanged ? Give one example of i) RNA editing by base substitution AND, ii) Alternative splicing.

Name one transcriptional inhibitor specific for prokaryote and one specific for eukaryote and mention the mechanism of action of any one of them.

3 + 3 + 2 + 1 + 2 + 2 + 2

11. What is the difference between anti-sense RNA technology and RNA*i* ? Describe the process of production of recombinant human insulin in *E.coli*. How Human Genome Project has been helpful to mankind ? 5 + 5 + 5

END