

D.K.M.COLLEGE FOR WOMEN (AUTONOMOUS), VELLORE-1.

II-B. Sc. MATHEMATICS

SUB: DIFFERENTIAL EQUATIONS

SUB. CODE: 15CMA3A

UNIT – 1: (Ordinary Differential Equations/linear)

SECTION-A

2 Marks

1. Define solvable for p.
2. Define solvable for x.
3. Define solvable for y.
4. Define Clairaut's equations.
5. Solve $p^2 - sp + 2 = 0$.
6. Solve $x^2p^2 - (2x + xy)p + 6y = 0$.
7. Solve $x^2p^2 + xyp - 6y^2 = 0$.
8. Find the general solution of $y = xp + \frac{\alpha}{p}$.
9. Solve $p = \tan(y - xp)$.
10. Solve $(y - px)(p - 1) = p$.
11. Solve $y = xp + \sqrt{1 + p^2}$.
12. Solve $y = px + \sqrt{a^2 + p^2}$.

SECTION-B

5 Marks

1. $xyp^2 + (x + y)p + 1 = 0$.
2. $x^2p^2 + 3xyp + 2y^2$.
3. $\frac{dy}{dx} - \frac{dx}{dy} = \frac{x}{y} - \frac{y}{x}$.
4. Solve $y = 2px + y^2p^3$.
5. Solve $y = 3px + 6p^2y^2$.
6. Solve $p^2 + px^3 - 2x^2y = 0$.
7. Solve $y - 2px = \tan^{-1}(xp^2)$.
8. Solve $y + xp = x^4p^2$.
9. Solve $y = p \sin p + \cos p$.
10. Solve $x^2p^2 - yp - x = 0$.
11. Solve $e^{3x}(p - 1) + p^3e^{2y} = 0$.

12. Solve $(px-y)(py+x)=2p$.

13. Solve $x^2(y - px) = yp^2$.

SECTION-C

10 Marks

1. Solve $p^2 + 2ypcotx - y^2 = 0$.

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

3. Solve $yp^2 - xp + 2y = 0$.

4. Solve $yp^2 - 2xp + y = 0$.

5. Solve $p^2 + y^2px + y^3 = 0$.

6. Solve $xyp^2 + (x^2 + xy + y^2)p + x^2 + xy = 0$.

7. Solve $(x^2 + x)p^2 + (x^2 + x - 2xy - y)p + y^2 - xy = 0$.

UNIT – II (Linear Differential equations of second Order with constant coefficients).

SECTION-A

2 Marks

1. Define linear differential equations of second order.

2. Solve $(D^2 - 4D + 3)y = 0$.

3. Solve $(D^2 + D + 1)y = 0$.

4. Solve $(D^2 - 6D + 9)y = 0$.

5. Solve $(D^2 - 1)y = e^x$.

6. Solve $(D^2 - 6D + 9)y = e^{3x}$.

7. $\frac{d^2y}{dx^2} = \frac{dy}{dx}$.

8. Solve $(D^2 + 3D + 2)y = \sin 3x$.

9. Solve $(D^2 + D + 1)y = x$.

SECTION-B

5 Marks

1. Solve $(D^2 - D - 2)y = e^{5x} + 2$.

2. Solve $\frac{d^2y}{dx^2} - \frac{2dy}{dx} - 3y = 8\cos 2x$.

3. Solve $(D^2 - 4D - 12)y = \sin x \sin 2x$.

4. Solve $(D^2 + 4D - 5)e^{3x} + 4\cos 4x$.

5. Solve $(D^2 + 3D - 2)y = \sin 3x \cos 2x$.

6. Solve $(D^2 + D - 2)y = x^2 - 2x + 3$.

7. Solve $(D^2 - 2D + 1)y = x^2 + 1 + \sin 2x$.

8. Solve $(D^2 + 4D + 3)y = 8xe^x - 6$.

9. Solve $(D^2 - 4D + 3)y = e^x \cos 2x$.

10. Solve $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} - 3y = e^{2x}(1 + x^2)$.

SECTION-C

10 Marks

1. Solve $(D^2 + a^2)y = \sin ax + a \cos ax$.

2. Solve $(D^2 + 2D + 2)y = -2\cos 2x - 4\sin 2x$, Given that $y(0)$ and $y'(0) = 1$.

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

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

UNIT -III -Linear Differential Equation of Second order with Variable co-efficients

SECTION-A

2 Marks

1. Define Cauchy – Euler equation.

2. Solve $\frac{x^2 d^2y}{dx^2} - \frac{xdy}{dx} + y = x^2$.

3. Convert $(x^3 D^2 + 3x^2 D + 5x)y = \pi$ into the differential equation with constant co-efficient.

4. Convert $(x^2 y^{11} - xy^1 + y) = \log x + \pi$ into the differential equation with constant co-efficient.

5. Convert $(2x+3)^2 y^{11} - 2(2x+3)y^1 + 2y = 6x$.

6. Define Legendre linear equation.

SECTION-B

5 Marks

1. Solve $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = \sin(\log x)$.

2. Solve $x^2 \frac{d^2y}{dx^2} + 4x \frac{dy}{dx} + 2y = 6x$.

3. Solve $\frac{d^2y}{dx^2} + \frac{1}{x} \frac{dy}{dx} = \frac{12 \log x}{x^2}$.

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

5. Solve $(x^2 D^2 - 2xD - 4)y = x^2 2 \log x$.

6. Solve $((1+x^2)D^2 + (1+x)D + 1)y = 4\cos(\log(1+x))$.

7. Solve $(x+1)^2 \frac{d^2y}{dx^2} - 3(x+1) \frac{dy}{dx} + 4y = x^2 + x + 1$.

8. Solve $(5+2x)^2 \frac{d^2y}{dx^2} - 6(5+2x) \frac{dy}{dx} + 4y = 6x$.

SECTION-C

10 Marks

1. Solve $x^2 \frac{d^2y}{dx^2} - 3x \frac{dy}{dx} + 5y = x^2 \sin(\log x)$.

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

3. Solve $x^2 \frac{d^2y}{dx^2} - x \frac{dy}{dx} + y = \frac{\log x (\sin \log x) + 1}{x}$.

4. Solve $(2x+1)^2 - 2(2x+1) \frac{dy}{dx} - 12y = 6x$.

5. Solve $(3x+2)^2 \frac{d^2y}{dx^2} + 3(3x+2) \frac{dy}{dx} - 36y = 3x^2 + 4x + 1$.

6. Solve $(1+x^2) \frac{d^2y}{dx^2} + (1+x) \frac{dy}{dx} + y = \log(1+x)^4 + \cos(\log(1+x))$.

UNIT – IV -Method of variation of parameter

SECTION-A

2 Marks

1. Define Wronskian.
2. Write about the trial solution for the method of undetermined co-efficients.
3. Solve $y^1 + y = e^{-x}$ by the method of variation of parameter.
4. Solve the differential equation $xy^1 - 2y = x^4$ by the method of variation of parameter.

SECTION-B

5 Marks

1. Solve $y^{11} + ya^2 = seax$ by the method of variation of parameter.
2. Solve $y^{11} + 4y = \tan 2x$ by the method of variation of parameter.
3. Solve $\frac{dy}{dx} - y \cos x = \sin 2x$ by the method of variation of parameter.
4. Solve $(D^2 + 1)y = x(\sin x)$ by the method of variation of parameter.
5. Solve $y^{11} + 3y^1 + 2y = 4e^{2x} + x$ by the method of undetermined co-efficients.
6. Solve $y^1 + y = \sin x$ by the method of undetermined co-efficients.

SECTION-C**10 Marks**

1. Solve $(D^2 + n^2)y = \operatorname{cosec} nx$ by the method of variation of parameter.
2. Solve $y^{11} + 7y^1 - 8y = e^{2x}$ by the method of variation of parameter.
3. Solve $(D^2 + 1)y = \sin x + \cos 2x$ by the method of undetermined co – efficient.
4. Solve $(D^2 + D)y = e^x \sin x$ by the method of undetermined co – efficient.
5. Solve $y^{11} - 3y^1 + 4y = 2\sin x$ by the method of undetermined co – efficient.

UNIT – 5-Simultaneous equations**SECTION-A****2 Marks**

1. Define Simultaneous equations.
2. Eliminate y between $\frac{dx}{dt} - 7x + y = 0$; $\frac{dy}{dt} - 2x - 5y = 0$.
3. Eliminate x between from the differential equation $\frac{dx}{dt} + 2y = 0$; $\frac{dy}{dt} - 2x = 0$.
4. Define simultaneous equations of first order and first degree.
5. solve $\frac{dx}{yz} = \frac{dy}{xz} = \frac{dz}{xz}$.
6. Solve the equation $\frac{dx}{-y^2 - z^2} = \frac{dy}{xy} = \frac{dz}{xz}$.

SECTION-B**5 Marks**

1. Solve the equations $\frac{dx}{dt} + 2y = -\sin t$; $\frac{dy}{dt} - 2x = \cos t$.
2. Solve the equations $\frac{dx}{dt} + 2y = \sin 2t$; $\frac{dy}{dt} - 2x = \cos 2t$.
3. Solve $\frac{dx}{dt} + \frac{dy}{dt} + x + y = 10e^t$; $\frac{dx}{dt} - \frac{dy}{dt} + x - y = 0$ Given that $x(0)=2$; $y(0)=3$.
4. Solve $\frac{dx}{dt} = 4x - 2ye^t$; $\frac{dy}{dt} = 6x - 3y$.
5. Solve $\frac{dx}{y-xz} = \frac{dy}{yz+x} = \frac{dz}{x^2+y^2}$.
6. Solve $\frac{dx}{mz-ny} = \frac{dy}{nx-lz} = \frac{dz}{ly-mx}$.
7. Solve $\frac{dx}{y+z} = \frac{dy}{z+x} = \frac{dz}{x+y}$.
8. Solve $\frac{dx}{x^2-y^2-z^2} = \frac{dy}{2xy} = \frac{dz}{2xz}$.
9. Solve $\frac{dx}{x(y-z)} = \frac{dy}{y(z-x)} = \frac{dz}{z(x-y)}$.

10. Solve $\frac{dx}{y+xz} = \frac{dy}{-x-yz} = \frac{dz}{x^2-y^2}$.

SECTION-C

10 Marks

1. solve $(2D-3)x + Dy = e^t$; $Dx + (D+2)y = \cos 2t$.

2. Solve the equation $2\frac{dx}{dt} + x + \frac{dy}{dt} = \cos t$; $\frac{dx}{dt} + 2\frac{dy}{dt} + y = 0$.

3. Solve $\frac{dx}{dt} + \frac{dy}{dt} - 2y = 2\cos t - 7\sin t$; $\frac{dx}{dt} - \frac{dy}{dt} + 2x = 4\cos t - 3\sin t$.

4. Solve $\frac{dx}{dt} + 5x - 2y = t$; $\frac{dy}{dt} + 2x + y = 0$, given that $x = 0$.

5. Solve $\frac{dx}{x(y^2-z^2)} = \frac{dy}{y(z^2-x^2)} = \frac{dz}{z(x^2-y^2)}$.

6. Solve $\frac{dx}{x^2+y^2+yz} = \frac{dy}{x^2+y^2-xz} = \frac{dz}{z(x+y)}$.

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