MATHS QUESTION PAPER

Time Duration: 2Hrs

Maximum Marks:40

Note : *(i)* *All questions are compulsory.*

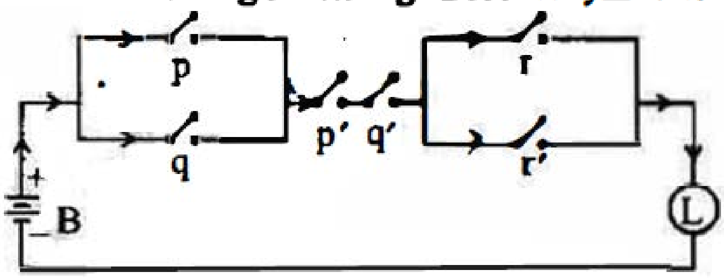
(ii) *Figures to the right indicate full marks.*

(iii) *Graph paper is not necessary for L. P. P.*

(iv) *Answer to every new question must be written on a new page.*

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

(i) Write the following switching circuit in symbolic form of Logic.



(3)

(ii) Prepare the truth table for the following statement pattern

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

(iii) Write down the negations of the following :

(a) If the diagonals of a parallelogram are perpendicular then it is a rhombus.

(b) Kanchanganga is in India and Everest is in Nepal.

(c) The Sun is a star or the Jupiter is a planet. (3)

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

(i) If the lines represented by $x^2 + kxy + 4y^2 = 0$ are coincident, then find the value of k. (2)

(ii) Find the centre and radius of the circle

$(x+2)(x-1)+(y-1)(y+3)=0$ (2)

Q. 2. (A) **Attempt any TWO of the following :** **[8]**

(i) If A, B, C and D are (1, 1, 1), (2, 1, 3), (3, 2, 2) and (3, 3, 4) respectively, then find the volume of the parallelopiped with AB, AC and AD as the concurrent edges. (3)

(ii) If G_1 and G_2 are the centroids of the triangles ABC and PQR respectively, then prove that

$AP + BQ + CR = 3\overline{G_1G_2}$ (3)

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

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

(i) Find k, if the line $x - y + 3 = 0$ touches the parabola $y^2 = 4kx$. (2)

(ii) Find the eccentricity and the length of latus rectum of hyperbola

$\frac{x^2}{25} - \frac{y^2}{9} = 1$ (2)

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

(i) Find the matrix B, such that

$\begin{bmatrix} 4 & 3 \\ 3 & 2 \end{bmatrix} B = \begin{bmatrix} 2 & 5 \\ 1 & 3 \end{bmatrix}$ (3)

(ii) Solve the following equations by Reduction Method

$2x - y + z = 1;\ x + 2y + 3z = 8,\ 3x + y - 4z = 1$ (3)

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

(i) Show that the acute angle θ between the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$ is given by

$$\tan\theta = \left|\frac{2\sqrt{h^2 - ab}}{a+b}\right| \text{ where } a+b \neq 0 \qquad (3)$$

(ii) Find the condition that the line $y = mx + c$ is tangent to the circle $x^2 + y^2 = a^2$. (3)

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

(i) If $\bar{a}, \bar{b}, \bar{c}$ are the position vectors of the points A, B, C respectively and $3\bar{a} + 4\bar{b} - 7\bar{c} = \bar{0}$, find the ratio in which point B divides the segment AC. (2)

(ii) If $\bar{a} = -\hat{i}$, $\bar{b} = -\hat{j}$ and $\bar{c} = 3\hat{k}$, find $(\bar{a} \times \bar{b}) \cdot \bar{c}$. (2)

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

(i) If the slope of one of the lines given by $ax^2 + 2hxy + by^2 = 0$ is 3 times the other, prove that $3h^2 = 4ab$. (3)

(ii) Find the length of tangent segment of the circle $4x^2 + 4y^2 + 16x - 24y + 3 = 0$ from the point $(-1, -1)$. (3)

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

(i) Two dice are thrown simultaneously. Find the probability that the score obtained is a perfect square or a prime number. (3)

(ii) A problem in statistics is given to solve to three students independently. Their chances of solving the problem are $\frac{1}{3}$, $\frac{1}{4}$ and $\frac{1}{5}$ respectively. Find the probability that the problem is solved. (3)

(B) Attempt any ONE of the following :

Find the equations of tangents to the ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ making an angle of 60° with the major axis. (2)

Find the equation of the normal to the hyperbola $x^2 - 4y^2 = 36$ at the point (16, 4). (2)

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

Find the equation of the parabola with vertex at the origin and directrix is the line $x + 3 = 0$. (3)

(ii) If the line $y = mx + \sqrt{a^2m^2 + b^2}$ is a tangent to the ellipse $b^2x^2 + a^2y^2 = a^2b^2$ at P(θ), then prove that $\tan\theta = \frac{-b}{am}$. (3)

(b) Attempt any ONE of the following :

(i) Find vector equation of line passing through the point whose position vector is $3\hat{i} - 4\hat{j} + \hat{k}$ and parallel to the vector $2\hat{i} + \hat{j} - 3\hat{k}$. Also write the equation in Cartesian form. (3)

(ii) Find the vector equation of the plane which bisects the line segment joining the points A(5, 7, 2) and B(−1, −3, 4) at right angle. (3)

(B) Attempt any ONE of the following :

(i) Draw the graph of the following inequalities :
$2x + 3y \leq 6$, $x + y \geq 1$, $x \geq 0$, $y \geq 0$.
Write the vertices of the feasible regio . (2)

(ii) An aeroplane can carry a maximum oad of 200 passengers. Baggage allowed to the first class ticket holder is 30 kg and for the economy class ticket holder is 20 kg. Maximum capacity of the aeroplane to carry the baggage is 4500 kg. The profit on each first class ticket is Rs. 500 and on each economy class ticket is Rs. 300. Formulate the problem. as L.P.P. to maximize the profit. (2)