BOARD QUESTION PAPER : OCTOBER 2014

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. Write the following statements in symbolic forms:
   a. Either 49 is a perfect square or 39 is divisible by 11.
   b. It is not true that if 'i' is a real number, then '2' is an even prime number. (2)

ii. 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)

iii. If $A = \begin{bmatrix} 7 & 1 \\ 2 & 5 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & -1 \end{bmatrix}$, then verify that $|AB| = |A|.|B|$ (2)

iv. 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)

v. Find the value of x for which the function
$f(x) = x^3 - 3x^2 - 9x + 25$ is increasing. (2)

vi. Differentiate: $\tan^{-1}(\cot 2x)$ w.r.t.x. (2)

vii. Discuss the continuity of the function

$$f(x) = \frac{\left(3 - \sqrt{2x+7}\right)}{x-1}, \text{ for } x \neq 1$$
$$= -\frac{1}{3}, \quad \text{for } x = 1; \text{ at } x = 1$$ (2)

viii. 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]**

i. Without using the truth table, show that
$p \wedge [(\sim p \vee q) \vee \sim q] \equiv p$ (3)

ii. If $y = \tan^{-1}\left[\frac{\cos 2x - \sin 2x}{\sin 2x + \cos 2x}\right]$ then find $\frac{dy}{dx}$. (3)

iii. Evaluate: $\int \frac{\tan x}{\sec x + \tan x} \cdot dx$ (3)

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

i. If the function

$f(x) = x^2 + ax + b, \quad x < 2$

$= 3x + 2, \quad 2 \le x \le 4$

$= 2ax + 5b, \quad 4 < x$

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 $x = a\,\text{cosec}\theta$, $y = b\,\cot\theta$, 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)