

[This question paper contains 6 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 1128 G
Unique Paper Code : 235161
Name of the Paper : MACT 303 : Mathematics and
Statistics
Name of the Course : B.Sc. (Hons.) Biochemistry, Bio-
Medical Science, Microbiology
Semester : II
Duration : 3 Hours Maximum Marks : 75

Instructions for Candidates:

1. Write your Roll No. on the top immediately on receipt of this question paper.
2. This question paper contains **three** sections.
3. Attempt any **two** questions from each section.
4. Use of non-programmable scientific calculators and statistical tables is permitted.

SECTION I

1. (a) Let L_1 and L_2 be two straight lines in a plane. Then write down all possible values of $L_1 \cap L_2$. (5½)

P.T.O.

(b) Suppose that only dried lentils and dried soyabeans are available for Rahul's daily requirement for protein which is 75 grams. 1 gram of lentil contains 0.26 gram of protein and 1 gram soyabean contains 0.35 gram of protein. Let his daily consumption be x grams of lentils and y grams of soyabean. Formulate equation giving relation between x and y . (5½)

(c) The size of a slowly growing bacteria culture is approximately given by $N(t) = N_0 + 52t + 2t^2$, where N_0 is the size at $t = 0$ and t is time in hours. Find the growth rate when time is 5 hours. (5½)

2. (a) Write first five terms of the sequence given by recursion formulae

$$a_1 = 1, a_{n+1} = a_n + \frac{1}{2n}; n \in N \quad (5\frac{1}{2})$$

(b) Find the following limits:

$$(i) \lim_{n \rightarrow \infty} \frac{3 + 5n^2}{n + n^2}$$

$$(ii) \lim_{n \rightarrow \infty} \frac{2n}{3^{n+1}} \quad (5\frac{1}{2})$$

(c) Prove that $e^x + e^{-x} = 2 \left(1 + \frac{x^2}{2!} + \frac{x^4}{4!} + \dots \right)$. (5½)

3. (a) Differentiate

$$(i) x^5 \log x + x^2$$

$$(ii) \frac{e^x}{\log x} \quad (5\frac{1}{2})$$

(b) If $y = e^{-x} \cos x$, prove that $\frac{d^2 y}{dx^2} - 2e^{-x} \sin x = 0$ (5½)

(c) Evaluate

$$(i) \int \frac{\tan 2x}{\sec 2x} dx$$

$$(ii) \int x \left(\frac{1 + x \log x}{x} \right) dx \quad (5\frac{1}{2})$$

SECTION II

4. (a) Let $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 2 & 1 \\ 3 & -1 \end{bmatrix}$, find $(A + B)^2$ (5)

- (b) Find the values of x, y, z, w which satisfy matrix equation.

$$\begin{bmatrix} x-y & z+x \\ 2x+y & z+w \end{bmatrix} = \begin{bmatrix} 1 & -1 \\ 2 & 1 \end{bmatrix} \quad (6)$$

5. (a) Find the image of point $(-2, 2)$ under the following transformations using matrix multiplication :

(i) contraction by a scale factor $1/2$.

(ii) reflection in origin.

(6)

(b) If $A = \begin{bmatrix} 0 & 3 \\ -2 & 5 \end{bmatrix}$, find k so that $kA^2 = 5A - 6I_2$. (5)

6. (a) If $f(x) = x^2 - 5x + 7$ and $A = \begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$, find $f(A)$. (5)

(b) For $A = \begin{bmatrix} 1 & 2 & 2 \\ 3 & 3 & 3 \\ 2 & 1 & -2 \\ 3 & 3 & 3 \\ -2 & 1 & 3 \\ 3 & 2 & -1 \\ 3 & 3 & 3 \end{bmatrix}$, find its transpose. Also verify

that $AA^T = I$.

(6)

Section III

- (a) Calculate the mean and standard deviation of the given data: 18, 19, 20, 21, 22, 23, 24, 25, 26, 27 (5)

- (b) For a moderately skewed distribution, the arithmetic mean is 100, coefficient of variation is 35 and Karl Pearson's coefficient of skewness is 0.2. Find the mode and median. (5)

8. (a) Calculate the coefficient of correlation for the following data :

X	1	2	3	4	5	6	7	8	9
Y	12	11	13	15	14	17	16	19	18

(5)

- (b) Fit a straight line to the following data taking y as dependent variable

X	1	2	3	4	5
Y	3	5	12	16	24

(5)

9. (a) A problem in Statistics is given to three students A, B, C whose chances of solving it are $1/2, 1/3, 1/4$ respectively. What is the probability that the problem is solved? (5)

P.T.O.

- (b) Suppose that 8% of people are left handed, find the probability that 2 or more out of 25 are left handed. Assume that the distribution is a Poisson distribution. (5)

10. (a) For a normal distribution with mean 12 and standard deviation 4. Find the probabilities:

(i) $P(X \geq 20)$

(ii) $P(X \leq 12)$

(5)

- (b) Hearing levels in two groups of school children with normal hearing in frequency of 500 cycles per second was found as follows:

	No. of children	Hearing threshold (dB)	SD (dB)
Group I	62	15.5	6.5
Group II	76	20	7.1

Test whether there is any difference between hearing levels in two groups at 5% level of significance. (5)

B. S. K. microbly