

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.SC. THIRD SEMESTER EXAMINATION, DECEMBER 2011

SECOND YEAR

MICROBIOLOGY (Honours)

Paper : III

Date : 16/12/2011

Time : 11 am – 2 pm

Full Marks : 75

[Use separate Answer Books for each group]

Group – A

1. Answer the following questions : [2×5 = 10]
 - a) Name a lipid molecule whose presence is biased on the outer layer of membrane. What does that indicate?
 - b) In the Messelson-Stahl experiment, which of the three modes of replication could be ruled out after one round of replication? After two rounds?
 - c) Name the subunits of *E.coli* RNA polymerase.
 - d) Why is the function of *lac* operon controlled negatively and also positively?
 - e) What is the major difference between a ribosomal protein and any factor required for the process of translation?
2. Answer **any three** questions : [3×10 = 10]
 - a)
 - i) What do you mean by semiconservative replication?
 - ii) What can be the other modes of replication?
 - iii) Describe the steps of looped rolling circle mode of replication. [3+2+5]
 - b)
 - i) What do you mean by promoter?
 - ii) Describe the consensus sequences of a standard promoter.
 - iii) Describe the intrinsic (rho-independent) termination of transcription process in prokaryotes. [2+3+5]
 - c)
 - i) Actinomycin D inhibits DNA-dependent RNA synthesis. This antibiotic is added to a bacterial culture in which a specific protein is monitored. Compared to a control culture, into which no antibiotic was added, translation of protein declines over a period of 20 minutes, until no further protein is made. Explain the results.
 - ii) When the growing *E. coli* is subjected to rapid increase in temperature a new and characteristic set of genes are expressed. Explain.
 - iii) If the non-template strand of a gene in *E.coli* had the sequence 5' TTGACA–(18 bases) – TATAAT – (8 bases) – GCCTTCCAGTC – 3', what would be the nucleotide sequence in the RNA transcript?
 - iv) How does a mutation in *Mycobacterium* makes it resistant against rifamycin used to treat tuberculosis? [3+2+2+3]
 - d)
 - i) Briefly mention the mechanism of recruitment of right kind of amino acid from cytosol by aminoacyl tRNA synthetase and its loading onto the 3' end of t RNA.
 - ii) Write true or false for the following statements—
 - ▶ mRNA binds to the ribosome by its initiation codon.
 - ▶ Peptidyl transferase reaction centre is present in the large subunit.
 - ▶ IF3 causes the binding of small and large subunits together.
 - iii) Why is the initiating amino acid in the growing polypeptide chain formylated? [4+3+3]
 - e)
 - i) For the partial diploid shown in the table, predict whether the structural genes are constitutive, permanently repressed or inducible in presence of lactose (use +/- signs)

Partial diploid	Constitutive	Repressed	Inducible
$I^+O^+Z^+ / F'I^+O^+Z^+$			
$I^+O^CZ^+ / F'I^+O^+Z^-$			
$I^+O^+Z^+ / F'I^+O^CZ^-$			
$I^S O^+Z^+ / F'I^+O^+Z^+$			
$I^+O^CZ^- / F'I^+O^+Z^+$			

- ii) Why is lactose not used as inducer while experimenting with *lac* operon? Name two such inducers used for this purpose.
- iii) A genetic cross between two lac^- *E.coli* strains yielded a few lac^+ cells. What would be your explanation for this result. [5+(2+1)+2]

- f) i) "Glycosides specifically inhibit $\text{Na}^+ - \text{K}^+$ ATPase". Explain.
 ii) Na^+ is smaller in size than K^+ . Because of its smaller size, one would expect Na^+ be able to penetrate any pore which permits K^+ . However, it does not happen. Explain why?
 iii) Explain why are the mitochondria considered as semiautonomous organelles.
 iv) Briefly describe the histochemical identification of different parts of Golgi apparatus by specific stains. [2+3+2+3]
3. Write short notes on the following (**any two**) : [2×5= 5]
 a) rho-dependent termination of transcription.
 b) DNA polymerase III.
 c) Leader sequence of polycistronic mRNA.
 d) Gramicidin.

Group – B

4. Answer **any five** questions : [5×2]
 a) Define coliform bacteria.
 b) What do you mean by enzyme poisoning?
 c) What do you mean by suicide inactivation?
 d) What do you mean by the terms :
 i) 1 International Unit (IU)
 ii) 1 Katal of enzyme activity?
 e) How would you measure BOD?
 f) Name two water-borne protozoan pathogens of human.
5. a) What do you mean by the velocity of an enzyme-catalyzed reaction?
 b) What do you mean by the term affinity of an enzyme towards a substrate?
 c) Deduce the relationship between reaction velocity and substrate concentration of an enzymatic reaction.
 d) What do you mean by competitive and non-competitive inhibition? Show the changes through Lineweaver-Burke plot. [2+2+3+3]

Or,

- a) What are the differences between : (**answer any two**)
 i) Phosphorylase and Phosphatase [2]
 ii) Catalase and Peroxidase [2]
 iii) Synthase and synthetase [2]
 b) What do you mean by E.C. 1:2:1:1 [1]
 c) Describe how Briggs and Haldane derived the equation for single substrate-enzyme reaction. [5]
6. a) Discuss the sources of water pollution. Mention the principle behind the indole test. [2+2]
 b) Discuss a few methods of controlling microbes in air. Name three airborne pathogens and mention the diseases they cause in humans. [3+3]

Or,

- a) What are the different sources of microorganisms present in air? What is bioaerosol? [2+2]
 b) How would you differentiate droplet proper from droplet nuclei? [2]
 c) Write two important procedures of differentiating faecal and non-faecal coliforms. [2+2]

