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

**Name : .....**

**Fifth Semester B.Sc. Degree Examination, December 2021**

**First Degree Programme under CBCSS**

**Mathematics**

**Core Course VII**

**MM 1543 : DIFFERENTIAL EQUATIONS**

**(2014, 2016 and 2017 Admission)**

Time : 3 Hours Max. Marks : 80

SECTION – I

All questions are compulsory. They carry **1** mark each.

1. Find the order of the differential equation $y'''+2x^2(y')^2=0$.

2. Write the general solution of $y''=-y$.

3. Define first order initial value problem.

4. Find the integrating factor of the differential equation $y'-y\tan x=3e^{-\sin x}$.

5. Find the degree of the differential equation $yy'=x(y')^3+c$.

6. Write the differential equation representing the family of curves $y=x^2+c$.

7. Verify whether $y=e^{-\frac{x}{2}}+x-3$ is a solution of the equation $2y'+y=x-1$.

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8. Write down the auxiliary equation of $y''-4y'+y=0$.

9. Show that $y=e^{4x}$ is solution of $y''-3y'-4y=0$.

10. Examine whether the differential equation

$(x^2-4xy-2y^2)dx+(y^2-4xy-2x^2)dy=0$ is exact.

**(10 × 1 = 10 Marks)**

SECTION – II

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

11. Find the solution of the curve for the problem $y'+4x=2,\ y(0)=5$.

12. Find and sketch the integral curve for the equation $y'=\frac{y}{2x}$ that passes through the point (2, 2).

13. Solve the equation $(y^2-2xy)dx=(x^2-2xy)dy$.

14. Solve the initial value problem $y'=\sin x,\ y(0)=1$.

15. Draw the integral curve for the equation $y'=\frac{-x}{y}$ that passes through the point (8, 6).

16. Solve the differential equation $y'+y\cot x=\cos x$.

17. Solve $(y\cos x+1)dx+\sin x dy=0$.

18. Check whether $e^{-2x}\sin 3x$ is a solution of $y''+4y'+13y=0$.

19. Solve the differential equation $y''-16y=0$.

20. Write down thy second order differential equation that has $y = e^{x}$ and $y = e^{-5x}$ as solutions.

21. Prove that the functions $y_1 = xe^{3x}$ and $y_2 = e^{3x}$ are linearly independent.

22. Solve the initial value problem $y'' - 3y' - 4y = 0,\ y(0) = 2,\ y'(0) = 1$.

**($8 \times 2 = 16$ Marks)**

SECTION – III

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

23. Find the particular solution of the equation $4yy' - 3x^2 = 0$.

24. Find a curve with x– intercept 4 and whose tangent line at the point (x, y) has slope $xe^{-y}$.

25. Solve the IVP $y' = \sin t + 1,\ y\left(\frac{\pi}{3}\right) = \frac{1}{2}$.

26. Solve the equation $2x \tan y dx + \sec^2 y dy = 0$.

27. Solve the equation $ye^{xy}dx + \left(xe^{xy} + 2y\right)dy = 0$.

28. Find the steady state oscillation of the mass spring system governed by the equation $y'' + 2y' + 4y = \sin 0.2t$.

29. Solve the differential equation $y'' + y = \sec x$ using method of variation of parameters.

30. Solve the differential equation $y'' - 3y' + 2y = \cos 3x$.

31. Solve $y'' + 4y = e^{2x}$.

**($6 \times 4 = 24$ Marks)**

## SECTION – IV

Answer any **two** questions from among the questions 32 to 35. They carry **15** marks each.

32. (a) At time t = 0, a tank contains 4 lb of salt dissolved in 100 gal of water. Then brine containing 2 lb of salt per gallon of brine is allowed to enter the tank at the rate of 5 gal/min and the mixed solution is drained from the tank at the same rate, How much salt is in the tank after 10 minutes?

(b) Solve the different equation $y'+y = sin(e^x)$

33. (a) Solve the different equation $(x^2 - yx^2)y'+y^2 + xy^2 = 0$.

(b) Solve the different equation $x^2y' = 3x^2 - 2xy + 1$.

34. (a) Solve the different equation $x^2y''+6xy'+6y = 0$.

(b) Solve the different equation $y''+2y = e^x \cos 2x$.

35. (a) Solve the different equation $x^2y''-2y = x^2 + \frac{1}{x}$.

(b) Solve the different equation $(D-2)^2 y = 8(e^{2x} + sin\,2x + x^2)$.

**(2 × 15 = 30 Marks)**

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