Total No. of Questions : 8] [Total No. of Printed Pages : 4

(1126)

B.A./B.Sc. (General) Ist Semester (0001) Examination

0043

MATHEMATICS

Paper : I

(Plane Geometry)

Time : 3 Hours] [Maximum Marks : 30

Note :– Attempt *five* questions in all, selecting at least *two* questions from each Section.

Section–A

1. (a) Transform $5x^2 - 2xy + 5y^2 + 2x - 10y - 7 = 0$ to rectangular axes through (0, 1) inclined at an angle $\frac{\pi}{4}$ to the original axes.

(b) Show that $x^2 + (\alpha \sqrt{3}\, y - 3)\, x + (3y^2 - 3\sqrt{3}\, y$, $-4) = 0$ respresents a pair of straight lines. Also find distance between mean. 3,3

A-18

Turn Over

2. (a) Prove that the joint equation of straight lines bisecting the angles between lines :

$$ax^2 + 24xy + by^2 = 0 \text{ is } \frac{x^2 - y^2}{a - b} = \frac{xy}{h}$$

(b) Find equation of pair of lines joining the origin to the points of intersection of line $y = mx + c$ with the curve $x^2 + y^2 = a^2$. Prove that they are perpendicular if $2c^2 = a^2(1 + m^2)$. 3

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

(b) Find the equation of the circle which passes through the origin and cuts orthogonally each of the circles $x^2 + y^2 - 8x + 12 = 0$ and $x^2 + y^2 - 4x - 6y - 3 = 0$. 3

4. (a) The point (2, 1) is a limiting point of a coaxial system of circle of which $x^2 + y^2 - 4y - 3 = 0$ is 9 member. Find the equation of the radical axis and the co-ordinates of the other limiting point.

(b) Find the equation of circle which passes through the point (2, 0) and touches the straight line $x + 2y - 1 = 0$ at the point (3, –3). 3,3

Section–B

5. (a) Prove that the locus of the middle points of the normal chords of the parabola $y^2 = 4ax$ is :

$$\frac{y^2}{2a} + \frac{4a^2}{y^2} = x - 2a$$

(b) Prove that in a parabola the chords of contact of tangents at eight angles passes through focus. 3,3

6. (a) Show that the minimum angle between a pair of conjugate diameter of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ is

$$\tan^{-1}\left(\frac{2ab}{a^2 - b^2}\right).$$

(b) Prove that the locus of the mid-points of the chords of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ which touch the circle on the join of the foci of the ellipse as diameter is :

$$\left(\frac{x^2}{a^2} + \frac{y^2}{b^2}\right)^2 = a^2e^2\left(\frac{x^2}{a^4} + \frac{y^2}{b^4}\right)$$ 3,3

7. (a) Prove that the pole of $px + my = 1$ w. r. t. the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ lies on the ellipse $\frac{x^2}{9a^2}+\frac{y^2}{9b^2}=1$ if $a^2p^2 + b^2m^2 = 9$.

(b) If $y = x$ is a diameter of the ellipse $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and eccentricity of the ellipse is $\frac{1}{\sqrt{3}}$, find the equation of the diameter conjugate to it.

8. (a) Show that the locus of the mid-points of the chords of the hyperbola $\frac{x^2}{16}-\frac{y^2}{9}=1$ whose pole lie on the line $x + y - 1 = 0$ is the hyperbola:

$$\frac{x^2}{16}-\frac{y^2}{9}=x+y$$

(b) Find the asymptotes of the hyperbola $xy - x - 2y - 5 = 0$. Also find the equation of the conjugate hyperbola.

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