PVP 20

Code: 20EC3404

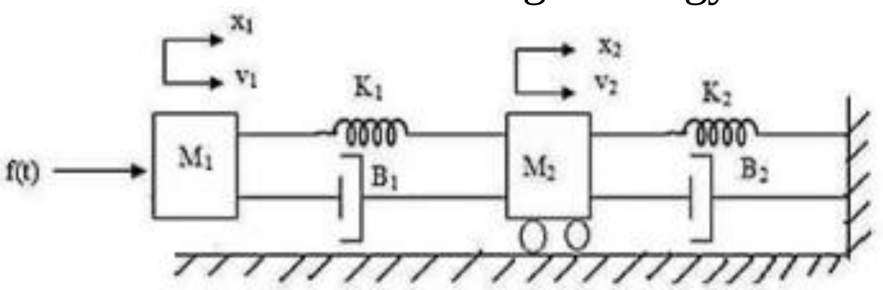
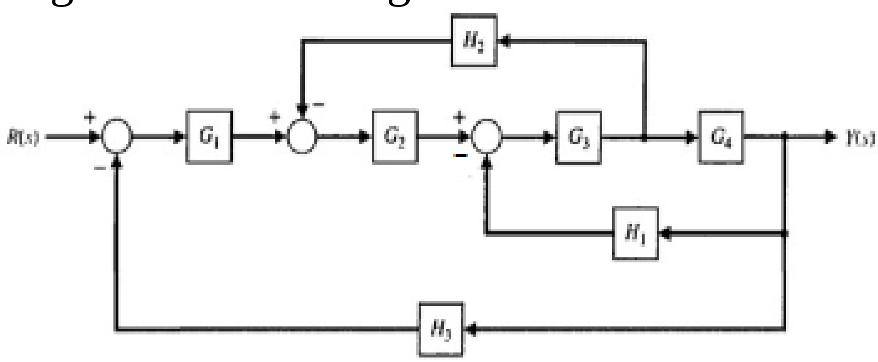
II B.Tech - II Semester – Regular / Supplementary Examinations MAY - 2024

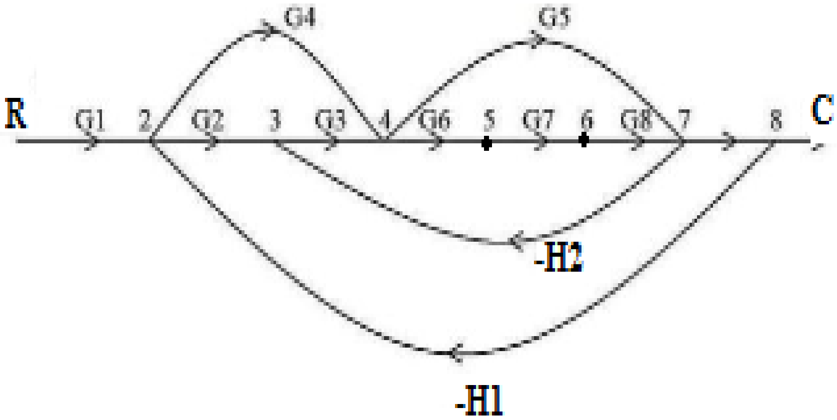
CONTROL SYSTEMS ENGINEERING
(ELECTRONICS & COMMUNICATION ENGINEERING)

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)	Write the differential equations governing the behavior of the mechanical system shown in Figure 1 and obtain an equivalent electrical circuit based on force-voltage analogy.  Figure 1	L3	CO1 CO3	7 M
	b)	Determine the transfer function for the block diagram shown in Figure 2.  Figure 2	L3	CO1 CO3	7 M

		OR			
2	a)	Define positive feedback and negative feedback in control systems. Discuss the advantages of using negative feedback in control systems. How does negative feedback contribute to system stability and performance?	L2	CO1 CO3	7 M
	b)	Determine the transfer function of the system shown in Figure 3 using Mason's Gain formula.  Figure 3	L3	CO1 CO3	7 M
		UNIT-II			
3	a)	For the following unit step response of second-order system find damping ratio, natural frequency, peak overshoot, settling time, rise time, and peak time. $$\frac{C(s)}{R(s)} = \frac{16}{s^2 + 3s + 16}$$	L3	CO1 CO2	8 M
	b)	Define steady-state error in control systems. Discuss the factors that influence steady-state error and how it can be minimized.	L2	CO1 CO2	6 M
		OR			

4	a)	For the following unit step response of second order system determine damping ratio, Natural frequency, peak overshoot, settling time, rise time, and peak time. $$\frac{C(s)}{R\,(s)} = \frac{36}{(s^2\ + 2s + 36)}$$	L3	CO1 CO2	8 M
	b)	Compare and contrast the effects of different types of controllers (P, PI, PD, and PID).	L3	CO1 CO2	6 M
UNIT-III					
5	a)	Using Routh Hurvitz stability criterion, find whether the system is stable or not, give the reasons. The characteristic equation is given as $S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$	L3	CO1 CO5	7 M
	b)	Sketch the root locus plot of a unity feedback system with the open loop transfer function. $$G(s) = \frac{K}{s(s+2)(s+4)}$$	L4	CO1 CO3	7 M
OR					
6	a)	Using Routh Hurvitz stability criterion, Determine the range of K for stability for the following closed-loop transfer function. $$\frac{C(s)}{R(s)} = \frac{K}{s(s^2\ + s + 1)(s+2) + K}$$	L3	CO1 CO5	7 M
	b)	Sketch the root locus for the unity feedback system. $$G(s) = \frac{K}{s(s+5)(s+10)}$$	L4	CO1 CO3	7 M
UNIT-IV					
7	a)	Explain about gain crossover frequency and phase cross over frequency.	L2	CO1 CO4	4 M

	b)	Sketch the Bode plot for the following system. $$G(s)\,H(s) = \frac{100(S+1)}{(S+10)(S+100)}$$	L4	CO1 CO4	10 M
OR					
8	a)	Explain the frequency domain specifications.	L2	CO1 CO4	4 M
	b)	Sketch the polar plot for the following system. $$G(s)H(s) = \frac{2000(S+1)}{S(S+10)(S+40)}$$	L4	CO1 CO4	10 M
UNIT-V					
9	a)	Distinguish between transfer function model and state space model.	L3	CO1 CO5	7 M
	b)	Obtain the transfer function for the system described below. $$\begin{bmatrix}\dot{x_1}\\ \dot{x_2}\end{bmatrix} = \begin{bmatrix}0 & 1\\ -6 & -5\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}0\\ 1\end{bmatrix}u(t)$$ $$y = \begin{bmatrix}8 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$	L3	CO1 CO5	7 M
OR					
10	a)	What is the significance of controllability and observability in the design of control systems?	L3	CO1 CO5	4 M
	b)	Determine the state variable form for the system whose transfer function is given by $$G(s) = \frac{(S+2)}{S(s^2+4s+3)}$$	L3	CO1 CO5	10 M