BOARD QUESTION PAPER : OCTOBER 2015

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.   L.P.P. problem should be solved on graph paper.

v.   Log 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.

Section – I

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

i.   Find x and y if $x + y = \begin{bmatrix} 7 & 0 \\ 2 & 5 \end{bmatrix}$, $x - y = \begin{bmatrix} 3 & 0 \\ 0 & 3 \end{bmatrix}$ (2)

ii.   Find $\dfrac{dy}{dx}$ if $y = \sin^{-1}\left(\sqrt{1-x^2}\right)$ (2)

iii. Use the quantifiers to convert each of the following open sentences defined on N into true statement:

a. $5x - 3 < 10$ b. $x^2 \geq 1$ (2)

iv.   Examine the continuity of the following function:

$$f(x) = \frac{x^2 - 16}{x - 4}, \quad \text{for } x \neq 4$$
$$\qquad = 8, \qquad \text{for } x = 4 \left.\right\} \text{ at } x = 4$$

(2)

v.   Find the adjoint of the matrix A = $\begin{bmatrix} 2 & -3 \\ 3 & 5 \end{bmatrix}$ (2)

vi.   Find the elasticity of demand if the marginal revenue is ₹ 50 and price is ₹ 75. (2)

vii. Evaluate: $\int \dfrac{\tan\sqrt{x}}{\sqrt{x}}\,dx$ (2)

viii. Evaluate: $\int \dfrac{1}{x^2 + 8x + 20}\,dx$ (2)

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

i.   Write converse, inverse and contrapositive of the statement.

"If two triangles are not congruent then their areas are not equal." (3)

ii.   Examine the continuity of the following function:

$$f(x) = x^2 \cos\left(\frac{1}{x}\right), \text{ for } x \neq 0$$
$$\qquad = 0, \qquad \text{for } x = 0 \left.\right\} \text{ at } x = 0$$

(3)

iii. Find $\dfrac{dy}{dx}$ if $y = x^x + 5^x$ (3)

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

i. Solve the following equations by reduction method:

$x + 2y + z = 8$

$2x + 3y - z = 11$

$3x - y - 2z = 5$ (4)

ii. Find the volume of the solid obtained by revolving about the X-axis, the region bounded by the curve $\dfrac{x^2}{4} - \dfrac{y^2}{9} = 1$ and the lines $x = 2, x = 4$ (4)

iii. If the demand function is $D = 50 - 3p - p^2$, find the elasticity of demand at

a. $p = 5$, b. $p = 2$, Interpret your result. (4)

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

i. By constructing the truth table, determine whether the following statement pattern is a tautology, contradiction or contingency.

$(p \rightarrow q) \wedge (p \wedge \sim q)$ (3)

ii. If $f(x) = \dfrac{1 - \sin x}{(\pi - 2x)^2}$, for $x \neq \dfrac{\pi}{2}$ is continuous at $x = \dfrac{\pi}{2}$, then find $f\left(\dfrac{\pi}{2}\right)$. (3)

iii. If $x^{5/3} y^{2/3} = (x + y)^{7/3}$, then show that $\dfrac{dy}{dx} = \dfrac{y}{x}$. (3)

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

i. Cost of assembling x wall clocks is $\left(\dfrac{x^3}{3} - 40x^2\right)$ and labour charges are $500\,x$.

Find the number of wall clocks to be manufactured for which average cost and marginal cost attain their respective minimum. (4)

ii. Evaluate: $\displaystyle\int_0^1 \dfrac{x.(\sin^{-1}x)^2}{\sqrt{1 - x^2}}\,dx$ (4)

iii. Evaluate: $\displaystyle\int \log(1 + x^2)\,dx$ (4)

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v.   Log table will be provided on request.
vi. Write answers of Section – I and Section – II in one answer book.

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.   Alex spends 20% of his income on food items and 12% on conveyance. If for the month of June 2010, he spend ₹ 900 on conveyance, find his expenditure on food items during the same month. (2)

ii. Find the Age Specific Death Rates for the following data:

Age group (in years)	Population	Number of Deaths
0 – 20	7000	140
20 – 45	20,000	180
45 – 65	10,000	120
65 and above	4,000	160

(2)

iii. Compute the coefficient of correlation for the following data:

n = 100, $\bar{x}$ = 62, $\bar{y}$ = 53, σ_X = 10, σ_Y = 12,

$$\sum \left(x_i - \bar{x}\right)\left(y_i - \bar{y}\right) = 8000$$

(2)

iv. A building is insured for 80% of its value. The annual premium at 70 paise percent amounts to ₹ 2,800. Fire damaged the building to the extent of 60% of its value. How much amount for damage can be claimed under the policy? (2)

v.   A random variable X has the following probability distribution:

X = x	–2	–1	0	1	2	3
P(x)	0.1	k	0.2	2k	0.3	k

Find the value of k and calculate mean. (2)

vi. A, B and C are in partnership. A's capital was ₹ 65,000. C's capital was ₹ 50,000. The total profit is ₹ 38,000, out of which B's profit is ₹ 15,000. What was B's capital? (2)

vii.

Age group (in years)	Population	Number of deaths
0 – 20	40,000	350
20 – 65	65,000	650
65 and above	15,000	x

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

viii. Draw scatter diagram for the following data and identify the type of correlation.

Capital (₹ in crore)	2	3	4	5	6	8	9
Profit (₹ in lakh)	6	5	7	7	8	12	11

(2)

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

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] (3)

ii. A fair coin is tossed 12 times. Find the probability of getting

    a.   exactly 7 heads

    b.   at least 2 heads (3)

iii. For the following problem find the sequence that minimizes total elapsed time (in hrs) required to complete the jobs on 2 machines M_1 and M_2 in the order $M_1 - M_2$. Also find the minimum elapsed time T:

Job	A	B	C	D	E	F
M_1	4	8	3	6	7	5
M_2	6	3	7	2	8	4

(3)

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

i. A bill of ₹ 2,000 drawn on 15th February 2003 for 10 months was discounted on 13th May 2003 at $3\frac{3}{4}$ % p.a. Calculate the banker's discount. (4)

ii. 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)

iii. A person makes two types of gift items A and B requiring the services of a cutter and a finisher. Gift item A requires 4 hours of the cutter's time and 2 hours of finisher's time. Gift item B requires 2 hours of the cutter's time and 4 hours of finisher's time. The cutter and finisher have 208 hours and 152 hours available time respectively every month. The profit on one gift item of type A is ₹ 75 and on one gift item of type B is ₹ 125. Assuming that the person can sell all the gift items produced, determine how many gift items of each type should he make every month to obtain the best returns? (4)

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

i. In a partially destroyed laboratory record of an analysis of regression data, the following data are legible:
Variance of X = 9
Regression equations: $8x - 10y + 66 = 0$ and $40x - 18y = 214$
Find on the basis of the above information:
   a. Mean values of X and Y.
   b. Correlation coefficient between X and Y. **(3)**

ii. Mr. Rajesh has ₹ 1,800 to spend on fruits for a meeting. Grapes cost ₹ 150/kg and peaches ₹ 200/kg. Let x and y represent the number of kilogrammes of grapes and peaches he can buy. Write and graph an inequation to model the amounts of grapes and peaches he can buy within his budget. **(3)**

iii. If a random variable X follows Poisson distribution such that $P[X = 1] = P[X = 2]$, find
   a. mean of the distribution
   b. $P[X = 0]$
   [Given $e^{-2} = 0.1353$]. **(3)**

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

i. Ranking of 8 trainees at the beginning (X) and at the end (Y) of a certain course are given below:

Trainees	A	B	C	D	E	F	G	H
X	1	2	4	5	6	8	3	7
Y	2	4	3	7	8	1	5	6

Calculate Spearman's rank correlation coefficient. **(4)**

ii. A computer centre has four expert programmers. The centre needs four application programmes to be developed. The head of the computer centre, after studying carefully the programmes to be developed, estimates the computer time in minutes required by the respective experts to develop the application programmes as follows:

Programmers	Programmes			
	1	2	3	4
	Times in minutes			
A	120	100	80	90
B	80	90	110	70
C	110	140	120	100
D	90	90	80	90

How should the head of the computer centre assign the programmes to the programmers so that the total time required is minimum? **(4)**

iii. From the data of 7 pairs of observations on X and Y following results are obtained:
$\Sigma(x_i - 70) = -38$; $\Sigma(y_i - 60) = -5$; $\Sigma(x_i - 70)^2 = 2990$;
$\Sigma(y_i - 60)^2 = 475$; $\Sigma(x_i - 70)(y_i - 60) = 1063$
Obtain:
   a. The line of regression of Y on X.
   b. The line of regression of X on Y. **(4)**