

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College under University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2015

FIRST YEAR

MICROBIOLOGY (Honours)

Date : 21/05/2015

Time : 11 am – 3 pm

Paper : II

Full Marks : 100

[Use a separate Answer book for each group]

Group - A

(Answer any five of the following)

1. Justify the statements :
 - a) Reverse electron flow reduces growth rate of bacteria. [2·5]
 - b) Moist heat is more effective than dry heat to control bacterial growth. [2·5]
 - c) Write a brief note on Thermal Death Time. [2]
2.
 - a) Mention different lithotrophic bacteria and the corresponding compounds that are utilised as electron donors. [2]
 - b) Differentiate between nitrification and denitrification. [2]
 - c) How does pH affect bacterial growth? [2]
 - d) Name one sulphur oxidizing bacteria. [1]
3.
 - a) What is the role of Fts Z protein? [2]
 - b) Write down the advantages of membrane filter count. [1·5]
 - c) How does ethylene oxide influence bacterial survival? [1·5]
 - d) Why is synchronous culture useful under certain conditions? [2]
4.
 - a) What are the adaptations of psychrophilic bacteria? [2]
 - b) What is the role of compatible solute? Give example. [2+1]
 - c) What is chemostat? [2]
5.
 - a) What is the difference between disinfectant and antiseptic? [3]
 - b) Classify bacterial world in terms of oxygen requirement and tolerance. [2]
 - c) What is the function of catalase? [2]
6.
 - a) What is the mode of action of penicillin? [2]
 - b) Write down three mechanisms of antibiotic resistance. [3]
 - c) Draw the structure of the sulfonamide function group and mention the enzyme that is inhibited by this group of antimicrobials. [2]
7.
 - a) What do you mean by regression equation? [2]
 - b) You are given the following data

	X	Y
Mean	39·5	47·5
Standard deviation	10·8	17·8

Correlation coefficient between X and Y is 0·42. Find both regression lines. [5]

8.
 - a) Compare between mean deviation and standard deviation. [2]
 - b) In a monohybrid experiment the F₂ results are as follows :
Round-884 & Wrinkled-288. Hypothesize 3 : 1 ratio and test the goodness of fit. [5]

$$\chi^2_{0.05(3)} = 7.82, \chi^2_{0.05(2)} = 5.99, \chi^2_{0.05(1)} = 3.84$$

9. a) Mention the application of 't' test. [2]
 b) Compute by x from the following data :
 x, y : (5, 2), (7, 4), (8, 3), (4, 2), (6, 4) [5]

Group - B

(Answer **any five** of the following)

10. a) What is artificial radioactivity? Explain with example. [2+1]
 b) K^{40} ($t_{1/2} = 1.3 \times 10^9$ yrs) constitutes 0.012% of potassium in nature. The human body contains about 0.35% K by weight. Calculate the total radioactivity resulting from K^{40} decay in a 70 kg human. [3]
 c) Define biological half-life of a radioisotope. [2]
11. a) Derive the equation to relate between half-life and average life of a radio-active substance. [2]
 b) What advantage/s does Liquid Scintillation Counter have over GM counter? [2]
 c) What is "radiocarbon dating"? [2]
 d) Define Rad and REM. [2]
12. a) What is LET? Explain its significance in biomedical applications. [1+2]
 b) Define specific activity and relative activity of a radioactive substance. [2]
 c) What factors govern the choice of a good solvent in Liquid Scintillation Counter? [3]
13. a) Draw an outline diagram of a simple UV-vis spectrophotometer. State the functions of its different components. [3]
 b) If 20.8% of the 340 nm radiation incident on a given solution of NADH is transmitted and if the extinction co-efficient of NADH at 340 nm is $6.22 \times 10^6 \text{ cm}^2 \text{ mol}^{-1}$, what is the concentration of NADH in the solution? (Assume a 1 cm pathlength). [3]
 c) State the principle of gel filtration chromatography. [2]
14. a) A suspension of bacteria containing 400 mg dry weight per litre has an absorbance of 1.00 in a 1 cm cuvette at 450 nm. What is the cell density in a suspension that has a transmission of 30% in a 3cm cuvette? [2]
 b) Calculate E_{max} for a compound whose maximum absorbance is $A_{\text{max}} = 1.2$. The cuvette cell length is 1.0 cm and the concentration is 0.076 g/L. The mass spectrum of the compound has the largest m/e value at 100. [2]
 c) What is FRET? Explain one principal application of this technique. [2+2]
15. a) How many HIO_4 molecules are required to digest pentasaccharides. Explain. [2]
 b) What happens when glucose is treated with phenyl hydrazine? [3]
 c) What are the differences between starch and cellulose? [2]
 d) Give an example of an amino-sugar. [1]
16. a) Anomeric effect is inversely proportional to the dielectric constant —Discuss it with suitable example. [2]
 b) Br_2 water oxidation of alpha-D-glucopyranose is 250 times faster than that of its beta anomers — Comment on the statement. [3]
 c) Why is sucrose known as invert sugar? [2]
 d) Give one example each of a reducing and a non-reducing disaccharide. [0.5+0.5]
17. a) Write down the structure and isomerism found naturally in the following compounds. [2×2]
 i) Elaidic acid ii) 1-stearo-2-linoleiyl glycerate
 b) Explain why coconut oil tends to solidify at room temperature during winter but mustard oil stays liquid? [2]
 c) Differentiate between simple lipid and derived lipid with example. [2]

18. a) What is saponification number? How can it be used to find the molecular weight of a lipid? [2+2]
b) What is the difference between soap, shampoo, detergent and syndet. [4]

Group - C

(Answer **any five** of the following)

19. a) How can you prove that the replication is semidiscontinuous? [3]
b) State the principal biological functions mediated by membrane carbohydrates. [2]
20. a) How does the cell cope up with the torsional strain introduced in the genome during replication? [2]
b) How does cholesterol contribute to the fluidity / rigidity of biological membranes? [3]
21. a) What is meant by the processivity of a DNA polymerase? How is the processivity of DNA polymerase III increased? [3]
b) What is the principal difference between a biomembrane and a micelle? [2]
22. a) Explain the role of SNARE proteins in vesicle shuttling. [3]
b) How is an open complex formed during initiation of replication of *E. coli* chromosome. [2]
23. a) Mention the crucial steps in the experiment of Avery, McCleod and McCarty by which they have concluded that DNA is the genetic material. [3]
b) How can you dislodge peripheral proteins from biomembranes? [2]
24. a) Why is addition of dNTPs or rNTPs during replication or transcription chemically forbidden in the 3' → 5' direction? [2]
b) Briefly describe the role of mitochondria in apoptosis. [3]
25. a) Cite two evidences in favour of prokaryotic ancestry of mitochondria. [2]
b) 'Golgi vesicles are often, referred to as the "traffic police" of the cell' Explain the statement with proper example. [3]
26. a) Name one plus end directed molecular motor and briefly explain its mechanism of action. [1+2]
b) Proteins destined for secretion are translated primarily by the rough endoplasmic reticulum instead of by free ribosomes. What factors probably account for this selectivity? [2]
27. a) What is gap junction? [2]
b) Archaea contain unique membrane lipids as compared to eubacteria — Elaborate giving chemical structures. [3]

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