

**BOARD QUESTION PAPER : OCTOBER 2014****Notes:**

- All questions are compulsory.
- Figures to the right indicate full marks.
- Answer to every question must be written on a new page.
- L.P.P. problem should be solved on graph paper.
- Log table will be provided on request.
- Write answers of Section – I and Section – II in one answer book.

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

- Write the following statements in symbolic forms:
 - Either 49 is a perfect square or 39 is divisible by 11.
 - It is not true that if 'i' is a real number, then '2' is an even prime number. (2)
- If $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & k & 2 \\ 5 & 7 & 3 \end{bmatrix}$ is a singular matrix, then find the value of 'k'. (2)
- If $A = \begin{bmatrix} 7 & 1 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$, then verify that $|AB| = |A| \cdot |B|$ (2)
- Discuss the continuity of the function at the point given. If the function is discontinuous then remove the discontinuity.
$$f(x) = \frac{\sin^2 5x}{x^2}, \quad \text{for } x \neq 0$$
$$= 5, \quad \text{for } x = 0; \text{ at } x = 0$$
 (2)
- Find the value of x for which the function $f(x) = x^3 - 3x^2 - 9x + 25$ is increasing. (2)
- Differentiate: $\tan^{-1}(\cot 2x)$ w.r.t. x . (2)
- Discuss the continuity of the function
$$f(x) = \frac{(3 - \sqrt{2x + 7})}{x - 1}, \text{ for } x \neq 1$$
$$= -\frac{1}{3}, \quad \text{for } x = 1; \text{ at } x = 1$$
 (2)
- Evaluate: $\int e^x \left[\frac{x+3}{(x+4)^2} \right] dx$ (2)

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

- Without using the truth table, show that $p \wedge [(\sim p \vee q) \vee \sim q] \equiv p$ (3)
- If $y = \tan^{-1} \left[\frac{\cos 2x - \sin 2x}{\sin 2x + \cos 2x} \right]$ then find $\frac{dy}{dx}$. (3)
- Evaluate: $\int \frac{\tan x}{\sec x + \tan x} \cdot dx$ (3)

**(B) Attempt any TWO of the following:****[8]**

i. If the function

$$f(x) = \begin{cases} x^2 + ax + b, & x < 2 \\ 3x + 2, & 2 \leq x \leq 4 \\ 2ax + 5b, & 4 < x \end{cases}$$

is continuous at $x = 2$ and $x = 4$, then find the values of a and b .

(4)

ii. The total cost function of a firm is $C = x^2 + 75x + 1600$ for output x . Find the output for which the average cost is minimum. Is $C_A = C_m$ at this output?

(4)

iii. Find the area of the ellipse $\frac{x^2}{4} + \frac{y^2}{25} = 1$

(4)

Q.3. (A) Attempt any TWO of the following:**[6][14]**i. Examine whether the following statement $(p \wedge q) \vee (\sim p \vee \sim q)$ is a tautology or contradiction or neither of them.

(3)

ii. Find: $\frac{dy}{dx}$ if $x = a \operatorname{cosec} \theta$, $y = b \cot \theta$, at $\theta = \frac{\pi}{4}$

(3)

iii. Evaluate: $\int \frac{1}{x^2 + 8x + 20} dx$

(3)

(B) Attempt any TWO of the following:**[8]**i. Express the following equations in matrix form and solve them by the method of inversion.
 $x + 2y + 3z = 8$, $2x - y + z = 1$, $3x + y - 4z = 1$

(4)

ii. The expenditure E_c of a person with income x is given by $E_c = (0.000035)x^2 + (0.045)x$. Find the marginal propensity to consume and marginal propensity to save when $x = 5000$. Also find the average propensity to consume and average propensity to save.

(4)

iii. Evaluate: $\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \frac{1}{1 + \sqrt{\cot x}} \cdot dx$

(4)



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Section – I

Question 1 to 3 (based on section I) are given in our book STD XII (COMMERCE) MATHEMATICS AND STATISTICS - I

Section – II

Q.4. Attempt any SIX of the following:

[12]

- i. Obtain the Crude Death Rate (CDR) for city A from the data given below. (2)

Age group (in years)	City A	
	Population	No. of deaths
Below 15	800	32
15 – 25	3000	12
25 – 65	4800	48
65 and above	1400	42

- ii. Compute the product moment coefficient of correlation for the following data:

$$n = 100, \bar{x} = 62, \bar{y} = 53, \sigma_x = 10, \sigma_y = 12, \sum (x_i - \bar{x})(y_i - \bar{y}) = 8000 \quad (2)$$

- iii.

Age group (in years)	Population	No. of deaths
0 – 20	40000	350
20 – 65	65000	650
65 and above	15000	x

Using the above information find x , if the CDR = 13.4 per thousand. (2)

- iv. The ranks of the 10 students in Mathematics and Accountancy are as follows:

Two numbers given in the brackets denote the ranks of the students in Mathematics and Accountancy respectively.

(1, 1), (2, 10), (3, 3), (4, 4), (5, 5), (6, 7), (7, 2), (8, 6), (9, 8), (10, 9).

Calculate the rank correlation coefficient. (2)

- v. If $X \sim N(4, 25)$, then find $P(x \leq 4)$. (2)

- vi. Find common region for the following system of linear inequations:

$$x \geq -3, 4x - 5y \geq -20, 3x + 4y \leq 12, y \geq -2 \quad (2)$$



- vii. For the following problem, find the sequence that minimizes total elapsed time (in hours) required to complete the following jobs on two machines M_1 and M_2 in the order $M_1 - M_2$:

Jobs	A	B	C	D	E
Machine M_1	5	1	9	3	10
Machine M_2	2	6	7	8	4

(2)

- viii. A company produces mixers and food processors. Profit on selling one mixer and one food processor is ₹ 2,000 and ₹ 3,000 respectively. Both the products are processed through three machines A, B, C. The time required in hours for each product and total time available in hours per week on each machine are as follows:

Machine	Mixer	Food Processor	Available Time
A	3	3	36
B	5	2	50
C	2	6	60

Formulate the problem as L.P.P. in order to maximize the profit.

(2)

Q.5. (A) Attempt any TWO of the following:

(6)[14]

- i. The defects on a plywood sheet occur at random with an average of the defect per 50 sq.ft. What is the probability that such sheet will have –

- No defect
- At least one defect

[Use $e^{-1} = 0.3678$]

(3)

- ii. A Banker's discount calculated for 1 year is 26 times his gain. Find the rate of interest.

(3)

- iii. For the two regression equations, $4y = 9x + 15$ and $25x = 6y + 7$, find correlation coefficient r , \bar{x} , \bar{y} .

(3)

(B) Attempt any TWO of the following:

(8)

- i. Incomes of Mr. Shah, Mr. Patel and Mr. Mehta are in the ratio 1 : 2 : 3, while their expenditures are in the ratio 2 : 3 : 4. If Mr. Shah saves 20% of his income, find the ratio of their savings.

(4)

- ii. A sample of 5 items is taken from the production of a firm. Length and weight of the five items are given below:

Length (cm.)	3	4	6	7	10
Weight (gm.)	9	11	14	15	16

Calculate Karl Pearson's coefficient of correlation between the length and weight and interpret the result.

(4)

- iii. A departmental head has three jobs and four subordinates. The subordinates differ in their capabilities and the jobs differ in their work contents. With the help of the performance matrix given below, find out which of the four subordinates should be assigned which jobs?

Subordinates	Jobs		
	I	II	III
A	7	3	5
B	2	7	4
C	6	5	3
D	3	4	7

(4)

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

- i. Raghu, Madhu and Ramu started a business in partnership by investing ₹ 60,000, ₹ 40,000 and ₹ 75,000 respectively. At the end of the year, they found that they have incurred a loss of ₹ 24,500. Find how much loss each one had to bear. (3)
- ii. A card is drawn at random and replaced four times from a well shuffled pack of 52 cards. Find the probability that –
 - a. Two diamond cards are drawn.
 - b. At least one diamond card is drawn. (3)
- iii. Find the agent's commission at 15% on the first premium if he places insurance for ₹ 2,00,000 on the life of a person, the premium being at the rate of ₹ 35 per thousand, per annum, paid annually. (3)

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

- i. Given the following table which relates to the number of animals of a certain species at age 'x', complete the life table.

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

(4)

- ii. Information on vehicles (in thousands) passing through seven different highways during a day (X) and number of accidents reported (Y) is given as follows:

$$\sum x_i = 105, \sum y_i = 409, n = 7, \sum x_i^2 = 1681, \sum y_i^2 = 39350, \sum x_i y_i = 8075.$$

Obtain the linear regression of Y on X.

(4)

- iii. In a factory there are six jobs to be performed, each of which should go through two machines A and B in the order A–B. The processing timing (in hours) for the jobs are given here. You are required to determine the sequence for performing the jobs that would minimize the total elapsed time T. What is the value of T? Also find the idle time for machines A and B.

Jobs	J ₁	J ₂	J ₃	J ₄	J ₅	J ₆
Machine A	1	3	8	5	6	3
Machine B	5	6	3	2	2	10

(4)