Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

B.E/B.TECH DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

Third Semester

Electronics and Communication Engineering

EC3351–Control Systems

(Usage of Polar Plot Can be Permitted)

Regulations - 2021

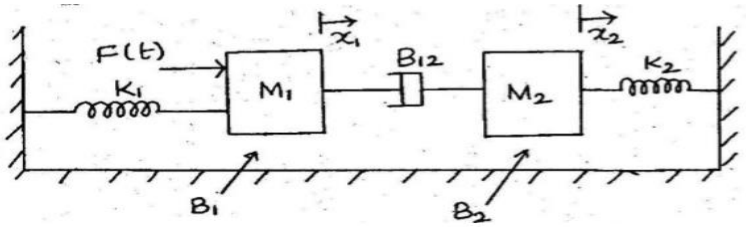
Duration : 3 Hrs ***Maximum : 100 Marks***

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

Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Compare open loop system with closed loop system.	L2	1	2
2.	Write Mason's gain formula of Signal flow graph.	L1	1	2
3.	Distinguish between steady state and transient response of the system.	L2	2	2
4.	The closed loop transfer function for a second order system is: T(s) = $\frac{9}{s^2+6s+9}$. Calculate the settling time for a 2 percent and 5 percent band.	L3	2	2
5.	Illustrate about phase and gain cross over frequency in Bode plot.	L1	3	2
6.	Draw the polat plot of $G(S) = \frac{1}{S(1+T_1S)(1+T_2S)}$.	L3	3	2
7.	For the polynomial $Q(s) = s^5 + s^4 + 2s^3 + 2s^2 + 3s + 15$, determine the number of roots which lie in the right and left half of the s-plane. Also Comment on stability.	L3	4	2
8.	What are asymptotes? Mention the formula to identify the angle of asymptote and centroid in root locus technique.	L1	4	2
9.	Identify the transfer function $Y(s)/U(s)$ of a system described by the state equations $\frac{dx}{dt} = -2x + 2u$ and $y(t) = 0.5x$.	L3	5	2
10.	State the properties of state transition matrix.	L1	5	2

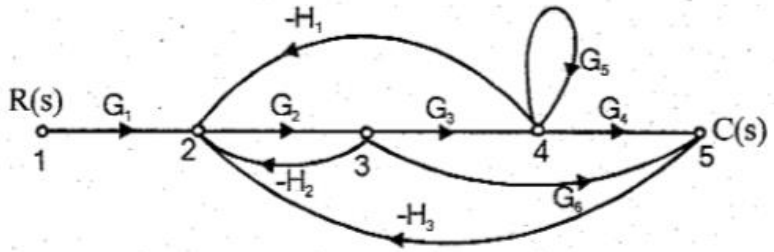
PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No		*Questions*	*BLT*	*CO*	*Marks*
11.	a	Identify the differential Equations governing the mechanical system shown in the figure.1 and determine the Force Voltage and Force Current analogous circuits and verify by writing Mesh and Node Equations.	L3	1	16



Or

	b	Obtain the Transfer function using Mason's Gain Formula for the figure.1 shown below.	L3	1	16



12.	a	Derive the expression for second order system for under damped case when the input is unit step.	L2	2	16

Or

	b i	Derive the equation of PID controller with necessary block diagrams.	L2	2	10
	ii	Illustrate on addition of poles and zeros to transfer function.	L2	2	6
13.	a	Plot the Bode diagram for the following transfer function and obtain the gain cross over frequency,phase cross over frequencies, Gain Margin and Phase Margin. $G(S)=\frac{10}{S(1+0.4S)(1+0.1S)}$	L3	3	16

Or

	b	The open loop transfer function of a unity feedback system is$G(S) = \frac{1}{S(1+S)^2}$. Sketch the Polar plot and determine the Gain margin and Phase margin.	L3	3	16
14.	a i	Construct Routh array and find the stability of the system whose characteristics equation is $s^5 + s^4 + 2s^3 + 2s^2 + 3s + 5 = 0$.Also find the number of roots falling in the RHS plane and LHS plane.	L4	4	8
	ii	Using Routh array and find the stability of the system whose characteristics equation is $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 24s^2 + 23s + 15 = 0$.Also find the number of roots falling in the RHS plane and LHS plane.	L4	4	8

Or

	b	Draw the root locus plot for a unity feedback system having forward path transfer function, $G(S)=\frac{K}{S(S^2+4S+13)}$. Determine the value of K for stability.	L4	4	16

15.	a	For a system represented by the state model $\begin{bmatrix} X_1' \\ X_2' \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$ and $y(t) = [1 \quad 0] \begin{bmatrix} x_1(t) \\ x_2(t) \end{bmatrix}$. Determine (a)The state transition matrix $\varphi(t)$ (b) The transfer function of the system	L4	5	16
		Or			
	b i	Test the controllability and observability of the system by any one method whose state space representation is given as: $A = \begin{bmatrix} 0 & 0 & 1 \\ -2 & -3 & 0 \\ 0 & 2 & -3 \end{bmatrix}; B = \begin{bmatrix} 0 \\ 2 \\ 0 \end{bmatrix}; C = [1 \quad 0 \quad 0]; D = [0]$	L4	5	8
	ii	Express the state transition matrix for the state model whose system matrix A is given by, $A = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix}$.	L3	5	8