HLM University, Greater Noida
Mid Semester Examination, Even Semester-2025

Roll No.	2410030068

Name of the School	School of Basic & Applied Sciences	**Name of the Department**	Department of Mathematics
Name of the Program	B. Tech.	**Course Code- Course Name/ Name of faculty**	UCS2005/ Mathematics for Computing
Session	2024-25	**Branch, Year & Semester**	CSE/R&AI, 1st, 2nd
Time/Maximum Marks	**90 Minutes/50**	**Set**	B
Note: Attempt all questions.			

Q No.	QUESTIONS	MARKS	CO
	SECTION-A		
1	Solve $(D^2 + 4D + 4)y = 0$, where $D \equiv \frac{d}{dx}$.	2	1
2	Find Particular Integral of $D^2y + y = sin2x$.	2	1
3	Solve $(D^2 + 1)y = 0$, where $D \equiv \frac{d}{dx}$.	2	1
4	Obtain the Laplace transform of $sin(a + bt)$.	2	2
5	Obtain the Laplace transform of t^3.	2	2
6	Solve $5\frac{\partial^2 z}{\partial x \partial y} + 4\frac{\partial^2 z}{\partial y^2} = 0$.	2	3
7	Solve the partial differential equation $(D - 1)(D - D' - 2)z = 0$.	2	3
	SECTION-B		
8	Solve $(D^2 + 5D + 4)y = x^2 + 7x + 9$.	6	1
9	Solve $(D^2 + 1)y = tanx$ by using the method of variation of parameters.	6	1
10	Obtain the Laplace transform of $te^t sin4t$.	6	2
11	Obtain the Laplace transform of $\frac{e^{at} - cosbt}{t}$.	6	2
12	Solve $4\frac{\partial^2 z}{\partial x^2} - 4\frac{\partial^2 z}{\partial x \partial y} + \frac{\partial^2 z}{\partial y^2} = e^{x+2y}$.	6	3
13	Solve $\frac{\partial^2 z}{\partial x^2} - \frac{\partial^2 z}{\partial x \partial y} = \sin x \cos 2y$.	6	3

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	Session	2024-25	**Branch, Year & Semester**	CSE, IBM, IOS 1st, 2nd
	Time/Maximum Marks	**180 Minutes/100**	**Set**	B
	Note: Attempt all questions.			

Q. No.	QUESTIONS	MARKS	CO
	SECTION-A		
1 (a)	Solve $$(D^2 - 2D + 4)y = 0$$; where $D \equiv \frac{d}{dx}$.	2	1
(b)	Obtain particular integral of $$(D^3 - 3D^2 + 4D - 2)y = e^x + \cos x.$$	2	1
(c)	Obtain the Laplace transform of $$F(t) = 3\sin t + \frac{1}{2}e^{3t}.$$	2	2
(d)	State the Convolution theorem for inverse Laplace transform.	2	2
(e)	Solve the partial differential equation $$r - 4s + 4t = 0.$$	2	3
(f)	Obtain particular integral of $$D\left(D - 2D' - 3\right)z = e^{x+2y}$$ where $D \equiv \frac{\partial}{\partial x}$ and $D' \equiv \frac{\partial}{\partial y}$.	2	3
(g)	Write Dirichlet's conditions for the existence of Fourier Series	2	4
(h)	Write the half-range Fourier Cosine series for a function $f(x)$ over the interval $0 < x < l$.	2	4
(i)	State Rank Nullity theorem.	2	5
(j)	If λ be an eigen value of a non-singular matrix A, then calculate the Eigen value of $5A + 2A^{-1} - 7A^2 - 3I$	2	5
	SECTION-B: Attempt all questions.		
2 (a)	Obtain the solution of $$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = e^x \sin x.$$	6	1
(b)	Obtain the Laplace transform of $$\frac{\cos at - \cos bt}{t}.$$	6	2
(c)	Solve $$(D-1)(D - D' + 1)z = \sin(x + 2y)$$ where $D \equiv \frac{\partial}{\partial x}$ and $D' \equiv \frac{\partial}{\partial y}$.	6	3
(d)	Expand $f(x) = x$ as a half range sine series in $0 < x < 2$.	6	4
(e)	Examine the vectors $$X_1 = (1, 2, 3), \quad X_2 = (2, -2, 0)$$ for linear dependence.	6	5

SECTION-C: Attempt all questions. Attempt any one part of each question.			
3 (a)	Solve the following differential equation by applying the method of changing the independent variable: $$\frac{d^2y}{dx^2} - \frac{1}{x}\frac{dy}{dx} + 4x^2y = x^4$$ OR	10	1
3(b)	Solve by applying the method of variation of parameters: $$y'' - 3y' + 2y = \frac{e^x}{1+e^x}$$		
4(a)	Obtain the inverse Laplace transform of the function: $$f(s) = \frac{s}{(s^2+1)(s^2+4)}$$ using convolution theorem. OR	10	2
4(b)	Solve the differential equation by applying Laplace transform: $$\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 5x = e^{-t}\sin t$$, where $x(0) = 0$ and $x'(0) = 1$		
5(a)	Solve: $(D^2 + 2DD' + D'^2)z = 2(y-x) + \sin(x-y)$ where $D \equiv \frac{\partial}{\partial x}$ and $D' \equiv \frac{\partial}{\partial y}$. OR	10	3
5(b)	Obtain the solution of the Lagrange's equation: $yzp - xzq = xy$.		
6(a)	Obtain the Fourier series for the function $f(x) = x^2$ in $-\pi \le x \le \pi$. Hence deduce that : $$\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \cdots = \frac{\pi^2}{6}$$ OR	10	4
6(b)	Obtain Fourier series to represent the function $f(x)$, given by: $$f(x) = \begin{cases} -k \ ; & -\pi < x < 0 \\ k \ ; & 0 < x < \pi \end{cases}$$		
7(a)	Solve the following system of linear equations by applying matrix method: $$x + y + z = 3$$ $$x + 2y + 3z = 4$$ $$x + 4y + 9z = 6$$ OR	10	5
7(b)	Find the Eigen values and Eigen vectors of the matrix $$A = \begin{bmatrix} 1 & -2 \\ -5 & 4 \end{bmatrix}$$		