

2025

**MICROBIOLOGY — HONOURS**

**Paper : DSCC-4**

**(Microbial Physiology and Metabolism)**

**Full Marks : 75**

*The figures in the margin indicate full marks.*

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

1. Answer **any ten** questions :

2×10

- (a) Name the enzymes present in aerobes which utilizes oxygen.
- (b) Define mixotroph with proper example.
- (c) PFK (Phosphofructokinase) is known as pacemaker of glycolysis. Justify.
- (d) Define chemoorganotrophic heterotrophy with example.
- (e) Name two ammonifying bacteria present on earth.
- (f) 'Facilitated diffusion is an energy driven process.' — Justify the statement.
- (g) Differentiate between thermophilic and thermoduric microorganism.
- (h) What enzyme is required for hydrogen bacteria to grow as H<sub>2</sub> chemolithotroph?
- (i) 'Rotenone is considered as an activator in electron transport chain.' — Comment on this statement.
- (j) Discuss homolactic acid fermentation with example.
- (k) How does leghemoglobin differ from hemoglobin?
- (l) Distinguish between primary and secondary active transport.
- (m) What do you mean by barophilic microbes?
- (n) What is assimilatory nitrogen fixation?
- (o) Write the role of leghemoglobin in plant-microbe symbiosis.

2. Answer **any ten** questions :

- (a) Oxygenic and anoxygenic phototrophs follow different metabolic pathways — Justify. 3
- (b) 'Iron oxidizing bacteria are acidophilic in nature' — Justify. Why is acetate formation in fermentation energetically beneficial? 1½+1½
- (c) What is the physiological adaptation present in thermophiles and psychrophiles compared to that of mesophiles? 3

Please Turn Over

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- (d) How much NADPH and ATP is required to make one hexose molecule by the Calvin Cycle? 3
- (e) What is methanogenesis? What coenzyme functions as C1 carriers in methanogenesis? 2+1
- (f) Discuss the advantages of continuous culture over batch culture. Give an example of psychrophilic bacteria. 2+1
- (g) For *E. coli*, why is more energy released in aerobic respiration than during nitrate reduction? 3
- (h) Why is hydrogen important for sulfate reducing bacteria? Give an example of sulfur disproportionation. 2+1
- (i) Differentiate between anaerobic respiration and fermentation. 3
- (j) Describe the importance of Pentose Phosphate Pathway in bacterial metabolism. 3
- (k) Name one direct and one indirect method of measuring bacterial growth and mention one advantage of each of these methods. 1+(1+1)
- (l) Describe asymbiotic nitrogen fixation and its importance in agriculture. 3
- (m) Mention the importance of lag phase during bacterial growth. How could you eliminate or reduce the length of lag phase? 1½+1½
- (n) Schematically represent peptidoglycan biosynthesis process in bacteria. 3
- (o) What are the substrates for ammonia mono-oxygenase? What do nitrifying bacteria use as their carbon source? 1+2

Answer **any five** questions.

3. What are the differences of ATP powered pump and the ion channel? Discuss briefly about the uniporter, symporter and the antiporter system. 2+3
4. What are the differences between photophosphorylation and oxidative phosphorylation? Write down the components of complex I in electron transport chain. 3+2
5. Write down the only ATP/GTP generation steps in TCA cycle. How does alpha-keto glutarate dehydrogenase differ from Pyruvate dehydrogenase? 2+3
6. Write down the physical and chemical factors that affect the synthesis of nitrogenase. How can activity of preformed nitrogenase be regulated and how would the cell benefit by doing this? 2+(2+1)
7. Calvin cycle is considered as reductive pentose phosphate pathway — Justify the statement. How many NADPH and ATP are required to make one hexose molecule in the calvin cycle? 2+(1½+1½)
8. (a) What is denitrification?  
 (b) Define ammonia assimilation.  
 (c) What is microaerophilic microbes?

( 3 )

( *D(1st Sm.)-Microbiology-HDSC-ACC* )

- 9.** (a) What are thermotolerant?  
(b) Write a short note on ABC Transporter. 2+3
- 10.** (a) Differentiate between facultative aerobes and anaerobes.  
(b) Mention the factors that influence microbial growth.  
(c) Write down the differences between Halophiles and Xerophiles. 2+1+2
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