

2015

MICROBIOLOGY — HONOURS

Third Paper

(Group – A)

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*

Answer *Question No. 1* and *any four* from the rest

1. (a) What is Pribnow Box? 5×2
- (b) Explain how Gramicidin affects bacterial cell membrane.
- (c) State two membrane proteins that are important for the generation and sustenance of the membrane potential.
- (d) What is the difference between  $\sigma$ -70 and  $\sigma$ -32?
- (e) Mention the constituent of cyclin dependent kinase and the function of each subunit.
2. (a) Distinguish between the roles of DnaB helicase and DnaA proteins in DNA replication. 2
- (b) Why does DNA replication require the enzyme DNA topoisomerase? 2
- (c) Explain with diagram what would have been the observation in the classical experiment of Messelson and Stahl, if DNA replication would have been conservative in nature. 3
- (d) State whether the following statements are *true* or *false* :  $1\frac{1}{2} + 1\frac{1}{2}$
- (i) The main enzyme in *Escherichia coli* DNA replication is DNA polymerase I.
- (ii) In DNA synthesis, the covalent bond is formed in between a 3'-OH and 5'-phosphate groups.

[Turn Over]

3. (a) Ribosome is unable to discriminate between correctly and incorrectly charged tRNA — Justify the statement with suitable example.

(b) Mention the important events that must occur to successfully initiate translation.

(c) Why there is no gene expression during M phase of cell cycle?

(d) Define :

(i) silent mutation (ii) nonsense mutation.

3+2+3+2

4. (a) Using a schematic diagram, sketch the process of transport of a protein across the bacterial cell membrane and the membrane of the endoplasmic reticulum.

$2\frac{1}{2} + 2\frac{1}{2}$

(b) What are the different classes of yeast sec mutants and how did they help to decipher the proteins involved in different steps of the secretory pathway? 3+2

5. Write short notes on :

$2\frac{1}{2} \times 4$

(a) Endoplasmic Reticulum

(b) MTOC (Mitosis Organisation Centre)

(c) Differential Codon Usage.

(d) *ara* operon.

6. (a) What is aquaporin?

(b) Give structural features of Mitochondria as an important organelle for energy transduction.

(c) “The cilia and the flagella have the same basic structure”. Using a schematic diagram, outline the arrangement of microtubules in these cellular structure.

(d) Write importance of sphingolmyelin and phosphatidyl serine as components of bio-membrane.

2+3+3+2

7. (a) Why transient haploid cells of *S. cerevisiae* switch their mating type?

(b) Name the organelle in cell where the proteins are post-translationally modified and name two such modifications.

(c) Operator and promoter are *cis*-dominant—Explain with reference to *lac* operon.

(d) What is Shine-Dalgarno Sequence?

(e) In what stage of life-cycle of protozoa, the Kinetoplast is associated to flagellum and why?

2×5

8. (a) Sodium-calcium exchanger plays an important role in muscle contraction —Justify the statement. 3

(b) What is blepharoplast? What are the polar arrangements of bacterial flagella?  $1 + 1\frac{1}{2}$

(c) What are 'heat-shock proteins' in *E. coli*? 2

(d) Match the following :  $\frac{1}{2} \times 5$

*Column A*

*Column B*

- |                      |  |
|----------------------|--|
| (i) Mitochondria     | (a) Protein Synthesis                  |
| (ii) DNA replication | (b) Allolactose                        |
| (iii) Ribosome       | (c) Krebs's Cycle                      |
| (iv) Lac Operon      | (d) Protein modification and targeting |
| (v) Golgi Complex    | (e) S-phase                            |
|                      | (f) A and P sites                      |
|                      | (g) DNA ligase                         |

9. (a) Comment on the following : "The genetic code is universal without exception". 2

(b) Why is universality of the genetic code important for the expression of recombinant protein in a foreign host? 2

(c) Explain how mitochondria are dependent on expression of nuclear genes for its proper function. 2

(d) What is the mode of action of Penicillin? 2

(e) What are the functions of proteasomes in the cell? 2