RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

B.A./B.Sc. SECOND SEMESTER EXAMINATION, MAY 2018
FIRST YEAR (BATCH 2017-20)
MICROBIOLOGY (Honours)

Date : 19/05/2018

Time : 11.00 am – 3.00 pm   Paper : II   Full Marks : 100

Group - A

Unit I

Answer ***any two*** questions from the following: [2×10]

1. a) What is the difference between antiseptic and disinfectant? 2

    b) Write down the different cellular sites of antimicrobial activity with example of antimicrobial agent acting on each site? 1½+1½

    c) What are the limitations of chlorine as antimicrobial agent? 2

    d) What is the limitation of filtration technique as sterilization process? Give an example of depth filter. 2+1

2. a) What are the different ways of inhibiting protein (prokaryotic) synthesis by drugs? Explain briefly with example. 4

    b) Why is metronidazole considered as pro-drug? 2

    c) Why are plate count results expressed as colony forming units? 2

    d) What do you mean by cryptic phase? 2

3. a) What is the basis of synchronous culture? 2

    b) Why might a culture have a long lag phase after inoculation? Why would cells that are vigorously growing when inoculated into fresh culture medium have a shorter lag phase than those that have been stored in a refrigerator? 1+2

    c) Why turbidity is an indirect method of cell mass measurement? Explain with diagram. 3

    d) Suppose the generation time of a bacterium is 90 minutes and the initial number of cells in a culture is 10^3 cells at the start of the log phase. How many bacteria will there be after 8 hours of exponential growth? 2

4. a) What are barotolerant bacteria? What metabolic and structural adaptations for extreme temperatures do psychrophiles and thermophiles have? 1+2

    b) What are the toxic effects of O_2? How do aerobes and other oxygen-tolerant microbes protect themselves from these effects? 1+2

    c) What do you mean by diauxic growth curve? 2

    d) Differentiate between enrichment and selective media with example. 2

Unit II

Answer ***any one*** question from the following: [1×10]

5. a) Consider the birth weight of babies in normally distributed with mean 3500 g and standard deviation 500 g. What is the probability that a baby is born that weighs less than 3100 g.
    (Given, $\phi(0.8) = 0.7881$. Solve the problem drawing proper graphs) 3

    b) Five unbiased coins were tossed together. What is the probability of obtaining three heads in a throw? 2

c) Calculate the correlation coefficient between ages of husband and wife of some tribal members: 5

Age of husband (X)	38	34	35	20	40	43	56
Age of wife (Y)	33	30	32	20	31	32	53

6. a) The mean weight of 500 male students in a college is 151 lbs. and standard deviation is 15 lbs. Assuming that the weights are normally distributed, how many students weight remain between 120 lbs. and 155 lbs. [$\phi(0.27) = 0.6064$ and $\phi(2.27) = 0.9808$. Solve the problem drawing proper graphs] 3

b) What do you mean by "rejection and acceptance" of hypothesis? 2

c) Given $\bar{x} = 36$, $\bar{y} = 85$, $I\sigma_x = 11$, $\sigma_y = 8$, $r_{xy} = 0.66$

Calculate the value of Y when $X = 10$. 5

Group - B

Unit I

Answer **any two** questions from the following: [2×10]

7. a) What do you mean by "Radioactive Hazards"? Give example. 2

b) Discuss the role of radioisotopes in medical diagnosis and treatment. 3+2

c) An isotope has a half life of 4 years. Calculate the decay constant (λ), in terms of yr^{-1}, day^{-1}, hr^{-1}, min^{-1} and sec^{-1}. 3

8. a) I^{131} has a half life of 8.1 days. Calculate the traction of I^{131} atoms that decays per day and per minute. 3

b) Write a short note on 'liquid scintillation counter' used for the measurement of radioactivity. 3

c) K^{40} ($t^{1/2} = 1.3 \times 10^9$ yr) constitute 0.012% of the potassium in nature. The human body contains about 0.35% potassium by weight. Calculate the total radioactivity resulting from K^{40} decay in a 75 kg human. 4

9. a) Name one each applications of electron spin resonance spectroscopy and atomic absorption spectroscopy. 1

b) What do you mean by deviation of Beer's law? 2

c) Using a 1 cm path length cuvette, the A_{280} value of an amino acid was measured to be 0.56. If the ε value of the amino acid in neutral pH is 5600 M^{-1} cm^{-1}, what is its concentration? 1

d) State two characteristic features of fluorescence spectroscopy as opposed to UV spectroscopy. What is meant by the term fluorescence quenching? 1+2

e) State diagrammatically TLC process. Also mention its limitation. 3

10. a) Briefly outline the functions of each components of UV-visible spectrophotometer. 4

b) The specific absorption coefficient $\left(\varepsilon_{1\%}^{1cm}\right)$ of a glycogen-iodine complex at 450 nm is 0.20. Calculate the concentration of glycogen in a solution of the iodine complex, which has an absorbance of 0.40 in a 2 cm cuvette. 1

c) N and C do not show IR band but NO_2 and CO_2 does – justify. 2

d) What is terminal velocity? State the relation between terminal velocity and sedimentation co-efficient? 1+2

Unit II

Answer ***any two*** questions from the following: [2×10]

11. a) What is saponification value? How would you derive the equation linking saponification value to molecular weight of a fatty acid?   2+3

    b) What is phase transition?   2

    c) Is there any role of derived lipid in controlling the effect of transition temperature in liposomal structure?   3

12. Write down the structures of the following: 2 × 5
    i) Phosphatidylcholine
    ii) Plasmalogen
    iii) Palmitic acid
    iv) Cardiolipin
    v) N-acyl sphingosine

13. a) What do you mean by invert sugar?   2

    b) How will you convert glucose to glucouronic acid?   2

    c) Write short notes on Smith degradation.   2

    d) Glucose and fructose give same osazone – justify.   2

    e) How will you prove that fructose present in sucrose are in β form?   2

14. a) β-D-glucose is more stable in aqueous solution but less stable in methanol – justify.   2

    b) How will you distinguish between propane 1,3, diol and ethylene glycol?   2

    c) How do you prove that amylopectin is a branched polysaccharide?   3

    d) What is mutarotation? Describe it's mechanism in brief.   3

Group - C

Unit I

Answer ***any one*** question from the following: [1×10]

15. a) What is the most preferred amino acid sequence of a collagen and why?   1+2

    b) Write down the function of talin protein in cell-matrix junction?   2

    c) What do you mean by Microtubule Associated Protein (MAP)? What is its significance in cell cytoskeleton?   1+2

    d) What is the utility of Lipid Raft?   2

16. a) State the difference between coated and uncoated vesicle.   2

    b) How Golgi help in despatching the packaged proteins to their correct destinations?   2

    c) What is KDEL? Why it is important?   1+1

    d) Match the followings pair: ½ × 4

1.	ATP synthetase	a)	Mitochondrial matrix
2.	mtDNA	b)	Inner mitochondrial membrane of mitochondria
3.	Porin	c)	Outer chamber of mitochondria
4.	Adenylate kinase	d)	Outer membrance of mitochondria

    e) What is the role of flippase?   2

Unit II

Answer *any two* questions from the following: [2×10]

17. a) Diagramatically represent Harshey-Chase experiment. Also state why it is better than Avery's experiment. 3+2

   b) How can you show that in a covalently closed circular or long linear DNA, $\Delta Tw + \Delta Wr = 0$? 3

   c) DNA was extracted from a culture of streptomycin-resistance $\left(str^r\right)$ *E. coli* cells and added to a growing culture of streptomycin sensitive $\left(str^s\right)$ *E. coli*. After many generations of growth the culture was plated containing streptomycin. What result would you expect? 2

18. a) During replication of circular DNA of *E. coli*, the region ahead of replication fork gets overwound making positive supercoils and subsequently replication may come to a halt. But nature had provided a solution to make this DNA to assume the original form to facilitate smooth replication. What is the solution and how does it operate? 3

   b) Telomeric DNA possesses a special structure – What it is? Nature has provided this structure to solve a problem in replication of this region faced by the DNA-polymerase – What is the problem? Which enzyme is responsible to add this special structure in the telomere region of DNA? Write structural peculiarities of this enzyme. 2+2+2

   c) Write one biological significance of DNA to be double stranded. 1

19. a) i) Design an experiment to prove the function of helicase protein in DNA Replication. 3

      ii) State the requirement of prokaryotic replication "*initiation*" only mentioning the role of initiation factors. 3

   b) How was it proved that DNA Pol. I is not needed in replication? 2

   c) What are SSB proteins needed for? 2

20. a) What will happen to a Helicase that is not attached to the 'Tow' subunit of DNA polymerase III during replication? 2

   b) What is the importance of the following in DNA polymerase III: 2×3
      i) Epsilon subunit
      ii) Beta subunit
      iii) Alpha subunit

   c) Why is proof reading activity of replication tightly regulated compared to transcription and translation? 2

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