



Reg. No. : .....

Name : .....

**Second Semester B.Sc. Degree Examination, July 2017**  
**First Degree Programme under CBCSS**  
**Complementary Course for Chemistry/Polymer Chemistry**  
**MM 1231.2 : MATHEMATICS – II**  
**Integration, Differential Equations and Analytic Geometry**  
**(2013 Admission)**

Time : 3 Hours

Max. Marks : 80

SECTION – I

All the first **ten** questions are **compulsory**. They carry **1** mark **each** :

1. Find the average value of the function  $f(x) = 3x$  over the interval  $[1, 3]$ .
2. Find  $\int_1^5 f(x) dx$  if  $\int_0^1 f(x) dx = -2$  and  $\int_0^5 f(x) dx = 1$ .
3. Evaluate  $\int [1 + \sin^2 \theta \csc \theta] d\theta$ .
4. Write the condition for the differential equation  $M(x, y) dx + N(x, y) dy = 0$  to be exact.
5. Solve  $x dx - y dy = 0$ .
6. Find the integrating factor of the equation  $\frac{dy}{dx} + 2xy = 2e^{-x^2}$ .
7. Write an equation for an ellipse with the ends of major axis at  $(0, \pm 5)$  and ends of minor axis at  $(\pm 1, 0)$ .
8. State the reflection property of a parabola.
9. Find a polar equation for a hyperbola that has its focus at the pole whose eccentricity is  $\frac{4}{3}$  and directrix  $x = -1$ .
10. Determine a rotation angle  $\theta$  that will eliminate the  $xy$  - term in  $2x^2 + xy + 2y^2 + x - y = 0$ .



## SECTION - II

Answer **any 8** questions from among the questions **11 to 22**. These questions carry **2 marks each**.

11. Find the area of the region enclosed by the curves  $y = x^3 - 4x$ ,  $y = 0$ ,  $x = 0$ ,  $x = 2$ .
12. Find the arc length of the curve  $24xy = y^4 + 48$  from  $y = 2$  to  $y = 4$ .
13. Evaluate  $\int_0^3 \int_0^{\sqrt{9-y^2}} y \, dx \, dy$ .
14. Change  $\int_1^4 \int_0^{\sqrt{1-x^2}} (x^2 + y^2)^{3/2} \, dy \, dx$  to an integral in polar coordinates.
15. Solve  $(3x - 2y) \, dx = x \, dy$ .
16. Solve  $\frac{d^3y}{dx^3} - 3 \frac{d^2y}{dx^2} + 3 \frac{dy}{dx} - y = 0$ .
17. Reduce the first order differential equation  $\frac{dy}{dx} = \frac{y}{x} + \tan \frac{y}{x}$  to the variable separable form.
18. Find the particular integral of  $\frac{d^3y}{dx^3} + 4 \frac{dy}{dx} = \sin 2x$ .
19. Find the vertex and directrix of the parabola  $x^2 - 4x + 2y = 1$ .
20. State Kepler's Laws.
21. Find the equation of the tangent to the ellipse  $9x^2 + 16y^2 = 180$  at the point  $(2, 3)$ .
22. Sketch the parabola  $y^2 = 6x$ .

## SECTION - III

Answer **any 6** questions from among the questions **23 to 31**. These questions carry **4 marks each**.

23. A particle with  $a(t) = t^2 - 3t + 1$ ,  $v(0) = 0$ ,  $s(0) = 0$  moves along an  $s$  - axis. Find the position of the particle.
24. Find the volume of the solid that results when the region enclosed by the curves  $y = x^2$  and  $y = x^3$  is revolved about the  $x$  - axis.
25. Use spherical coordinates to evaluate :

$$\int_{-3}^3 \int_{-\sqrt{9-y^2}}^{\sqrt{9-y^2}} \int_{-\sqrt{9-x^2-y^2}}^{\sqrt{9-x^2-y^2}} \sqrt{x^2 + y^2 + z^2} \, dz \, dx \, dy.$$



26. Solve  $(1 + 2xy \cos x^2 - 2xy) dx + (\sin x^2 - x^2) dy = 0$ .
27. Find the orthogonal trajectories of the family of parabolas  $6ay^2 = x - 3$ , where  $a$  is a parameter.
28. Reduce the Legendre's equation  $(1 + x)^2 \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = 0$  to a linear equation with constant coefficients.
29. Find a polar equation of a hyperbola with vertices  $\left(3, \frac{\pi}{2}\right)$  and  $\left(-7, \frac{3\pi}{2}\right)$ .
30. Identify and sketch the curve  $34x^2 - 24xy + 41y^2 - 25 = 0$ .
31. Find the asymptotes of the hyperbola  $2x^2 + 5xy + 2y^2 + 4x + 5y = 0$ .

#### SECTION - IV

Answer **any 2** questions from among the questions **32 to 35**. These questions carry **15 marks each**.

32. a) Find the area of the surface that is generated by revolving the portion of the curve  $x = \sqrt[3]{y}$  between  $y = 1$  and  $y = 8$  about the  $x$ -axis.
- b) Find the volume of the solid bounded above by the paraboloid  $z = 9x^2 + y^2$ , below by the plane  $z = 0$  and laterally by the planes  $x = 0$ ,  $y = 0$ ,  $x = 3$  and  $y = 2$ .
33. Solve  $\frac{d^2y}{dx^2} - 4 \frac{dy}{dx} + 4y = e^x + \sin 2x + x^2$ .
34. a) Solve  $(x^3 + y^3) dx = (x^2y + xy^2) dy$ .
- b) Solve  $x^2 \frac{d^2y}{dx^2} + 3x \frac{dy}{dx} + y = 0$ .
35. a) Sketch the graph of  $r = \frac{16}{4 + 3 \sin \theta}$  in polar coordinates.
- b) Halley's comet has an eccentricity of 0.97 and semimajor axis of 18.1 AU :
- Find the equation of its orbit in the polar coordinate system.
  - Find its perihelion and aphelion distances.