PVP 20

Code: 20EE3501

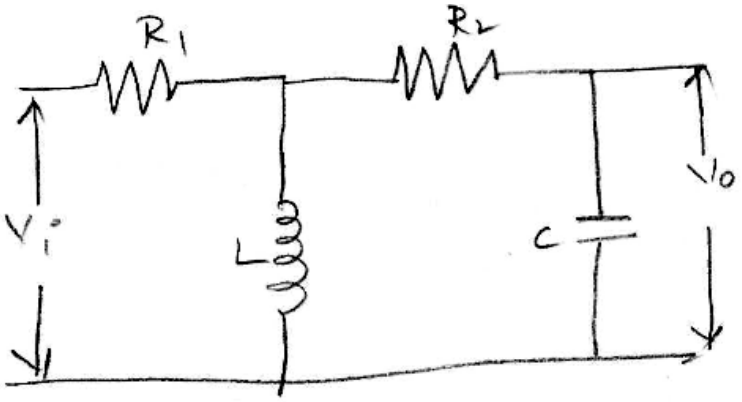
III B.Tech - I Semester – Regular / Supplementary Examinations
NOVEMBER 2024

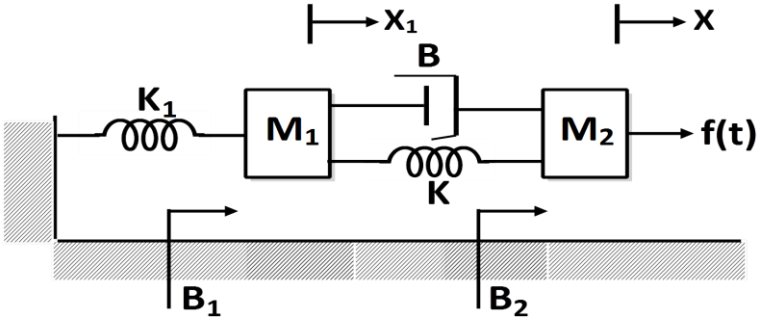
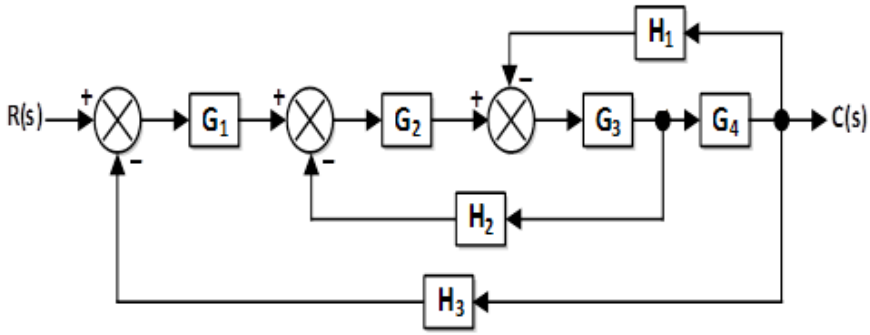
CONTROL SYSTEMS
(ELECTRICAL & ELECTRONICS ENGINEERING)

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)	List the basic elements of mechanical translational systems? Write its force balance equation.	L2	CO1	6 M
	b)	Determine the transfer function of the given electrical network as shown in Figure 1.  Figure 1	L4	CO4	8 M

		OR			
2	a)	Classify the various types of control systems and explain any two.	L2	CO1	6 M
	b)	Write the differential equations governing the mechanical system shown in Figure 2 and determine the transfer function.  Figure 2	L3	CO2	8 M
		UNIT-II			
3	a)	Determine the transfer function for the block diagram shown in Figure 3 using block diagram reduction rules.  Figure 3	L3	CO2	8 M
	b)	Distinguish between Block diagram Reduction Technique and Signal Flow Graph.	L3	CO2	6 M
		OR			
4	a)	List any three block diagram reduction rules to determine the transfer function of the system.	L3	CO2	6 M

	b)	Deduce an expression for the transfer function of an armature controlled DC servo motor.	L3	CO2	8 M
		UNIT-III			
5	a)	Deduce the expressions for the following time domain specifications for unit step input. i. Peak time ii. Settling time for 5% tolerance	L3	CO3	8 M
	b)	Determine the angle of asymptotes and the centroid for the following transfer function: $G(s)H(s) = \frac{K}{(s+1)(s+2+j2)(s+2-j2)}$.	L3	CO3	6 M
		OR			
6	a)	Derive the step response of first order system and plot its response.	L3	CO3	6 M
	b)	Consider the characteristic equation of a closed loop control system is represented by the following equation: $S^4 + 25S^3 + 15S^2 + 20S + K = 0$ Apply the Routh Hurwitz criterion to determine the following: i. Range of values of 'K' for the system to be stable. ii. Frequency of sustained oscillations.	L4	CO4	8 M
		UNIT-IV			
7	Sketch the Bode plot for the system having following transfer function to determine the phase margin and gain margin. $G(s)H(s) = \frac{50}{S\,(1+S)\,(1+0.5\,S)}$		L4	CO4	14 M

		OR			
8	a)	Illustrate the advantages and limitations of frequency response methods.	L3	CO3	6 M
	b)	Describe the significance of the phase crossover frequency and gain crossover frequency in determining the stability of a system.	L3	CO3	8 M
		UNIT-V			
9	a)	Point out any four properties of state transition matrix.	L4	CO5	4 M
	b)	Determine the controllability and observability of a control system which is represented by the state space model given below: $$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} [u]$$ $$Y = [0 \quad 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$	L4	CO5	10 M
		OR			
10	a)	Determine the state space model for the following transfer function: $$\frac{Y(S)}{U(S)} = \frac{1}{S^2 + S + 1}$$	L4	CO5	7 M
	b)	Define state of a system, state variables, state space and state vector. What are the advantages of state space analysis?	L2	CO1	7 M