QP CODE: 26020929

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REAPPEARANCE/ MERCY CHANCE EXAMINATIONS, APRIL 2026

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

BA9A162A

Time: 3 Hours Max. Marks : 80

Part A

*Answer any **ten** questions.*

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

1. Find the volume of the solid generated by revolving the region bounded by the curve y = x^2 and the lines y = 0, x = 2 about the x-axis.
2. The region in the first quadrant enclosed by the parabola y = x^2, the y-axis and th eline y = 1 is revolved about the line $x = \frac{3}{2}$ to generate a solid. Find the volume of the solid.
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 the double integral $\iint_R y^2 x \, dA$ over the rectangle $R = \{(x, y) : -3 \leq x \leq 2, 0 \leq y \leq 1\}$.
5. Find the area bounded between the curve $y = x^2$ above the $x-$axis and below the line $y = 2$.
6. Define the average value of an integrable function of one variable.
7. Find the degree and the order of a differential equation $y(\frac{dy}{dx})^2 + 2x\frac{dy}{dx} - y = 0$.

8. Verify that the function $x^2 + y^2 = c$ is a solution of the differential equation $y\frac{dy}{dx} + x = 0$.

9. Solve $\frac{dy}{dx} + 2xy = 4x$.

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

11. Define partial differential equations with examples

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. A curved wedge is cut from a cylinder of radius 3 by two planes. One plane is perpendicular to the axis of the cylinder. The second plane crosses the first plance at a 45^0 angle at the center of th ecylinder. Find the volume of the wedge.

14. Find the area of the surface generated by revolving the curve $y = \sqrt{2x+1}, 0 \leq x \leq 3$, about the x-axis.

15. Change the order of integration and hence evaluate the double integral $\int_0^1 \int_{e^x}^{e} \frac{dxdy}{\log y}$.

16. Find the volume of the solid enclosed between the paraboloids $z = 5x^2 + 5y^2$ and $z = 6 - 7x^2 - y^2$.

17. Solve $(x^2 - yx^2)dy + (y^2 + xy^2)ydx = 0$.

18. Make the following equation $ydx + (x^2y - x)dy = 0$exact and hence solve.

19. Solve $\frac{dy}{dx} - y = xy^5$.

20. Find the equation of the tangent plane to the surface

    1. $x^2 + y^2 + z^2 = 1$ at the point $\left(\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}\right)$
    2. $.x + y + z = 0$ at the point $\left(\frac{1}{\sqrt{14}}, \frac{2}{\sqrt{14}}, \frac{-3}{\sqrt{14}}\right)$

21. Find the solution of the differential equation $u(x+y)u_x + u(x-y)u_y = x^2 + y^2$ with the data $u = 0$ on $y = 2x$.

(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. Use double integration to find the volume of each solid,

    (i) Find the volume of the solid bounded above by the parabola $z = 1 - x^2 - y^2$ and below by the $xy-$plane.

    (ii) The wedge cut from the cylinder $4x^2 + y^2 = 9$ by the planes $z = 0$ and $z = y + 3$.

24. a)Solve $\frac{dy}{dx} = \frac{x^2+y^2}{x^2+xy}$.

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

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)