Code: 20EC3404

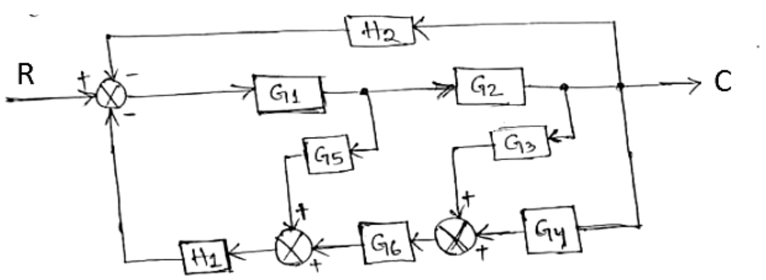
II B.Tech - II Semester – Regular / Supplementary Examinations
MAY - 2023

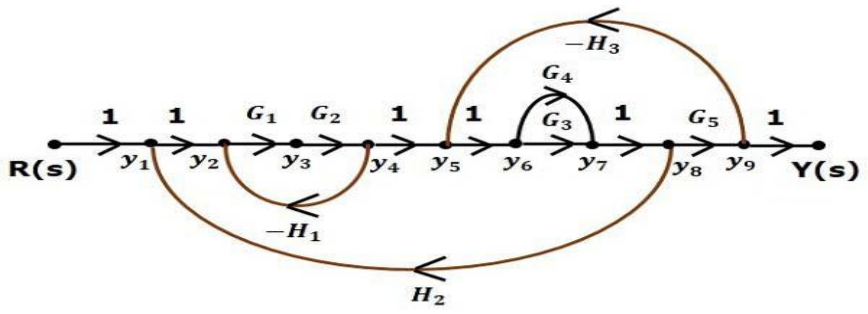
CONTROL SYSTEMS ENGINEERING
(ELECTRONICS & COMMUNICATION ENGINEERING)

Duration: 3 hours　　　　　　　　　　　　Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

BL – Blooms Level　　　　　　　　　　　　CO – Course Outcome

			BL	CO	Max. Marks
UNIT-I					
1	a)	What is meant by open loop and closed loop systems? Differentiate both the systems.	L2	CO1	7 M
	b)	Calculate the overall transfer function C/R for the block diagram shown in figure below by using block diagram reduction rules.  	L3	CO1	7 M
OR					
2	a)	Explain the rules of block diagram reduction.	L2	CO1	7 M
	b)	Obtain the transfer function of below signal flow graph using Mason's Gain formula.	L4	CO1	7 M

					
		UNIT-II			
3	a)	A unity feedback system has the forward transfer function $G(s) = \frac{K_1(2s+1)}{s(5s+1)(s+1)^2}$: If the unit step input is applied to the system. Solve the value of K_1 if the steady error is to be less than 0.1.	L3	CO2	7 M
	b)	Analyze the response of a first order system $\frac{C(S)}{R(S)} = \frac{1}{1+ST}$ for unit step input.	L4	CO2	7 M
		OR			
4	a)	What is meant by transient response and steady state response?	L2	CO2	7 M
	b)	Explain about PD and PID Controllers.	L2	CO3	7 M
		UNIT-III			
5	a)	Discuss the stability condition using R-H stability criterion.	L2	CO3	4 M
	b)	The characteristic polynomial of a system is: $s^7 + 9s^6 + 24s^5 + 24s^4 + 24s^3 + 23s^2 + 15s = 0$. Examine the location of roots on s-plane and hence the stability of the system.	L4	CO3	10 M
		OR			

6	Draw the complete root locus for $(s)H(s) = \frac{K}{s(s+2)(s+4)}$. From the root locus plot, analyze the range of values of K for which the system will have damped oscillatory response.		L4	CO4	14 M
UNIT-IV					
7	Sketch the bode plot for the following transfer function and analyze phase margin and gain margin: $G(s) = \frac{K(s+1)}{s(s-1)(s^2+11s+24)}$		L4	CO5	14 M
OR					
8	a)	Derive an expression for resonant peak and resonant frequency for a standard second order system.	L4	CO4	7 M
	b)	Construct the polar plot for the open loop transfer function of a unity feedback system given by $G(s) = \frac{1}{s\,(s+1)^2}$	L4	CO4	7 M
UNIT-V					
9	a)	Determine the state transition matrix for $\dot{X} = \begin{bmatrix} -2 & 1 & 0 \\ 0 & -2 & 1 \\ 0 & 0 & -2 \end{bmatrix} x$	L4	CO5	7 M
	b)	Deduce the condition for controllability and observability.	L3	CO1	7 M
OR					
10	a)	State and Prove the properties of state transition matrix.	L3	CO1	7 M

	b)	Consider a system with state model given below: $$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -6 & -11 & -6 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \, ;$$ Evaluate the state controllability.	L4	CO5	7 M