RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. FOURTH SEMESTER EXAMINATION, JUNE 2022

SECOND YEAR [BATCH 2020-23]

Date : 21/06/2022

MICROBIOLOGY (HONOURS)

Time : 11 am – 1 pm

Paper : VIII [CC8]

Full Marks : 50

Answer **any ten** of the following questions: [10×2]

1. a) How can the satellite DNA be differentiated from the bulk of chromosomal DNA?
   b) Write down the significance of the presence of two nuclei in Tetrahymena sp.
   c) Chromosomal DNA of eukaryotes are organised in the form innumerable loops radiating from a central scaffold. How can it be shown?
   d) E.coli cells with the genotype recA-uvr- are very much sensitive to UV- rays. Why?
   e) How can you determine whether a point mutation is due to AT->GC or GC-> AT transition?
   f) State the roles of SOS repair in induced mutagenesis.
   g) Mention the important features of the his- strains of Salmonella typhimurium used by Ames to test the mutagenicity of chemicals.
   h) State the advantages of a three-point cross over a too point cross in determination of gene order.
   i) What is meant by classIII revertants of suppressor mutation?
   j) State the roles of histone tail domain of nucleosome in chromatin assembling and functioning.
   k) What is composite transpososn?
   l) What is polar mutation? How does it differ from point mutation?
   m) What do you mean by the term host range of plasmid?
   n) What do mean by the term “High Frequency Transductants “ ?
   o) What is the role of SSB proteins in Transformation process ?

Answer **any three** questions of the following: [3×10]

2. a) During transformation of Bacillus subtilis an enzymatically active change takes place leading to make the cells competent. How can you prove it?
   b) In generalised transaction some of the gal+ transductants isolated are not stable? Why?
   c) What is meant by autonomously replicating sequence?
   d) How can the genome size be known from Cot analysis? (2+3+2+3)

3. a) How does bromouridine bring a change in the DNA base composition leading to creation of mutants? (Show in flow diagram)
   b) How did S. Benzer prove that rII locus of bacteriophage T4 contains two genes?
   c) How can you prove genetically that the E.coli chromosome is circular?
   d) You have isolated ten leu- mutants of E.coli. How can you prove that the mutants arose from a change in the same gene or different genes? (2.5+2.5+2.5+2.5)

4. a) An F'lac+/Strs is mated with a lac-Strr recipient that also carries a dnaG(Ts) mutation. Mating is at a nonpermissive temperature. After 30 minutes of mating, streptomycin and an inducer of lac operon are added. Will any β-galactosidase be made in the culture? Briefly explain your answer.

   b) If, in a particular cell type, rifampicin were to inhibit DNA transfer, what would you conclude about the transfer mechanism?

   c) If ColE1 plasmid could be altered to contain insertion sequences homologous to sequences in the chromosome, such that it could integrate in the chromosome, would Hfr-like cells arise?

   d) Replication of unintegrted F, but not integrated F, is inhibited by exposing E. coli to acridine orange. Make use of this finding

      i) To obtain F- from F+ cells.

      ii) To identify colonies as F+, Hfr, or F-.

   e) A strain carrying F'gal+, which forms red colonies in MacConkey- galactose agar (Gal- colonies are white), is mutagenized and plated. A few colonies are found that are slightly smaller and more intensely red. Further study shows that they have ten copies of F'gal+ per cell rather than usual number. What types of mutations have occurred? Explain briefly. (2+2+2+2+2)

5. a) How will you identify the ori region of plasmid?

   b) How ColE1 derived plasmid regulate their copy number?

   c) How will you detect the transposable element genetically and physically?

   d) What do you mean by the term Ts mutation? [2+2+(2+2)+2]

6. a) Following publications of the transformation experiments of Avery, MacLeod and McCarty, opponents of the DNA=gene theory, who believed that genes were made of proteins, argued that the transformation was caused by proteins that were contaminating the DNA sample.

      i) If transformation was indeed carried out by protein rather than DNA molecules and if the DNA preparation used contained at most 0.02% protein, how many protein molecules (each consisting of about 300 amino acids) would have been present in 1 ml of a DNA solution at a concentration of 10-7 mg/ml ?

      ii) If protein was the active agent in transformation, would the number calculated in part (a) account for the fact that in a typical transformation experiment 1000 transformants result from 0.0001 gm of *S. pneumoniae* DNA ?

   b) How does a bacterial cell become Competent? [(4+2)+4]

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