Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

UG/PG DEGREE END SEMESTER THEORY EXAMINATIONS, APR/MAY 2026

Fifth Semester

Electrical and Electronics Engineering

EE3503 – CONTROL SYSTEMS

(Use of semi-log graph and Polar graph and Normal Graph sheet Can be Permitted)

Regulations - 2021

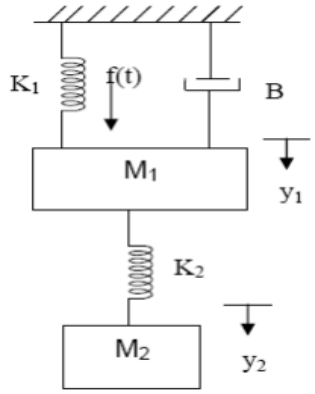
Duration : 3 Hrs ***Maximum : 100 Marks***

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

Q.No	Questions	BTL	CO	Marks
1.	Give the advantages of closed loop control system over open loop control system.	L4	1	2
2.	Write the Mason's gain formula.	L1	1	2
3.	How the system is classified depending on the value of damping?	L2	2	2
4.	Mention the effects of adding poles to an open loop transfer function.	L4	2	2
5.	What are frequency domain specifications?	L1	3	2
6.	Find the corner frequencies for the transfer function G(s) = 10 / [(s+1) (s+5)].	L3	3	2
7.	Draw the block diagram representation of state model.	L3	4	2
8.	State the duality between controllability and observability.	L1	4	2
9.	What is the need of compensator in a control system?	L2	5	2
10.	Write the transfer function of lag compensator and draw its pole-zero plot.	L2	5	2

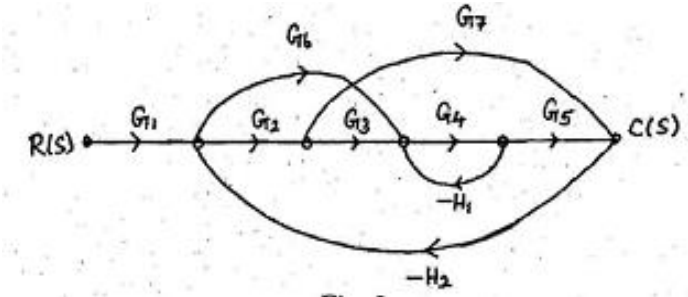
PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No		Questions	BLT	CO	Marks
11.	a	Find the transfer function Y2(S) / F(S)	L3	1	16



Or

	b	Consider the signal flow graph shown below. Obtain the closed loop transfer function C(S)/R(S) by the use of Mason's gain formula.	L3	1	16



12.	a	i	The unity feedback system is characterized by an open loop transfer function is G(S) = K / S(S+10). Determine the gain K, so that the system will have a damping ratio of 0.5. For this value of K, determine settling time, Peak overshoot and time to Peak overshoot for a unit-step input.	L3	2	8
		ii	Use the Routh stability criterion to determine the location of roots on the S-plane and comment on the stability for the system represented by the characteristic equation, $S^6 + S^5 + 3S^4 + 3S^3 + 3S^2 + 2S + 1 = 0$.	L3	2	8
			Or			
	b		Sketch the root locus of the system whose open loop transfer function is G(s) =K/[S (S+2) (S+4)]. Find the value of K so that damping ratio of the closed loop system is 0.5.	L3	2	16
13.	a		Plot the Bode diagram for the following transfer function and obtain the gain and phase cross over frequencies $G(S) = KS^2 / [(1+0.2S)(1+0.02S)]$.Determine the value of K for a gain cross over frequency of 5 rad/sec.	L3	3	16
			Or			
	b		The open loop transfer function of a unity feedback system is given by G(S) =1/[S (1+S) (1+2S)]. Sketch the polar plot and determine the gain margin and phase margin.	L3	3	16
14.	a	i	Derive the Solutions of Homogeneous state equations.	L2	4	8
		ii	Construct a state model for a system characterized by the differential equation, $\frac{d^3y}{dt^3} + 6\frac{d^2y}{dt^2} + 11\frac{dy}{dt} + 6y + u = 0$ Give the block diagram representation of the state model.	L3	4	8
			Or			
	b		The state model of a system is given by $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 0 & 1\\ -2 & -3 & 0\\ 0 & 2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 2\\ 0\end{bmatrix}[u]; y = [1 \quad 0 \quad 0]\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix}$ Check the condition of controllability and observability.	L3	4	16
15.	a		Obtain the transfer function of a lead compensator. Discuss the procedure to design a lead compensator using root-locus plot.	L2	5	16
			Or			
	b		Construct a suitable lag compensator so that phase margin is 40° and the steady state error for ramp input is less than or equal to 0.2 for a unity feedback system having an open loop transfer function of G(S) = K/[S (1+2S)].	L3	5	16

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