

H. S. C. MATHEMATICS & STATISTICS - PAPER I

Date 26/3/2010

(Arts & Science)

Time : 2 Hrs.)

Question Paper : March 2010

(Max. Marks : 40)

Note : Please See to Question Paper March 2008

Q. I . (A) Attempt any TWO of the following.

(8)

(i) Which of the following sentences are statements?

(a) A cyclic trapezium has its non-parallel sides congruent.

(b) Do you like Mathematics?

(c) The sun rises in the east.

(ii) Determine whether the following statement pattern is a 'tautology' or a 'contradiction' or 'neither' of the two.

$$(\sim p \vee q) \rightarrow p \vee (q \vee \sim q)$$

(iii) Using the truth table, show that

$$\sim (p \leftrightarrow q) \equiv (p \vee \sim q) \vee (q \vee \sim p)$$

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(B) Attempt any ONE of the following.

(4)

- (i) Find the values of K if the lines represented by $K(x^2 + y^2) = 8xy$ are co-incident.
(ii) Find the lengths of intercepts made by the circle $x^2 + y^2 + 2x - 2y - 3 = 0$ on the co-ordinate axes.

Q. 2. (A) Attempt any TWO of the following.

(4)

- (i) Find 'P' if the vectors $\vec{i} + \vec{j} - 3\vec{k}$, $2\vec{i} + \vec{j} - 4\vec{k}$ and $\vec{i} - \vec{j} + \vec{k}$ are co-planar.
(ii) Using Vector method, show that the medians of a triangle are concurrent."
(iii) If \vec{a} , \vec{b} , \vec{c} are three non-zero, non-coplanar vectors, then prove that any vector \vec{r} in the space can be uniquely expressed as a linear combination $x\vec{a} + y\vec{b} + z\vec{c}$, where x, y and z are scalars.

(B) Attempt any ONE of the following.

(4)

- (i) If D is mid-point of seg AB and E is the mid-point of seg CD, then show that $\vec{AC} + \vec{BD} = 2\vec{DE}$.
(ii) Find the volume of the parallelopiped formed by the vectors.
 $\vec{a} = \vec{i} + 2\vec{j} + 3\vec{k}$, $\vec{b} = 2\vec{i} + \vec{j} + 4\vec{k}$ and $\vec{c} = 3\vec{i} + 4\vec{j} + \vec{k}$.

Q. 3. (A) Attempt any ONE of the following.

(3)

- (i) If $A = \begin{bmatrix} 4 & 3 & 3 \\ -1 & 0 & -1 \\ -4 & -4 & -3 \end{bmatrix}$, then find A^{-1} by Adjoint method.

(ii) Solve the following equations by Reduction method.

$$x - y + z = 2; 2x + y - z = 7; x + 2y + z = 8$$

(b) Attempt any ONE of the following.

(3)

- (i) If ' θ ' is the measure of acute angle between the lines represented by $ax^2 + 2hxy + by^2 = 0$, then show that

$$\tan \theta = \frac{2\sqrt{h^2 - ab}}{a + b}$$

- (ii) Find equation of a tangent to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$ at the point P (x_1, y_1).

(B) Attempt any ONE of the following.

(2)

(i) A dealer wishes to purchase a number of fans and sewing machines. He has only Rs. 5,760 to invest and has space for 20 items only. A fan costs Rs. 360 and a sewing machine costs Rs. 240. His expectation is that he can sell a fan at a profit of Rs. 22 and a sewing machine at a profit of Rs. 18. Assuming that he can sell all items that he can buy, formulate this problem as a L. P. P. to maximize his profit.

(ii) Two food products A and B are to be purchased. Their contents and price per unit are given in the following table.

Product	A	B
Calories	2	3
Vitamins	2	1
Price	3	4

Minimum requirements of calories and vitamins are 36 and 14 units respectively. Formulate this problem as a L.P.P. to minimize the cost.

Q. 4. (A) Attempt any ONE of the following.

(3)

- (i) Find the values of p and q if the equation.
 $12x^2 + 7xy - py^2 + 18x + qy + 6 = 0$ represents a pair of perpendicular lines.

(ii) Find the equation of the circle passing through the points (1, -4) (5, 2) and whose centre lies on the line $x - 2y + 9 = 0$.

(b) Attempt any ONE of the following.

(3)

- (i) If A and B are two events of a sample space S such that

$$P(A) = \frac{5}{8}, P(B) = \frac{3}{4} \text{ and } P(A \cap B) = \frac{1}{2}, \text{ then find}$$

(a) $P(A \cap B)$, (b) $P(A/B)$, (c) $P(A \cup B)$.

- (ii) If a coin is tossed three times and X = number of heads, then find E (X) and V (X).

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(B) Attempt any ONE of the following.

(2)

(i) Find the equation of a parabola whose vertex is at the origin, having X axis as the axis and passing through the point (3, 6).

(ii) Find the coordinates of the foci and length of latus rectum of the ellipse $3x^2 + 4y^2 = 12$.

Q. 5. (A) (a) Attempt any ONE of the following.

(3)

(i) Find the equation of the tangents to the hyperbola $16x^2 - 25y^2 = 400$ passing through the point (1, -4).

(ii) Find the equation of common tangents to the parabolas $y^2 = 4x$ and $x^2 = 4y$.

(b) Attempt any ONE of the following.

(3)

(i) Find the equation of a line in the Cartesian form passing through the point (3, 2, -1) and perpendicular to the vectors $3\vec{i} - 4\vec{j} + 5\vec{k}$ and $\vec{i} - \vec{j} + \vec{k}$.

(ii) Find the Cartesian equation of the plane passing through the points (1, 1, 1), (2, 4, 3) and (5, 9, 7) using Vector method.

(B) Attempt any ONE of the following.

(2)

(i) Find the equation of a normal to the ellipse $2x^2 + 3y^2 = 30$ at the point (-3, 2).

(ii) If the line $y = mx + \sqrt{a^2m^2 - b^2}$ touches the hyperbola $b^2x^2 - a^2y^2 = a^2b^2$ at the point P

(a sec θ , b tan θ), then show that $\sin \theta = \frac{b}{am}$.

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