Reg. No………………………………….. Name…………………………………… **25U328-MS**

## B. Sc. DEGREE END SEMESTER EXAMINATION - OCTOBER 2025

### SEMESTER – 3: MATHEMATICS

**(CORE COURSE FOR B. Sc. MATHEMATICS AND B. Sc. COMPUTER APPLICATIONS)**

COURSE: **15U3CRMAT3-15U3CRCMT3: CALCULUS**

*(For Supplementary (Mercy Chance) 2018/2017/2016/2015 Admissions)*

Time: Three Hours Max Marks: 75

### PART A

***Answer all questions. Each question carries 1 mark***

1. Expand log (a + x) by Taylor's theorem
2. Find the nth derivative of sin (ax+b)
3. Define envelope of a one parameter of family of curves.
4. Find the critical points of f(x,y)=xy
5. Define critical point of a function f(x, y).
6. Evaluate $\int_0^3 \int_0^2 (4 - y^2)$ dy dx
7. Write surface area formula for revolution about y axis.
8. Find the area of the region enclosed by x = $2y^2$, x = 0 and y = 3.
9. Find the area of the region *R* bounded by y = x and y = $x^2$ in the first quadrant using double integrals.
10. Find a spherical coordinate equation for the cone z = √($x^2$ + $y^2$).

(1 x 10 = 10)

### PART B

***Answer any eight questions. Each question carries 2 mark***

11. Find the radius of curvature of the cycloid x = a ( t + sint) , y = a (1 - cost).
12. Find the envelope of $\frac{x}{\alpha} + \frac{y}{a-\alpha} = 1,$ where a is a constant
13. Find all second order partial differential equation of the function f(x, y) = x + y + xy.
14. Draw a tree diagram for the chain rule for functions of 3 variables
15. Find the area enclosed by the lemniscate $r^2$ = 4cos2θ.
16. Find the length of the curve y = $x^{3/2}$ from x = 0 to x = 4.
17. Find the area of surface of the region generated by revolving the curve x = $y^3/3$ , 0 ≤ y ≤ 1 about x axis.
18. Verify that $w_{xy} = w_{yx}$ for $w$ = ln (2$x$ + 3$y$).
19. Find a spherical co-ordinate equation for the cone z = $\sqrt{x^2 + y^2}$
20. Reverse the order of integration, and evaluate the integral $\int_0^\pi \int_x^\pi \frac{\sin y}{y} dydx$.

(2 x 8 = 16)

## PART C

Answer any five questions. Each question carries 5 mark

21. Prove that $\tan^{-1} x = x - \frac{x^3}{3} + \frac{x^5}{5} - \cdots$
22. Find the points of inflexion on the curve $y = (\log x)^3$.
23. Find the absolute maximum and minimum values of $f(x, y) = 2 + 2x + 2y - x^2 - y^2$ on the triangular region in the first quadrant bounded by the lines x = 0, y = 0, y = 9 – x.
24. Find the area between the curves $x + y^2 = 0$ and $x + 3y^2 = 2$
25. Find the volume of the solid generated by the region bounded by the curve $y = x^2 + 1$ and the line y = -x +3 is revolved about the x axis.
26. Find the area of the surface generated by revolving the curve $y = 2\sqrt{x}$, $1 \le x \le 2$ about the x axis.
27. If $w = \tan^{-1}\frac{x}{y}$, x=ucosv , y=usinv find $\frac{\partial w}{\partial u}$ and $\frac{\partial w}{\partial v}$

(5 x 5 = 25)

## PART D

Answer any two questions. Each question carries 12 mark.

28. Find the $n^{th}$ derivative of $y = \cos(m \sin^{-1}x)$ for x = 0.
29. Find the centroid ($\delta = 1$) of the solid enclosed by the cylinder $x^2 + y^2 = 4$ bounded above by the paraboloid $z = x^2 + y^2$ and bounded below by the *xy*-plane.
30. Find the absolute maximum and minimum values of $f(x,y)= 2x^2-4x+y^2-4y+1$ on the closed region in the first quadrant bounded by x=0,y=2,y=2x
31. a) The region bounded by the curve $y = x^2$, the line y = 2 – x and the y- axis for $x \ge 0$ is revolved about the y-axis to generate a solid. Find the volume of the solid using shell method

    b) Find the length of the curve $y = \frac{1}{3}(x^2 + 3)^{3/2}$ from x=0 to x=3

(12 x 2 = 24)

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