QP CODE: 25022754

25022754

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) IMPROVEMENT / REAPPEARANCE/ MERCY CHANCE EXAMINATIONS, APRIL 2025

Second Semester

Complementary Course - MM2CMT01 - MATHEMATICS - INTEGRAL CALCULUS AND DIFFERENTIAL EQUATIONS

(Common for B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry,B.Sc Chemistry Model III Petrochemicals, B.Sc Electronics and Computer Maintenance Model III, B.Sc Food Science & Quality Control Model III, B.Sc Geology Model I, B.Sc Geology and Water Management Model III, B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance)

2017 Admission Onwards

38BF41A5

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. The solid lies between planes perpendicular to the x-axis at x - -1 and x = 1. Find a formula for the area A(x) of the cross-sections, if
   (a) The cross-sections, perpendicular to x-axis, between these planes, are circular disk with diameters run from the semicircle $y = -\sqrt{1-x^2}$ to the semicircle $y = \sqrt{1-x^2}$.
   (b) (a) The cross-sections, perpendicular to x-axis, between these planes, are squares with side run from the semicircle $y = -\sqrt{1-x^2}$ to the semicircle $y = \sqrt{1-x^2}$.

2. Find the volume of the solid generated by revolving the region bounded by y = x, y = 1, x = 0 about the x-axis.

3. Find the length of the curve y = log(sec x) between the points given by x = 0 and x = $\frac{\pi}{3}$.

4. Evaluate $I = \int_0^3 \int_0^2 xy\, dxdy$.

5. Change the order of integration of the double integral $\int_0^4 \int_{\sqrt{y}}^2 e^{x^3}\, dxdy$.

6. Use a double integral to find the volume of the solid that is bounded above by the plane $z = 4 - x - y$ and below by the rectangle $R = [0,1] \times [0,2]$.

7. Solve $x^3\,dx + (y+1)^2\,dy = 0$.

8. Write the standard form of first order linear differential equation.

9. Solve $\frac{dy}{dx} + y = \frac{x}{y}$

10. Write the general form of the integral curves of the set of equations $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$.

11. Solve the partial diffrential equation $\frac{\partial^2 u}{\partial x^2} - 4 = 0$

12. Form the partial differential equation by eliminating the constants a and b from $z = ax + by + ab$

(10×2=20)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Find the volume of the solid generated by revolving the region between the y-axis and the curve x = tan($\frac{\pi y}{4}$), 0 ≤ y ≤ 1, about the y-axis.

14. Find teh surface area of the cone frustum generated by revolving the line segement y = $\frac{x}{2} + \frac{1}{2}, 1 \le x \le 3$, about the x-axis.

15. Find the average value of $f(x, y) = \sin(x + y)$ over the rectangle $0 \le x \le \pi,\ 0 \le y \le \pi$.

16. Find the volume of the ellipsoid $\frac{x^2}{a^2} + \frac{y^2}{b^2} + \frac{z^2}{c^2} = 1$.

17. Find values of A and B so that the function $y(x) = Ae^x + Bxe^x + x^2e^x$ satisfy the initial conditions $y(1) = 1, y'(1) = -1$.

18. Solve $\frac{dx}{dt} = x^2 - 2x + 2$.

19. Solve $(x^2 - 4xy - 2y^2)dx + (y^2 - 4xy - 2x^2)dy = 0$.

20. Show that the direction cosines of the tangent at the point $ax^2 + by^2 + cz^2 = 1$, $x + y + z = 1$are propotional to $(by - cz, cz - ax, ax - by)$.

21. Find the solution of the differetial equation $(y - u)u_x + (u - x)u_y = x - y$ with the data $u = 0$ on $xy = 1$

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **15** marks.*

22. (a) The region bounded by the curve $y = \sqrt{4x - x^2}$, the x-axis and the line x = 2 is revolved about x-axis to generate a solid. Find the volume of the solid.

(b) Find the volume of the solid generated by revolving the region bounded by the curve $y = \sqrt{x}$, the x-axis and the line x = 4 about (i) x-axis (ii) y-axis.

23. (a) Find the area of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, using double integration.

(b) Using double integration, find the area of the region encloesd by the parabola $y = x^2$ and the line $y = x + 2$.

24. a) Solve $(x^2 + y^2 + x)dx + xydy = 0$.

b) Solve $(2xy^4e^y + 2xy^3 + y)dx + (x^2y^4e^y - x^2y^2 - 3x)dy = 0$.

25. Find the integral curves of the equations

1. $\frac{dx}{x(y^2 - z^2)} = \frac{dy}{y(z^2 - x^2)} = \frac{dz}{z(x^2 - y^2)}$.
2. $\frac{dx}{y + zx} = \frac{dy}{-(x + yz)} = \frac{dz}{x^2 - y^2}$.

(2×15=30)