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Reg. No. : .....

Name : .....

Fifth Semester B.Sc. Degree Examination, December 2022

First Degree Programme under CBCSS

Mathematics

Core Course

MM 1544 : DIFFERENTIAL EQUATIONS

(2018 Admission Onwards)

Time : 3 Hours Max. Marks : 80

PART – A

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

1. Define order and degree of a ordinary differential equation.

2. Solve $\frac{dy}{dx} = 4y$ and $y(0) = 2$.

3. Show that the differential equation $\left(y^2 + \cos^2 x\right)\frac{dy}{dx} = y \sin 2x$ is exact.

4. Solve the differential equation $\frac{dy}{dx} = xy$.

5. Find the integrating factor of the differential equation $\frac{dy}{dx} + \frac{x}{1+y^2} = \frac{\tan^{-1} y}{1+y^2}$.

6. Write the general form of Euler – Cauchy equation.

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7. Find the complementary function of the differential equation $\frac{d^2y}{dx^2} + 4 = 8\cos x$.

8. Solve the second order differential equation $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} = 4x$ to find $\frac{dy}{dx}$.

9. Show that $y_1 = e^x$ and $y_2 = xe^x$ are Linearly independent functions.

10. Define Basis of solutions of a differential equation $y''+P(x)y'+Q(x)y = 0$.

(10 × 1 = 10 Marks)

PART – B

Answer any **eight** questions. Each question carries **2** marks.

11. Solve the differential equation $\frac{dy}{dx} + 2xy = 4x$.

12. Solve $3e^x \tan y + (1 - e^x)\sec^2 y \frac{dy}{dx} = 0$.

13. Find the integral factor of the differential equation $\frac{dy}{dx} + y\tan x = \cos^3 x$.

14. Solve the differential equation $xy'+y = 0$.

15. Find the solution of the initial value problem $y' = 3x^2e^{-y}$ and $y(0) = 2$.

16. Solve the differential equation $\frac{dy}{dx} = x + y + 1$.

17. Write a short note on a first-order linear and non-linear ordinary differential equations.

18. Write the general form of Bernoulli equation.

19. Solve the differential equation $y''+y = 0$.

20. Solve $y''-y = x$.

21. Find the solution of the second order ODE, $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = 0$.

22. Find a particular integral for $y'' - 3y' + 2y = e^x$.

23. Solve $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = 0$.

24. Write a differential equation of the form $y''+ay'+by = 0$ for which the functions e^{7x} and e^{4x} form a basis.

25. Find a real general solution of $x^2y''-20y = 0$.

26. Solve the differential equation $\left(D^2 + 4D + 4\right)y = 0$.

(8 × 2 = 16 Marks)

PART – C

Answer any **six** questions. **Each** question carries **4** marks.

27. Solve $\cos(x+y)dx + \left(3y^2 + 2y + \cos(x+y)\right)dy = 0$.

28. Solve the differential equation $\frac{dy}{dx} = -\frac{2}{y} - \frac{3y}{2x}$.

29. Solve the differential equation $(ax + hy + g)dx + (hx + by + f)dy = 0$.

30. Solve the differential equation $\frac{dy}{dx} = \frac{y}{x} + \tan\left(\frac{y}{x}\right)$.

31. Solve the Bernoulli's equation $\frac{dy}{dx} + \frac{y}{x} = 2x^3y^4$.

32. Solve Differential equation $\frac{dy}{dx} + \frac{y}{x} = y^2 \log x$

33. Solve the second order ordinary differential equation $\left(D^2 + 4\right)y = \sin^2 x$.

34. Solve $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + \frac{2}{y^3} = 0$.

35. Solve the differential equation $4x^2 \frac{d^2y}{dx^2} + 4x\frac{dy}{dx} + \left(x^2 - 1\right)y = 0$.

36. Solve $x^3\frac{d^2y}{dx^2}-\left(x^3+xy\right)\frac{dy}{dx}+\left(y^2+xy\right)=0$.

37. Solve the initial value problem $y''+y=0.001x^2; y(0)=0, y'(0)=1.5$.

38. Using the method of variation of parameters find the particular integral of $y''+y=\sec x$.

(6 × 4 = 24 Marks)

PART – D

Answer any **two** questions. **Each** question carries **15** marks.

39. (a) Solve the equation $\left(x^2-3y^2\right)dx+2xydy=0$.

(b) Solve the Bernoulli differential equation, $\frac{dy}{dx}+y=xy^3$.

40. (a) Solve the initial-value problem $\left(2x\cos y+3x^2y\right)dx+\left(x^3-x^2\sin y-y\right)dy-0$; $y(0)=2$.

(b) Solve the differential equation $\frac{dy}{dx}=\frac{2x-5y+3}{2x+4y-6}$.

41. Solve the initial-value problem $\left(y+\sqrt{x^2+y^2}\right)dx-xdy=0,\quad y(1)=0$.

42. (a) Solve the initial-value problem $y''-y'-12y=0,\ y(0)=3,\ y'(0)=5$.

(b) Solve the differential equation, $y^2dx+(3x-1)dy=0$.

43. (a) Use the variation-of-parameters method to solve $\frac{d^2y}{dx^2}+y=\operatorname{cosec} x$ subject to the boundary conditions $y(0)=y(\pi/2)=0$.

(b) Find the general solution of the differential equation $y''+4y=8\cos 2x$.

44. (a) Solve the initial value $y''+3y'+2.25y=-10e^{-1.5x},\ y(0)=1,\ y'(0)=0$.

(b) Find the solution of the Homogeneous Linear Equation $x^2y''+2xy'-20y=x^4$.

(2 × 15 = 30 Marks)

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