Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, NOV/DEC 2025

First Semester

Power Systems Engineering

PPST2413 - System Theory

Regulations – 2024

Duration : 3 Hrs *Maximum : 100 Marks*

*PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)*

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Give any two approaches to convert the transfer function approach to the state space model.	L2	1	2
2.	Distinguish the difference between physical variable model and phase variable model.	L2	1	2
3.	Construct the state transition matrix by Laplace Transform method: $A = \begin{bmatrix} 0 & 5 \\ -1 & -2 \end{bmatrix}$	L3	2	2
4.	What is eigen values and eigen vectors?	L1	2	2
5.	Define the duality of the system between controllability and observability concept.	L1	3	2
6.	What is the condition for O/P controllability by Kalman's method?	L1	3	2
7.	Analyze the concept of equilibrium points.	L4	4	2
8.	Mention the advantages of Lyapunov's stability criteria.	L2	4	2
9.	Illustrate the general form of observable phase variable form of state model.	L2	5	2
10.	What is meant by Control law?	L1	5	2

*PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)*

Q.No			*Questions*	*BLT*	*CO*	*Marks*
11.	a	i	Develop the expression for the state space model for the continuous system and also draw the state diagram for it.	L3	1	10
		ii	Explain about armature control of DC Motor.	L2	1	6
			Or			
	b	i	Solve the state space model for the given system Y(S)/U(S)=8/(S+1)(S+2)(S+3) by the method of (i) Laplace Transform (ii) Signal Flow Graph Method.	L3	1	10
		ii	Explain the following terms: (i) Linearity (ii) Non uniqueness (iii) Time invariance for state space model	L2	1	6

12.	a	Obtain the state space Model:	L3	2	16

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 4 \\ 5 \end{bmatrix} U \quad ; y=[1\ 0\ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

Convert the state space model into canonical form. Also calculate the value of state transition matrix

Or

12	b	The given state space model:	L3	2	16

$$A = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}$$

Calculate the (i) Eigen values and Eigen vectors (ii) Rank of the matrix

13.	a	i	Develop the expression for the controllable canonical form.	L3	3	6
		ii	Derive and examine the expression for the observable canonical form.	L4	3	10
			Or			
	b	i	Demonstrate and explain about the reducibility.	L3	3	6
		ii	Analyze the System Realization with an example for each for solving a problem.	L4	3	10
14.	a		Explain the Lyapunov's stability criteria with diagrammatic representation of following conditions. (i) Asymptotically stable (ii) Stable (iii) Unstable	L2	4	16
			Or			
	b		Illustrate the following methods for stability analysis with suitable example. (i) Krasovskii Method (ii) Variable-Gradient Method	L2	4	16
15.	a		Examine the design of pole placement concept for SISO and MIMO System with suitable diagram and expression.	L4	5	16
			Or			
	b		Analyze the effect of state feedback gain by pole placement (i) Open loop state space without feedback gain (ii) Closed loop state feedback gain with control law for obtaining gain K by any one of the methods with necessary condition.	L4	5	16