U.S.N.										

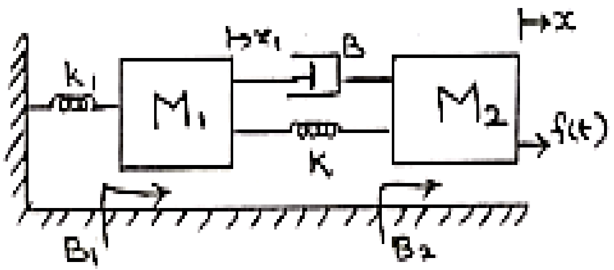
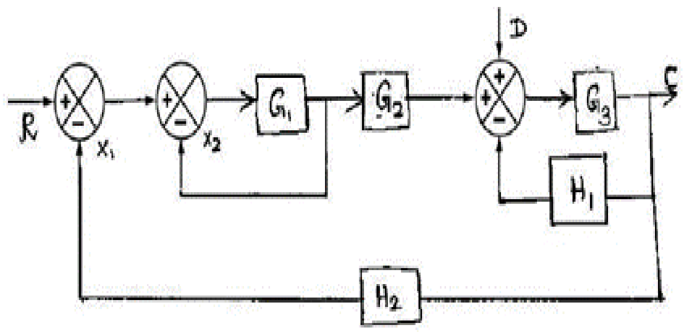
B.M.S. College of Engineering, Bengaluru-560019

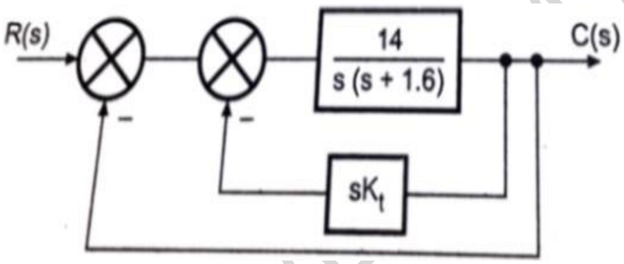
Autonomous Institute Affiliated to VTU

June 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**
Branch: ES CLUSTER (EEE/ECE/EIE/ETE) **Duration: 3 hrs.**
Course Code: 22ES4ESCST **Max Marks: 100**
Course: Control Systems

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)	Differentiate between open-loop and closed-loop control systems, highlighting their key characteristics and providing an example to illustrate their difference.	*CO1*	-	**08**
	b)	Write the differential equations governing the mechanical translational system as shown in figure 1b and determine the transfer function.  **Figure 1b**	*CO2*	*PO1*	**12**
		OR			
2	a)	Define signal flow graph and explain Mason Gain's formula	*CO1*	-	**8**
	b)	For the block diagram shown in figure 1b, find the output C due to R under the following conditions i) D=0 ii) R=0  Figure 1b	*CO2*	*PO1*	**12**

			UNIT - II			
	3	a)	Derive the output expression and draw the response of first order system for unit step input.	*CO2*	*PO1*	**8**
		b)	With suitable block diagrams and equations, explain the following types of controllers employed in control systems: a) Proportional controller b) Proportional-plus-integral controller, c) PID controller	*CO1*	-	**12**
			OR			
	4	a)	A Unity Feedback System Has G(s)= (40) (s+2)/(s)(s+1) (s+4) Determine (i) Type of the system (ii)All error coefficients and error for step input with magnitude 4.	CO3	PO2	**10**
		b)	The system shown in figure 4b uses a rate feedback controller. Determine the tachometer constant Kt so as to obtain the damping ratio as 0.5. Calculate corresponding T_p, M_p, W_d, T_s.  figure 4b	CO3	PO2	**10**
			UNIT - III			
	5	a)	Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function $\frac{C(S)}{R(S)} = \frac{K}{S(S^2+S+1)(S+2)+K}$	*CO3*	*PO2*	**6**
		b)	Sketch the root locus for the open loop transfer function of unity feedback control system given below. $G(s) = \frac{k}{s(s^2+4s+13)}$	*CO3*	*PO2*	**14**
			OR			
	6	a)	Plot The Root Locus for the system having G(s)H(s)= (K(S^2+4S+20))/(S(S+3))	CO3	PO2	**10**
		b)	Analyze the equation and examine the stability of system using Routh's Criterion a) $S^6+2S^5+8S^4+12S^3+20S^2+16S+16=0$ b) $S^5+S^4+2S^3+2S^2+3S+15=0$	CO3	PO2	**10**

			UNIT - IV			
	7	a)	A unity feedback control system is to work under Proportional Control. The process transfer function is described as follows: $$G(s) = \frac{1}{s^3 + 2s^2 + 3s + 4}$$ Apply the Nyquist criterion to determine the system closed loop stability.	*CO3*	*PO2*	**14**
		b)	Sketch the polar plot for the given transfer function and determine the points of intersection $$G(s)H(s) = \frac{1}{(1 + 10s)}$$	*CO3*	*PO2*	**06**
			OR			
	8	a)	Sketch the bode plot for the following transfer function and determine the phase margin & gain margin $$G(s)H(s) = \frac{20}{s(1+3s)(1+4s)}$$	*CO3*	*PO2*	**14**
		b)	Explain gain margin and phase margin of control system with respect to stability.	*CO1*	-	**06**
			UNIT - V			
	9	a)	Obtain the state model of the system described by the following transfer function $$\frac{Y(s)}{U(s)} = \frac{5}{s^2 + 6s + 7}$$	*CO3*	*PO2*	**10**
		b)	Obtain the transfer function model for the following state space system $$\mathbf{A}=\begin{bmatrix} 1 & 1 \\ -6 & -5 \end{bmatrix}, \mathbf{B}=\begin{bmatrix} 1 \\ 0 \end{bmatrix}, \mathbf{C}=\begin{bmatrix} 1 & 0 \end{bmatrix}, \mathbf{D}=\begin{bmatrix} 0 \end{bmatrix}$$	*CO3*	*PO2*	**10**
			OR			
	10	a)	$A=\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 0 \\ -1 & -2 & -3 \end{bmatrix}$ $B=\begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$ $C=\begin{bmatrix} 1 & 0 & 0 \end{bmatrix}$ Find the transfer function of the given State model	CO3	PO2	**10**
		b)	Derive linear time invariant system state model equation.	CO3	PO2	**06**
		c)	Define the following a) state b) state variable c) state vector d) state space	CO1	-	**04**

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