



QP CODE: 24027207



24027207

Reg No :

Name :

**B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE
EXAMINATIONS, OCTOBER 2024
Third Semester**

Core Course - MM3CRT01 - CALCULUS

Common to B.Sc Computer Applications Model III Triple Main, B.Sc Mathematics Model I, B.Sc
Mathematics Model II Computer Science

2017 Admission Onwards

467CD5C0

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

*Each question carries **2** marks.*

1. Using Taylor's series , expand $f(x) = \frac{1}{x-1}$ in powers of $(x-2)$.
2. Find the points of inflection of the curve $y = 3x^4 - 4x^3 + 1$.
3. Find the centre of curvature of the given point on the curve $y = x^2$; $(1/2, 1/4)$.
4. Define envelope of one parameter family of curves.
5. If $f(x, y) = x - y$, find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$
6. Find $\frac{dw}{dt}$ if $w = xy$, $x = \cos t$, $y = \sin t$.
7. Explain the absolute minimum of a continuous function at a point (a, b) defined on a bounded region R.
8. Find the volume of the solid of cross sectional area $A(x) = 2x + 1$ from $x = 1$ to $x = 2$.
9. Obtain the volume of solid of revolution generated by rotating the region between the Y-axis and graph of the function $x = g(y)$; $c \leq y \leq d$ about Y-axis.
10. If $R(y)$ and $r(y)$ denote the outer and inner radius of cross section of a solid of revolution about Y-axis, with hole at y ; $c \leq x \leq d$. Find the volume of solid.





11. Write an equivalent double integral of $\int_0^1 \int_2^{4-2x} dy dx$ with the order of integration reversed.
12. Write the formula for finding average value of a function $f(x, y)$ over a region R in XY-plane..

(10×2=20)

Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Obtain the expansion of $\log \cosh x$ in powers of x by Maclaurin,s series.
14. Find the asymptotes parallel to the co-ordinates axes of the curve $(x^2 + y^2)x - ay^2 = 0$.
15. Verify that $w_{xy} = w_{yx}$ where $w = x^2 \tan(xy)$.
16. Find all local extreme values and saddle point, if any, of the function $f(x, y) = x^3 - y^3 - 2xy + 6$.
17. Find the volume of the solid generated by revolving the region bounded by the curves and lines $y = x^2$, $y = 2 - x$, $x = 0$ for $x \geq 0$ about the Y-axis using shell method.
18. Find the length of the curve $y = \int_0^x \tan t dt$, $0 \leq x \leq \pi/6$
19. Find the average value $f(x, y, z) = x + y + z$ over the cubical region D bounded by the coordinate planes $x = 2$, $y = 2$ and $z = 2$ in the first octant.
20. Evaluate the spherical integral $\int_0^\pi \int_0^{\pi/4} \int_0^2 (\rho \cos \phi) \rho^2 \sin \phi d\rho d\phi d\theta$.
21. Find the image under the transformation $u = 3x + 2y$, $v = x + 4y$ of the triangular region in the XY-plane bounded by the X-axis, Y-axis and the line $x + y = 1$. Sketch the transformed region in the UV-plane.

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **15** marks.

22. a) Find the evolute of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.
- b) Find the envelope of the line $\frac{x}{a} + \frac{y}{b} = 1$ where the parameters a and b are connected by the relation $a^2 + b^2 = c^2$.





23. (a). If $\sin u = \frac{x+y}{\sqrt{x} + \sqrt{y}}$, prove that $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} = \frac{1}{2} \tan u$.
- (b). Find the maximum and minimum values that the function $f(x, y) = 3x + 4y$ takes on the circle $x^2 + y^2 = 1$
24. (a). Using the shell method to find the volumes of the solids generated by revolving the regions bounded by the lines and curves
 $y = x + 2$; $y = x^2$ about (i) the X-axis (ii) the line $x = 2$.
- (b). Find the area of the surface generated by revolving the curve
 $y = 2\sqrt{x}$; $1 \leq x \leq 2$ about the X-axis.
25. (a). Evaluate $\int_0^1 \int_0^{1-x^2} \int_3^{(4-x^2-y)} x \, dz \, dy \, dx$
- (b). Evaluate the cylindrical coordinate integral $\int_0^{2\pi} \int_0^1 \int_r^{\sqrt{2-r^2}} dz \, r \, dr \, d\theta$
- (2×15=30)

