



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
(2014 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – I

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

1. What is the average value of $f(x) = \sqrt{x}$ over the interval $[1, 4]$?
2. Suppose that a particle moves along s-axis so that its velocity at time t is $v(t) = t^3 - 2t^2 + 1$ and $s(0) = 1$. Find the position function of the particle.
3. Evaluate $\int_0^{\pi} \cos x dx$.
4. Evaluate $\int_2^4 \int_0^1 x^2 y dx dy$.
5. Find the equation of the parabola with vertex at (1, 2) and focus at (4, 2).
6. Find the eccentricity of the conic $4x^2 - 9y^2 = 36$.
7. Solve the differential equation $\frac{dy}{dx} = 3y$.
8. Define an exact differential equation.
9. Write the general form of Bernoulli differential equation.
10. Find a particular integral of the differential equation $y'' - y = 2$.



SECTION - II

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

11. Evaluate $\int \frac{\cos x}{\sin^2 x} dx$.
12. Suppose that a particle moves so that its position function is $s(t) = 6t^2 + t$. Find the average velocity of the particle over the time interval $1 \leq t \leq 4$.
13. Find the area of the region between the x-axis and the curve $y = x^3 - x^2 - 2x$.
14. Find the volume of the solid generated by revolving the region bounded by the parabola $y = x^2$ and the line $y = 1$ about the line $y = -1$.
15. Find the area of the surface that is generated by revolving the portion of the curve $y = 2\sqrt{x}$ between $x = 1$ and $x = 2$ about x-axis.
16. Find the equation of the hyperbola with foci $(0, \pm\sqrt{2})$ and asymptotes $y = \pm x$.
17. Find the equation of the ellipse with foci $(\pm 2, 0)$ and eccentricity $e = \frac{1}{2}$.
18. Solve the differential equation $(2x^2 + y) dx + (x^2y - x) dy = 0$.
19. Solve the differential equation $(x \cos y - y \sin y) dy + (x \sin y + y \cos y) dx = 0$.
20. Find a general solution for the differential equation $9y'' - 30y' + 25y = 0$.
21. Solve the differential equation $\frac{dy}{dx} = \cos(x + y)$.
22. Evaluate $\int_0^1 \int_0^{1-x} \int_0^{x+y} e^z dz dy dx$.



SECTION - III

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

23. Solve the initial value problem $\frac{d^2y}{dx^2} = e^x + x + 1$, $y'(0) = 2$, $y(0) = 1$.
24. Find the length of the curve $x = \frac{y^3}{3} + \frac{1}{4y}$ from $y = 1$ to $y = 3$.
25. Find the volume enclosed by the coordinate planes and that portion of the plane $x + y + z = 1$ which lies in the first octant.
26. Find the area of the cardioid $r = a(1 + \cos \theta)$.
27. The parabola $y^2 = 8x$ is shifted down 2 units and right 1 unit to generate a new parabola. Find the vertex, focus and directrix of the new parabola.
28. Find a particular integral of the differential equation $y'' + y = x$. Find the equation of the ellipse of eccentricity $\frac{2}{3}$ and has the line $x = 9$ as a directrix and $(4, 0)$ as the focus.
29. Solve the initial value problem $x \frac{dy}{dx} - 2y = 2x^4$, $y(2) = 8$.
30. Find the orthogonal trajectories of the family of curves $y = cx^2$.
31. Solve the differential equation $\frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 4y = e^{-3x}$ using inverse operator method.

SECTION - IV

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

32. a) Find the volume bounded by the cylinder $x^2 + y^2 = 4$ the plane $y + z = 4$ and $z = 0$.
- b) Find the area of the region bounded by the cardioids $r = 1 + \cos \theta$ and $r = 1 - \cos \theta$.



33. a) Solve the differential equation $\frac{dy}{dx} + \frac{1}{3}y = \frac{1}{3}(1 - 2x)y^4$.
- b) Solve the initial value problem $16y'' - 8y' + 5y = 0$, $y(0) = 1$, $y'(0) = 2$.
- c) Solve the differential equation $\frac{d^3y}{dx^3} - 3\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 6y = 0$.
34. a) Solve the initial value problem $y'' + y' = 2 + 2x + x^2$, $y(0) = 8$, $y'(0) = -1$.
- b) Solve the differential equation $(D^2 + 1)y = \tan x$ using method of variation of parameters.
35. a) Find two values of k such that the line $x + 2y = k$ is tangent to the ellipse $x^2 + 4y^2 = 8$. Find the points of tangency.
- b) The orbit of Halley's comet has an eccentricity of 0.97 and a semimajor axis given by $a = 18.1$ A.
- i) Find the equation of its orbit in polar coordinate system
 - ii) Find the period of its orbit
 - iii) Find its perihelion and aphelion distances.
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