U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

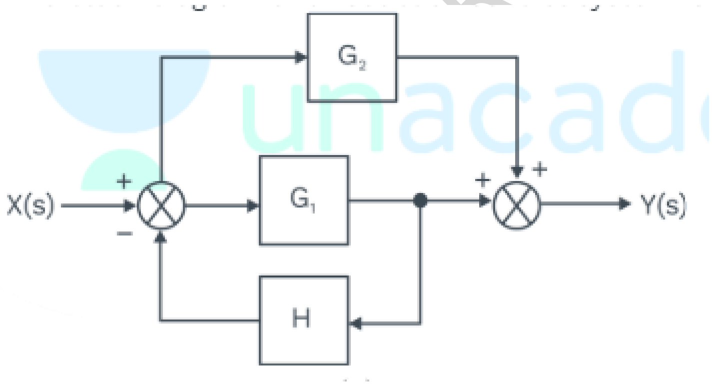
Autonomous Institute Affiliated to VTU

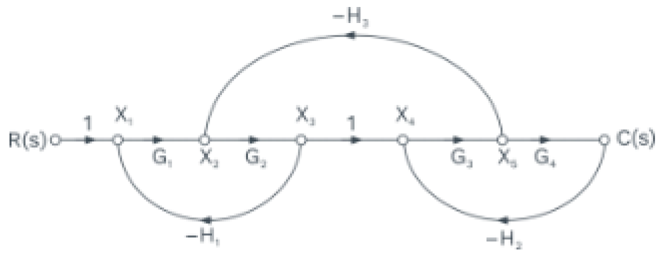
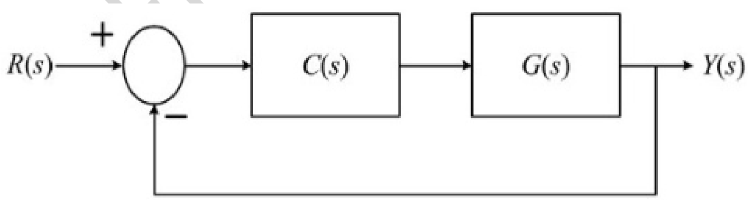
October 2024 Supplementary Examinations

Programme: B.E.
Branch: ES Cluster (EEE/ET/ECE/EIE/MD)
Course Code: 23ES4ESCST
Course: Control Systems

Semester: IV
Duration: 3 hrs.
Max Marks: 100

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

		UNIT – I	***CO***	***PO***	**Marks**
1	a)	The block diagram of a feedback control system is given below. Determine the transfer function of the system. 	***CO2***	***PO2***	**6**
	b)	The transfer function of a system is given below. Determine poles, zero's, characteristic equation and pole zero plot in the S- plane. $T(S)=\frac{(S+6)}{S(S+2)(S+5)(S^2+7S+12)}$	***CO1***	***PO1***	**6**

		c)	Determine the transfer function of the system for the following signal flow graph.  	***CO2***	***PO2***	**8**
			UNIT – II			
	2	a)	A system with the differential equation is given below, where ‘y’ is the output and ‘x’ is the input. Determine all the time domain specifications for the unit step input. $$\frac{d^2y}{dt^2} + 6\frac{dy}{dt} + 16y = 16x$$	***CO2***	***PO2***	**8**
		b)	For a system given below, find the value of K to limit steady state error to 20 when the input to the system is 1 +10t + $\frac{40t^2}{2}$ $$G(S)H(S)=\frac{K}{S^2(S+2)(S+4)}$$	***CO2***	***PO2***	**6**
		c)	The block diagram of closed loop control system is given below where $G(S)=\frac{1}{S(S+1)}$ and $C(S)=K\left[\frac{(S+1)}{(S+3)}\right]$. If the steady state error for the unit ramp input is 0.1. Find the value of K.  	***CO2***	***PO2***	**6**
			UNIT - III			
	3	a)	For unity feedback system given below, Find the range of K, marginal value of K and the frequency of sustained oscillations. $$G(S)=\frac{K}{S(1+0.4S)(1+0.25S)}$$	***CO1***	***PO1***	**6**

		b)	Draw the approximate root locus diagram for a closed loop system whose loop transfer function is given below. Comment on the stability. $$G(S)H(S)=\frac{K}{S(S+5)(S+10)}$$	***CO2***	***PO2***	**9**
		c)	Determine the stability of the given characteristic equation by Hurwitz's method. $$F(S)=S^3+S^2+S+4$$	***CO1***	***PO1***	**5**
			OR			
	4	a)	Find marginal value of K and frequency of the sustained oscillations for the system given below. $$S^4+22S^3+10S^2+S+K=0$$	***CO1***	***PO1***	**5**
		b)	Sketch the complete root locus of system having the following $$G(S)H(S)=\frac{K}{S(S+1)(S+2)(S+3)}$$	***CO2***	***PO2***	**9**
		c)	For the given characteristic equation, Use Routh Hurwitz criterion and determine (i) Number of roots in the left half of S-plane (ii) Number of roots in the right half of S-plane (iii) Number of roots on imaginary axis $$F(S)=S^4+2S^2+1$$	***CO1***	***PO1***	**6**
			UNIT – IV			
	5	a)	Draw the polar plot for the open loop transfer function $$G(s)H(s)=\frac{ks^3}{(s+1)(s+2)}$$	***CO2***	***PO2***	**8**
		b)	Draw the Bode plot for the open loop transfer function as given below. Determine the gain crossover frequency, phase crossover frequency, gain margin and phase margin. Comment on the stability of the system. $$G(S)=\frac{40}{S(S+2)(S+20)}$$	***CO2***	***PO2***	**12**

			OR			
	6	a)	For the given open loop transfer function, Draw the Nyquist plot using Nyquist criteria and check the stability of the system. $$G(S)H(S)=\frac{20}{(S+1)(S+2)}$$	***CO2***	***PO2***	**8**
		b)	For the unity feedback system $$G(s)H(s) = \frac{ks^3}{(s+1)(s+2)}$$ Construct the table for magnitude and phase angle for the Bode plot.	***CO1***	***PO1***	**12**
			UNIT – V			
	7	a)	Derive the expression of the transfer function from the state model.	***CO1***	***PO1***	**5**
		b)	Obtain the state model for the system with the transfer function given below $$TF = \frac{S^2 + 7S + 9}{S^3 + 6S^2 + 4S + 3}$$	***CO2***	***PO2***	**8**
		c)	The state model of the system is given below, obtain the state transition matrix $$\begin{bmatrix} \dot{X}_1 \\ \dot{X}_2 \end{bmatrix} = \begin{bmatrix} 0 & 1 \\ -3 & -4 \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \end{bmatrix} + \begin{bmatrix} 0 \\ 1 \end{bmatrix} u(t)$$	***CO2***	***PO2***	**7**

****