23124521

QP CODE: 23124521

Reg No : ....

Name : ....

B.Sc DEGREE (CBCS) REGULAR / IMPROVEMENT / REAPPEARANCE EXAMINATIONS, MAY 2023

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

2FCE0D04

Time: 3 Hours

Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. The solid lies between the planes perpendicular to the y-axis at y = 0 and y = 2. The cross-sections perpendicular to the y-axis are circular disks with diameters running from the y-axis to the parabola $x = \sqrt{5}y^2$. Find the volume of the solid.
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. Write Shell formula for revolution about a vertical line.
4. Evaluate $\iint_R xy\, dA$ over the region R enclosed between $y = \frac{1}{2}x,\ y = \sqrt{x},\ x = 2$ and $x = 4$.
5. 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 $R = [0, 1] \times [0, 2]$.
6. Define the average value of an integrable function of two variables.

7. Verify that the function $y = Acosx$ is a solution of the differential equation $\frac{dy}{dx} + ytanx = 0$

8. Find an integrating factor for $\frac{dy}{dx} + \frac{4}{x}y = x^4$.

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. Find the integral curves of the equations $\frac{dx}{x} = \frac{dy}{y} = \frac{dz}{z}$.

12. Define the order and degree of partial differential equations with examples

(10×2=20)

Part B

*Answer any **six** questions.*

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

13. Find the length of the astroid $x^{2/3} + y^{2/3} = 1$.

14. Find the area of the surface generated by revolving the curve x = $2\sqrt{4-y}$, 0 $\le y \le \frac{15}{4}$, about the y-axis.

15. Evaluate $I = \int_0^1 \int_1^2 (x^2 + y^2)\, dxdy$.

16. Using the idea of triple integral, find the volume of the solid enclosed by the sphere $x^2 + y^2 + z^2 = a^2$.

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 the initial value problem $2x\frac{dy}{dx} - 3y = 0; y(1) = 4$.

19. Find integrating factor and hence solve the differential equation $y^2dx + (1 + xy)dy = 0$

20. By means of an example, prove that parametric equations of a surface are not unique.

21. Find the solution of the differential equation $u_x - u_y = 1$.

(6×5=30)

Part C

*Answer any **two** questions.*

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

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

(b) Find the volume of the solid generated by revolving the region between the parabola x = y^2 + 1 and the line x = 3 about the line x = 3.

23. Find the area of the region bounded by the given lines and the curves,

(i) The lines $x = 0,\ y = 2x,$ and $y = 4.$

(i) The curves $y = \ln x$ and $y = 2\ln x$ and the line $x = e$, in the first quadrant.

24. a) Solve $(3x^2y + e^y)dx + (x^3 + xe^y - 2y)dy = 0.$

b)Solve the initial value problem $3x^2y^4dx + 4x^3y^3dy = 0; y(1) = 2$

25.

1. Form the partial differential equation of the family of planes, the sum of whose $x,\ y,\ z$ intercepts is equal to unity.
2. Form the partial differential equation by eliminating the arbitrary function from $f(x + y + z,\ x^2 + y^2 + z^2) = 0$

(2×15=30)