UNLIMITED FUN, JOYFUL LEARNING

Reg. No: 24BBT0300

R/K/TY

Final Assessment Test – November 2025

VIT
Vellore Institute of Technology

Course: BMAT203L - Linear Algebra and Differential Equations
Class NBR(s): 0703 / 0709
Slot: A2+TA2+TAA2
Time: Three Hours
Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Solving system of equations by matrix method.
CO2	Apply concepts of sequences and series to model real life applications.
CO3	Understanding the concept of ordinary differential equations of first and second order linear differential equations.
CO4	Formulate practical problems using various mathematical techniques.
CO5	Apply the techniques of differential equations to model dynamic problems.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

Answer ALL Questions
(10 X 10 = 100 Marks)

1. Find the eigen values and eigenvectors of the matrix $\begin{bmatrix} 2 & 1 & -1 \\ 1 & 1 & -2 \\ -1 & -2 & 1 \end{bmatrix}$. CO1 BL1

2. Solve the following system of linear equations by Gauss elimination method $2x - y + z + w = 6, x + 2y - z - w = 3, -x + 2y + 2z + 2w = 14,$ $x - y + 2z + w = 8.$ CO1 BL2

3. Estimate the partial sum of 10 terms in the series $\sum_{n=1}^{\infty}\left(\frac{1}{\sqrt{n}} - \frac{1}{\sqrt{n+1}}\right)$. Further examine the series is diverges or converges. CO2 BL3

4. Find the power series representation of the function for $\frac{1}{x+10}$. Hence determine its radius of convergence and interval of convergence. CO2 BL2

5. Find the Taylor series for $f(x) = \cos(x)$ centered at the value $x = \pi/2$ up to cubic expansion and discuss its radius and interval of convergence. CO2 BL3

6. Determine the slope field, source and sink at equilibrium points further draw the phase line and sketch the solutions curves for the autonomous differential equation $\frac{dP}{dt} = \left(1 - \frac{P}{20}\right)^3 \left(\frac{P}{5} - 1\right) P^7$. CO3 BL1

7. Newton's law of cooling is used to homicide investigation to determine the time of death. The normal body temperature is 98.6° F, immediately following death the body begins to cool in one hour to 24.6° F assuming time is measured in hours, suppose that temperature of surroundings is 60° F. CO4 BL2
   (i) Find the temperature function that models entire scene in t hours after death.
   (ii) If the temperature of the body is now 70° F, how long before was death happened.

8.a)	Use Euler's method to solve the linear system of equations and find an approximate solutions up to four time level $\frac{dx}{dt} = y, \frac{dy}{dt} = -x + (1 - x^2)y$ subject to the initial condition when $(x_0, y_0) = (1, 1)$ with step size 0.25.	CO3	BL3
	OR		
8.b)	Use matrix method, to solve the linear system of differential equations $\frac{dx}{dt} = 5x + 4y, \frac{dy}{dt} = x + 2y$ subject to the initial condition $(x, y) = (1, 1)$ when $t = 0$.	CO3	BL3
9.a)	For hormonic oscillator with mass $m = 1$, spring constant $k = 6$ and damping coefficient $b = 7$ (i) Write the second order equation and corresponding system. (ii) Find the eigenvalues and eigenvectors. (iii) Discuss the motion of the mass for the initial condition $(y(0), v(0)) = (2, 0)$.	CO4	BL3
	OR		
9.b)	Consider the liner system $\frac{dY}{dt} = \begin{pmatrix} -2 & 1 \\ 0 & 2 \end{pmatrix} Y$ (i) Show that (0, 0) is the saddle. (ii) Find the eigenvalues and eigenvectors and sketch the phase plane.	CO4	BL3
10.	Find the Resonance from the general solution of hormonic oscillator equation $4x'' + 64x = 4\cos 4t$ under given initial conditions $x(0) = 0,\ x'(0) = 0$.	CO5	BL3

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