

11122

**B.A. Mathematics(1<sup>st</sup> Semester)**  
**Regular/Re-appear/Improvement**  
**Examination, 2021**

# **CALCULUS**

**Paper Code : 12BAM112**

**Time : 2 hours**

**Max. Marks : 27**

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard will be entertained after examination.

**Note :** Attempt four questions in all. Question no. 9 is compulsory. All questions carry equal marks.

1. (a) Show that the function :

$$f(x) = \begin{cases} \frac{e^{\frac{1}{x}} - e^{-\frac{1}{x}}}{e^{\frac{1}{x}} + e^{-\frac{1}{x}}}, & x \neq 0 \\ 0 & x = 0 \end{cases}$$

Is discontinuous at  $x = 0$

- (b) Show that the function  $f(x) = |x|$  is continuous at  $x = 0$  but not derivable at  $x = 0$ .

2. (a) If  $y = \sin(m \sin^{-1} x)$ , show that  
 $(1 - x^2)y_{n+2} = (2n + 1)xy_{n+1} + (n^2 - m^2)y_n$ .  
 Find  $y_n(0)$ .

- (b) Assuming the possibility of expansion, expand  $f(x) = \tan^{-1} x$  as far as term containing  $x^5$ .

3. (a) Find the asymptotes of the curve  
 $x^3 + 3x^2y - 4y^3 - x + y + 3 = 0$ .

- (b) If CP and CD be a pair of conjugate semi-diameters of the ellipse

$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ , prove that the radius of curvature at any point P is  $\frac{(CD)^2}{ab}$ .

4. (a) Determine the concavity and points of inflexion of the curve  
 $y = x^4 - 4x^3 - 18x^2 + 1$ .

- (b) Determine the position and nature of the double points on the curve  $x^3 - y^2 - 7x^2 + 4y + 15x - 13 = 0$ .

5. (a) Trace the curve  $y(a^2 + x^2) = a^2x$ .  
 (b) Obtain the Reduction formula for  
 $\int (a^2 + x^2)^{\frac{n}{2}} dx, n$  being a positive integer.
6. (a) Find the entire length of the cardioid  
 $r = a(1 + \cos \theta)$ .  
 (b) Find the intrinsic equation of the parabola  
 $x^2 = 4ay$  taking the origin as the fixed  
 point. <https://www.iguonline.com>
7. (a) Find the area enclosed by the curve  
 $a^2x^2 = y^3(2a - y)$ .  
 (b) Find the area common to the circles  
 $x^2 + y^2 = 4$  and  $x^2 + y^2 = 4x$ .  $\text{Ans} \rightarrow 1\pi, 2$
8. (a) Find the volume of the solid generated by  
 rotating the ellipse  $4x^2 + y^2 = 4$  about the  
 x-axis.  
 (b) Find the surface area of a sphere of radius  
 a.

**(Compulsory Question)**

9. Attempt all parts

- (a) Show that  $\lim_{x \rightarrow 0} \frac{\sin ax}{\sin bx} = \frac{a}{b} (b \neq 0)$ .

- (b) If  $y = e^{ax} \sin bx$ , prove that  $y_1 - 2ay_1 + (a^2 + b^2)y = 0$ .  
 (c) State Taylor's series in powers of  $(x-a)$  and  
 obtain the Maclaurin's Series.  
 (d) Define the Curvature, radius of curvature,  
 cusps, nodes and conjugate points.  
 (e) Find the asymptotes of the following curve  
 parallel to the axes:  
 $x^2y^2 - x^2y - xy^2 + x + y + 1 = 0$ .  
 (f) State theorems of Pappus and Guldinus.

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