RAMANASRI
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Ordinary Differential Equations (ODE)

IFoS (IFS) Previous Year Questions (PYQ) from 2025 to 2009

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2025

1. Solve the differential equation $\frac{dy}{dx} + \frac{y}{(1-x^2)^{3/2}} = \frac{x + (1-x^2)^{1/2}}{(1-x^2)^2}$.

[8 Marks]

2. Solve the differential equation $x^2\frac{d^2y}{dx^2} - x\frac{dy}{dx} + 4y = \cos(\log x) + x\sin(\log x)$.

[8 Marks]

3. Given that $y = x + \frac{1}{x}$ is a solution of the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = 0$. Find the other linearly independent solution and write down the general solution of the given differential equation.

[10 Marks]

4. Use the method of variation of parameters to show that the solution of $\frac{d^2y}{dx^2} + k^2y = \phi(x)$, satisfying the conditions $y(0) = 0 = \left.\frac{dy}{dx}\right|_{x=0}$, is given by $y(x) = \frac{1}{k}\int_0^x \phi(t)\sin k(x-t)\,dt$.

[15 Marks]

5. Find the general and singular solutions of $3xy = 2px^2 - 2p^2$, where $p = \frac{dy}{dx}$.

[15 Marks]

2024

6. Solve the differential equation $p^2 + \left(x + y - \frac{2y}{x}\right)p + xy + \frac{y^2}{x^2} - y - \frac{y^2}{x} = 0$, where $p = \frac{dy}{dx}$.

[8 Marks]

7. Solve the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \cosh x$.

[8 Marks]

8. Solve the differential equation $\frac{d^2y}{dx^2} + 10\frac{dy}{dx} + 29y = xe^{5x} + \sin 2x$.

[10 Marks]

9. Solve the differential equation $\frac{d^2y}{dx^2} - \cot x\frac{dy}{dx} - (1 - \cot x)y = e^x \sin x$.

[15 Marks]

10. Using the method of variation of parameters, solve the differential equation $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} - y = x^2\log x$, $x > 0$.

[15 Marks]

2023

11. Find the solution of the differential equation $2x^2y\left(\frac{dy}{dx}\right) = \tan(x^2y) - 2xy^2$. What will be the definite value of the arbitrary constant, appearing in the solution, on coordinate axes?

[8 Marks]

12. Identify that one solution of the equation $xy'' + (x-1)y' - y = 0$ is of the form $ce^{\pm ax}$ and then find the other solution by method of reduction of order.

[8 Marks]

13. Solve the differential equation $y(xy + 2x^2y^2)\,dx + x(xy - x^2y^2)\,dy = 0$. Verify that the obtained solution satisfies the given differential equation.

[10 Marks]

14. Find the complete solution of $x^2\frac{d^2y}{dx^2} - 3x\frac{dy}{dx} + y = \frac{\log x \sin(\log x) + 1}{x}$.

[15 Marks]

15. Find singular solution of the differential equation $y^2\left(\frac{dy}{dx}\right)^2 - 2xy\left(\frac{dy}{dx}\right)\tan^2\beta + y^2\sec^2\beta - x^2\tan^2\beta = 0$ directly and from its complete primitive. Determine tac-locus. Show that the envelope of family of curves, which is represented by the given equation, is $y = \pm x\tan\beta$.

[15 Marks]

2022

16. Find the general solution of the differential equation $p^2\cos^2 y + p\sin x\cos x\cos y - \sin y\cos^2 x = 0$, where $p = \frac{dy}{dx}$.

[8 Marks]

17. Solve the differential equation $(D^2 - 1)y = e^x(1 + x^2)$, where $D = \frac{d}{dx}$.

[8 Marks]

18. Solve the differential equation $4(xp^2 + yp) = y^4$, where $p = \frac{dy}{dx}$.

[10 Marks]

19. Given that $y_1 = x^2$ is a solution of the differential equation $x^3\frac{d^2y}{dx^2} - (x^2 + 3x)\frac{dy}{dx} + 6y = 0$, find the other linearly independent solution of the above differential equation and write down the general solution of the differential equation.

[15 Marks]

20. Solve the differential equation $x^3\frac{d^3y}{dx^3} + x^2\frac{d^2y}{dx^2} - 2x\frac{dy}{dx} + 2y = 15x^4 + 8x^3$.

[15 Marks]

2021

21. Solve the differential equation $\frac{d^2y}{dx^2} - 3\frac{dy}{dx} + 2y = \frac{e^x}{1+e^x}$ by the method of variation of parameters.

[8 Marks]

22. Solve the differential equation $y - x\frac{dy}{dx} = f\left(y^2 + \frac{dy}{dx}\right)$.

[8 Marks]

23. Solve the differential equation $(D^4 + D^2 + 1)y = e^{-x/2}\cos\left(\frac{\sqrt{3}}{2}x\right)$.

[10 Marks]

24. Find the general solution of the differential equation $(1+2x)^2\frac{d^2y}{dx^2} - 6(1+2x)\frac{dy}{dx} + 16y = 8(1+2x)^2$.

[15 Marks]

25. (i) Reduce the differential equation $axyp^2 + (x^2 - ay^2 - b)p - xy = 0$, where $p = \frac{dy}{dx}$, to Clairaut's form and find the general solution.

(ii) Find the singular solution of the differential equation $9p^2(2-y)^2 = 4(3-y)$, where $p = \frac{dy}{dx}$.

[8+7=15 Marks]