

# RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. THIRD SEMESTER EXAMINATION, DECEMBER 2018

SECOND YEAR [BATCH 2017-20]

MICROBIOLOGY [Honours]

Date : 15/12/2018

Time : 11 am – 3 pm

Paper : III

Full Marks : 100

**[Use a separate Answer Book for each Group]**

## **Group – A**

**Answer any six questions from Question Nos. 1 to 12 :**

[6×10]

1. a) Design an experiment to show that RNA synthesis takes place in the 5' → 3' direction. [3]  
b) How does sigma factor mediate exact binding of RNA polymerase to the promoter in prokaryotes? [2]  
c) How does FACT deal with the histone proteins during elongation process of eukaryotic transcription? [3]  
d) Define the terms 'open promoter complex' and 'promoter clearance.' [2]
2. a) Briefly explain the Rho-dependent and Rho-independent termination of transcription in prokaryotes. [2+2]  
b) What are snRNPs ? How are they responsible for RNA splicing? [3]  
c) "Alternative splicing is regulated by activators and repressors". Explain. [3]
3. a) What are the DNA sequences that serve as promoters in case of eukaryotes? [2.5]  
b) What are the functions of the eukaryotic RNA polymerases? [2.5]  
c) State the functions of the following enzymes in capping process of mRNA  
I. RNA triphosphatase  
II. Guanylyl transferase  
III. guanine-7-methyltransferase [1+1+1]  
d) Mention any two inhibitors of transcription in *E.coli*. [2]
4. a) "The Ribosome is a ribozyme." Explain this statement. [2]  
b) Mention the function of different domains present in the terminal module of non-ribosomal peptide synthetase. [2]  
c) Construct partial diploids of *E.coli* cells by which you can prove that  $lacI^+$  gene is *trans* dominant but  $lacO^c$  is *cis* dominant. [3]  
d) How can you prove that GTP hydrolysis is necessary for binding of aminoacyl tRNA to the 'A'- site of ribosome. [3]
5. a) Human can produce several hundred thousand different proteins from the approximately 25,000 genes in the haploid genome. With suitable examples explain this phenomenon. [3]  
b) Briefly mention the process by which the fidelity of translation is increased. [3]  
c) What is meant by RNA interference? [2]  
d) What are the components of the *ara* operon? Is it a catabolic or an anabolic operon? [1+1]
6. a) What will happen if the following changes are done in the structure of t RNA  
i) Last odd base pair C:A of the acceptors arm is replaced by G:C.

- ii) The stem of anticodon arm is changed to three consecutive A:T pairs. [2]
- b) What will happen to *lac* operon functioning if the gene (*cya*) encoding adenylyl cyclase is mutated? [2]
- c) What do you mean by codon degeneracy? Define ORF and monocistronic mRNA. [3]
- d) How does a riboswitch exercise its regulatory action on gene functioning? [3]
7. a) Write down the role of 5'-UTR of mRNA in translation. [2]
- b) Apolipoprotein B gene of mammals encodes two kinds of protein- one kind in liver cells and another kind in intestinal cells. How is this achieved? [2]
- c) Describe the phenomenon of Catabolite repression. [3]
- d) Explain the role of  $T_u$  and  $T_s$  factors in prokaryotic translation. [2]
- e) How does puromycin inhibit the translation process? [1]
8. a) What is meant by charging of t RNA? How are amino acyl t RNA synthetases involved in this process? [3]
- b) How does mi RNA in eukaryotic cells exerts its effect on gene regulation? [2]
- c) State the general regulatory mechanism involved in the activity of *trp* operon under varied environment? [3]
- d) Write down the mechanism of peptide bond formation immediately after the binding of aminoacyl t-RNA to P- and A-sites of ribosome. [2]
9. a) What is Winogradsky column? Where do the sulphate reducing bacteria grow in the column? Justify your answer. [2+1+2]
- b) Who introduced the term *contagium vivum fluidum*? What does it signify? [1+2]
- c) Define Eutrophication. What are oligotrophic lakes? [2]
10. a) What do you mean by stratification of water? How does thermal stratification occur in temperate lakes? [2+3]
- b) What are the important criteria of ideal indicator bacteria to judge microbiological quality of water? [2]
- c) Explain the principle of IMViC test. Define BOD. What does high BOD value of a water sample indicate about the water quality? [2+.5+.5]
11. a) How does hydrothermal vent form? Name the producer in that ecosystem? How do these producers get energy to fix  $CO_2$ ? [2+1+2]
- b) What is the difference between barotolerant and obligate barophilic bacteria? What type of fatty acids are predominant in their cell membrane and why? [3+2]
12. a) What do you mean by bioaerosol? Name any two air-borne diseases. [2+2]
- b) What is the principle of electrostatic precipitation of aerosol? Explain with a suitable diagram. [2+2]
- c) How would you mechanically reduce microbial load from a hospital room? [2]

## **Group – B**

### **Unit - I**

**Answer any four questions from Question Nos. 13 to 20:** [4×10]

13. a) Describe the similarities and differences between the mechanism of import into the mitochondrial matrix and the chloroplast stroma. [3]
- b) Briefly describe the import of peroxysomal matrix proteins. Explain with proper diagram. [3]
- c) Design an experimental to prove that SRP molecules are required to transport protein/peptide into endo-plasmic reticulum. [3]

- d) What do you mean by exocytosis? [1]
14. a) (i) Define enzyme unit (IU). [2]  
 (ii) Specific activity of an enzyme determines the purity-justify. [2]
- b) What do you mean by Bisubstrate enzymatic reactions? How many types of bisubstrate enzymatic reactions can be possible? [2+4]
15. a) What are Homotropic and Heterotropic allosteric regulation? [2+2]  
 b) What are the types of feedback inhibition? [3]  
 c) What are metalloenzyme and metal activated enzyme? Give examples. [3]
16. a) Define the terms: a) cofactor b) Prosthetic group c) conenzyme d) Holoenzyme. [2×4]  
 b) How do we isolate and purify intracellular cytoplasmic enzymes? [2]
17. a) What are the basic differences between MWC model and KNF model of allosterism? [4]  
 b) In an enzyme catalyzed biochemical pathway, what do you mean by "Rate limiting step"? [4]  
 c) Enzyme reactions are partly 1<sup>st</sup> order and partly zeroth order-Justify. [2]
18. a) Explain how G-proteins act as molecular ON/OFF switches in signalling and what accessory factors are needed. Which two classes of G-proteins do we find in signal transduction pathways? Give one specific example of each class. [3+1+1]  
 b) cAMP is considered as 2<sup>nd</sup> messenger –Justify. [2]  
 c) Write short note on receptor tyrosine kinase. [3]
19. a) How are oligosaccharides linked to membranes proteins? How are they related to human blood types? [2+2]  
 b) Lipid bilayer is asymmetric in nature.-Justify. [2]  
 c) State the pathways of K<sup>+</sup> and Na<sup>+</sup> transports in *E.coli*. [2]  
 d) What are the differences between glucose transporter and glucose –Na<sup>+</sup> transporter? [2]
20. a) Defective ion channels can have severe physiological consequences- elaborate the nature of defect in chloride transport in case of Cystic Fibrosis. [6]  
 b) Which of the following are permeable, semi permeable or selectively permeable?  
 i) Glucose ii) Urea iii) Ethanol iv) Na<sup>+</sup> v) Water vi) N<sub>2</sub> vii) Maltose viii) amino acids. [4]

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