



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours 3rd Semester Examination, 2023-24

MCBACOR05T-MICROBIOLOGY (CC5)



Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

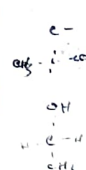
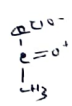
Question No. 1 is compulsory and answer any four questions from the rest

1. Answer any **four** questions from the following:

2×4 = 8

P.T.O.

- (a) Compare between antiport and symport.
 - (b) What do you mean by mixed acid fermentation?
 - (c) Show the reaction in Glycolysis where oxidation coupled with phosphorylation takes place.
 - (d) What is uncoupler? Give an example.
 - (e) What are siderophores?
 - (f) Write down any two inhibitors of TCA cycle.
 - (g) What are ionophores?
2. (a) What is oxidative phosphorylation? 2
 - (b) What is the significance of ATP synthase? 2
 - (c) Write down the NADH producing steps of the TCA cycle. [Structures should be mentioned] 3
 - (d) Which reaction of the glycolysis pathway is inhibited by fluoride? 1
3. (a) Explain how PFK-1 is regulated by ATP. 2
 - (b) What is Warburg effect? 2
 - (c) What is alcoholic fermentation? How is ethanol produced from pyruvate? 1+3
Mention the reactions involved.
4. (a) What are chemolithotrophs? Give examples. 2
 - (b) Differentiate between homolactic and heterolactic fermentation. 2
 - (c) What is Pasteur effect? 2
 - (d) What do you mean by P/O ratio? 2
5. (a) 'Gluconeogenesis is a regulated process.' — Justify. 2
 - (b) What is the effect of denitrification in the environment? 2
 - (c) How do the aerobic nitrogen fixing bacteria protect nitrogenase from oxygen? 2
 - (d) What are capnophiles? 1
 - (e) What do you mean by facilitated diffusion? 1



6. (a) Differentiate between assimilatory and dissimilatory nitrate reduction. 2
 (b) Differentiate between oxygenic and anoxygenic photosynthesis. 2
 (c) What do you mean by cyclic and non-cyclic photophosphorylation? 2
 (d) What is the significance of reverse electron flow in anoxygenic phototrophs? 2
7. (a) Draw the structure of 2-keto-3-deoxy phosphogluconate. How is it formed? 1+2
 (b) Explain the steps of pentose phosphate pathway where transketolase and transaldolase enzymes are used. 3
 (c) Write down the ATP producing steps of glycolysis. 2
8. (a) What is the chemiosmotic hypothesis? 2
 (b) What is the function of Complex IV in electron transport chain? 2
 (c) Describe briefly the mechanism of lactose permease. 2
 (d) Explain anammox. 2

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MCBACOR06T-MICROBIOLOGY (CC6)

Time Allotted: 2 Hours

Full Marks: 40

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Question No. 1 is compulsory and answer any four questions from the rest

1. Answer any **four** questions from the following: 2×4 = 8
 - (a) Define cell adhesion and its importance in Multicellular organism.
 - (b) Explain the relationship between histones and DNA in chromosome packaging.
 - (c) How do Micropores contribute to the structures of nuclear pores?
 - (d) Mention the significance of mitochondrial matrix in cellular respiration.
 - (e) Identify two membrane bound organelles found in eukaryotic cell.
 - (f) Compare between autocrine and paracrine signalling.
 - (g) What is the function of β and γ subunits of G protein?
 - (h) Compare between apoptosis and necrosis.
2. (a) Diagrammatically explain the structure of gap junctions. 3
 - (b) Which proteins are involved in tight junctions and desmosomes? 3
 - (c) What are the components of extracellular matrix? 2
3. (a) Distinguish between N-linked and O-linked glycosylation. 2
 - (b) How do proteins destined for lysosomes receive Mannose-6-phosphate tags in the golgi apparatus? 2
 - (c) What is the function of the Medial Golgi Cisternae? 2
 - (d) Name the enzymes present in lysosomes and their optimal pH for activity. 2
4. (a) Diagrammatically explain the function of p21 protein in cell cycle arrest. 3
 - (b) What is the role of G2/M checkpoint in cell cycle? How does this checkpoint ensure proper cell division? What molecular events are crucial for its activation and progression? 1+2+2
5. (a) Compare between stimulatory and inhibitory G protein. 1
 - (b) Cite one metabolic pathway related to G protein coupled receptors (GPCR). Demonstrate the regulation of the pathway by cAMP stimulated by protein kinase A. 1+3
 - (c) Elaborate the mechanism of receptor tyrosine kinase activation with a suitable diagram. What is its role in signal transduction? 3

6. (a) Discuss the significance of the nuclear envelope in regulating the passage of molecules between the nucleus and cytoplasm. 3
- (b) Name the major types of nuclear transport receptors and their functions in nucleocytoplasmic transport. 3
- (c) Contrast the mechanisms of ligand gated ion channel and G protein coupled receptor in transmitting extracellular signal. 2
7. (a) How do chaperone proteins assist in correct folding of proteins in the endoplasmic reticulum? 3
- (b) What are the functions of the following proteins in intracellular trafficking? 2
- (i) Sar1
- (ii) Dynamin.
- (c) What are microsome? What is constitutive secretion? $1\frac{1}{2} + 1\frac{1}{2}$
8. (a) Give two examples of antiapoptotic protein. Explain the role of one antiapoptotic protein in development of breast cancer. 1+2
- (b) How caspases are activated at the time of apoptotic cell death? 2
- (c) Distinguish between A type and B type lamins in terms of their structure and localization. 3

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WEST BENGAL STATE UNIVERSITY
B.Sc. Honours 3rd Semester Examination, 2023-24

MCBACOR07T-MICROBIOLOGY (CC7)

Time Allotted: 2 Hours

Full Marks: 40

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Candidates should answer in their own words and adhere to the word limit as practicable.*

Question No. 1 is compulsory and answer any four questions from the rest

1. Answer any **four** questions from the following: 2×4 = 8
 - (a) Which of the following DNA shows higher T_m ?
 - (i) DNA containing 65% GC
 - (ii) DNA containing 42% GC.
 - (b) How many bands will be observed if you run purified *E.coli* RNA polymerase on SDS PAGE and why?
 - (c) What is abortive initiation of transcription?
 - (d) Define cis and trans splicing.
 - (e) DNA also present in some organelle other than nucleus in eukaryotes — Justify the statement whether true or false.
 - (f) What do you understand by the term 'elongation ternary complex' in relation to bacterial transcription?
 - (g) What will happen in respect to protein synthesis in a cell that lacks GTP?
 - (h) Why IPTG is preferred over lactose for inducing lac operon in vitro?
2. (a) Why two strands of double stranded DNA get separated on heating? How can you (2+3)+2+1 experimentally show that?
- (b) How many and what type of supercoiling is needed to a 5.3 kb DNA with linking No. 475 to maintain a value of 10.6 bp/twist?
- (c) Where can you find positive supercoiled DNA?
3. (a) Can you grow *E.coli* strain having mutation in lac z gene in lactose containing medium? Explain your answer. 2+3+3
- (b) Explain how the Mechanism of attenuation is dependent on the translation of transcripts at the trp operon. What would happen on the regulation of trp operon both in presence and absence of tryptophan; if you mutate the two trp codon at the leader sequence by UAG?
4. (a) Why the primers used for DNA replication is RNA instead of DNA? 2+3+2+1
- (b) Describe how RNA primers are removed from the Okazaki fragments and the RNA sequence of the primer is replaced by DNA sequence.

- (c) Mention the difference between DNA ligases obtained from *E.coli* and T4 phage.
- (d) What is the size of Okazaki fragment?
5. (a) Distinguish between Class I and Class II aminoacyl tRNA synthetase. 2+3+3
- (b) How does RF1 and RF3 facilitate chain termination during translation?
- (c) How can you experimentally prove that protein synthesis occurs in 5'-3' direction of mRNA?
6. (a) How telomerase solve the end replication problem of eukaryotic chromosome? 3+2+3
- (b) What is θ mode of replication? How can you experimentally show that?
- (c) Schematically describe the assembly and functions of different subunits of *E.coli* DNA polymerase III.
7. (a) What is Klenow fragment? What will happen if you apply Klenow fragment to a (2+3)+2+1 dsDNA having single strand nick — Explain.
- (b) RNA polymerase core enzyme has a general affinity towards the DNA for binding. Then what role does σ factor plays in transcription initiation?
- (c) Whether same σ factor is used by *Bacillus subtilis* in normal and sporulating condition?
8. (a) What do you understand by post transcriptional modification of mRNA? Why this modification is essential? 3+3+2
- (b) Briefly explain the mechanism of 5' and 3' end modification of mRNA.
- (c) Mention the function of snRNA.

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WEST BENGAL STATE UNIVERSITY

B.Sc. Major 3rd Semester Examination, 2025-26

MCBDSC303T-MICROBIOLOGY (MAJOR)

Time Allotted: 2 Hours

Full Marks: 50

*The figures in the margin indicate full marks.
Candidates should answer in their own words and adhere to the word limit as practicable.
All symbols are of usual significance.*

Answer Question Number 1 and any four questions from the rest

1. Answer any **five** questions from the following:

2×5 = 10

- What are cofactors?
- What is uncompetitive inhibition of enzyme action?
- What could be the approximate molecular weight of a protein with 100 amino acids?
- What is turnover number of an enzyme?
- What are phi and psi angles in protein structure?
- Why do peptide bonds have partial double bond characters?
- What are isozymes?
- Why is lactose considered as a reducing sugar?
- Draw the Fischer projection formula of N-acetylglucosamine.
- Name one polar uncharged and one non-polar amino acid.

- Draw Haworth and Fischer projection structures of fructose.
 - Write down the Henderson and Hasselbalch equation.
 - Isoelectric point of Glutamate is 3.22 whereas isoelectric point of glycine is 5.97. Explain.
 - What is the significance of buffer capacity?
 - What is mutarotation?

- Write down the differences between exergonic and endergonic reactions.
 - Write down the first law of thermodynamics.
 - $\Delta H^\circ = -120.0 \text{ kJ} \cdot \text{mol}^{-1}$ and $\Delta S^\circ = -250.0 \text{ J} \cdot \text{mol}^{-1} \cdot \text{K}^{-1}$. Compute ΔG° at 298.15K.
 - What is a chemical equilibrium constant? How can we find out free energy values from it?
 - What are coupled reactions? Give an example.

- Define epimers and anomers of carbohydrates with examples.
 - What are homopolysaccharides? Give an example.

Turn Over

- (c) Write a biochemical test to confirm presence of reducing sugars. 2
- (d) What is the significance of proteoglycans and glycoproteins? 2
- (e) Write down the differences between starch and cellulose. 2
5. (a) Explain how a peptide bond is formed. 3
- (b) What are the features of β sheet as a protein secondary structure? 2
- (c) What are tertiary structure of proteins? 2
- (d) Which amino acid is helix breaker? 1
- (e) Why do proteins give absorption maxima at 280nm? 2
6. (a) Why is Phosphoenolpyruvate considered as an energy-rich compound? 2+1
- (b) What is the structural composition of
- (i) Peptidoglycan 1+1
- (ii) Cellulose 2
- (c) Name one storage of polysaccharide in animals. What types of bonds are present in it? 1
- (d) What is chitin?
- (e) Name one method for determining protein secondary structures. 3
7. (a) What are the forces responsible for maintaining tertiary structures of proteins? 2
- (b) Differentiate between coenzymes and cofactors. 2+2
- (c) What are the features of an uncompetitive enzyme inhibition? Draw the double reciprocal plot of an uncompetitive inhibition. 1
- (d) What is K_m ? 3
8. (a) What are the advantages of the induced fit hypothesis of enzyme kinetics? 2
- (b) What do you mean by inversion of sugars? 3
- (c) In an enzymatic reaction, $V_{max} = 120 \mu\text{mol. min}^{-1}$ and $K_m = 30 \mu\text{M}$. Calculate the initial reaction rate of the reaction. [Take substrate concentration to be equal to the K_m .] 2
- (d) Explain the term allosteric enzyme. $\frac{1}{2} \times 4 = 2$
9. (a) Classify the following enzymes:
- (i) Aldolase
- (ii) Glucose-6-phosphate dehydrogenase
- (iii) Amylase
- (iv) Hexokinase 2
- (b) Give an example of an acidic buffer and of a basic buffer. $\frac{1}{2} \times 4 = 2$
- (c) Name any four amino acids present in the active sites of enzymes. 2
- (d) Write down the differences between simple lipids and derived lipids. 2
- (e) Define specific activity of an enzyme.

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