RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2014

THIRD YEAR

Date : 05/05/2014 **MICROBIOLOGY (Honours)**

Time : 11 am – 1 pm **Paper :** VII Full Marks : 50

Group – A

[Use a separate Answer Book for each Unit]

Unit - I

1. Answer **all** the questions :
   a) What are the drawbacks of Ames Test? [2]
   b) Why are DNA polymerase IV or V called error prone polymerases? [2]
   c) What are apurinic lesions and how do they arise? [2]
   d) What is Hardy-Weinberg equilibrium? [2]
   e) What are retrotransposons? [2]

Answer **any two** :

2. a) i) Write the mechanisms by which a protooncogene can be converted to an oncogene. What are v-myc and c-myc genes? [2]
   ii) How are thymine dimers formed? How can they be repaired? [1+2]
   iii) What are the differences between base excision repair and nucleotide excision repair? [2]
   iv) In human, ability to roll the tongue depends on the presence of a fully dominant allele T. In a population of 124 tongue rollers and 86 nonrollers at HW equilibrium, what are the allele and genotype frequencies? What is the expected number of heterozygous individuals? When are the allele frequencies and genotype frequencies fixed as predicted by HW law? [3]

   b) i) What are meant by dominant gain of function and recessive loss-of-function in relation to oncogenic conversion? [2]
   ii) In UV irradiated mutagenesis how can you prove that the target molecule of this non-ionizing radiation is DNA? [2]
   iii) What is Dam methylase? How does it function in DNA repair? [3]
   iv) Schemetically show how a mutation can be induced at a specific site of a cloned gene. Name a product of such a mutated gene available commercially. [3]

   c) i) Why is rat liver extract added to the assay systems for testing mutagenicity of chemicals? [2]
   ii) Write the features of auxotrophic strains of *Salmonella typhimurium* used by Ames and his coworkers to study the mutagenicity of chemicals. [3]
   iii) What is a suppressor mutation? State the mechanisms of intragenic and intergenic suppressor mutations. [1+4]

   d) i) Write down the roles of Rec A and Rec BCD to carry out homologous recombination. [3]
   ii) A Luria-Delbruck fluctuation test was done to determine the rate of mutation to resistance against phage F_0. Twenty tubes of medium were inoculated with *Salmonella typhimurium* cells and the cultures were grown to 10^8 cells/ml. A 0·1 ml sample of each culture was then spread on plates with phage F_0. On incubation the number of tubes which showed no F0 resistant mutants were 10 in number. What is the mutation rate? [2]
   iii) How can you determine whether a particular mutation was an A.T $\rightarrow$ G.C or a G.C $\rightarrow$ A.T transition? [3]
   iv) Why is it misleading to use the term "jumping gene" for transposons? [2]

Unit - II

3. Answer **all** the questions :
   a) What are cosmids? Why they are better than plasmid? [2]
   b) What are the advantages and disadvantages of RAPD over RFLP? [2]
   c) How does the binary vector differ from a Ti plasmid? [2]
   d) It is essential to calculate the Tm value of the primers used in PCR — Justify. [2]
   e) Why are two antibiotic genes inserted in plasmid pBR 322? [2]

Answer **any one** :

4. a) i) What is blue white screening? How is it done? [3]
   ii) While making a gene library of an organism with a genome size of 10^{12} kb , you made DNA fragments of 6×10^{5} kb. How many recombinant colonies must you transfect with the fragments so that every gene is included in the gene library (consider a probability of 0·99)? [2]
   iii) Why are the type I and III restiction enzymes not used by molecular biologists? [2]
   iv) State the principle of the dideoxy method of DNA sequencing briefly. [3]

   b) i) A linear 7·5 kb DNA fragment is cleaved with restriction enzymes Hind III and Sma I and then with a combination of both enzymes. The fragments obtained are :

Hind III	:	2·5 kb, 5 kb
Sma I	:	2·0 kb, 5·5 kb
Hind III + Sma I	:	2·5 kb, 3·0 kb, 2·0 kb

   [2]

   Deduce the restriction map.
   ii) What are the essential features of an ideal plasmid vector? [2]
   iii) What are shuttle vectors? Why do plasmid transcription vectors characteristically lack polyadenylation sequence? What is the cassette size of pBR 322. [½+1+½]
   iv) What are isoschizomers and isocaudomers? Give examples of both. [2]
   v) What are VNTR and STS? Why and how are they used in forensics? [2]