BOARD QUESTION PAPER : MARCH 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. Write answers of Section – I and Section – II in one answer book.

Section – I

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

i. Express the following statement in symbolic form and write its truth value.
"If 4 is an odd number, then 6 is divisible by 3." (2)

ii. Find the values of x and y, if

$$2\begin{bmatrix}1 & 3\\ 0 & x\end{bmatrix}+\begin{bmatrix}y & 0\\ 1 & 2\end{bmatrix}=\begin{bmatrix}5 & 6\\ 1 & 8\end{bmatrix}$$ (2)

iii. Find the value of 'k' if the function

$$f(x)=\frac{\tan 7x}{2x}, \quad \text{for } x\neq 0$$
$$=k, \quad \text{for } x=0$$

is continuous at $x = 0$ (2)

iv. Find $\frac{dy}{dx}$ if $y=\cos^{-1}\left(\sqrt{x}\right)$ (2)

v. The price P for demand D is given as $P = 183 + 120D – 3D^2$.
Find D for which the price is increasing. (2)

vi. Evaluate: $\int\frac{1}{x(3+\log x)}dx$ (2)

vii. If $A=\begin{bmatrix}2 & 1\\ 1 & 1\end{bmatrix}$ show that $A^2 – 3A + I = 0$ (2)

viii. Evaluate: $\int x\cos x\,dx$. (2)

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

i. Prove that the following statement pattern is equivalent:
$(p \vee q) \rightarrow r$ and $(p \rightarrow r) \wedge (q \rightarrow r)$ (3)

ii. Examine the continuity of the following function:

$$\left.\begin{aligned} f(x)&=x^2-x+9, \quad \text{for } x\leq 3\\ &=4x+3, \quad \text{for } x>3\end{aligned}\right\}\ \text{at } x=3$$ (3)

iii. Find $\frac{dy}{dx}$ if $y=\tan^{-1}\left(\frac{6x}{1-5x^2}\right)$ (3)

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

i. Find the inverse of the following matrix by elementary row transformations if it exists.

$$A = \begin{bmatrix} 1 & 2 & -2 \\ 0 & -2 & 1 \\ -1 & 3 & 0 \end{bmatrix}$$ (4)

ii. Find area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ (4)

iii. The expenditure E_c of a person with income I is given by $E_c = (0.000035)I^2 + (0.045)\ I$. Find marginal propensity to consume (MPC) and marginal propensity to save (MPS) when I = 5000. Also find A (average) PC and A (average) PS. (4)

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

i. Express the truth of each of the following statements by Venn diagram:

a. Some hardworking students are obedient.

b. No circles are polygons.

c. All teachers are scholars and scholars are teachers. (3)

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

$$f(x) = \frac{15^x - 3^x - 5^x + 1}{x \tan x},\ x \neq 0$$ (3)

iii. Find $\frac{dy}{dx}$ if $x = e^{2t}, y = e^{\sqrt{t}}$ (3)

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

i. Evaluate: $\int \frac{(1 + \log x)}{x(2 + \log x)(3 + \log x)} dx$ (4)

ii. Evaluate: $\int_0^{\frac{\pi}{2}} \frac{dx}{1 + \cot x}$ (4)

iii. A firm wants to maximize its profit. The total cost function is C = 370 Q + 550 and revenue is $R = 730Q - 3Q^2$. Find the output for which profit is maximum and also find the profit amount at this output. (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. The ratio of number of boys and girls in a school is 3 : 2. If 20 % of the boys and 30 % of the girls are scholarship holders, find the percentage of students who are not scholarship holders (2)

ii. Obtain crude death rates (C.D.R.) for city A and city B from the data given below:

Age group (in years)	City A		City B	
	Population	No. of deaths	Population	No. of deaths
Below 15	800	32	900	12
15 – 25	3000	12	1500	8
25 – 65	4800	48	4500	38
65 and above	1400	42	600	30

(2)

iii. Coefficient of rank correlation between x and y is 0.5 and $\sum d_i^2 = 42$. Assuming that no ranks are repeated, find the number of pairs of observations. (2)

iv. An agent charges 12 % commission on the sales. What does he earn if the total sale amounts to ₹ 36,000? What does the seller get? (2)

v. Find the age standard death rate (S.D.R.) for the following data:

Age group (in years)	Population (in ′000)	No. of deaths
0 – 10	11	240
10 – 20	12	150
20 – 60	9	125
60 and above	2	90

(2)

vi. Following table gives the age of husbands and age of wives.

Age of wives (in years)	Age of husbands (in years)			
	20–30	30–40	40–50	50–60
15 – 25	5	9	3	–
25 – 35	–	10	25	2
35 – 45	–	1	12	2
45 – 55	–	–	4	16
55 – 65	–	–	–	4

Find:

a. The marginal frequency distribution of the age of husbands.

b. The conditional distribution of the age of husbands when the age of wives lies between 25 – 35. (2)

vii. The present worth of the sum of ₹ 5,830, due 9 months hence, is ₹ 5,500. Find the rate of interest. (2)

viii. For a binomial distribution mean is 6 and variance is 2. Find n and p. (2)

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

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

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

(3)

ii. Mr. Natarajan and Mr.Gopalan are partners in the company having capitals in the ratio 4 : 5 and the profits received by them are in the ratio 5 : 4. If Mr. Gopalan invested capital in the company for 16 months, how long was Mr. Natarajan's investment in the company? (3)

iii. From a lot of 25 bulbs of which 5 are defective a sample of 5 bulbs was drawn at random with replacement. Find the probability that the sample will contain

a. exactly 1 defective bulb

b. at least 1 defective bulb. (3)

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

i. Given the following table which relates to the number of parrots at age x, complete the life table for parrots.

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

(4)

ii. You are given the following information about advertising expenditure and sales:

	Advertisemet	
	Expenditure (₹ in lakh) (X)	Sales (₹ in lakh) (Y)
Arithmetic mean	10	90
Standard deviation	3	12

Correlation coefficient between X and Y = 0.8.

a. Obtain the two regression equations.

b. What is the likely sales when the advertising budget is ₹ 15 lakh?

c. What should be the advertising budget if the company wants to attain sales target of ₹ 120 lakh? (4)

iii. Electro Corp.Co. manufactures two electrical products: Air conditioners and Fans. The assembly process for each is similar in which both require a certain amount of wiring and drilling. Each air conditioner takes 4 hours for wiring and 2 hours for drilling. Each fan also takes 2 hours for wiring and 1 hour for drilling. During the next production period, 240 hours of wiring time are available and upto 100 hours of drilling time may be used. Each air-conditioner assembled may be sold for ₹ 2,000 profit and each fan assembled may be sold for ₹ 1,000 profit. Formulate this problem as an L.P.P. in order to maximize the profit.

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

i. The equations given of the two regression lines are:
$2x + 3y - 6 = 0$ and $5x + 7y - 12 = 0$
Find:
a. Correlation coefficient
b. $\frac{\sigma_X}{\sigma_Y}$ (3)

ii. Find graphical solution for the following system of linear inequations:
$2x + 3y \geq 12, -x + y \leq 3, x \leq 4, y \geq 3$ (3)

iii. The number of complaints which a bank manager receives per day is a Poisson random variable with parameter m = 4. Find the probability that the manager will receive
a. only two complaints on any given day.
b. at most two complaints on any given day
[Use $e^{-4} = 0.0183$] (3)

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

i. A warehouse valued at ₹ 10,000 contained goods worth ₹ 60,000. The warehouse was insured against fire for ₹ 4,000 and the goods to the extent of 90% of their value. A fire broke out and goods worth ₹ 20,000 were completely destroyed, while the remainder was damaged and reduced to 80% of its value. The damage to the warehouse was to the extent of ₹ 2,000. Find the total amount that can be claimed. (4)

ii. In the following data, one of the values of Y is missing. Arithmetic means of X and Y series are 6 and 8 respectively.

X	6	2	10	4	8
Y	9	11	?	8	7

a. Estimate the missing observation.
b. Calculate correlation coefficient. (4)

iii. A job production unit has four jobs A, B, C, D which can be manufactured on each of the four machines P, Q, R and S. The processing cost of each job is given in the following table :

Jobs	Machines			
	P	Q	R	S
	Processing Cost (₹)			
A	31	25	33	29
B	25	24	23	21
C	19	21	23	24
D	38	36	34	40

How should the jobs be assigned to the four machines so that the total processing cost is minimum? (4)