BOARD QUESTION PAPER : MARCH 2016

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.   If $y = (\sin x)^x$, find $\dfrac{dy}{dx}$.   (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) $\forall\, y \in N,\ y^2 + 3 \le 7$
(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: $\displaystyle\int \dfrac{\sec^2 x}{\tan^2 x + 4}\, dx$ (2)

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

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

Where $f(x) = \dfrac{\sqrt{4+x} - 2}{3x}$, for $x \ne 0$

$\qquad\qquad = \dfrac{1}{12}\qquad$, 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.
(b) $\sqrt{-4}$ is a rational number.   (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 $\left\{ 3\begin{bmatrix} 1 & 2 & 0 \\ 0 & -1 & 3 \end{bmatrix} - \begin{bmatrix} 1 & 5 & -2 \\ -3 & -4 & 4 \end{bmatrix} \right\} \begin{bmatrix} 1 \\ 2 \\ 1 \end{bmatrix} = \begin{bmatrix} x \\ y \end{bmatrix}$ (3)

iii.   Evaluate: $\displaystyle\int \tan^{-1} x\, dx$.   (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: $\int_{3}^{9} \dfrac{\sqrt[3]{12-x}}{\sqrt[3]{x}+\sqrt[3]{12-x}}\,\mathrm{d}x$ (4)

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

i. If $f(x) = \dfrac{e^{2x}-1}{ax}$, for $x < 0$, $a \neq 0$

   $= 1$, for $x = 0$

   $= \dfrac{\log(1+7x)}{bx}$, 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 $f(x) = \dfrac{\cos 3x - \cos x}{x^2}$, $x \neq 0$ (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 $\left(\dfrac{x^3}{3} - 40x^2\right)$ and labour charges are $500x$. Find the number

   of wallclocks to be manufactured for which marginal cost is minimum. (4)

iii. If $\cos^{-1}\left(\dfrac{x^2 - y^2}{x^2 + y^2}\right) = 2k$,

   show that $y\dfrac{\mathrm{d}y}{\mathrm{d}x} = x\tan^2 k$. (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.   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 $b_{YX} = -1 \cdot 2$ and $b_{XY} = -0 \cdot 3$,
     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

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

     $= 0,$ otherwise

     Find $P(x \le 1)$.   (2)

vi. From the two regression equations

     $y = 4x - 5$ 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 $\Sigma d^2 = 66$ 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 $q_{92} = \dfrac{27}{59}$.   (3)

ii. Calculate CDR for districts A and B and compare them.
Also state which district is more healthy. (3)

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

iii. If for a bivariate data $\bar{x} = 10$, $\bar{y} = 12$, Var(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, $\bar{x} = 25$, $\bar{y} = 18$, $\sigma_X = 3.01$, $\sigma_Y = 3.03$, $\sum (x_i - \bar{x})(y_i - \bar{y}) = 122$ (4)

ii. Solve the following minimal assignment problem and hence find minimum time where '–' indicates that job connot 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 the following system of linear inequations:
$3x + 2y \le 180$; $x + 2y \le 120$, $x \ge 0$, $y \ge 0$
Hence find co-ordinates of corner points of the common region. (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 varibale X has probability distribution function

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

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