Roll.No. | 25UMACT1002

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
**25UMACT1002 - Differential Calculus**

Total Duration : 2 Hrs.30 Mins. Total Marks : 60

## Section B

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

1. If $xy = ae^x + be^{-x}$, Prove that $x\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - xy = 0$.
2. If $y = \sin(m \sin^{-1} x)$ Prove that $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} + (m^2 - n^2)y_n = 0$.
3. Given that $x + y = u, y = uv$, change the variables to $u, v$ in the integral $\int\int (xy(1-x-y))^{1/2} dxdy$ taken over the area of the triangle with sides $x = 0; y = 0; x + y = 1$ and evaluate it.
4. What is the radius of curvature of the curve $x^4 + y^4 = 2$ at the point (1,1)?
5. Find the radius of the curvature of the cardioids $r = a(1 - \cos\theta)$.
6. From the polar equation of the parabola, show that $\rho^2 = ar$.
7. Find the asymptotes of the cubic $y^3 - 6xy^2 + 11x^2y - 6x^3 + x + y = 0$.
8. Find the equation of a cubic which has the same asymptotes as the cubic $x^3 - 6x^2y + 11xy^2 - 6y^3 + x + y + 1 = 0$. and which touches the axis of y at the origin and goes through the point (3,2).

## Section C

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

9. Find the $n^{th}$ differential coefficient of $\cos^5\theta \sin^7\theta$.
10. If $u = a^3x^2 + b^3y^2 + c^3z^2$ where $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 1$, find the minimum value of u using Lagrange's method of undetermined multipliers.
11. Find the envelope of the circles drawn on the radius vectors of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ as diameter.
12. Find the evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
13. Find 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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