

2021
MICROBIOLOGY
[HONOURS]
Paper : V

Full Marks : 75

Time : 4 Hours

*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*

Write the answers to questions of each Group in separate answerscript.

GROUP-A
(Microbial Genetics)

[Marks : 35]

1. Answer any **three**: 1×3=3
 - a) The frequency of producing mutant arb^- is 2×10^{-6} per generation and mutant snd^- is 8×10^{-3} . What is the frequency of producing arb^-snd^- mutant in a single event?
 - b) What do you mean by non sense mutation?
 - c) What is a episome?
 - d) Name any one chemical mutagen and any one physical mutagen.

[Turn over]

- e) What are prototrophs?
2. Answer any **two** questions: 2×2=4
 - a) What is the difference between a true revertant and a suppressor?
 - b) What are mobilisable plasmids?
 - c) What is a cistron?
 - d) What is a frame-shift mutation? Can it be reversed?
3. Answer any **three** questions: 6×3=18
 - i)
 - a) What are the roles of DNA synthesis in the donor (F^+) and recipient (F^-) cells?
 - b) What are the functions of the tra genes of F factor? 3+3=6
 - ii)
 - a) Rank the following mutations increasing order of reversion frequencies. (i) deletion (ii) point mutation (iii) double mutation.
 - b) What are mutational hot spots?
 - c) If a cell contains 2000 genes and if the average mutation rate per gene is 1×10^{-5} per generation, what is the average number of new mutations per cell per generation? 2+2+2=6

- iii) a) How is a co-integrate formed in the transposition of Tn^3 ? Mention the enzymes involved in this process.
- b) Does a composite transposon necessarily have terminal inverted repeats? $4+2=6$
- iv) a) Differentiate between homologous and site-specific recombination.
- b) What do you mean by abortive transduction? $4+2=6$
- v) a) How are F' factors created?
- b) A transformation experiment is carried out using donor DNA that is $A^+B^+C^+$ and recipient DNA that is $A^-B^-C^-$. A^+ transformants were selected and was found that 64% are B^+ and none are C^+ . Also B^+ are selected and 8% are also C^+ . What is the gene order? $3+3=6$

4. Answer any **one** question: $10 \times 1 = 10$

- i) a) Mention any two activities of RecA protein.
- b) What is copy number of a plasmid? What are stringent and relaxed plasmid?

- c) What is the significance of the Interrupted mating experiment?
- d) What is plasmid partitioning?

$$2+(1+2)+3+2=10$$

- ii) a) Describe briefly the genome organisation in prokaryotes.
- b) Explain SOS repair and excision repair by uvrABC exonuclease.
- c) Differentiate between transition and transversion. $3+5+2=10$

GROUP-B

(Molecular Biology)

[Marks : 40]

5. Answer any **two** of the following: $1 \times 2 = 2$

- a) What do you mean by Okazaki fragments?
- b) Which RNA can function as both structural and catalytic component?
- c) What is function of tRNA?
- d) What is operon?

6. Answer any **two** of the following: $2 \times 2 = 4$

- a) What is an inducer?
- b) Are all triplet codons universal? Give example in support of your opinion.

- c) What is mean by central dogma?
- d) How do bacterial DNA differ from human DNA?

7. Answer any **four** of the following: $6 \times 4 = 24$

- a) Design an experiment to prove semi-conservative mode of DNA replication.
- b) Write down the physical consequence of binding of the lac repressor to the lac operator.
- c) Write down the definition and importance of phylogenetic tree. $2+4$
- d) Write short notes on ϕ mode of replication. Why is RNA synthesis not as carefully monitored for errors as is DNA synthesis? $4+2$
- e) Describe briefly the process of post transcriptional modification of mRNA of eukaryotic system.
- f) Describe in brief the different characteristic features of genetic code.
- g) Describe the formation of initiation complex during bacterial translation with suitable sketch.

8. Answer any **one** of the following: $10 \times 1 = 10$

- a) What are the three stop codons? Does an mRNA molecule codify only one type of protein? How are amino acids brought to the sites of the cell where translation takes place? What is Phylogenetic marker? Describe its importance in molecular phylogeny.

$2+2+2+2+2$

- b) What is catabolic repression? How does it occur? RNA is readily hydrolyzed by alkali, whereas DNA is not. Why? The sequence of part of an mRNA is 5' AUGGGGAACAGCAAGAGUGGGGCCCUGU-CCAAGGAG-3'. What is the sequence of the DNA coding strand? What is linker DNA?

$1+2+2+3+2$