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B.A./B.Sc. IInd Semester Degree Examination

Mathematics

(Calculus - II)

Paper : 2.2

(New)

Time : 3 Hours

Maximum Marks : 60

Instructions to Candidates : Answer all questions

Section - A

I. Answer any TEN of the following : (10 × 2 = 20)

- 1) Find the angle between the radius vector and the tangent of the curve $r^2 = a^2 \cos 2\theta$.
- 2) Show that the curves intersect orthogonally $r^2 \cos 2\theta = a^2$ and $r^2 \sin 2\theta = b^2$.
- 3) Find the polar sub - normal at any point on $r = a(1 + \cos \theta)$.
- 4) Find $\frac{ds}{dt}$ for the curve $x = a \sec t$ and $y = b \tan t$.
- 5) Find the radius of curvature at any point (p.r) the curve $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2} - \frac{r^2}{a^2 b^2}$.
- 6) Find the envelope of the family of lines $x \cos \alpha + y \sin \alpha = r$ where α is a parameter.
- 7) Define node and cusp.
- 8) Find the asymptotes parallel to the co-ordinates axes for the curve $x^2 y - y = x$.
- 9) If $I_n = \int_0^{\pi/4} \tan^n x dx$. Show that $I_n + I_{n-2} = \frac{1}{n-1}$.
- 10) Find the area bounded by the curve $y = \sin^2 x$ the x -axis and the lines $x = 0$ and $x = \pi/2$.
- 11) Show that the volume of sphere of radius is 'a' is $\frac{4\pi a^3}{3}$.
- 12) Define solid of revolution and surface of revolution.

Section - B

II Answer any **two** of the following.

(2 × 5 = 10)

- 1) Show that for the curve $r^2 = a^2 \sec 2\theta$ the length of the perpendicular from the pole to the tangent is $a\sqrt{\cos 2\theta}$.
- 2) Find the pedal equation for the curve $r = a + b \cos \theta$.
- 3) Find the pedal equation for the Cartesian curves $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$.

Section - C

III Answer any **four** of the following.

(4 × 5 = 20)

- 1) Find $\frac{ds}{dr}$ for the curve $r = a(1 - \cos \theta)$.
- 2) With usual notations prove that $\rho = \frac{(1 + y_1^2)^{3/2}}{y_2}$.
- 3) Find the radius of curvature at any point of the curve $r^n = a^n \cos n\theta$.
- 4) Find the co-ordinate of centre of curvature of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$. Also find its evolute.
- 5) Find all the asymptotes of the curve $y^2 = 4ax$.
- 6) Trace the curve $y = a \cosh \left[\frac{x}{a} \right] (a > 0)$.

Section - D

IV Answer any **two** of the following.

(2 × 5 = 10)

- 1) Obtain the reduction formulae for $\int \sin^n x dx$ and hence. Evaluate $\int_0^{\pi/2} \sin^4 x dx$.
- 2) Find the perimeter of curve $r = a(1 - \cos \theta)$.
- 3) Find the area common to the parabola $x^2 = 4ay$ and $y^2 = 4ax$.

