

(Pages : 4)



P – 1266

Reg. No. :

Name :

Second Semester B.Sc. Degree Examination, September 2022

First Degree Programme under CBCSS

Mathematics

Complementary Course for Chemistry/Polymer Chemistry

**MM 1231.2 : MATHEMATICS II – INTEGRATION, DIFFERENTIAL
EQUATIONS AND ANALYTIC GEOMETRY**

(2014-2017 Admissions)

Time : 3 Hours

Max. Marks : 80

SECTION – I

All the first ten questions are compulsory. They carry one mark each.

1. Define antiderivative of a function.
2. State the arc length formula for parametric curves.
3. Evaluate $\int_1^3 \int_2^4 (40 - 2xy) dy dx$.
4. $\iint_R C f(x, y) dA = \dots$
5. State whether the equation $y' + y^2 \tan x = \cos^3 x$ is linear or non-linear.
6. Write down the standard form of a linear differential equation of second order.
7. Write down the auxiliary equation of the differential equation $y'' + y' - 3y = 0$.

P.T.O.

8. Define the conic ellipse.
9. State reflection property of parabola.
10. State Kepler's second law.

(10 × 1 = 10 Marks)

SECTION – II

Answer any **eight** questions from among the questions. These questions carry 2 marks each.

11. Suppose that a particle moves on a coordinate line so that its velocity at time t is $v(t) = (t^2 - 2t)m / s$. Find the displacement of the particle during the time interval $0 \leq t \leq 3$.
12. Find the average value of the function $f(x) = \sqrt{x}$ over the interval $[1,4]$.
13. Find the volume of the solid that is obtained when the region under the curve $y = \sqrt{x}$ over the interval $[1,4]$ is revolved about the x -axis.
14. Evaluate the double integral $\iint_R y^2 x dA$ over the rectangle $R = \{(x, y) : -3 \leq x \leq 2, 0 \leq y \leq 1\}$
15. Use a polar double integral to find the area enclosed by the three-petaled rose $r = \sin 3\theta$.
16. Solve $y' + y^2 \sin x = 0$.
17. Solve the differential equation $y' - y = e^{2x}$.
18. Solve the differential equation $y' + 3y = 0$.
19. Find the focus and directrix of the parabola $x^2 = 12y$.
20. Sketch the graph of the parabola $y^2 + 8x = 0$.

21. Find an equation for the ellipse with foci $(0, \pm 2)$ and major axis with endpoints $(0, \pm 4)$.
22. Find an equation for the parabola that has its vertex at $(1, 2)$ and its focus at $(4, 2)$.

(8 × 2 = 16 Marks)

SECTION – III

Answer any **six** questions. These questions carry **4** marks each.

23. Suppose that a curve $y = f(x)$ in the xy -plane has the property that at each point (x, y) on the curve, the tangent line has slope $2x + 1$. Find an equation for the curve given that it passes through the point $(-3, 0)$.
24. Find the area of the region that is enclosed between the curves $y = x^2$ and $y = x + 6$.
25. Find the volume of the solid generated when the region between the graphs of the equations $f(x) = \frac{1}{2} + x^2$ and $g(x) = x$ over the interval $[0, 2]$ is revolved about the x -axis.
26. Find the arc length of the curve $y = x^{3/2}$ from $(1, 1)$ to $(2, 2\sqrt{2})$.
27. Evaluate $\int_0^2 \int_{y/2}^1 e^{x^2} dx dy$.
28. Solve $\cos(x + y)dx + (3y^2 + 2y + \cos(x + y))dy = 0$.
29. Solve $(D^2 - 3D - 40)y = 0$.
30. Solve the differential equation $y'' - 4y' + 5y = 0$.
31. Sketch the graph of $r = \frac{6}{2 + \cos \theta}$ in polar coordinates.

(6 × 4 = 24 Marks)

SECTION – IV

Answer any **two** questions. These questions carry **15** marks each.

32. (a) Derive the formula for the volume of a right pyramid whose altitude is h and whose base is a square with sides of length a .
- (b) Find the area of the surface that is generated by revolving the portion of the curve $y = x^3$ between $x = 0$ and $x = 1$ about the x -axis.
33. (a) Evaluate $\iint_R (2x - y^2) dA$ over the triangular region R enclosed between the lines $y = -x + 1$, $y = x + 1$, and $y = 3$.
- (b) Use a double integral to find the area of the region R enclosed between the parabola $y = \frac{1}{2}x^2$ and the line $y = 2x$.
34. Solve the following
- (a) $y'' + 5y' + 4y = 10e^{-3x}$
- (b) $(D^2 + 2D + \frac{3}{4}I)y = 3e^x + \frac{9}{2}x$.
35. Describe the graph of the equation $16x^2 + 9y^2 - 64x - 54y + 1 = 0$.
(2 × 15 = 30 Marks)
-