Q.P Code: D141641	Total Pages 3	Name 760306
		Register No.

SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2026

MATHEMATICS

MAT2MN101

Differential Equations and Matrix Theory

2024 Admission Onwards

Maximum Time :2 Hours | **Maximum Marks :70**

Section A

All Question can be answered. Each Question carries 3 marks (Ceiling : 24 Marks)

1	Explain Implicit Solution of an ordinary differential equation
2	Solve the differential equation $\frac{dy}{dx} = e^{2x+3y}$
3	Find $\mathscr{L}\{t^3\}$
4	Find $\mathscr{L}^{-1}\left\{\frac{1}{s^2+7}\right\}$
5	Determine whether the set of vectors $\{x^2, (x+1)^2, (x+2)^2, 1\}$ is linearly independent or linearly dependent in P_2.
6	Show that the following system is consistent $$x - y = 1$$ $$x + 2y = 5$$
7	Suppose $\mathbf{A}$ is an $n \times n$ matrix such that $\mathbf{A}^2 = I$. Then show that det $\mathbf{A} = \pm 1$.
8	Find a_0 in the Fourier series expansion of the function $f(x) = \begin{cases} 1 & \text{if } -\pi < x < 0 \\ -x & \text{if } 0 \leq x < \pi \end{cases}$
9	Explain Fourier Cosine and Sine Series
10	Classify the following partial differential equation $3\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial y}$

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Section B

All Question can be answered. Each Question carries 6 marks (Ceiling : 36 Marks))

11 Solve $2xydx + (x^2 - 1)dy = 0$.

12 Find the general solution of

$$y^{(4)} - 2y'' + y = 0$$

13 Find $\mathscr{L}^{-1}\left\{\dfrac{6s+3}{s^4+5s+4}\right\}$

14 Determine whether the following sets are subspace of the vector space $C(-\infty, \infty)$. Justify your answer

1. All functions f such that $f(-x) = f(x)$
2. All differentiable functions f

15 Solve the following system of linear equations

$x + y + z = 3$

$x + 2y + 3z = 4$

$x + 4y + 9z = 6$

16 Find the eigen values and the corresponding eigen vectors of the matrix $\begin{bmatrix} -2 & -1 \\ 5 & 4 \end{bmatrix}$

17 Expand $f(x) = \begin{cases} 1 & \text{if } -1 < x < 0 \\ x & \text{if } 0 \leq x < 1 \end{cases}$ in a Fourier Series.

18 Use separation of variables to find product solutions for the following partial differential equation.

$$x\frac{\partial u}{\partial x} = y\frac{\partial u}{\partial y}$$

Section C

Answer any ONE. Each Question carries 10 marks (1x10=10 Marks))

19	Solve the initial-value problem $$y''' + 12y'' + 36y' = 0, y(0) = 0, y'(0) = 1, y''(0) = -7$$
20	Expand $f(x) = x^2, 0 < x < L$ 1. in a cosine series 2. in a sine series 3. in a Fourier series