MATHS QUESTION PAPER

Time : 2 Hrs. Max. Marks : 40

Q. 1 (A) Attempt any TWO of the following : [8]

(i) By Vector method, prove that the altitudes of a triangle are concurrent. (3)

(ii) If $\bar{a}$ and $\bar{b}$ are two non-zero, non-collinear vectors, then show that any vector $\bar{r}$ coplanar with them can be uniquely expressed as linear combination of $\bar{a}$ and b. (3)

(iii) If $\bar{a} = 2\bar{i} + 3\bar{j} - \bar{k}, \bar{b} = 4\bar{i} + 2\bar{j} + 3\bar{k}, \bar{c} = 2\bar{i} - 5\bar{j} + 9\bar{k}$,

Interpret your result. find $a \cdot (b \times c)$. (3)

(B) Attempt any ONE of the following :

(i) Find the equation of the circle with centre at $(-2, 3)$ and touching to the line $8x - 15y + 27 = 0$. (2)

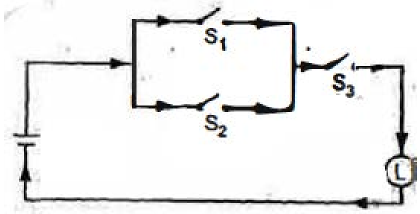
(ii) Find k, if the equation $kxy + 10x + 6y + 4 = 0$ represents pair of lines. (2)

Q. 2 (A) (a) Attempt any ONE of the following : [8]

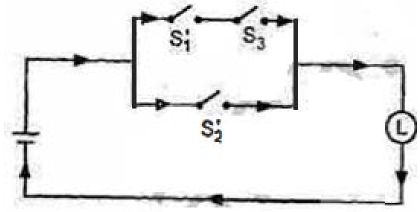
(i) Using truth table prove that $\sim p \wedge q \equiv (p \vee q) \wedge (\sim p)$ (3)

(ii) Express following switching circuits in symbolic form. (3)

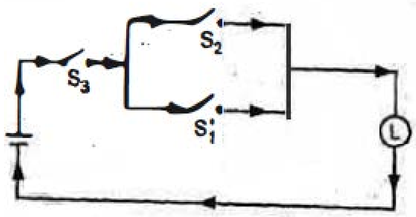
(a)



(b)



(c)



(iii) Examine whether the statement pattern $(p \rightarrow q) \wedge (p \wedge \sim q)$ is a Tautology, Contradiction or Neither. (3)

(B) Attempt any ONE of the following :

(i) Find eccentricity and the length of latus rectum for the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$. (2)

(ii) Find the equation of the normal to the parabola $y^2 = 3x$ at $(12, -6)$. (2)

Q. 3 (A) (a) Attempt any ONE of the following : [8]

(i) If $A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 1 & 0 \end{bmatrix}, B = \begin{bmatrix} 1 & 2 \\ 2 & 1 \\ 0 & 1 \end{bmatrix}$, then find $(A \cdot B)^{-1}$. (3)

(ii) Solve the following equations using Method of Reduction

$x + y - z = -2,$

$2x + 3y - z = -3,$

$3x + 4y + z = 1$ (3)

(b) **Attempt any ONE of the following :**

(i) Show that the acute angle 'θ' between the pair of the lines represented by the equation.

$ax^2 + 2hxy + by^2 = 0$ is given by $\tan\theta = \left|\dfrac{2\sqrt{h^2 - ab}}{a+b}\right|$ (3)

(ii) Find the equation of the locus of a point, the tangents drawn from which to the circle $x^2 + y^2 = a^2$ are mutually perpendicular. (3)

(B) Attempt any ONE of the following :

(i) A company manufactures two products. The basic time data, machine capacity and profit contribution are given in the following table : (2)

Machines	Product A	Product B	Hours available per week
Lathes	1	1	80
Milling	1	2	120
Profit in Rs.	6	8	

Formulate the above L.P.P. to maximize the profit. (2)

(ii) Solve with the help of the following graph :

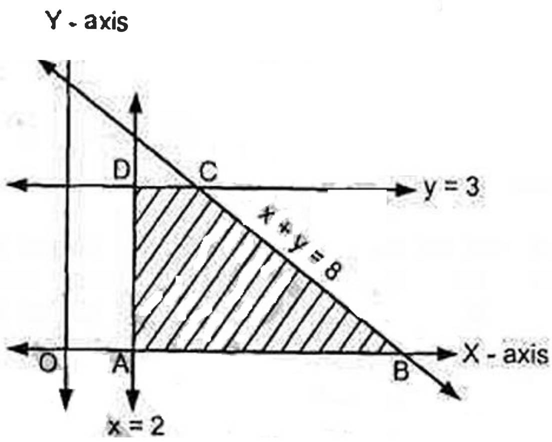
Minimize : $Z = 100x + 70y$

Subject to : $2x \geq 4$

$y \leq 3$

$x + y \leq 8$

$x \geq 0,\ y \geq 0$ (2)



Q. 4 (A) (a) **Attempt any TWO of the following :** [8]

(i) Find the combined equation of a pair of lines passing through the origin and making an angle of 30° with the line $2x - y = 5$. (3)

(ii) Find the equations of the tangents to the circle $x^2 + y^2 + 4x - 2y - 8 = 0$ having slope $\dfrac{-3}{2}$. (3)

(b) **Attempt any ONE of the following :**

(i) The probability that a person stopping at petrol pump will ask for petrol is 0.80, the probability that he will ask for water is 0.70 and the probability that he will ask for both is 0.65.

Find the probability that the person will ask for the following :

(1) Either petrol or water (2) Neither petrol nor water (3)

(ii) Three unbiased coins are tossed. X denotes the number of heads turn up, then write down the probability distribution of X. (3)

(B) Attempt any ONE of the following :

(i) Find the equation of ellipse standard form whose foci are at $(\pm 4, 0)$ & eccentricity is $\dfrac{1}{3}$. (2)

(ii) Find 'k' if the line $y = x + k$ is tangent to the hyperbola $9x^2 - 16y^2 = 144$. (2)

Q. 5 (A) (a) **Attempt any ONE of the following :** **[8]**

(i) Find the equations of the tangents to the parabola $y^2 = 36x$ drawn from the point (2, 9). (3)

(ii) If P is any point on the ellipse $\frac{x^2}{25} + \frac{y^2}{9} = 1$, S and S' are its foci, then find the perimeter of triangle SPS'. (3)

(b) **Attempt any ONE of the following:**

(i) Find the vector equation of the line passing through the point $\bar{i} + 2\bar{j} - \bar{k}$ and perpendicular to vectors $2i + 3j + k$ and $\bar{i} - \bar{j} + 4\bar{k}$. (3)

(ii) A is (–1, 1, 2) and B is (5, –3, 4), find the equation of plane in vector and Cartesian form which passes through mid-point of Seg AB and perpendicular to line AB. (3)

(B) **Attempt any ONE of the following :**

(i) Prove that : $\left[\bar{a}\ \bar{b} + \bar{c}\ \bar{a} + \bar{b} + \bar{c}\right] = 0$ (2)

(ii) If $8\,AB - 3\,\overline{AC} - 5\,AD = \bar{0}$ then prove that the points B, C, D are collinear. (2)