

Roll No. \_\_\_\_\_

[Total No. of Pages : 3

**SIIS-N 71 A-16**  
**B.A./B.Sc. IInd Semester Degree Examination**  
**Mathematics**  
**(Calculus - II)**  
**Paper : BSM 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  $r = a(1 - \cos \theta)$
2. Find the angle between the curves at their point of intersection  $r = a$ ,  $r = 2a \cos \theta$
3. Show that for the curve  $r = a\theta$ , the polar subtangent varies as the square of the radius vector.
4. Write the formula for the derivatives of an arc in Cartesian form.
5. Define curvature and radius of curvature.
6. Find the radius of curvature of the curve  $y = 4 \sin x - \sin 2x$  at  $x = \pi/2$
7. Find the envelope of the family of lines  $y = mx + \frac{9}{m}$ , where 'm' is a parameter
8. Show that the curve  $y = e^x$  is concave upwards everywhere
9. Evaluate  $\int_0^{\pi/2} \sin^6 x \, dx$

10. Write the expression for the length of an arc of the curve  $\theta = f(r)$  between the points  $r = r_1$  and  $r = r_2$ .
11. Find the area bounded by the parabola  $y = 2x - x^2$  and the x - axis.
12. Define solid of revolution and surface of revolution.

**Section - B**

**II. Answer any Two of the following :** **(2×5=10)**

- Find the angle between the curves at their point of intersection  $r = a \log \theta$ ,  $r = \frac{a}{\log \theta}$
- If  $r = f(\theta)$  is a polar curve then at any point of the polar sub-tangent is  $r^2 \frac{d\theta}{dr}$  and polar subnormal is  $\frac{dr}{d\theta}$
- Find the pedal equation of the curve astroid  $x^{2/3} + y^{2/3} = a^{2/3}$

**Section - C**

**III. Answer any Four of the following :** **(4×5=20)**

- Find  $\frac{ds}{d\theta}$  and  $\frac{ds}{dr}$  for the curve  $r^n = a^n \cos n\theta$
- With usual notations prove that  $\rho = \frac{(1+y_1^2)^{3/2}}{y_2}$
- Find the co-ordinates of centre of curvature of the ellipse  $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , Also find its evolute
- Find the envelope of the family of lines  $y = mx + \frac{9}{m}$ , where 'm' is a parameter.

5. Find all the asymptotes of  $x^3 + y^3 - 3axy = 0$ .
6. Find the position and nature of the double points of curve  $x^3 + x^2 + y^2 - x - 4y + 3 = 0$

**Section - D**

**IV. Answer any Two of the following :**

**(2×5=10)**

1. Evaluate completely  $\int \tan^n x \, dx$  for all positive integral values of 'n'
  2. Find the perimeter of the cardioid  $r = a(1 + \cos \theta)$
  3. Show that the volume of sphere of radius 'a' is  $\frac{4\pi a^3}{3}$
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