U.S.N.										

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

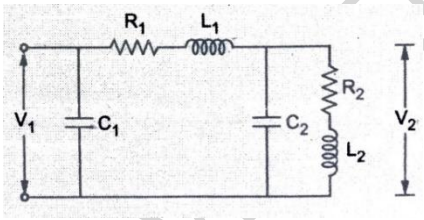
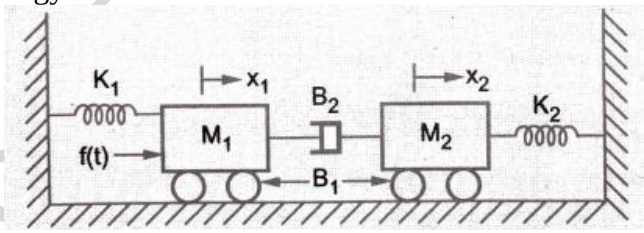
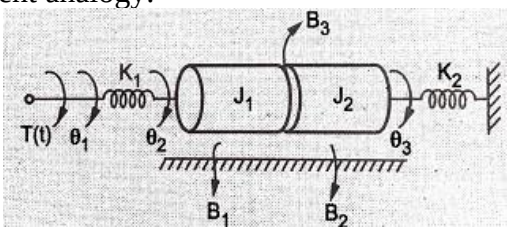
Autonomous Institute Affiliated to VTU

August 2024 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.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		UNIT - I	*CO*	*PO*	Marks
1	a)	Define control system. Distinguish between open loop and closed loop control system.	*CO1*	-	**05**
	b)	Find the transfer function $\frac{V_2(S)}{V_1(S)}$ for the electrical system shown in Fig.Q1 (b).  Fig. Q1(b)	*CO3*	*PO2*	**07**
	c)	Construct mathematical model for the mechanical system shown in Fig.Q1(c). Also draw the equivalent electrical circuit based on F-V analogy.  Fig.Q1(c)	*CO3*	*PO2*	**08**
		OR			
2	a)	Describe closed loop control system. Mention its advantages and disadvantages.	*CO1*	-	**08**
	b)	For the system shown in Fig.Q2(b), write its mechanical network and obtain mathematical model and electrical analogous based on Force – Current analogy.  Fig.Q2(b)	*CO3*	*PO2*	**08**

		c)	Explain with relevant equations of Mass and Spring of Translational mechanical system.	*CO1*	-	**04**
			UNIT - II			
	3	a)	For the given type-0 system, find the following i) All state error constants [Kp, Kv, Ka] ii) Steady state error for the input r(t)=5u(t).	*CO2*	*PO1*	**08**
		b)	For the unity feedback system, $G(S) = \frac{20}{(S+1)(S+4)}$, obtain the closed loop transfer function, damping ratio, natural frequency and expression for the output response if the system is subjected to unit step input.	*CO3*	*PO2*	**08**
		c)	Explain any two standard test inputs used in time domain analysis.	*CO1*	-	**04**
			UNIT - III			
	4	a)	Check the stability of the given polynomial using Routh-Hurwitz's method. $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$	*CO2*	*PO1*	**08**
		b)	Sketch the complete root locus for $G(s)H(S) = \frac{K}{S(S+3)(S+5)}$ and comment on stability.	*CO3*	*PO2*	**12**
			UNIT - IV			
	5	a)	Draw the polar plot of $G(s)H(S) = \frac{100}{(S+2)(S+4)(S+8)}$.	*CO2*	*PO1*	**10**
		b)	Explain the following with respect to the frequency response specifications of a system. i) Gain Crossover frequency ii) Phase Crossover frequency iii) Gain Margin iv) Phase Margin	*CO1*	-	**10**
			OR			
	6	a)	A unity feedback control system has $G(s) = \frac{80}{S(S+2)(S+20)}$. Draw the Bode plot. Determine Gain Margin, Phase Margin. Comment on stability.	*CO3*	*PO2*	**14**
		b)	Clearly explain the steps to solve problems by Nyquist criterion.	*CO1*	-	**06**
			UNIT - V			
	7	a)	Define the following terms with respect to state space analysis: i) State ii) State variables iv) State space	*CO1*	-	**06**
		b)	List the advantages of state variable analysis.	*CO1*	-	**04**
		c)	Obtain the state transition matrix and inverse transition matrix for $A = \begin{bmatrix} 0 & -1 \\ 2 & -3 \end{bmatrix}$	*CO2*	*PO1*	**10**

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