

**2021**  
**MICROBIOLOGY**  
**[HONOURS]**  
**Paper : IV**

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.**

**Answer all the questions.**

**GROUP-A**

**(Marks : 50)**

**(Bioenergetics and Microbial Metabolism)**

1. Answer any **two** of the following: 1×2=2
  - i) Write the electron donor and acceptor in overall anoxygenic photosynthesis.
  - ii) What is the precursor molecule of fatty acid biosynthesis?
  - iii) What is organotrophy?

- iv) How many ATP molecules are produced from oxidative phosphorylation of two NADH?
2. Answer any **five** of the following: 2×5=10
    - i) How does carnitine help in lipid metabolism?
    - ii) Describe the energetic state of a reaction in equilibrium.
    - iii) In which type of photosynthesis oxygen is not produced? Cite an example.
    - iv) Write the conditions that favour sulphate reduction by microorganisms.
    - v) Write the potential inhibitors of nitrogenase.
    - vi) What is catabolism? Give one example of inorganic electron acceptor used in catabolic process.
    - vii) What is myxotrophy?
  3. Answer any **three** of the following: 6×3=18
    - i) What are Homolactic fermenters and Heterolactic fermenters? Describe the lactic acid fermentation with key enzyme involved. 2+4
    - ii) Write the steps of glycolysis where 3 carbon molecules are produced by the breakdown of 6 carbon molecules. How many carbon atoms

are present in the molecules that enter the TCA cycle from glycolysis? Write the steps of TCA cycle where NADH, GTP and FADH<sub>2</sub> molecules are produced. 1+1+4

iii) Depict the electron transport system of iron oxidising bacteria. What is ammonification? 6

iv) How does nitrogenase work? Why is the N<sub>2</sub> fixation process considered wasteful to cell? 5+1

v) Name the glucose breakdown pathway which is exclusively found in prokaryotes. Describe the key steps of HMP pathway and enzyme involved. 1+5

4. Answer any **two** of the following: 10×2=20

i) Depict the electron transport chain of aerobic H<sub>2</sub> and Fe<sup>2+</sup> -oxidising bacteria. What is anammox? 4+4+2

ii) What is anabolism? What do you mean by amphibolic pathway? Depict the anabolic pathways of fatty acid metabolism. Write the catabolic products of odd chain and even chain fatty acids. 1+1+6+2

iii) Write short notes on the following:

$$2\frac{1}{2} \times 4 = 10$$

- a) Syntrophy
- b) Proton motive force
- c) Anoxygenic photosynthesis
- d) Methanogenesis

### GROUP-B

(Marks : 25)

5. Answer any **three** of the following: 1×3=3

- a) What will be the energy yield coefficient of an anaerobic bacterium having molar yield coefficient of 20?
- b) Define Critical Dilution rate ( $D_{crit}$ ).
- c) What are polyene antibiotics? Give examples.
- d) What are the eurythermal bacteria? Give examples.
- e) Why is growth of bacteria occurred by geometrical progression with a constant factor of 2?

6. Answer any **three** of the following: 2×3=6

- a) How to obtain similar specific growth rate value of linearization with modified Gompertz model fitting?

- b) Is it possible for cultured bacteria that are in their stationary phase to go back into their log phase after addition of depleted source? Justify your answer.
- c) What are peptide antibiotics? Give examples.
- d) What is the doubling time of a culture growing in a 75 ml chemostat if the flow rate for the growth medium is 0.3 min?
- e) Differentiate between pasteurization and appertization.

7. Answer any **one** of the following:  $6 \times 1 = 6$

- a) Briefly describe the regulation of endospore formation in *Bacillus cereus*.
- b) Describe the role of fts, Mre and Min in the regulation of bacterial cell cycle.

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

- a) Write a comparison of Fed-batch and continuous bioreactors. Mention the various applications of fed-batch culture.
- b) Describe the mode of action of a  $\beta$ -lactam and an aminoglycoside antibiotics.

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