RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SIXTH SEMESTER EXAMINATION, MAY 2016

THIRD YEAR [BATCH 2013-16]

Date : 04/05/2016 **MICROBIOLOGY (Honours)**

Time : 11 am – 1 pm **Paper :** VII [A&B] Full Marks : 50

[Use a separate Answer Book for each group]

Group - A

(*Answer **any three** of the following*)

1. a) What are the different causes of spontaneous mutations? [2]
   b) Mentioning the functions of individual components, briefly describe the role of RecBCD complex and RecA in homologous recombination. [3]
   c) How can you explain that an staggered cut is made during transposition? [2]
   d) State the role of DNA adenine methyl transferase in repair mechanism. [2]
   e) Define insertional mutagenesis. [1]

2. a) What are composite transposons? What are the major genes required for transposition of Tn 3? How will you identify their function during the transposition process? [1+1+3]
   b) Before presenting the structure of double helical model for DNA Watson and Crick had to explain the mechanism of spontaneous mutations. How did they explain these? [3]
   c) What is meant by dominant gain-of-function in the context of cancer development. [2]

3. a) In a two-point crossing experiment with *Neurospora crassa* using the parents with the genotypes m^1m^{2+} and $m^{1+}m^2$, most of the asci showed the usual segregation of traits in ascospores in $m^{1+} : m^1 = 4:4$ and $m^{2+} : m^2 = 4:4$ ratios. But a few of the asci exhibited segregation of traits in ascorpores in the $m^{2+} : m^2 = 5:3$, $m^{2+} : m^2 = 6:2$ ratios. How can you explain these anomolous results? [2]
   b) How can you prove that the target molecule of UV-irradiation is DNA and not the protein? [2]
   c) Write two ways by which a protooncogene is converted to an oncogene? [2]
   d) Give examples of each— (i) autosomal recessive single gene disorder (ii) X-linked dominant single gene disorder [1+1]
   e) Define exinuclease. [2]

4. a) In a population of humans, the following blood type frequencies were observed.
   A group = 0·55, B group = 0·12, C group = 0·24 and AB group = 0·09
   Calculate the gene frequencies for I^A, I^B and I^O [3]
   b) In template transition mutation, the continuous presence of 5–BU in the medium is not necessary but substrate transition occurs only when 5–BU is present in the culture medium. Explain these with a flow chart. [3]
   c) What is a Philadelphia chromosome? [1]
   d) Which DNA polymerase is said to be the error-prone polymerase? Why is it so called? [3]

5. a) "Loss of heterozygosity is a prerequisite for certain types of cancer to develop". Explain this statement with suitable illustrations. [3]
   b) Why is bacteriophage mu (μ) is considered to be a mutagen? [2]
   c) What is AP glycosylase? [2]
   d) "UV-induced damage in *E. coli* could be partially reversed, if following irradiation, the cells are exposed briefly to the blue range of visible spectrum". Why does the reversion occur? [2]
   e) What is the effect of 5-bromouracial on living cells? [1]

6. a) What are meant by *v-onc* and *c-onc*? Cite examples for each. Which gene is said to be the guardian of the genome? [2+1]
   b) Briefly mention the mechanism of removal of thymine dimer following base excision repair mechanism. [3]
   c) How do alkylating agents bring mutational effects in organisms? [3]
   d) Write two factors which alter Hardy-Wienberg equilibrium. [1]

Group - B

(*Answer **any two** of the following*)

7. a) 'The size and copy number of a plasmid are important as far as cloning is concerned.' Explain why? [2]
   b) "Bacterial system is not ideal for cloning of the eukaryotic genes." Justify the statement. [2]
   c) What enzymatic reaction is preferred to enhance the cloning efficiency by reducing the self ligation frequency in a vector? [2]
   d) Define adaptors and linkers. Comment on their importance while joining different cleavage sites. [1+1+2]

8. a) Suppose you have inserted human insulin cDNA in the cloning vector PUCI9 and transformed the clone into *E coli* DH5α cells. However, insulin was not expressed. Propose your hypothesis to explain why did it so happen? [3]
   b) Suppose you want to clone a 30 kb DNA in *E. coli*. Which vector will you prefer as a cloning vehicle if you have four different cloning vectors namely Cosmids, Plasmids, lambda insertion vector or lambda replacement vector. Justify your comment. [3]
   c) Define hot start PCR. [2]
   d) Define nested PCR. [2]

9. a) Define 'isoschizomers' and neoschizomers'. Explain with example. [1·5+1·5]
   b) What do you mean by multiplex PCR? [3]
   c) Why it is important to equalize the amounts of RNA in Northern gels? How this can be achieved? [1+3]

10. a) Explain the strategy for regulating the expression of genes cloned into pET vectors. [3]
    b) Define star activity of a restriction enzyme. State one example. [1+1]
    c) Differentiate between cDNA library and genomic DNA library. [3]
    d) Differentiate between *E. coli* DNA ligase and T4 DNA ligase. [2]

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