



MAR IVANIOS COLLEGE (AUTONOMOUS)
THIRUVANANTHAPURAM

Reg. No. :

Name :

Second Semester B.Sc. Degree Examination, June 2015

First Degree Programme under CBCSS

Complementary Course: Mathematics – II (for Chemistry)

AUMM231.2b: Integration, Differential Equations and Analytic Geometry

Time: 3 Hours

Max. Marks: 80

SECTION – A

Answer ALL questions / problems in one or two sentences.

1. Evaluate the integral $\int \frac{1}{x^3} dx$.
2. Find the arc length of the curve $y = x^{\frac{2}{3}}$ over the interval $[1, 8]$.
3. Find the area between $y = x$ and $y = x^3$ from $x = -1$ to $x = 1$.
4. Solve $\sqrt{1+x^2} dy + \sqrt{y^2-1} dx = 0$.
5. Check whether the differential equation $(x+y) dx + (x+y^2) dy = 0$ is exact or not.
6. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} = 0$
7. Solve $\frac{d^2y}{dx^2} + \frac{dy}{dx} - 2y = 0$.
8. Find the equation of the hyperbola with vertices $(0, \pm 8)$ and asymptotes $y = \pm \frac{4}{3}x$.
9. Find the eccentricity of the conic $r = \frac{3}{2+\sin\theta}$.
10. Sketch the parabola $x^2 = 8y$.

(10 x 1 = 10 Marks)

P.T.O.

SECTION – B

Answer any **EIGHT** questions / problems, not exceeding a paragraph.

11. Find the area enclosed by the curves $y = x^2$ and $y = x + 6$.
12. Find the surface area of the solid obtained by revolving the curve $x = \sqrt{9 - y^2}$, $-2 \leq y \leq 2$ about the y -axis.
13. A particle moves with an acceleration $v(t) = t^3 - 3t^2 + 2t$ m/s² along an s -axis. Find the displacement and distance of the particle during $0 \leq t \leq 3$.
14. Evaluate $\int_0^1 \int_0^2 xy(x - y) dx dy$.
15. Evaluate $\int_0^1 \frac{x dx}{\sqrt{4 - x^2}}$.
16. Find the particular solution of $\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} + 2y = 5e^x$.
17. Solve $x\frac{dy}{dx} - 3y = x^2$.
18. Solve $\frac{d^2 y}{dx^2} + 4\frac{dy}{dx} + 5y = 10$.
19. Describe the equation $x^2 - 4y^2 + 2x + 8y - 7 = 0$.
20. Identify the curve $153x^2 - 192xy + 97y^2 - 30x - 40y - 200 = 0$.
21. Define an ellipse. State the reflection property of ellipses.
22. Find the equation of the ellipse with eccentricity $e = \frac{2}{7}$ and ends of the minor axis at the points $(0, \pm 3)$.

(8 x 2 = 16 Marks)

SECTION – C

Short essay type problems : Answer any **SIX** questions.

23. Evaluate the double integral $\int_0^1 \int_y^1 x^2 e^{xy} dx dy$ by changing the order of integration.
24. Find the length of the asteroid $x = \cos^3 t$, $y = \sin^3 t$, $0 \leq t \leq 2\pi$.
25. Find the area of the surface generated by revolving the curve about $y = x^3$, $0 \leq x \leq \frac{1}{2}$ the x -axis.
26. Find the volume of the solid enclosed between the paraboloids $z = 5x^2 + 5y^2$ and $z = 6 - 7x^2 - y^2$ using triple integrals.

27. Use spherical coordinates to find the volume of the solid between the sphere $\rho = \cos \theta$ and the hemisphere $\rho = 2, z \geq 0$.
28. Find the length of the cardioid $r = 1 - \cos \theta$.
29. Solve $\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} - 10y = -3$.
30. Solve $y'' - y' = 2 \sin x$.
31. Solve $\frac{d^2 y}{dx^2} - \frac{dy}{dx} = x^3$.

(6 x 4 = 24 Marks)

SECTION – D*Long essay type problems : Answer any TWO questions.*

32. i). The line segment $x = 1 - y, 0 \leq y \leq 1$ is revolved about the y – axis to generate the cone. Sketch the graph and find its lateral surface area.
- ii). The region in the first quadrant bounded by the coordinate axes, the line $y = 3$ and the curve $x = \frac{2}{\sqrt{y+1}}$ is revolved about the y – axis to generate a solid. Find the volume of the solid.
33. i). Solve the equation $\frac{d^2 y}{dx^2} - \frac{dy}{dx} = 5e^x - \sin 2x$.
- ii). Solve the equation $\frac{d^2 y}{dx^2} - 3 \frac{dy}{dx} = e^{3x} - 12x$.
34. i). Find the equation the line tangent to the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the point $(2,3)$.
- ii). Find the equation of the tangent at the point (x_1, y_1) on the parabola $y^2 = 4ax$.
- iii). Find the equation of the tangent at the point $(at_1^2, 2at_1)$ on the parabola $y^2 = 4ax$.
35. i). Find the equation of asymptotes of the curve $3x^2 - 5xy - 2y^2 + 17x + y + 14 = 0$
- ii). Analyze the curve $9x^2 + 4y^2 + 36x - 8y + 4 = 0$.
- iii). Identify and Sketch the curve given in polar coordinates $r \cos \theta = -1$.

(2 x 15 = 30 Marks)
