

Serial No.	Questions	CO	Bloom's Taxonomy Level	Difficulty Level	Competitive Exam Question Y/N	Area	Topic	Unit	Marks
1	Define ordinary differential equation and give an example.	CO4	K1	Low	N	ordinary differential equation	Definition	4	2
2	Define order and degree of ordinary differential equation	CO4	K1	Low	N	ordinary differential equation	order and degree	4	2
3	Identify order and degree in each of the following differential equations $\frac{d^3y}{dx^3} - 5x\frac{dy}{dx} = e^x + 1$	CO4	K2	Medium	N	ordinary differential equation	order and degree	4	2
4	Identify order and degree in each of the following differential equations $y\left(\frac{dy}{dx}\right)^2 = x^2 + 1$	CO4	K2	Medium	N	ordinary differential equation	order and degree	4	2
5	Define general and particular solution of the ODE.	CO4	K1	Medium	N	Type of solution	Definition	4	2
6	Show that $y = e^{5x}$ is the particular solution of the ODE $y' - 5y = 0$ .	CO4	K2	Low	N	Type of solution	Verifying of type of solution	4	2
7	Verify that $y = ce^t$ is the general solution of the differential equation $\frac{dy}{dt} = y$ .	CO4	K2	Medium	N	Type of solution	Verifying of type of solution	4	2
8	What is the necessary and sufficient condition for $M(x, y)dx + N(x, y)dy = 0$ to be an exact differential equation.	CO4	K1	Low	N	Exact ODE of first order	necessary and sufficient condition for exactness	4	2
9	Determine the exactness of the differential equation $ydx + xdy = 0$ .	CO4	K2	Low	N	Exact ODE of first order	Checking of exactness	4	2
10	Find the solution of the differential equation $(D^2 - 4)y = 0$ .	CO4	K2	Medium	N	Homogeneous linear differential equation with constant coefficients	Complementary function	4	2
11	For the initial value problem $\frac{dy}{dx} = \sin(x)$ , $y(0) = 0$ Find the value of y at $x = \pi/3$ .	CO4	K2	Low	Y	Differential equation with constant coefficient	Solution of differential equation	4	2

	<b>(Gate 2017)</b>								
12	Define linearly independent of two functions.	CO4	K1	Medium	N	Homogeneous linear differential equation with constant coefficient	Independence	4	2
13	Is $y(x) = c_1 \sin 2x + c_2 \cos 2x$ , where $c_1$ and $c_2$ are arbitrary constants, a solution of $y'' + 4y = 0$ ?	CO4	K2	Medium	N	Homogeneous linear differential equation with constant coefficient	Solution of differential equation	4	2
14	Find the P.I of $\frac{1}{D^2 + 4} \cos 2x$	CO4	K2	High	N	Non-Homogeneous linear differential equation with constant coefficients	Particular integral	4	2
15	Find PI of $(D^2 - 2D)y = 5$ .	CO4	K2	High	N	Non-Homogeneous linear differential equation with constant coefficients	Particular integral	4	2
16	Solve the differential equation $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} + y = 0$ , (Gate 2008)	CO4	K2	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Repeated roots)	4	2
17	Find the general solution of second order linear homogeneous differential equation $\frac{d^2 y}{dt^2} - 6 \frac{dy}{dt} + 25y = 0$ , (Gate 2018)	CO4	K2	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Real and distinct roots)	4	2
18	Determine whether the differential equation $\cos(x+y)dx + (3y^2 + 2y + \cos(x+y))dy = 0$ is exact, If exact solve it.	CO4	K2	Medium	N	Exact ODE of first order	Test and Solution	4	6
19	Determine whether the differential equation $x^3 dx + y^3 dy = 0$ is exact, If exact, solve it.	CO4	K2	Medium	N	Exact ODE of first order	Solution	4	6
20	Determine whether the differential equation $2x \tan y dx + \sec^2 y dy = 0$ is exact, If exact, solve it.	CO4	K2	Medium	N	Exact ODE of first order	Solution	4	6
21	Determine whether the	CO4	K2	Medium	N	Exact ODE of first order	Solution	4	6

	<p>differential equation</p> <p><math>e^{x^2} (2xydx + dy) = 0</math> is exact, If exact, solve it.</p>								
22	<p>Solve:</p> $\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} - 5y = 0$ <p><b>(Gate 2017)</b></p>	CO4	K3	High	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (complex roots)	4	6
23	<p>Solve the differential equation <math>\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = 0</math>, given that <math>y=0</math> and <math>y' = 3e^{-1}</math> at <math>x=0</math>, Find <math>y(2)</math>. <b>(Gate 2016)</b></p>	CO4	K3	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Repeated roots)	4	6
24	<p>Solve:</p> $\frac{d^2 y}{dx^2} + 2 \frac{dy}{dx} + y = 0$ <p><math>y(0) = 1, y'(0) = 0</math></p> <p><b>Gate 2016)</b></p>	CO4	K3	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Repeated roots)	4	6
25	<p>Solve the differential equation <math>\frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} = 0</math>, given that <math>y=0</math> and <math>\frac{dy}{dx} = 1</math> at <math>x=0</math>. <b>(Gate 2018)</b></p>	CO4	K3	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Real and distinct roots)	4	6
26	<p>A function <math>y(t)</math> satisfies the differential</p> $\frac{d^2 y}{dt^2} - 2 \frac{dy}{dt} + y = 0,$ <p>and subjected to initial conditions <math>y(t=0)=0</math> and <math>dy/dt(t=0)=1</math>. Then find <math>y(t=1)</math>. <b>(Gate 2013)</b></p>	CO4	K3	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Real and distinct roots)	4	6
27	<p>Consider the second order linear ordinary differential equation <math>\frac{d^2 y}{dx^2} - 4 \frac{dy}{dx} + 4y = 0</math>, with the boundary conditions <math>y(0) = 1, \frac{dy}{dx} _{x=0} = 1</math>. Find the value of <math>y</math> at <math>x=1</math>. <b>(GATE 2016)</b></p>	CO4	K2	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Repeated roots)	4	6
28	<p>Find the particular solution of the differential equation <math>y'' - 4y' + 3y = 2x - 3x^2</math>. <b>(Gate 2017)</b></p>	CO4	K2	Medium	Y	Non-Homogeneous linear differential equation with	particular solution	4	6

						constant coefficients			
<b>29</b>	Solve: $y'' + y' - 2y = 0,$ $y(0) = 4, y'(0) = -5$	CO4	K2	Medium	N	Homogeneous linear differential equation with constant coefficients	Complementary function (Real and distinct roots)	4	6
<b>30</b>	Solve: $\frac{d^2 y}{dx^2} + 5\frac{dy}{dx} + 4y = 10e^{-3x}$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>31</b>	Solve: $\frac{d^2 y}{dx^2} + 3\frac{dy}{dx} + 2y = 12x^2$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>32</b>	Solve: $\frac{d^2 y}{dx^2} + 4\frac{dy}{dx} + 4y = e^{-x} \cos x$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>33</b>	Solve: $\frac{d^2 y}{dx^2} + 2\frac{dy}{dx} + y = 2x \cos x$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>34</b>	Solve: $3\frac{d^2 y}{dx^2} + 27y = 3\cos x + \cos 3x$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>35</b>	Solve: $\frac{d^2 y}{dx^2} - 2y = 6e^{2x} - 4e^{-2x}$	CO4	K3	High	N	Non-homogeneous linear differential equation with constant coefficients	CF and PI	4	6
<b>36</b>	Solve the non homogeneous ODE by method of variation of	CO4	K3	High	N	Non-homogeneous	Variation of	4	6

	parameter: $\frac{d^2y}{dx^2} + y = \sec x$					linear differential equation with constant coefficients	parameter		
37	Find the solution of the differential equation $x^2 \frac{d^2y}{dx^2} + 5x \frac{dy}{dx} + 4y = 0$ (Gate 2017)	CO4	K3	Medium	Y	Homogeneous linear differential equation with variable coefficients	Cauchy-Euler equation	4	6
38	Solve: $x^2 y'' - xy' + y = 0$	CO4	K3	Medium	N	Homogeneous linear differential equation with variable coefficients	Cauchy-Euler equation	4	6
39	Find the current $I(t)$ in the LC - circuit with the following data assuming initial current and charge: L=2 Henry, C= 0.005 Farad and E=220 Sin 4t volts.	CO4	K3	Medium	N	Application of Linear Differential Equations to Electric circuits	LC – CIRCUIT	4	6
40	The equation of an L – R circuit is given by $L \frac{dI}{dt} + RI = 10 \sin t$ If $I = 0$ at $t = 0$ , express $I$ as a function of $t$ .	CO4	K3	Low	N	Application of Linear Differential Equations to Electric circuits	LR CIRCUIT	4	6
41	A resistance of 100 ohms and an inductance of 0.5 Henry are connected in series with a battery of 20 volts. Find the current in a circuit as a function of t.	CO4	K3	Medium	N	Application of Linear Differential Equations to Electric circuits	RL SERIES	4	6
42	The position of a particle y(t) is described by the differential equation $\frac{d^2y}{dt^2} + \frac{dy}{dt} + \frac{5}{4}y = 0$ , the initial conditions are $y(t=0)=0$ and $dy/dt(t=0)=1$ . Find the position at $t = \pi$ . (Gate 2018)	CO4	K3	Medium	Y	Homogeneous linear differential equation with constant coefficients	Complementary function (Roots are complex)	4	6
43	Apply Method of variation of parameters to solve:	CO4	K3	High	N	Variation of parameter method	P.I of a second order linear	4	9

	$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 6e^{2x}/x^4$						differential equation.		
44	Apply Method of variation of parameters to solve: $y'' - y = e^{-x} \sin(e^{-x}) + \cos(e^{-x})$	CO4	K3	High	N	Variation of parameter method	P.I of a second order linear differential equation.	4	9
45	Apply Method of variation of parameters to solve $y'' - 2y' - 3y = xe^{-x}$	CO4	K3	High	N	Variation of parameter method	P.I of a second order linear differential equation.	4	9
46	Solve: $x^2y'' - 3xy' + 3y = 3 \ln x - 4$	CO4	K2	High	N	Homogeneous linear differential equation with variable coefficient	Cauchy-Euler equation	4	9
47	Solve: $(x^2D^2 - xD + 1)y = \left(\frac{\log x}{x}\right)^2$ (GATE 2014)	CO4	K3	High	Y	Homogeneous linear differential equation with variable coefficients	Cauchy-Euler equation	4	9
48	Solve: $(x^2D^2 - 4xD + 6I)y = 21x^{-2}$	CO4	K3	High	N	Homogeneous linear differential equation with variable coefficients	Cauchy-Euler equation	4	9
49	Solve the class of simultaneous differential equations: $\frac{dx}{dt} + 2\frac{dy}{dt} - 2x - y = e^{2t}$ $\frac{dy}{dt} + x - 2y = 0$	CO4	K3	Medium	N	System of linear differential equations.	Simultaneous linear differential equations with constant coefficient	4	9
50	Solve the set of simultaneous differential equations $(3D+1)x + 3Dy = 3t + 1$ $(D-3)x + Dy = 2t$	CO4	K3	Medium	N	System of linear Diff. equations	simultaneous differential equations	4	9
51	Solve the simultaneous differential equation	CO4	K3	Medium	Y	System of linear Diff. equations	Simultaneous linear differential equations	4	9

	$\frac{d^2x}{dt^2} + 4x + y = te^t$ $\frac{d^2y}{dt^2} + y - 2x = \sin^2 t$ <p><b>(GATE 2009)</b></p>						with constant coefficient		
<b>52</b>	Find the current in the <i>RLC</i> circuit given that $R = 20$ ohms, $L = 5$ henries, $C = 10^{-2}$ farad, $E = 425 \sin 4t$ volts.	CO4	K3	Medium	N	Application of Linear Diff. equations to Electric circuits	RLC CIRCUIT	4	9
<b>53</b>	Find the steady current in the <i>RLC</i> circuit with $R = 8$ ohms, $L = 0.1$ henries, $C = 1$ farad, $E = 160 \cos 5t$ volts.	CO4	K3	Low	N	Application of Linear Differential Equations to Electric circuits	RLC CIRCUIT	4	9
<b>54</b>	An input voltage $v(t) = 10\sqrt{2} \cos(t + 10^\circ) + 10\sqrt{3} \cos(2t + 10^\circ)$ volts is applied to a series combination of resistance $R = 1\Omega$ and an inductance $L = 1H$ . Find the resulting steady current in amperes. <b>(GATE 2003)</b>	CO4	K3	Low	Y	Application of Linear Differential Equations to Electric circuits	RLC CIRCUIT	4	9