RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2014
FIRST YEAR

Date : 23/05/2014   **MICROBIOLOGY (Honours)**

Time : 11 am – 2 pm   Paper : II   Full Marks : 75

[Use a Separate Answer Books for each group]

Group – A

1. Answer **all** the questions : [1×5]
   a) Define microelements.
   b) What is generation time?
   c) What is cryptic phase?
   d) What is HEPA?
   e) Write the name of the element maximally present in a cell on dry weight basis.

2. Answer **any two** questions :
   a) i) What do you mean by mixotroph? Give an example. [2+1]
      ii) Which types of metabolic flexibility are shown by *Rhodospirillum rubrum*? [2]
      iii) Schematically present the steps in ammonia oxidation and electron flow. [3]
      iv) What is the function of FtSZ ring? [2]

   b) i) When would you not find lag phase in a bacterial growth curve? [2]
      ii) How does dilution rate affect bacterial reproduction? [2]
      iii) What do you mean by exponential growth? [2]
      iv) Write down the differences between chemostat and turbidostat. [2]
      v) How would you get synchronized growth? [2]

   c) i) What is synthetic medium? [2]
      ii) Define microaerophilic bacteria, Give an example. [2+1]
      iii) What are psychrophiles? Write down their adaptations. [1+2]
      iv) Why moist heat is more effective than dry heat? [2]

   d) i) What do you mean by therapeutic index? [2]
      ii) Name one protein synthesis inhibiting antibiotic and its mode of action. [1+2]
      iii) State the mechanism of penicillin resistance in bacteria. [2]
      iv) What are the criteria of a good disinfectant? [2]
      v) What is iodophor. [1]

3. Answer **any one** question :
   a) i) Mention the different types of regression. [1½]
      ii) Give the formula of t test. [1½]
      iii) Mention the formula of contingency chi-square. [2]

   b) Calculate 'r' value from the following data. [5]

weight of father (kg)	65	66	67	67	68	69	71	73
weight of son (kg)	67	68	67	68	72	70	69	70

Group – B

4. Answer **any one** question :
   a) i) Mutarotation always occur in presence of acid and base only —comment. [3]
      ii) Identify the reagents to be used for the following transformations :
      Arabinose to glucosamine [2]

iii) What happens when raffinose is treated with HIO_4. [3]

iv) Equillibrium mixture of D-glucopyranose contains 50% of α form whereas in water it is 38% —Comment on this result. [2]

b) i) Sucrose is a nonreducing sugar but maltose is the reducing one. Comment. [2]

ii) β-D-glucopyranose undergoes oxidation with bromine at a faster rate than α-D-glucopyranose —explain [2]

iii) Write short notes on Smith degradations. [3]

iv) How many HIO_4 molecules are required to digest pentasaccharides? Explain. [2]

v) Write down a structure of heteropolysaccharides? [1]

5. Answer **any one** question :

a) i) Write a short note on Cis – Trans isomerism in fatty acids. [3]

ii) Write down the structure of glycolipid. [2]

b) i) What are phospholipids? Mention one function of phospholipid. [1+1]

ii) Describe the Dunstan's test for glycerol. [3]

Group – C

6. Answer **any one** question :

a) i) State and explain the mathematical expressions of the first law of thermodynamics. [3]

ii) Calculate the standard state ΔG values at—

pH 'O' and

pH '5' for the dissociation of acetic acid : $HOA_C \rightleftharpoons OA_C^- + H^+$. $K_a = 1.75 \times 10^{-5}$.

Calculate ΔG_{ion} at pH 5·0. [3]

iii) Explain with example why active transport is alternatively called energy linked transport. [2]

iv) Define intensive and extensive properties with example. [2]

b) i) The concentration of chloride ion in blood serum is about 0·10M. The concentration of chloride ion in urine is about 0·16M. Calculate the energy expanded by the kidneys in transporting chloride from plasma to urine. [2]

ii) Briefly discuss the kinetic scheme for the transport of Na^+ and K^+ ions through Na^+- K^+ ATPase. [3]

iii) State the laws of osmotic pressure. [2]

iv) What do you mean by diffusion co-efficient? What is the driving force for diffusion? [1+2]

7. Answer **any one** question :

a) i) State and explain group displacement law. [2]

ii) What is the specific activity of pure C^{14} in terms of DPM/g, Ci/g and Ci/g-atom.

(Given, $\lambda = 2.31 \times 10^{-10} \, min^{-1}$) [3]

iii) Write a short note on "artificial radioactivity". [2]

iv) Comment on stability of radioisotope. [3]

b) i) Calculate the number of radioactive atoms of phosphorous in 1 Ci of pure P^{32}. The half life of P^{32} is 14·3 days. [2]

ii) C^{14} has a half life of 5700 years. Calculate the fraction of the C^{14} atoms that decays—

per year and per minute. [2]

iii) Write a short note on "Radioimmunoassay.". [3]

iv) Briefly discuss the application of "Liquid Scintillation Counter" in the measurement of radioactivity. [3]

8. Answer **any one** question :

a) i) State one use each of electron spin resonance, γ-ray, atomic absorption spectroscopy and infra red spectroscopy in the field of biology. [2]

ii) Why is absorption spectrum specific for a substance? [3]

iii) Looking at absorption spectrum and fluorescence spectrum of Tryptophan. how can you state which is what? A protein, bovine serum albumin (BSA), causes 1-anilino-8-naphthalene sulfonate (ANS) to fluoresce. Explain with the help of a diagram how the spectral characteristics (intensity and λ_{max}) alter when the increasing concentration of BSA is added to a fixed concentration of ANS kept in a nonpolar environment. [3]

iv) State the principle of gel filtration chromatography. [2]

b) i) You are supplied with two bacterial DNA of different (G+C) content and each suspended in 0·02M and 0·20M phosphate buffers at pH 7·8. Carry out an experiment to determine the melting temperatures (T_m) of four such samples using an UV spectrophotometer. Interpret your observations. [4]

ii) What is called fluorescence quenching? Name a few compounds that are used as fluorescence quencher. [3]

iii) Dialysis is a molecular filtration —Comment.
What are the factors that affect rate of dialysis? While purifying a protein, you sometime need to apply the techniques of dialysis — mention two such uses. [3]

ഇൗ❁ഌ