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2019 III 02

1100

J - 64

(E)

MATHEMATICS & STATISTICS (88)
(COMMERCE)

Time : 3 Hrs.

(7 Pages)

Max. Marks : 80

- Notes :**
- (i) All questions are compulsory.
 - (ii) Figures to the right indicate full marks.
 - (iii) Graph paper is compulsory for L. P. P.
 - (iv) Logarithm table will be provided on request.
 - (v) Answers to the questions in Section-I and Section-II should be written in **two separate** answer books.
 - (vi) Questions from Section - I attempted in the answer book of Section - II and vice-versa will not be assessed / not be given any credit.
 - (vii) Answers to every question must be written on a new page.

SECTION - I

Q. 1. Attempt any SIX of the following : **[12]**

- (i) Write converse and inverse of the following statement :
"If a man is a bachelor then he is unhappy." (2)
- (ii) Discuss the continuity of f at $x = 1$

$$\text{Where } f(x) = \frac{3 - \sqrt{2x+7}}{x-1} \text{ for } x \neq 1$$

$$= \frac{-1}{3} \text{ for } x = 1 \quad (2)$$

(iii) Find the value of 'k' if the function

$$f(x) = \frac{(e^x - 1) \sin x}{x^2}, \text{ for } x \neq 0$$
$$= k, \text{ for } x = 0$$

is continuous at $x = 0$. (2)

(iv) Find the marginal revenue if the average revenue is 45 and elasticity of demand is 5. (2)

(v) Find $\frac{dy}{dx}$ if $x^3 + y^2 + xy = 7$ (2)

(vi) Find the area bounded by the curve $y = x^4$, X-axis and lines $x = 1$ and $x = 5$. (2)

(vii) Evaluate: $\int_{-2}^3 \frac{dx}{x+5}$ (2)

(viii) Evaluate: $\int \frac{dx}{16 - 9x^2}$ (2)

Q. 2. (A) Attempt any TWO of the following : (6) [14]

(i) Prove that the following statement pattern is a tautology :

$$(q \rightarrow p) \vee (p \rightarrow q) \quad (3)$$

(ii) Find $\frac{dy}{dx}$ if $y = x^x + 5^x$ (3)

(iii) Evaluate: $\int x \cos^{-1} x \, dx$ (3)

(B) Attempt any TWO of the following : (8)

(i) Find the inverse of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 1 & 5 \\ 2 & 4 & 7 \end{bmatrix}$ by using adjoint method. (4)

(ii) If f is continuous at $x=0$ then find $f(0)$

$$\text{where } f(x) = \frac{5^x + 5^{-x} - 2}{x^2}, x \neq 0 \quad (4)$$

(iii) A manufacturer can sell x items ($x > 0$) at a price of ₹ $(280 - x)$ each. The cost of producing x items is ₹ $(x^2 + 40x + 35)$. Find the number of items to be sold so that the manufacturer can make maximum profit. (4)

Q. 3. (A) Attempt any TWO of the following : (6) [14]

(i) If p and q are true statements and r and s are false statements, find the truth value of the following :
 $(p \wedge \sim r) \wedge (\sim q \wedge s)$ (3)

(ii) Differentiate e^{4x+5} w. r. t. e^{3x} (3)

(iii) Evaluate : $\int \frac{e^x(1+x)}{\cos^2(xe^x)} dx$ (3)

(B) Attempt any TWO of the following : (8)

(i) If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 0 \\ 3 & 1 \end{bmatrix}$, find $(AB)^{-1}$. (4)

(ii) For manufacturing x units, labour cost is $150 - 4x$ and processing cost is x^2 . Price of each unit is $p = 10,800 - 4x^2$. Find the values of x for which :

(a) Total cost is decreasing.

(b) Revenue is increasing (4)

(iii) Evaluate :
$$\int_3^9 \frac{\sqrt[3]{12-x}}{\sqrt[3]{x} + \sqrt[3]{12-x}} dx$$
 (4)

SECTION - II

Q. 4. Attempt any SIX of the following :

[12]

(i) Two fair coins are tossed simultaneously.

If X denotes the number of heads, find the probability distribution of X . Also find $E(X)$. (2)

(ii) If the correlation coefficient between X and Y is 0.8 , what is the correlation coefficient between

(a) X and $3Y$

(b) $X - 5$ and $Y - 3$ (2)

(iii) Find the premium on property worth ₹ 12,50,000 at 3% if the property is insured to the extent of 80% of its value. (2)

(iv) If the sum of squares of differences of ranks for 10 pairs of observations is 66, find the rank correlation coefficient. (2)

(v) If the present worth of a bill due 6 months hence is ₹ 2,500 at 10% per annum, what is the true discount? (2)

(vi) From the following table find q_0 :

x	0	1	2	3	4	5
l_x	1000	940	780	590	25	0

(2)

(vii) Compute CDR using the information given below :

Age group (years)	0 -15	15 - 35	35 - 65	65 and above
Population	9000	25000	32000	9000

Total number of deaths in a year is given to be 900. (2)

(viii) What must be subtracted from each of the numbers 5, 7 and 10, so that the resulting numbers are in continued proportion? (2)

Q. 5. (A) Attempt any TWO of the following : (6) [14]

(i) An article is marked at ₹ 1,500. A trader allows a discount at 3% and still gains 20% on the cost. Find the cost price of the article. (3)

(ii) For a binomial distribution $n = 6$ and $p = 0.3$, find the probability of getting exactly 3 successes. (3)

(iii) Diet for a sick person must contain at least 4000 units of vitamins, 50 units of minerals and 1500 calories. Two foods F_1 and F_2 cost ₹ 50 and ₹ 75 per unit respectively. Each unit of food F_1 contains 200 units of vitamins, 1 unit of minerals and 40 calories, whereas each unit of food F_2 contains 100 units of vitamins, 2 units of minerals and 30 calories. Formulate the above problem as L.P.P. to satisfy the sick person's requirements at minimum cost. (3)

(B) Attempt any TWO of the following : (8)

(i) Two samples from bivariate populations have 15 observations each. The sample means of X and Y are 25 and 18 respectively. The corresponding sum of

squares of deviations from means are 136 and 148. The sum of product of deviations from respective means is 122. Obtain the equation of line of regression of X on Y. (4)

- (ii) Suggest optimum solution to the following assignment problem, also find the total minimum service time.

Service Time (in hrs.)

Counters	Salesmen			
	A	B	C	D
W	41	72	39	52
X	22	29	49	65
Y	27	39	60	51
Z	45	50	48	52

(4)

- (iii) From the following table which relates to the number of animals of a certain species at age x , complete the life table : (4)

x	0	1	2	3	4	5
l_x	1000	850	760	360	25	0

Q. 6. (A) Attempt any TWO of the following : (6) [14]

- (i) For 50 students of a class, the regression equation of marks in statistics (X) on the marks in accountancy (Y) is $3y - 5x + 180 = 0$. The mean marks in accountancy are 44 and the variance of marks in statistics

is $\left(\frac{9}{16}\right)^{\text{th}}$ of the variance of marks in accountancy.

Find the mean marks in statistics and the correlation coefficient between marks in the two subjects. (3)

- (ii) The p. d. f. of a random variable X is given by :

$$f(x) = 2x, \quad 0 \leq x \leq 1$$
$$= 0, \quad \text{otherwise}$$

Find $P\left(\frac{1}{3} < x < \frac{1}{2}\right)$ (3)

- (iii) Find the sequence that minimizes the total elapsed time required to complete the following task. The table below gives the processing time in hours. Also, find the minimum elapsed time and idle times for both machines.

Jobs	1	2	3	4	5
M_1	3	7	4	5	7
M_2	6	2	7	3	4

(3)

- (B) Attempt any TWO of the following : (8)

- (i) A bill of ₹ 7,500 was discounted for ₹ 7,290 at a bank on 28th October 2006. If the rate of interest was 14% p.a., what is the legal due date? (4)

- (ii) The following data gives the marks of 20 students in mathematics (X) and statistics (Y) each out of 10, expressed as (x, y) . Construct ungrouped frequency distribution considering single number as a class. Also prepare marginal distributions :
(2, 7) (3, 8) (4, 9) (2, 8) (2, 8) (5, 6) (5, 7) (4, 9)
(3, 8) (4, 8) (2, 9) (3, 8) (4, 8) (5, 6) (4, 7) (4, 7)
(4, 6) (5, 6) (5, 7) (4, 6). (4)

- (iii) Find the feasible solution for the following system of linear inequations :
 $0 \leq x \leq 3, \quad 0 \leq y \leq 3, \quad x + y \leq 5, \quad 2x + y \geq 4$ (4)

