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2016 II 26

1100

J-751

(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) Answer to every question must be written on a new page.
 - (iv) Graph paper is compulsory for L. P. P.
 - (v) Logarithm table will be provided on request.
 - (vi) Answers to the questions in Section I and Section II should be written in two separate answer books.
 - (vii) Questions from section-I attempted in the answer book of section-II and vice-versa will not be assessed/not be given any credit.

SECTION - I

Q. 1. Attempt any SIX of the following :

[12]

- (i) If $y = (\sin x)^x$, find $\frac{dy}{dx}$. (2)
- (ii) If $A = \begin{bmatrix} 1 & 3 \\ 3 & 1 \end{bmatrix}$ show that $A^2 - 2A$ is a scalar matrix. (2)
- (iii) Write the negation of the following statements :
 - (a) $\forall y \in \mathbb{N}, y^2 + 3 \leq 7$
 - (b) If the lines are parallel then their slopes are equal. (2)
- (iv) The total revenue $R = 720x - 3x^2$ where x is number of items sold. Find x for which total revenue R is increasing. (2)

(v) Evaluate : $\int \frac{\sec^2 x}{\tan^2 x + 4} dx$ (2)

✓(vi) Find $\frac{dy}{dx}$, if $y = \cos^{-1}(\sin 5x)$ (2)

(vii) Discuss the continuity of function f at $x = 0$

where $f(x) = \frac{\sqrt{4+x} - 2}{3x}$, for $x \neq 0$
 $= \frac{1}{12}$, for $x = 0$ (2)

✓(viii) State which of the following sentences are statements. In case of statement, write down the truth value :

(a) Every quadratic equation has only real roots. ℓ

(b) $\sqrt{-4}$ is a rational number. ℓ (2)

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

✓(i) Solve the following equations by the inversion method :
 $2x + 3y = -5$ and $3x + y = 3$ (3)

✓(ii) Find x and y , if

$$\left\{ 3 \begin{bmatrix} 1 & 2 & 0 \\ 0 & -1 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 5 & -2 \\ -3 & -4 & 4 \end{bmatrix} \right\} \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix} \quad (3)$$

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

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

✓(i) (a) Express the truth of each of the following statements using Venn diagram.

(1) All teachers are scholars and scholars are teachers.

(2) If a quadrilateral is a rhombus then it is a parallelogram.

(b) Write converse and inverse of the following statement:

“If Ravi is good in logic then Ravi is good in Mathematics.” (4)

(ii) Find the area of the region bounded by the lines $2y + x = 8$, $x = 2$ and $x = 4$. (4)

✓(iii) Evaluate: $\int_3^9 \frac{\sqrt[3]{12-x}}{\sqrt[3]{x+1} \sqrt[3]{12-x}} dx$ (4)

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

(i) If $f(x) = \frac{e^{2x} - 1}{ax}$, for $x < 0$, $a \neq 0$
 $= 1$, for $x = 0$
 $= \frac{\log(1+7x)}{bx}$, for $x > 0$, $b \neq 0$

is continuous at $x = 0$ then find a and b . (3)

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

where $f(x) = \frac{\cos 3x - \cos x}{x^2}$, $x \neq 0$ (3)

(iii) If $f'(x) = 4x^3 - 3x^2 + 2x + k$ and $f(0) = 1$, $f(1) = 4$, find $f(x)$. (3)

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

✓(i) Find MPC (Marginal Propensity to Consume) and APC (Average Propensity to Consume) if the expenditure E_c of a person with income I is given as $E_c = (0.0003)I^2 + (0.075)I$ when $I = 1000$. (4)

- (ii) Cost of assembling x wallclocks is $\left(\frac{x^3}{3} - 40x^2\right)$ and labour charges are $500x$. Find the number of wallclocks to be manufactured for which marginal cost is minimum. (4)

- (iii) If $\cos^{-1}\left(\frac{x^2 - y^2}{x^2 + y^2}\right) = 2k$,
show that $y \frac{dy}{dx} = x \tan^2 k$. (4)

SECTION - II

Q. 4. Attempt any SIX of the following : [12]

- ✓(i) Anandi and Rutuja invested ₹10,000 each in a business. Anandi withdrew her capital after 7 months. Rutuja continued for the year. After one year, the profit earned by them was ₹5,700. Find the profit earned by each person. (2)
- ✓(ii) Calculate age specific death (A-SDR) rates for the following data :

Age group (in years)	Population (‘000)	Number of Deaths
Below 10	25	50
10 – 30	30	90
30 – 45	40	160
45 – 70	20	100

(2)

- ✓(iii) For a bivariate data $b_{yx} = -1.2$ and $b_{xy} = -0.3$, find the correlation coefficient between x and y . (2)
- ✓(iv) A random variable x has the following probability distribution :

x	0	1	2	3	4	5	6
$P(X = x)$	k	$3k$	$5k$	$7k$	$9k$	$11k$	$13k$

Find ‘ k ’. (2)

- (v) The probability distribution function of continuous random variable X is given by

$$f(x) = \frac{x}{4}, \quad 0 < x < 2$$

$$= 0, \quad \text{otherwise}$$

find $P(x \leq 1)$. (2)

- ✓(vi) From the two regression equations

$$y = 4x - 5 \text{ and } 3x = 2y + 5$$

find $\bar{x}$ and $\bar{y}$. (2)

- (vii) Draw scatter diagram for the following data and interpret it :

x	10	20	30	40	50	60	70
y	32	20	24	36	40	28	38

(2)

- ✓(viii) If $\sum d^2 = 66$ and $n = 10$ then find the rank correlation coefficient. (2)

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

- ✓(i) Determine l_{92} and l_{93} , given that $l_{91} = 97$, $d_{91} = 38$ and

$$q_{92} = \frac{27}{59}. \quad (3)$$

- ✓(ii) Calculate CDR for districts A and B and compare them. Also state which district is more healthy.

Age group (in years)	District A		District B	
	No. of persons (‘000)	No. of Deaths	No. of persons (‘000)	No. of Deaths
0 – 15	1	20	2	50
15 – 60	3	30	7	70
60 and above	2	40	1	25

(3)

- (iii) If for a bivariate data $\bar{x} = 10$, $\bar{y} = 12$, $V(X) = 9$, $\sigma_y = 4$ and $r = 0.6$, estimate y when $x = 5$. (3)

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

- (i) Calculate the coefficient of correlation between X and Y series from the following data :

$$n = 15, \bar{x} = 25, \bar{y} = 18, \sigma_x = 3.01, \sigma_y = 3.03$$

$$\Sigma(x_i - \bar{x})(y_i - \bar{y}) = 122 \quad (4)$$

- (ii) Solve the following minimal assignment problem and hence find minimum time where '-' indicates that job cannot be assigned to the machine :

Machines	Processing time in hours				
	A	B	C	D	E
M ₁	9	11	15	10	11
M ₂	12	9	-	10	9
M ₃	-	11	14	11	7
M ₄	14	8	12	7	8

(4)

- (iii) Solve the following maximal assignment problem :

Branch Manager	Monthly Business (₹ lakh)			
	A	B	C	D
P	11	11	9	9
Q	13	16	11	10
R	12	17	13	8
S	16	14	16	12

(4)

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

- (i) Find the true discount, banker's discount and banker's gain on a bill of ₹ 36,600 due 4 months hence at 5% p.a. (3)

- ✓(ii) Mr. Anil wants to invest at most ₹ 60,000 in Fixed Deposit (F.D.) and Public Provident Fund (P.P.F.). He wants to invest at least ₹ 20,000 in F.D. and at least ₹ 15,000 in P.P.F. The rate of interest on F.D. is 8% p.a. and that on P.P.F. is 10% p.a. Formulate the above problem as L.P.P. to determine maximum yearly income. (3)

- ✓(iii) Find graphical solution for following system of linear inequations :

$$3x + 2y \leq 180; x + 2y \leq 120, x \geq 0, y \geq 0$$

Hence find co-ordinates of corner points of the common region. <https://www.maharashtrastudy.com> (3)

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

- (i) Mrs. Menon plans to save for her daughter's marriage. She wants to accumulate a sum of ₹ 4,00,000 at the end of 4 years. How much should she invest at the end of each year from now, if she can get interest compounded at 10% p.a.? [Given : $(1.1)^4 = 1.4641$] (4)

- ✓(ii) A car valued at ₹ 4,00,000 is insured for ₹ 2,50,000. The rate of premium is 5% less 20%. How much loss does the owner bear including the premium if value of the car is reduced to 60% of its original value? (4)

- (iii) If a random variable X has probability distribution function

$$f(x) = \frac{c}{x}, 1 < x < 3, c > 0,$$

find c, E(X) and Var(X). (4)



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