



**WEST BENGAL STATE UNIVERSITY**  
B.Sc. Honours 5th Semester Examination, 2020, held in 2021

**MCBADSE02T-MICROBIOLOGY (DSE1/2)**

Time Allotted: 2 Hours

Full Marks: 40

*The figures in the margin indicate full marks.  
Candidates should answer in their own words and adhere to the word limit as practicable.  
All symbols are of usual significance.*

**Question No. 1 is Compulsory. Answer any four from the rest**

1. Answer any **four** questions from the following: 2×4 = 8
- (a) Draw the scatter diagrams for:  
(i) Positive correlation      (ii) No correlation
- (b) What relationship exists between  $K_M$  &  $[S]$  when an enzyme catalysed reaction proceeds at 80% of  $V_{max}$ ?
- (c) Mention any four measures of dispersion.
- (d) Write down the significance of chi square test.
- (e) Write down the mathematical expression of Gibb's free energy change.
- (f) What do you mean by zero order reaction?
- (g) Define frequency density.
2. (a) A cell free extract contains an enzyme that hydrolyses glucose 6-phosphate.  $K_M$  and  $V_{max}$  of the enzyme are  $6.7 \times 10^{-4}M$  and 300 nmoles/lit/minute respectively. Galactose 6-sulphate is a competitive inhibitor of the enzyme. At  $10^{-6}M$  galactose 6-sulphate &  $2 \times 10^{-4}M$  glucose 6-phosphate initial velocity is 1.5 nmols/lit/min. Calculate  $K_I$  for galactose 6-sulphate. 4
- (b) From the given data, calculate the value of  $K_M$  &  $V_{max}$  by approximate graphical representation. (No separate graph paper will be supplied to the students) 4
- | [S] $\mu\text{mol}$   | $V_0 \mu\text{mol/min}$ |
|-----------------------|-------------------------|
| $1.5 \times 10^{-3}$  | 0.21                    |
| $2.0 \times 10^{-3}$  | 0.24                    |
| $3.0 \times 10^{-3}$  | 0.28                    |
| $4.0 \times 10^{-3}$  | 0.33                    |
| $8.0 \times 10^{-3}$  | 0.4                     |
| $16.0 \times 10^{-3}$ | 0.45                    |
3. (a) What is the difference between order and molecularity of a chemical reaction? 2
- (b)  $C^{14}$  has a half-life of 5700 years. Calculate the fraction of the  $C^{14}$  atoms that decays per second. 3
- (c) Deduce the relation between  $t_{1/2}$  and  $\lambda$  of a radioisotope. 2
- (d) Give two examples of radioisotopes that are used in biological science. 1

4. (a) What are the conditions to become a reaction spontaneous? 3
- (b) (i) Calculate the overall free energy change when -a) glycolysis occurs under the following conditions: [glucose] = 5 mM, [Pi] = 1 mM, [ADP] = 0.5 mM, [ATP] = 3 mM, [lactate] = 3 mM 3+2
- (ii) What will be the free energy change when lactate concentration is increased to 100 mM?
5. (a) 40 out of 100 diabetics and 25 out of 120 non-diabetics suffered from hypertension while the others of both the groups did not. Is there a significant association between diabetes and hypertension? (Given tabulated chi square value at 5% level of significance and degrees of freedom 1 is 3.84) 4
- (b) Calculate rank correlation coefficient of the following data: 3
- |                       |    |    |    |     |    |     |     |    |    |     |
|-----------------------|----|----|----|-----|----|-----|-----|----|----|-----|
| % marks in Anatomy    | 78 | 81 | 83 | 89  | 86 | 83  | 90  | 88 | 84 | 83  |
| % marks in Physiology | 92 | 95 | 97 | 100 | 99 | 109 | 105 | 99 | 89 | 104 |
- (c) What are the parameters of the Normal distribution? 1
6. (a) Give examples of equally likely events. 1
- (b) If  $P(A) = 0.35$ ,  $P(B) = 0.3$  and  $P(A \cap B) = 0.2$ , find  $P(B/A)$  1
- (c) State the Multiplication rule of probability. 2
- (d) If a clinical variable X is normally distributed with standard deviation of 8 and mean of 60. What is the probability X assumes values greater than 58? (Given that area under the standard normal curve i.e  $z = 0$  to  $z = 0.25$  is 0.2517) Also give proper justification to support your answer. 3
- (e) If both the parents are Thalassemia carriers, what is the probability that their only biological child is normal? 1
7. (a) Compute the standard error of the mean using the following frequency distribution of colony numbers that are obtained from the serial dilution of a water sample. 4
- |            |         |         |         |         |         |
|------------|---------|---------|---------|---------|---------|
| Colony no. | 156-160 | 161-165 | 166-170 | 171-175 | 176-180 |
| Frequency  | 4       | 14      | 25      | 11      | 6       |
- (b) Write down the significance of t-test. 2
- (c) What is correlation coefficient? 2
8. (a) What is Standard error of mean? Calculate the standard error of mean if sample size is 16 and  $\sigma$  is 3. 2
- (b) Find out the probability of random occurrence of 4 goitre cases in a sample of 8 drawn from a population with 40% incidence of endemic goitre. 3
- (c) In a rural hospital the mortality rate for malignant malaria is 6 out of 1000. What is the probability of just 2 deaths from the disease in a group of 500 people? 3

**N.B. :** *Students have to complete submission of their Answer Scripts through E-mail / Whatsapp to their own respective colleges on the same day / date of examination within 1 hour after end of exam. University / College authorities will not be held responsible for wrong submission (at in proper address). Students are strongly advised not to submit multiple copies of the same answer script.*

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