



WEST BENGAL STATE UNIVERSITY

B.Sc. Honours Part-II Examination, 2019

MICROBIOLOGY

PAPER: MCBA-III

Time Allotted: 4 Hours

Full Marks: 100

*The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.*

Use Separate Answer Scripts for each Group and mention Group on Answer Scripts.

GROUP-A

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

1. Answer any *five* questions from the following: 2×5 = 10
 - (a) What is the significance of meiotic cell division in higher eukaryotes?
 - (b) What is leader peptide?
 - (c) How does prokaryotic ribosomes recognize the 5' end of mRNA?
 - (d) What would happen for a lipid bilayer if phospholipids had only one hydrocarbon chain instead of two?
 - (e) What is DNA gyrase? Briefly mention its function.
 - (f) After cell division, how are nuclear and cytosolic proteins resorted so that new nucleus receives only nuclear proteins?
 - (g) How does proof reading take place during DNA replication?
 - (h) What would happen for mutant cells that cannot degrade cyclins?

2.
 - (a) How effector molecules and regulatory proteins control the lac operon? 2
 - (b) How glucose acts as catabolic repressor? 3
 - (c) How does AraC protein act both as activator as well as inhibitor of BAD operon? 3
 - (d) What is gratuitous inducer? 2

3.
 - (a) 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
 - (b) Describe the role of OriC in *E. coli* replication. 2

- (c) What are the roles of primase, helicase and SSB protein in DNA replication? 3
- (d) Why do eukaryotes have multiple origins of replication in contrast to prokaryotes which usually has one? 2
4. (a) Explain why t-RNA molecules must have both unique and common structural features. According to the Wobble principle what is the minimum number of t-RNAs required to decode the six leucine codons — UUA, UUG, CUU, CUC, CUA and CUG? Provide explanation for your answer. 4
- (b) *E. coli* mutants that are $lacY^-$ retain the capacity to synthesize β -galactosidase. However, even though $lacI^-$ gene remains intact, β -galactosidase can no longer be induced by adding lactose to the medium. Explain. 3
- (c) What will be the number of OriC in a Eukaryotic DNA containing 3×10^9 bP (replication rate 1,50,000 nucleotides/min, cell cycle $G_1 = 10$ hrs, $S = 8$ hrs, $G_2 = 5.5$ hrs and $M = 30$ min.) Is the process applicable in prokaryotic replication system? 3
5. Write short notes on: 2 $\frac{1}{2}$ \times 4 = 10
- (a) Cilia
- (b) Polysome
- (c) r-RNA
- (d) Okazaki fragments.
6. (a) What are the differences between eukaryotic and prokaryotic transcription? 3
- (b) What is transcriptional attenuator? How is it involved in regulation of anabolic operon? 2+1
- (c) Operator and promoter are cis-dominant. — Explain with reference to lac operon. 2
- (d) Define Microtubule organizing centre. 2
7. (a) How do prokaryotes distinguish between Initiator and internal AUG? 4
- (b) If Poly G is used as mRNA in an incorporation experiment, glycine is incorporated into a polypeptide. If Poly C is used, proline is incorporated. However if both poly G and poly C are used, no amino acid actid is incorporated. Explain. 3
- (c) Draw the level the clover leaf structure of tRNA stating a specific feature of each arm. 3
8. (a) Why do *S. cerevisiae* α -mating type cells mate only with a-mating type cells? Design an experiment to determine the mating type of *S. cerevisiae* cells. 3+3
- (b) How is RER different from SER? 2
- (c) What is MPF? 2

GROUP-B

Answer Question No. 9 and any *four* questions from the rest

9. Answer any *five* questions from the following: 2×5 = 10
- (a) Explain why yeast consumes more sugar when growing anaerobically than when growing aerobically.
 - (b) What are glucogenic amino acids? State with two examples.
 - (c) Why is phosphofructokinase regarded as a pacemaker enzyme?
 - (d) Which reaction of glycolysis is inhibited by fluoride? Write the reaction.
 - (e) What is allosteric enzyme? Give one example.
 - (f) What do you mean by turnover no. of enzyme?
 - (g) What is the common structural feature of ATP, FAD and NAD?
 - (h) What are aromatic amino acids? Give one example.
- 10.(a) Why does the same coenzyme behave differently in case of transaminase and aldolase? 3
- (b) Why is lactic acid produced under anaerobic conditions by some microorganisms? 2
- (c) Hexokinase transfers phosphoryl groups from ATP to glucose but not water. $2\frac{1}{2}$
- (d) Pyruvate dehydrogenase and α keto glutarate dehydrogenase have similarities — Justify. $2\frac{1}{2}$
- 11.(a) Which enzymes are involved in linking the pentose phosphate pathway with glycolysis? Give reactions. 2
- (b) If glucose is in excess of normal demands, it is converted to glucose-6-phosphate. Why? 1
- (c) Write down the ATP/GTP generating steps of TCA cycle. 4
- (d) Define holoenzyme. What is the importance of metal ions in enzyme reactions? 3
- 12.(a) In anaerobic and energy starved conditions, what will be the fate of Pyruvic acid? 4
- (b) What is PFK? How does it act? 2
- (c) Illustrate the reaction with enzymes and coenzymes in TCA cycle that are involved in generation of NADH. 4
- 13.(a) What do you mean by redox-potential? 2
- (b) Write down two main differences between prokaryotic and eukaryotic ETC. 2
- (c) Briefly illustrate the chemiosmotic hypothesis. 4
- (d) Describe briefly the components of ATP Synthase enzyme. 2

14. Write short notes on: 2×5 = 10
- (a) Zymogen
 - (b) Non protein enzyme
 - (c) Metalozymes
 - (d) Isozymes
 - (e) Modulators.
- 15.(a) What is photophosphorylation? How does it differ from oxidative phosphorylation? 2+2
- (b) How carnitine deficiency affects fatty acid oxidation? 4
- (c) What is meant by direct oxidation pathway? 2
- 16.(a) How does carbamoyl phosphate synthase I differ from carbamoyl phosphate synthase II? 2
- (b) “Initial rate of an enzyme catalysed reaction is independent of substrate concentration” — Justify the statement. 2
- (c) What types of changes occur in K_m and V_{max} in competitive, non-competitive and uncompetitive inhibition? 6

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