STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI - 600 086
(For candidates admitted during the academic year 2019–20 and thereafter)

B. Sc. DEGREE EXAMINATION, NOVEMBER 2023
BRANCH I - MATHEMATICS
THIRD SEMESTER

COURSE   :   **MAJOR – CORE**
PAPER   :   **DIFFERENTIAL EQUATIONS**
SUBJECT CODE   :   **19MT/MC/DE34**
TIME   :   **3 HOURS**   **MAX. MARKS :   100**

SECTION-A
Answer any TEN questions   **(10 x 2 = 20)**

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

2. Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 4y = 0$.

3. Solve $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$.

4. Solve $\frac{dx}{-y^2-z^2} = \frac{dy}{xy} = \frac{dz}{xz}$.

5. A 4 lb weight is attached to a spring whose spring constant is 16 lb/ft. What is the period of simple harmonic motion?

6. Solve $\frac{1}{8}x'' + 8x = 0$.

7. Solve by eliminating the constants a and b from the equation $z = (x + a)(y + b)$.

8. Solve $x^2 p + y^2 q = z^2$.

9. Solve $\frac{\partial^2 z}{\partial x^2} + a^2 \frac{\partial^2 z}{\partial y^2} = 0$.

10. Solve $r - 4s + 4t = 0$.

11. Calculate the particular integral for $(D^2 + 4)y = xe^{2x}$.

12. Solve $z = px + qy + p^2 + q^2$.

SECTION-B
Answer any FIVE questions   **(5 x 8 = 40)**

13. Solve $(D^2 - 4D + 3)y = e^{-x} \sin x$.

14. Solve $\frac{dx}{mz-ny} = \frac{dy}{nx-lz} = \frac{dz}{ly-mx}$.

15. An 8 lb weight stretches a spring 2 ft. Assuming that a damping force numerically equal to 2 times the instantaneous velocity acts on the system, determine the equation of motion if the weight is released from the equilibrium position with an upward velocity of 3ft/s.

16. Solve $(y^2 + z^2 - x^2)p - 2xyq + 2xz = 0$.

17. Solve $\dfrac{\partial^2 z}{\partial x^2} - \dfrac{\partial^2 z}{\partial y^2} = x - y$.

18. Solve $x^2 \dfrac{d^2 y}{dx^2} + 8x \dfrac{dy}{dx} + 12y = x^4$.

19. Solve $p^2 + q^2 = x + y$.

SECTION-C
Answer any TWO questions   **(2 x 20 = 40)**

20. (a) Solve $\dfrac{d^2 y}{dx^2} + n^2 y = secnx$ by the method of variation of parameter.   (10 marks)

    (b) Find the differential equation from $\varphi(x + y + z, x^2 + y^2 + z^2) = 0$ (10 marks)

21. (a) Solve the equations   (10 marks)

$$2\dfrac{dx}{dt} + x + \dfrac{dy}{dt} = cost$$

$$\dfrac{dx}{dt} + 2\dfrac{dy}{dt} + y = 0$$

    (b) Solve $\left(D' - 6DD' + 9D'^2\right) = 12x^2 + 36xy$.   (10 marks)

22. (a) Find the solution of the initial value problem   (10 marks)

$$\dfrac{d^2 y}{dx^2} = \dfrac{w}{T_1}\left(1 + \left(\dfrac{dy}{dx}\right)^2\right)^{\frac{1}{2}}$$

$$y(0) = \dfrac{T_1}{w}, y'(0) = 0.$$

    (b) Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$.   (10 marks)

▲▲▲▲▲▲▲▲▲