

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 - APRIL 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. Find y_n when $y = \frac{1}{x^2 + a^2}$.
2. Prove that if $y = \sin(m \sin^{-1} x)$, then $(1 - x^2) y_2 - xy_1 + m^2 y = 0$.
3. Find the maxima and minima of the function $2(x^2 - y^2) - x^4 + y^4$.
4. Find the minimum value of $x^2 + y^2 + z^2$ when $x + y + z = 3a$.
5. Determine the radius of curvature of the curve $x^4 + y^4 = 2$ at the point (1,1).
6. Find the radius of curvature of the cardioid $r = a(1 - \cos \theta)$.
7. Determine the radius of curvature of the curve $r^2 = a^2 \sin 2\theta$ by using $p - r$ equation.
8. Obtain the asymptote of $x^3 + y^3 = 3axy$.

Section C

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

9. If $y = a \cos(\log x) + b \sin(\log x)$,
then show that $x^2 y_{n+2} + (2n + 1)xy_{n+1} - (n^2 + a^2)y_n = 0$.
10. If $u = a^3 x^2 + b^3 y^2 + c^3 z^2$ where $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$, then find the minimum value of u by using Lagrange multipliers.
11. Prove that the radius of curvature at any point of the cycloid
 $x = a(\theta + \sin \theta)$ and $y = a(1 - \cos \theta)$ is $4a \cos \frac{\theta}{2}$.
12. Find the evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
13. Find the asymptotes of the curve $y^3 - 6xy^2 + 11x^2 y - 6x^3 + x + y = 0$.
