THIAGARAJAR COLLEGE OF ENGINEERING

(A Govt. Aided Autonomous Institution Affiliated to Anna University)

MADURAI- 625 015.

Department of Mathematics

22IT210 - LINEAR ALGEBRA, ORDINARY DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

Assignment - II

Assignment Date: 07.05.2024 **Due date: 13.05.2024**

Course Outcomes (COs) for Assessment

COs	Course Outcome
CO4	Apply matrix algebra techniques for transformations to diagonalize and to produce single value decomposition
CO5	Solve homogeneous and non-homogeneous second-order ordinary differential equations
CO6	Apply the concept of the Laplace transform to engineering problems.

Qn. No	Question	CO	Marks
1.	Find the eigenvalues. Find the corresponding eigenvectors $\begin{bmatrix} 13 & 5 & 2 \\ 2 & 7 & -8 \\ 5 & 4 & 7 \end{bmatrix}$	CO4	10
2.	Given A in a deformation find the principal directions and corresponding factors of extension or contraction. A = $\begin{bmatrix} 1.25 & 0.75 \\ 0.75 & 1.25 \end{bmatrix}$	CO4	10
3.	Are the following matrices symmetric, skew-symmetric, or orthogonal? Find the spectrum of each, $\begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{bmatrix}$ $\begin{bmatrix} \frac{4}{9} & \frac{8}{9} & \frac{1}{9} \\ -\frac{7}{9} & \frac{4}{9} & -\frac{4}{9} \\ -\frac{4}{9} & \frac{1}{9} & \frac{8}{9} \end{bmatrix}$	CO4	10
4.	Verify this for A and If y is an eigenvector of P, show that are eigenvectors of A. Show the details of your work. $\mathbf{A} = \begin{bmatrix} -5 & 0 & 15 \\ 3 & 4 & -9 \\ -5 & 0 & 15 \end{bmatrix}, \quad \mathbf{P} = \begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$	CO4	10
5.	What kind of conic section (or pair of straight lines) is given by the quadratic form? $4x_1^2 + 12x_1x_2 + 13x_2^2 = 16$ Transform it to principal axes.	CO4	10
6.	Find the singular value decomposition of each of the following matrices: **(a)** $\begin{bmatrix} 1 & 1 \\ 2 & 2 \end{bmatrix}$ **(b)** $\begin{bmatrix} 2 & -2 \\ 1 & 2 \end{bmatrix}$	CO4	10

7.	Solve the initial value problem $y" + y = \delta(t-\pi) - \delta(t-2\pi),\ y(0) = 0, y'(0) = 1$.	CO5	10
8.	Solve the Euler-Cauchy equation $x^2y" - xy' + y = 0, y(1) = 4.3,\ y'(1) = 0.5$.	CO5	10
9.	Solve the initial value problem $9y" - 30y + 25y = 0, y(0) = 3.3, y'(0) = 10$.	CO5	10
10.	Solve the Euler-Cauchy equation $(9x^2D^2 + 3xD + I)y = 0, y(1) = 1,\ y'(1) = 0$.	CO5	10
11.	Use method of variation of parameters to solve $y" + 9y = \csc\ 3x$.	CO5	10
12.	Solve the initial value problem $y" + y = 0.001\,x^2\,, y(0) = 0, y'(0) = 1.5$.	CO5	10
13	Solve the initial value problem $y" - y' - 6y = 0, y(0) = 11, y'(0) = 28$ using Laplace transform techniques.	CO6	10
14.	Solve the initial value problem $y" + 2y' + 5y = 50t - 100, y(2) = -4, y'(2) = 14$ Using Laplace transform techniques.	CO6	10
15	Using the Laplace transform, solve $y'' + 3y' + 2y = 4t$ if $0 < t < 1$ and 8 if $t > 1$; $y(0) = 0,\ y'(0) = 0$	CO6	10
16	Solve the initial value problem $y" + 5y' + 6y = u(t-1) + \delta(t-2), y(0) = y'(0) = 1$ Using Laplace transform techniques.	CO6	10
17	Find the inverse Laplace transform using convolution $\frac{240}{(s^2+1)(s^2+25)}$	CO6	10
18	Find the inverse Laplace transform using convolution $\frac{18s}{(s^2+36)^2}$	CO6	10

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