Course Code: 2050206 Roll No: **MLRS-R20**

MARRI LAXMAN REDDY
INSTITUTE OF TECHNOLOGY AND MANAGEMENT
(AN AUTONOMOUS INSTITUTION)
(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)
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III B.Tech I Sem Regular End Examination, December 2022

Control Systems

(ECE/EEE)

Time: 3 Hours. **Max. Marks: 70**

Note: 1. Question paper consists: Part-A and Part-B.
2. In Part – A, answer all questions which carries 20 marks.
3. In Part – B, answer any one question from each unit.
Each question carries 10 marks and may have a, b as sub questions.

PART- A

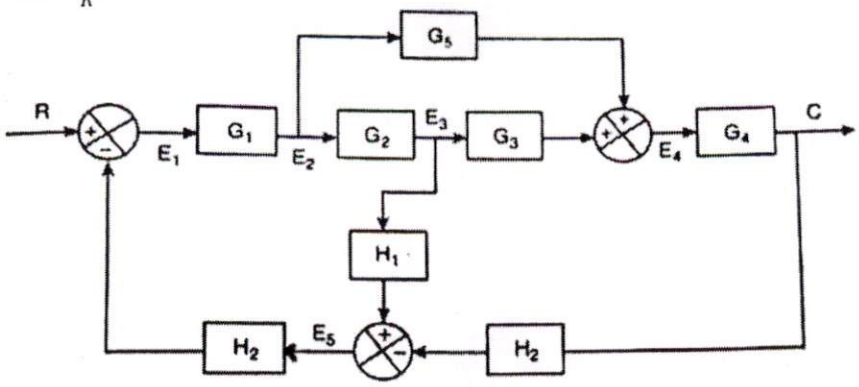
(10*2 Marks = 20 Marks)

1.	a)	Explain how feedback effects the overall gain of the system.	2M	CO1	L2
	b)	What do you mean by mechanical translational systems?	2M	CO1	L1
	c)	Why derivative controller is not used alone in control systems?	2M	CO2	L2
	d)	A unity feedback system has a open loop transfer function of $G(s) = \frac{10}{(s+1)(s+2)}$. Determine steady state error for unit step input.	2M	CO2	L3
	e)	State limitations for Routh's stability.	2M	CO3	L2
	f)	Draw the Root-Locus plot of $G(S)\,H(S) = \frac{K}{S+P}$.	2M	CO3	L3
	g)	What is the effect on polar plot if a non-zero pole is added to the transfer function?	2M	CO4	L2
	h)	Write the differences between lead and lag compensator.	2M	CO4	L4
	i)	What is the characteristic equation of a system for generalized State Matrix?	2M	CO5	L3
	j)	State the properties of state transition matrix.	2M	CO5	L1

PART- B

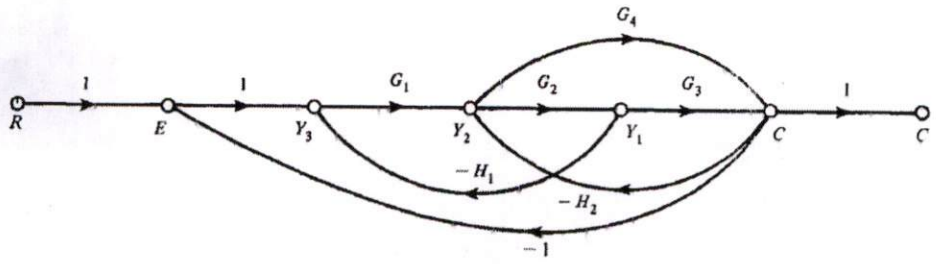
(10*5 Marks = 50 Marks)

2	a)	Explain open loop control system and closed loop control system with example.	5M	CO1	L4
	b)	For the block diagram shown below, determine the transfer function $\frac{C}{R}$.	5M	CO1	L3



OR

3	a)	Find the closed loop transfer function of the system shown below	5M	CO1	L3



	b)	Define the terms i) mass ii) linear spring iii) friction, for translational motion subject to mathematical modelling of mechanical systems.	5M	CO1	L1
4		Derive the time domain specifications of second order system with unit step input.	10M	CO2	L2
		OR			
5		A unity feedback system has a forward path transfer function $G(s) = \frac{8}{s(s+2)}$. Find the value of damping ratio, undamped natural frequency of the system, percentage over shoot, peak time and settling time.	10M	CO2	L2
6	a)	Determine the RH stability of given characteristic equation, $s^4 + 8s^3 + 18s^2 + 16s + 5 = 0$.	5M	CO3	L5
	b)	Determine the range of values of K for the stability of a unity feedback system whose open loop transfer function is given by $G(s) = \frac{K}{s(s+1)(s+2)}$	5M	CO3	L3
		OR			
7		The open loop transfer functions of a unity feedback are given below. Sketch the root locus. $G(s) = \frac{K}{s(s+3)(s^2+2s+2)}$.	10M	CO3	L3
8		The open loop transfer function of a system is given by: $G(s) = \frac{20}{s(s+1)(1+0.01s)}$ Sketch the Bode plot and determine the gain Margin and Phase Margin.	10M	CO4	L4
		OR			
9		Explain in detail about lag-lead compensator technique.	10M	CO4	L4
10	a)	Define: (i) state (ii) State Variables (iii) State Space representation	5M	CO5	L1
		Determine the state model of the system whose transfer function is:	5M	CO5	L5
	b)	$T(s) = \frac{2(s+5)}{(2+s)(3+s)(4+s)}$ and draw block diagram representation of the state model.			
		OR			
11		Consider a system with state model given below: $\dot{x} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -1 & -5 & -1 \end{bmatrix} X + \begin{bmatrix} 0 \\ 5 \\ -24 \end{bmatrix} u, Y = [1 \quad 0 \quad 0]x + [0]u$ Verify the system is observable and controllable.	10M	CO5	L4

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