Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.Tech(BT)/SEM-1/MBT-102/2009-10

2009

GENETIC ENGINEERING

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 the following : $10 \times 1 = 10$

   i) Genetic engineering techniques that depend on the formation of RNA-DNA + hybrids is

   a) DNA sequencing b) northern blotting

   c) western blotting d) none of these.

   ii) Which of the following components terminates the chain in sequencing reaction ?

   a) Klenow fragment b) Deoxy nucleotide

   c) DNA primer d) Dideoxy nucleotide.

   iii) A vector DNA sequence containing multiple unique restriction enzyme cut sites, convenient for inserting foreign DNA called

   a) ribosome binding site b) multiple cloning site

   c) promoter d) none of these.

iv) Which of the following techniques would you allow a researcher to determine the genetic relatedness between two samples of DNA ?
   a) Inverse PCR
   b) TA cloning
   c) Reverse transcribed PCR
   d) Randomly amplified polymorphic DNA.

v) A nucleic acid segment used to identify specific DNA molecules bearing the complementary sequence, in recombinant DNA techniques is
   a) probe b) repetitive DNA
   c) satellite DNA d) none of these.

vi) A section of DNA that has been inserted into vector molecules (e.g. plasmid or phase chromosome) and then replicated to form many copies, called
   a) cosmid b) phagemid
   c) DNA clone d) none of these.

vii) Why are gene libraries constructed ?
   a) To find a new gene
   b) To sequence whole genome
   c) To create a "bank" of all the genes in an
   d) All of these.

viii) A technique that only separates molecules according to their net charge in an electrical field, usually on solid or semi-solid support media such as paper or agarose
   a) Electrophoresis b) Chromatography
   c) Southern blotting d) Northern blotting.

ix) Bacterial enzyme that break phosphodiester bonds in DNA at specific base sequence is
   a) Restriction enzyme b) DNA ligase
   c) Agarase d) Pronase.

x) In an Amplicon, foreign gene is incorporated in a vector
   a) where all viral genes are removed
   b) some viral genes are removed
   c) only the packaging and replication genes are kept
   d) none of these.

GROUP – B

(Short Answer Type Questions)

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

2. Write short note on any *one* of the following :
   a) pBR322
   b) pUC18
   c) Cosmid
   d) Directional cloning.
3. Write only the reaction and *one* use of the following enzymes in genetic engineering : 5 ∞ 1
   a) DNA polymerase-I
   b) T_4 DNA ligase
   c) Bacterial alkaline phosphates
   d) Polynucleotide kinase
   e) Terminal deoxynucleotide transferase.
4. What is blue-white screening ? Describe with diagram.
5. The human genome contains about $3 \infty 10^9$ bp of DNA. How many recombinant clone you have to screen, if would you want to clone 20 kb DNA fragment into BAC vector to get a genomic library to have 95% probability of including a particular sequence.
6. a) Name two common selectable markers used to select transformed animal cell lines.
   b) Briefly describe three methods of gene transfer to anima cell. 2 + 3
7. Describe the features of a good vector and a good host in genetic engineering.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

8. a) Write the requirement of PCR.
   b) Describe the detailed mechanism of PCR (draw a flow diagram).
   c) How will you optimize the PCR reaction condition ?
   d) Write the applications of PCR in biology.
   e) What is RT – PCR ? How will you synthesize *ds* cDNA ?

2 + 3 + 3 + 3 + 4

9. Write short notes on any *three* of the following : 3 × 5
   a) RFLP
   b) Maxam Gilbert method of DNA sequencing
   c) Southern blotting
   d) Pyrosequencing
   e) Nested PCR.

10. a) Write in detail about the features of a general expression vector with a diagram.
    b) Write the mechanism of the control of expression of a cloned gene in a pET vector system with diagram. 8 + 7

11. a) What is restriction enzyme (RE) ? Write the names of different types of RE.
    b) Compare properties of the different types of restriction enzymes.
    c) Which types of RE's are useful for genetic engineering and why ?
    d) The restriction eznyme HindIII recognize sequence "AAGCTT". If the genomic DNA of random sequence, size 50 kb is cleaved with HindIII, what will be the average size of a fragments and how many fragments will be there ? 2 + 5 + 3 + 5

12. a) Describe transfection by liposomes and write the advantages of these method ?
    b) What is *T*-DNA ? Describe the molecular mechanism of *T*-DNA transfer by *Agrobacterium tumefaciens*.
    c) Describe the transfection method to ES cells.
    d) What are the different biosafety levels assigned to the rDNAs ? 3 + 6 + 4 + 2

13. Write about the application of genetic engineering in any *three* of the following : 3 × 5
    a) Human gene therapy
    b) Fighting against AIDS
    c) DNA based diagnosis of genetic diseases
    d) Medicine and health care.