2022

MICROBIOLOGY — HONOURS

Paper : CC-8

(Microbial Genetics)

[Units 1-5]

Full Marks : 50

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Question no. **1** is compulsory and answer ***any three*** questions from the rest.

1. Answer ***any ten*** questions : 2×10

(a) Define mutational hot spots.

(b) Why should we not expect to find both 'bio' and 'gal' markers in λ-transducing phage?

(c) What are the modes of replication of plasmids during their reproduction and conjugation?

(d) Why a F^- recipient cell remains F^- even after conjugation with an Hfr donor but becomes F^+ after mating with F^+ donor?

(e) Differentiate between silent and neutral mutations.

(f) Differentiate between transition and transversion.

(g) Can a mutation induced by nitrous acid be induced to revert at the same site by treatment with nitrous acid?

(h) What are 'Chi' sites?

(i) Is there any relation between plasmid size and copy number?

(j) What is meant by co-transduction?

(k) Define auxotropic mutants.

(l) T_4 rII strains are conditional lethal. – Explain.

(m) How many chromosomes are there in *Saccharomyces cerevisiae*? Write down its genome site.

(n) How does ultraviolet light produce revertible mutations?

(o) What is the linking number?

2. (a) Why plasmids may remain 'extrachromosomal'?

(b) What do you mean by fertility inhibition of a plasmid? Name the gene(s) and protein(s) involved in fertility inhibition.

(c) State the significance of Ames Test.

(d) Briefly state the difference between transformation in Gram positive and Gram negative bacteria. 2+(1+2)+2+3

3. (a) A donor bacterial cell having genotype of $A^+B^+C^-$ was used to transduce a recipient bacterial cell $A^-B^-C^+$. 100 A^+ transductants were selected and tested for the presence of other markers. The following data were obtained –

Genotypes observed	Number of colonies
$A^+B^+C^+$	5
$A^+B^+C^-$	19
$A^+B^-C^+$	49
$A^+B^-C^-$	27

Determine the order of A, B and C.

(b) Why are $F^+ \times F^+$ matings incompatible?

(c) Write down the function of suppressor t-RNA. Why are the mutants having suppressor t-RNA slow-growing than the wild-type cells?

(d) What is the function of counterselective marker in Hfr × F^- mating? 3+2+(2+1)+2

4. (a) How does natural competence differ from artificial one?

(b) What are transformasomes?

(c) What experimental results showed that transformation consists of a permanent genetic change?

(d) Why is the term 'Jumping gene' a misnomer for some transposoms?

(e) Why transposition always leads to formation of direct repeats in the host DNA? 2+2+2+2+2

5. (a) Discuss sexduction.

(b) How do you prove that generalized transducing particles contain only bacterial DNA?

(c) Discuss the function of RecA.

(d) State how does tautomerism lead to changes in DNA sequence. Explain using schematic representation. 2+3+2+3

6. (a) If a plasmid is mobilizable but non-conjugative, what function does it lack?

(b) Why R plasmids are of considerable medical interest?

(c) Why T_4 DNA is called terminally redundant?

(d) Describe any one mechanism of copy number control by plasmid.

(e) Is frameshift mutation always lethal? 2+2+2+3+1

7. Write short notes on (***any four***) : 2½×4

(a) Ti plasmid

(b) Plasmid incompatibility

(c) Inter-genic suppression

(d) Base analog

(e) Nucleosomes

(f) Non-replicative transpositions.