

(i) Printed Pages: 3

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(ii) Questions : 8

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B.A./B.Sc. (General) 1<sup>st</sup> Semester

1128

MATHEMATICS

Paper-I : Plane Geometry

Time Allowed : Three Hours] [Maximum Marks : 30

Note :— Attempt five questions in all by selecting at least two questions from each section.

SECTION—A

- I. (i) Transform the equation  $3x^2 + 2xy + 3y^2 + 18x + 22y + 50 = 0$  to the form  $Ax^2 + By^2 = C$  by the suitable transformation of axes. 3
- (ii) Show that if  $ax^2 + 2hxy + by^2 = 1$  and  $a'x^2 + 2h'xy + b'y^2 = 1$  represent the same conic and axes are rectangular, then  $(a - b)^2 + 4h^2 = (a' - b')^2 + 4h'^2$ . 3
- II. (i) Prove that the straight lines joining the origin to the points of intersection of straight lines  $2x - 3y + 4 = 0$  with the curve  $x^2 + 4xy + 2y^2 + 12x + 4y = 0$  are at right angles. 3
- (ii) Find the equation of straight lines bisecting the angle between straight lines  $ax^2 + 2hxy + by^2 = 0$ . 3

III. (i) Prove that the two circles :

$$x^2 + y^2 + 2ax + c = 0, x^2 + y^2 + 2by + c = 0 \text{ where } a^2, b^2 > c \text{ touches if } \frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{c}. \quad 3$$

(ii) Find the equation of the circle through the points of intersection of the circles  $x^2 + y^2 + 6x + 4y - 12 = 0$  and  $x^2 + y^2 - 4x - 6y - 12 = 0$  and cutting the circle  $x^2 + y^2 - 2x + 3 = 0$  orthogonally. 3

IV. (i) Find the radical axis and limiting points of co-axial system determined by circles  $x^2 + y^2 - 6x - 6y + 4 = 0$  and  $x^2 + y^2 - 2x - 4y + 3 = 0$ . 3

(ii) Find the locus of mid-points of the chords of the circle  $x^2 + y^2 = 16$  which touches the circle  $(x - 4)^2 + (y - 3)^2 = 36$ . 3

#### SECTION—B

V. (i) Prove that the locus of middle points of the normal chords of the parabola  $y^2 = 4ax$  is  $\frac{y^2}{2a} + \frac{4a^3}{y^2} = x - 2a$ . 3

(ii) Prove that the locus of the middle points of parallel chords of parabola is a straight line parallel to axis. 3

VI. (i) Show that the equation of director circle of ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$  is  $x^2 + y^2 = a^2 + b^2$ . 3

(ii) Find the length of the semi-diameter conjugate to the diameter  $y = 3x$  of the ellipse  $9x^2 + 4y^2 = 36$ . 3

VII. (i) Show that the locus of the poles of the normal chords of the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$  is the curve  $\frac{a^6}{x^2} - \frac{b^2}{y^2} = (a^2 + b^2)^2$ . 3

(ii) Find the joint equation of asymptotes to the hyperbola  $3x^2 - 5xy - 2y^2 + 5x + 11y - 8 = 0$ . Also find the equation of conjugate hyperbola. 3

VIII. (i) Show that the tangents at the extremities of a focal chord of a parabola intersect each other perpendicular on the directrix. 3

(ii) Identify the curve  $x^2 - 4xy + 4y^2 - 32x + 4y + 16 = 0$  and find its vertex and focus. 3