

B. Sc. DEGREE EXAMINATION, NOVEMBER 2022
BRANCH I - MATHEMATICS
THIRD SEMESTER

COURSE : MAJOR – CORE
PAPER : DIFFERENTIAL EQUATIONS
TIME : 3 HOURS

MAX. MARKS : 100

SECTION-A

Answer any TEN questions

(10 x 2 = 20)

1. Solve : $(x+1)^2 \frac{d^2y}{dx^2} - 3(x+1) \frac{dy}{dx} + 4y = 0$.
2. Solve : $x^2 \frac{d^2y}{dx^2} + x \frac{dy}{dx} + y = 0$.
3. Solve : $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xy}$.
4. Solve : $\frac{dx}{xz} = \frac{dy}{yz} = \frac{2dz}{(x+y)^2}$.
5. Write down the differential equation of free damped motion.
6. An 8lb weight stretches a spring 2ft. Assuming that a damping force numerically equal to 2 times the instantaneous velocity acts on the system, form the differential equation if the weight is released from the equilibrium position with an upward velocity of 3ft/sec.
7. Eliminate the constants a and b from the equation $2z = (ax + y)^2 + b$ and form the differential equation.
8. Solve : $z = pq$.
9. Solve : $(D^2 - 4DD' + 4D'^2)z = 0$.
10. Find the particular integral of $(D^2 + DD' + D'^2)z = e^{2x+3y}$.
11. Find the complete integral of $q = e^{\frac{p}{\alpha}}$.
12. Reduce the differential equation $(x+a)^2 \frac{d^2y}{dx^2} - 4(x+a) \frac{dy}{dx} + 6y = x$ into a standard differential equation.

SECTION-B

Answer any FIVE questions

(5 x 8 = 40)

13. Solve: $(D^2 - 4D + 3)y = e^{-x} \sin x$.
14. Solve : $\frac{dx}{y - xz} = \frac{dy}{yz + x} = \frac{dz}{x^2 + y^2}$.

15. Find the solution of the IVP $\frac{d^2y}{dx^2} = \frac{\omega}{T_1} \left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{\frac{1}{2}}$, $y(0) = \frac{T_1}{\omega}$, $y'(0) = 0$.
16. Solve: $z = px + qy + c\sqrt{(1+p^2+q^2)}$.
17. Solve: $(D^2 - D'^2)z = x - y$.
18. Solve: $(y+z)p + (z+x)q = x + y$.
19. Solve: $\frac{d^2y}{dx^2} + y = \sec x$ by the method of variation of parameters.

SECTION-C

Answer any TWO questions

(2 x 20 = 40)

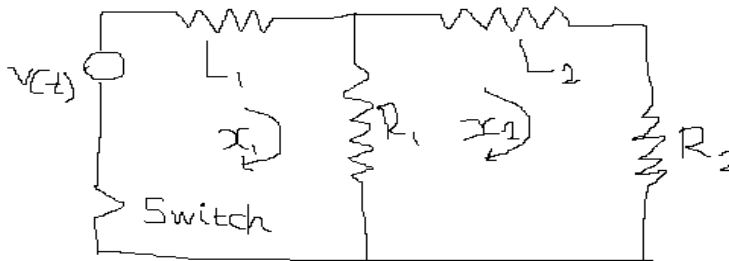
20. (a) Solve: $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \frac{\log x \sin(\log x) + 1}{x}$. (10 Marks)

$$2 \frac{dx}{dt} + x + \frac{dy}{dt} = \cos t$$

(b) Solve: Solve the equation (10 Marks)

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

21. With reference to the following figure, determine x_1 and x_2 when the switch is closed if $L_1 = L_2 = 2$ henry, $R_1 = 3$ ohm, $R_2 = 8$ ohm and $v(t) = 6$ volt. Assume that the initial current in the circuit is zero.



22. (a) Solve: $\frac{\partial^3 z}{\partial x^3} - \frac{\partial^3 z}{\partial y^3} = x^3 y^3$. (10 Marks)

(b) Solve: $pz = 1 + q^2$. (10 Marks)

