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# E – 4423

Reg. No. : ..................................

Name : ......................................

**Second Semester B.Sc. Degree Examination, August 2018**
**First Degree Programme under CBCSS**
**Complementary Course for Chemistry/Polymer Chemistry**
**MM 1231.2 : MATHEMATICS – II**
**Integration, Differential Equations and Analytic Geometry**
**(2014 Admission Onwards)**

Time : 3 Hours Max. Marks : 80

SECTION – I

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

1. Define integral curves of a function.
2. Suppose that a particle moves so that its velocity at time t is v(t) = sint m/s. Find the displacement of the particle during the time interval $0 \le t \le \frac{\pi}{2}$.
3. Find the points of intersections of the curve $y = x^2$ and the line y = 3x – 2.
4. Evaluate $\int_0^1 \int_0^2 dxdy$.
5. What is the standard equation of the ellipse with center (m, n) and major axis x = m ?
6. Find the eccentricity of the conic $r = \frac{3}{2 - 2\cos\theta}$.
7. Find the order of the differential equation $\frac{d^2y}{dx^2} + \left(\frac{dy}{dx}\right)^4 - \left(\frac{d^3y}{dx^3}\right)^{\frac{1}{2}} = 3y^2$.
8. Solve the differential equation $\frac{dy}{dx} = 1 + y^2$.
9. Find the integrating factor of the differential equation – ydx + xdy = 0.
10. Find a particular integral of the differential equation y″ + y = x.

P.T.O.

SECTION – II

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

11. Evaluate $\int x^2 \log 2x \, dx$.

12. Suppose that a particle moves so that its velocity at time t is $v(t) = |t - 3|$ m/s. Find the displacement and distance travelled by the particle during the time interval $0 \leq t \leq 5$.

13. Find the area bounded by the x-axis and the parabola $y = 4 - x^2$.

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 $y = x^3$ between $x = 0$ and $x = 1$ about x-axis.

16. Find the equation for the ellipse with foci $(0, \pm 2)$ and major axis with end points $(0, \pm 4)$.

17. Find the equation of the hyperbola with foci $(0, \pm 8)$ and asymptotes $y = \pm \frac{4}{3} x$.

18. Solve the differential equation $(1 + xy)\, y dx + (1 - xy)\, x dy = 0$.

19. Find a general solution for the differential equation $y'' + 9y' + 20y = 0$.

20. Solve the differential equation $y' + y = e^{-x}$.

21. Find the Wronskian of the functions $y_1(x) = \cos x$ and $y_2(x) = \sin x$.

22. Evaluate $\int_0^a \int_0^x \int_0^y xyz \, dz \, dy \, dx$.

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 $\frac{d^2y}{dx^2} = x + \cos x$, $y'(0) = 2$, $y(0) = 1$.

24. Find the length of the astroid $x = \cos^3 t$, $y = \sin^3 t$, $0 \leq t \leq 2\pi$.

25. Find the volume of the region bounded by the paraboloid $z = x^2 + y^2$ and below by the triangle enclosed by the lines $y = x$, $x = 0$ and $x + y = 2$ in the xy-plane.

26. Find the value of the double integral $\iint xy\,dx\,dy$ over the positive quadrant of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

27. Derive the standard equation of an ellipse in standard positions.

28. Find the center, foci, vertices and directrices of the ellipses $9x^2 + 25y^2 - 18x - 100y - 116 = 0$.

29. Solve the initial value problem $\left(x^2 + 1\right)\frac{dy}{dx} + 4xy = x$, $y(2) = 1$.

30. Find the orthogonal trajectories of the family of circles $x^2 + y^2 = c$.

31. Solve the differential equation $\frac{d^2y}{dx^2} - 13\frac{dy}{dx} + 12y = e^{-2x}$ 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 of the paraboloid of revolution $x^2 + y^2 = 4z$ cut off by the plane $z = 4$.

    b) Find the area of the common region that is inside the cardioid $r = 4 + 4\cos\theta$ and outside the circle $r = 6$.

33. a) Solve the differential equation $\frac{dy}{dx} + y = xy^3$.

    b) Solve the initial value problem $y'' - y' - 2y = 0$, $y(0) = -4$, $y'(0) = -17$.

    c) Solve the differential equation $\frac{d^3y}{dx^3} - 5\frac{d^2y}{dx^2} + 7\frac{dy}{dx} - 3y = 0$.

34. a) Solve the initial value problem $y'' - 6y' + 13y = 4e^{3x}$, $y(0) = 2$, $y'(0) = 4$.

b) Solve the differential equation $(D^2 + 4D + 4)y = \frac{e^{-2x}}{x^2}$ using method of variation of parameters.

35. a) Derive the equation of the tangent to ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at the point $(x_0, y_0)$.

b) The Planet Pluto has an eccentricity of 0.249 and a semimajor axis given by a = 39.5 AU.

i) Find the equation of its orbit in polar coordinate system if the center of the sun at the pole.

ii) Find the period of its orbit.

iii) Find its perihelion and aphelion distances.

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