RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2016

FIRST YEAR [BATCH 2015-18]

Date : 18/05/2016 **MICROBIOLOGY (Honours)**

Time : 11 am – 3 pm **Paper : II** Full Marks : 100

[Use a separate Answer Book for each group]

Group – A

Answer **any three** questions of the following : (3 × 10)

1. a) Define 'thermal death time' and 'decimal reduction time'. (2)
   b) Briefly describe the mode of action and practical application of ionizing and non ionizing radiation in destruction of microorganisms. (2 + 2)
   c) Why is methyl alcohol not generally employed for controlling growth of microorganisms? (2)
   d) Write down the structure and function of sulfanilamide. (2)
2. a) Briefly discuss the mode of action and practical application of chlorine and its compounds in controlling growth of microorganisms. (2 + 2)
   b) In evening primrose pure red-flowered plants were crossed with white-flowered plants, F_1 plants were all pink flowered. Inbreed F_1 plants produced 113 red, 242 pink and 129 white flowered plants. What is the phenotypic ratio of the F_2 progeny plants? It is to note that this phenotypic ratio also seems to be genotypic ratio of the F_2 of a Mendelian monohybrid cross involving a gene responsible for flower pigmentation. (2 df=5.99, 3df=7.82) (6)
3. a) Write a short note on "fractional sterilization." (2)
   b) How is the divisome assembled in a bacterial cell? (3)
   c) Write down the process of binary fission with a suitable diagram. (3)
   d) What is nitrification? (2)
4. Write down the differences between
   a) Macroelement and microelement with examples (2)
   b) Auxotroph and prototroph with examples (2)
   c) Lithotroph and organotrph (2)
   d) Batch culture and continuous culture (2)
   e) Spread plate and pour plate (2)
5. a) What is lag phase? (2)
   b) Differentiate chemostat and turbidostat. (3)
   c) State the application of continuous culture of bacteria. (2)
   d) What is viable cell count method? (3)
6. a) Define synthetic media with example. (2 + 1)
   b) The constituents of medium A is as follows :-
   Peptone, Lactose, Bile Salt, Sodium Chloride, Neutral red, Crystal violet, Agar, Water.
   State the nature of the Medium A and Justify your answer. (4)

c) Classify microorganisms on the basis of oxygen requirement with suitable example. (3)

Group – B

Answer **any four** questions of the following : (4 × 10)

7. a) Define 'carrier' and 'tracer'. (1 + 1)
   b) Discuss the principle of "rate-zonal" centrifugation. (3)
   c) Looking at absorption spectrum and fluorescence spectrum of tryptophan how can you state which is what? (2)
   d) 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 concentrations of BSA is added to a fixed concentration of ANS kept in a non-polar environment. (3)
8. a) Ca^{45} has a half life of 163 days. Calculate the decay constant (λ) in terms of day^{-1} and sec^{-1}. (2)
   b) What is a "cuvette"? What are the distinguishing features of the cuvettes used in visible, UV and fluorescence spectrophotometry respectively? (1 + 3)
   c) What is called fluorescence quenching? Name a few compounds that are used as fluorescence quencher. (2)
   d) A solution at a concentration of 32 μg/ml of a substance having a molecular weight of 423 has an absorbance of 0.27 at 540 nm measured in a cuvette with a 1-cm light path. What is the molar absorption coefficient at 540 nm? Assume that Beer's law is obeyed. (2)
9. a) Write a short note on following :- (2 + 2)
      i) Radiocarbon dating
      ii) MRI
   b) Explain, with the help of a diagram, how would you distinguish between a ds DNA sample and a RNA sample using thermal denaturation followed by renaturation upon slow cooling. (3)
   c) Dialysis is a kind of molecular filtration – Explain. What are the factors that affect the rate of dialysis?(3)
10. a) Mention the importance of radioisotopes in metabolic studies. (3)
    b) Define relative activity and specific activity of a radioactive substance. (2)
    c) What is "bound" fat? Give one example of each of (i) fatty acid with odd number of carbon atoms, and (ii) fatty acid with conjugated double bonds. (1 + 2)
    d) What is Polenske Number? (2)
11. a) Write a short note on "liquid scintillation counter". (3)
    b) Deduce a relation between half-life and average life of a radioactive substance. (2)
    c) The "gauche" conformer of 1, 2 difluroethane is stabler than the staggered conformer – Explain. (3)
    d) How will you distinguish between propane-1, 3-diol and ethylene glycol? (2)

12. a) The half life of Zn – 71 is 2.4 minutes. If one had 100.0 gm. at the beginning, how many grams would be left after 7.2 minutes have elapsed. (2)

b) Enumerate how the change of factors like pH and polarity helps understand various structural aspects of a protein using electronic spectroscopy. Hence generate a few rules. (3)

c) "α-amylose forms a left-handed helix" – Explain. (3)

d) β-D-glucose is more stable in aqueous solution but less stable in methanol.-Justify. (2)

13. a) What do you mean by Transition Temperature? How does it help animals in arctic to survive? (2 + 3)

b) What is oxidative rancidity of fats and oils? (2 + 2)

c) What is acetyl number of a lipid sample? (1)

14. a) What happen when sucrose is treated with acid followed by Benedict's reagent. (2)

b) How would you convert D-ribose to D-ribitol? (1 + 1)

c) How will you prove that maltose have one and four glycosidic linkage? (2)

d) "Glucose and fructose form the same osazone" – Justify. (2)

e) What is the function of hyaluronic acid in mammals? (2)

Group – C

Answer **any three** questions of the following : (3 × 10)

15. a) *E. coli* cells were allowed to grow for several generations in a medium containing $^{15}NH_4Cl$ as sole nitrogen source. The cells were then transferred to a "light" medium containing $^{14}NH_4Cl$ and allowed to grow further for several generations. The DNA was extracted from a portion of growing cells and its buoyant density was determined by centrifugation in CsCl density gradient.

What percent of the daughter DNA strands will remain heavy after 3rd generation? Explain your answer with proper diagram / flowchart? (3)

b) Write down the crucial step in the Avery, McLeod and McCarty's experiment by which they concluded that "DNA in the genetic material of *Streptococcus pneumoniae*". (2)

c) Cite evidences in favour of the endosymbiotic hypothesis of mitochondrial origin. (2)

d) How are phospholipids transferred from their site of synthesis in the Endoplasmic Reticulum to the membranes of mitochondria and plastid? (3)

16. a) How was it proved that the daughter DNA synthesised on lagging strand template follows a discontinuous manner? (3)

b) Double stranded regions of RNA adopts the A – form of DNA instead of B – form. Explain why is it so? (2)

c) Why is proteolytic processing a common event in the secretory transport of proteins? (2)

d) Golgi complex is primarily a 'processing plant' – Explain. (3)

17. a) Linking number of a cccDNA in an integer but the twist and writhing numbers are either integer or fraction. Explain it mathematically. (3)

b) What is nick translation? Explain whether a mutation in DNA polymerase I will be lethal for the cell? (2 + 1)

c) Write down the function of cadherin. (2)

d) Contrast the roles of COPI and COPII coated vesicles in protein trafficking. (2)

18. a) Mention the effect of increasing concentration of ethidium bromide on DNA supercoiling. (3)

b) The activity of telomerase must be tightly regulated inside the cell. Explain why. (2)

c) Which factors regulate the fluidity of lipid bilayer? (3)

d) What are plasmodesmata? (2)

19. a) How does the DNA polymerase I add nucleotides in the growing polynucleotide chain? (3)

b) "Photograph 51 played a key role in unravelling the structure of DNA" – What is this photograph 51? (2)

c) What are 'non-canonical' base pairs and where are they frequently found? (2)

d) Explain with proper illustration the mode of action of Gramicidin. (3)

20. a) How does ciprofloxacin kill the pathogenic bacteria if administered to a patient? (2)

b) Briefly describe the process of initiation of replication in *E. coli* chromosome. (3)

c) Explain the functions of cholesterol in the lipid bilayer. (2)

d) In terms of membrane phospholipid composition, what is the difference between eubacteria and archebacteria? (1)

e) How can you experimentally distinguish between integral and peripheral membrane proteins? (2)

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