Register No : _____

THE KAVERY ENGINEERING COLLEGE

(An Autonomous Institution)

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

Fifth Semester

Electrical and Electronics Engineering

EE3503 – Control Systems

Regulations - 2021

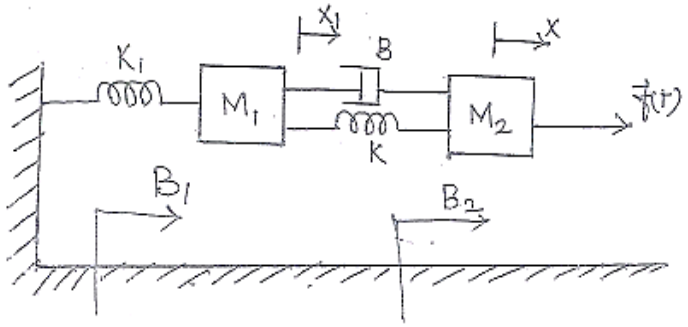
Duration : 3 Hrs ***Maximum : 100 Marks***

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

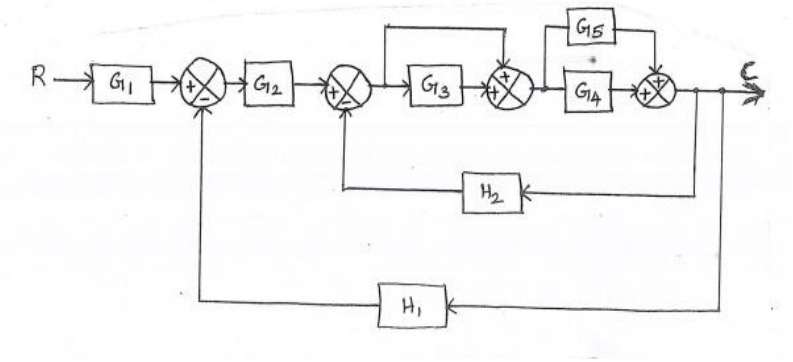
Q.No	*Questions*	*BLT*	*CO*	*Marks*
1.	Recall the differences between open loop and closed loop systems.	L2	1	2
2.	Define transfer function and write its expression.	L1	1	2
3.	Point out the standard test signals used in control systems.	L1	2	2
4.	Compute the damping ratio and natural frequency of oscillations, whose open loop transfer function is given as $C(S)/R(S)=200/(s^2+20s+200)$.	L2	2	2
5.	Define phase margin and gain margin.	L1	3	2
6.	Label the polar plot for the transfer function $G(S)=1/(1+sT)$.	L2	3	2
7.	Outline the advantages of state space model over transfer function model.	L2	4	2
8.	Write the state space equations of a linear time invariant system.	L1	4	2
9.	Mention the need of compensators in control systems.	L2	5	2
10.	Recall the transfer function of a 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	Write the differential equations governing the mechanical system as shown in figure and determine its transfer function.	L3	1	16



Or

	b	Consider the following system represented as block diagram shown in the figure and obtain the transfer function C/R using block diagram reduction technique. 	L3	1	16
12.	a	A unity feedback control system has an open loop transfer function of G(s)=10/s(s+2). Find the rise time, peak time, percentage of maximum peak overshoot and settling time for a step input of 12 units.	L3	2	16
		Or			
	b	A unity feedback system is characterized by the following open loop transfer function $G(s)=1/s^2(s+1)(s+4)$. Calculate the following: a) Position, velocity and acceleration constants b) Steady state errors to unit parabolic input	L3	2	16
13.	a	Sketch the bode plot for the following transfer function and determine the phase margin and gain margin $G(S)=75(1+0.2S)/S(S^2+16S+100)$.	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 following: a) Phase margin b) Gain margin c) Phase crossover frequency d) Gain crossover frequency	L3	3	16
14.	a	Obtain the state space model of the system whose transfer function is given by $Y(S)/U(S)=10/(S^3+4S^2+2S+1)$.	L3	4	16
		Or			
	b	A system is characterized by the transfer function given as $Y(S)/U(S)=2/(S^3+6S^2+11S+6)$. Test the controllability and observability of the system.	L3	4	16
15.	a	Design a lead compensator for the system to satisfy the following specifications, whose open loop transfer function is given as $G(S)=K/S(S+8)$, Percentage of peak overshoot=9.5%, Natural frequency of oscillations=12 rad/sec, Velocity error constant ≥ 10.	L3	5	16
		Or			

b	Discuss in detail about the design of PID controllers for an application of your own choice and elaborate their design calculations with a neat mathematical background.	L3	5	16