

Roll.No.

20UMACT1002

SHRIMATHI DEVKUNVAR NANALAL BHATT VAISHNAV COLLEGE FOR WOMEN  
(AUTONOMOUS)

(Affiliated to the University of Madras and Re-accredited with 'A+' Grade by NAAC)  
Chromepet, Chennai - 600 044.

B.Sc Mathematics- END SEMESTER EXAMINATIONS - NOVEMBER 2025  
SEMESTER - I

**20UMACT1002 - Differential Calculus**

Total Duration : 2 Hrs.30 Mins.

Total Marks : 60

### Section B

Answer any **SIX** questions ( $6 \times 5 = 30$  Marks)

1. If  $xy = ae^x + be^{-x}$ , show that  $x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - xy = 0$ .
2. Prove that the radius of the curvature at any point of the cycloid  $x = a(\theta + \sin \theta)$  and  $y = a(1 - \cos \theta)$  is  $4a \cos \frac{\theta}{2}$ .
3. Compute the maximum or minimum values of  $2(x^2 - y^2) - x^4 + y^4$ .
4. Find the asymptotes of  $x^3 + y^3 = 3axy$ .
5. Apply Leibnitz formula, find the  $n^{\text{th}}$  differential coefficient of  $x^2 \log x$ .
6. Compute the radius of curvature of the curve  $x^4 + y^4 = 2$  at the point (1,1).
7. Find the radius of the curvature of the cardioid  $r = a(1 - \cos \theta)$ .
8. Determine the asymptotes of the cubic  $y^3 - 6xy^2 + 11x^2y - 6x^3 + x + y = 0$ .

### Section C

Answer any **THREE** questions ( $3 \times 10 = 30$  Marks)

9. Determine the  $n^{\text{th}}$  differential coefficient of  $\cos^5 \theta \sin^7 \theta$ .
10. Compute the maxima and minima of the function  $x^3y^2(6 - x - y)$ .
11. Determine  $\rho$  at the point 't' of the curve  $x = a(\cos t + t \sin t)$ ;  $y = a(\sin t - \cos t)$ .
12. Prove that the Evolute of the cycloid  $x = a(\theta - \sin \theta)$  and  $y = a(1 - \cos \theta)$  is another cycloid.
13. Determine the rectilinear asymptotes of  $2x^4 - 5x^2y^2 + 3y^4 + 4x^3 - 6y^3 + x^2 + y^2 - 2xy + 1 = 0$ .

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