U.S.N.										

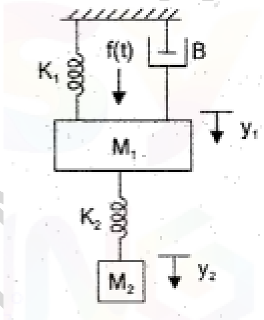
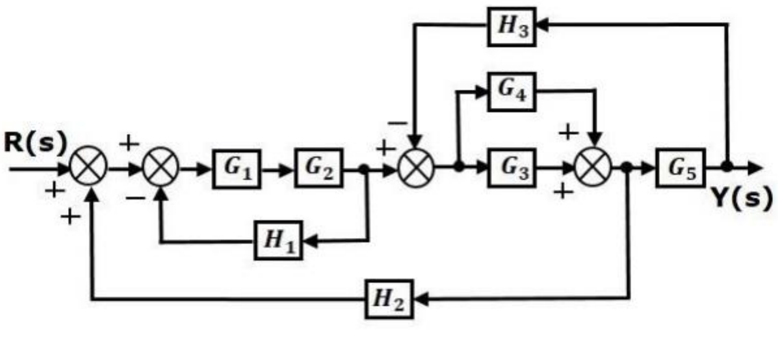
B.M.S. College of Engineering, Bengaluru-560019

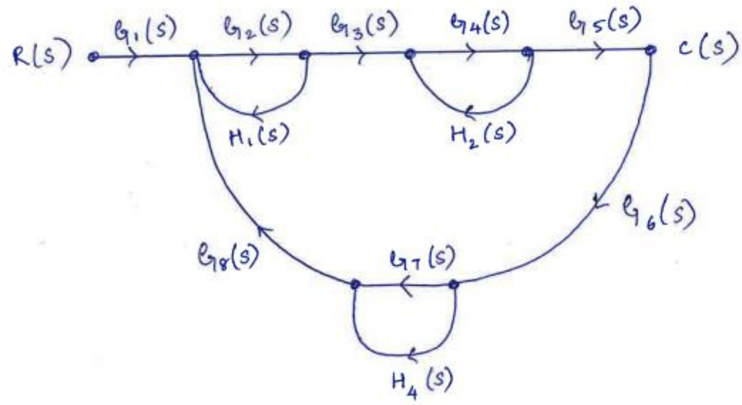
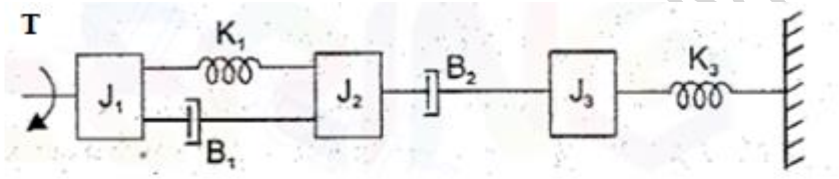
Autonomous Institute Affiliated to VTU

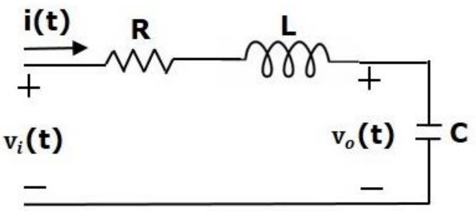
December 2023 Supplementary Examinations

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)	Compare open loop and closed loop control systems based on different aspects.	*CO1*	-	**04**
	b)	Analyze the mechanical system given below and determine the transfer function $\frac{Y_{2(S)}}{F(S)}$ 	*CO3*	*PO2*	**08**
	c)	Consider the block diagram shown in the following figure. Simplify this block diagram using the block diagram reduction rules. 	*CO2*	*PO1*	**08**
		OR			

	2	a)	Analyze the signal flow graph shown in fig. 2.a. and obtain the closed loop transfer function of the system by using Mason's gain formula.  fig. 2.a.	*CO3*	*PO2*	**10**
		b)	Write the differential equations governing the mechanical system shown in fig 2.b. and obtain the torque-voltage analogous and torque-current analogous systems.  fig 2.b.	*CO3*	*PO2*	**10**
			UNIT - II			
	3	a)	Obtain an expression for response of a under damped second order system for unit step input and sketch the response.	*CO2*	*PO1*	**06**
		b)	State and explain the effects of PD and PI controller on the system dynamics with neat diagrams.	*CO1*	-	**06**
		c)	The open loop transfer function of a unity feedback system is G(s)=$\frac{10(s+2)}{S^2(S+1)}$ .Evaluate the static error coefficients of the system. Obtain the steady state error of the system when subjected to an input given by R(s) = $\frac{3}{S} + \frac{2}{S^2} + \frac{1}{3S^3}$	*CO3*	*PO2*	**08**
			UNIT - III			
	4	a)	Examine the stability of the following system whose characteristic equation is given below by using Routh-Hurwitz stability criterion $s^5 + 2s^4 + 2s^3 + 4s^2 + 4s + 8 = 0$.	*CO3*	*PO2*	**08**
		b)	Draw the root-locus of the feedback system whose open-loop transfer function is given by G(s)H(s)= $\frac{K}{S^2(S+1)}$,	*CO3*	*PO2*	**12**
			UNIT - IV			
	5	a)	Define the following frequency domain specifications with a diagram	*CO1*	-	**06**

			(i) Resonant peak (ii) Resonant frequency (iii) Cut-off frequency (iv) Phase cross-over frequency (v) Gain cross-over frequency			
		b)	For the open loop transfer function given below: $G(s)H(s) = \frac{500K(S+2)}{S(S+1)(S^2+5S+100)}$ i) Construct the Bode plots, ii) Find the Gain crossover frequency and the Gain Margin, iii) The phase crossover frequency and the Phase Margin, iv) Determine the value of K to change the gain crossover frequency to 1 rad/s, then find the corresponding Gain and Phase Margins,	*CO3*	*PO2*	**14**
			OR			
	6	a)	For the unity-feedback system of where $G(s) = \frac{K}{S(S+3)(S+5)}$, find the range of gain, K, for stability, instability, and the value of gain for marginal stability. Use the Nyquist criterion.	*CO3*	*PO2*	**10**
		b)	For the following T.F draw the Bode plot and obtain Gain cross over frequency, Phase cross over frequency , Gain Margin and Phase Margin. $G(s) = \frac{20}{S(1+3S)(1+4S)}$	*CO3*	*PO2*	**10**
			UNIT - V			
	7	a)	Derive an expression for the transfer function of the system from the state model $\dot{X}$ = Ax + Bu and y = Cx + Du	*CO2*	*PO1*	**06**
		b)	Obtain the state equation in phase variable form for the following differential equation: $2d^3y/dt^3 + 4d^2y/dt^2 + 6\ dy/dt + 8y = 10u(t)$	*CO2*	*PO1*	**06**
		c)	Derive a state space model for the system shown. The input is $v_i(t)$and the output is $v_o(t)$ 	*CO3*	*PO2*	**08**

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