

Q.P Code <b>D 122901</b>	Total Pages <b>3</b>	Name <b>603174</b>
		Register No.
<b>SECOND SEMESTER (CUFYUGP) DEGREE EXAMINATION, APRIL 2025</b>		
<b>MATHEMATICS</b>		
<b>MAT2MN101 Differential Equations and Matrix Theory</b>		
<b>2024 Admission Onwards</b>		
<b>Maximum Time :2 Hours</b>		<b>Maximum Marks :70</b>

## Section A

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

1	Explain the difference between ordinary differential equation and partial differential equation with examples
2	Solve the differential equation $\frac{dy}{dx} = \frac{-y}{x}$
3	Find the general solution of the given differential equation. $\frac{dy}{dx} + y = e^{3x}$
4	Find $\mathcal{L}\{\sinh t\}$
5	Find $\mathcal{L}^{-1}\left\{\frac{1}{s+1}\right\}$
6	Solve $2x + y = 4, 3x - 4y = 7$
7	Evaluate the determinant of $\begin{pmatrix} 1 & 5 & 6 \\ 7 & 3 & 2 \\ 3 & 9 & 1 \end{pmatrix}$
8	Explain Eigenvalues and Eigenvectors of a matrix
9	Expand $f(x) = x, -2 < x < 2$ , in a Fourier series.
10	Classify the following partial differential equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial x \partial y} = 0$

## Section B

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

11	Solve the initial-value problem $\frac{dy}{dx} - 2xy = 0; y(0) = 1$
12	Solve the initial-value problem $(4y + 2t - 5)dt + (6y + 4t - 1)dy = 0, y(-1) = 2$
13	Find $\mathcal{L}^{-1} \left\{ \frac{3s + 16}{s^2 - s - 6} \right\}$
14	Define a Vector Space. Prove or Disprove that the set of all rational numbers under usual addition and multiplication is a real vector space.
15	<p>Solve the system of linear equations</p> $5x + 3y + 7z = 4$ $3x + 26y + 2z = 9$ $7x + 2y + 10z = 5$
16	Using row reduction find the rank of $\begin{pmatrix} 1 & 7 & 4 & 5 & 4 \\ 0 & 2 & 3 & 10 & 3 \\ 2 & 5 & 9 & 1 & 0 \\ 6 & 3 & 4 & 1 & 3 \end{pmatrix}$
17	Expand $f(x) = \begin{cases} 0 & \text{if } -\pi < x < 0 \\ \pi - x & \text{if } 0 \leq x < \pi \end{cases}$ in a Fourier Series.
18	<p>Use separation of variables to find product solutions for the following partial differential equation.</p> $\frac{\partial u}{\partial x} = \frac{\partial u}{\partial y}$

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

19 Use the Laplace transform to solve the initial-value problem.  $y'' + 5y' + 4y = 0, y(0) = 1, y'(0) = 0$

20 Find the eigen values and the corresponding eigen vectors of the following matrix

$$\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

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