

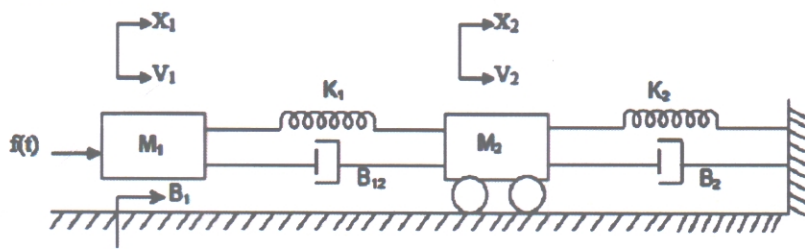
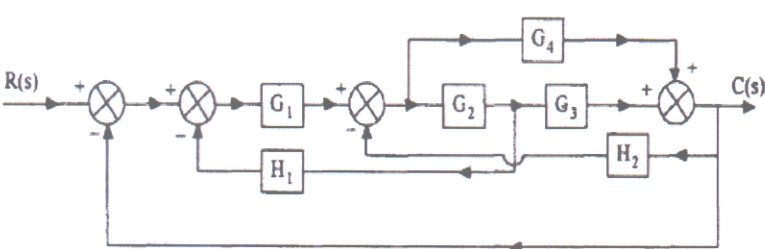
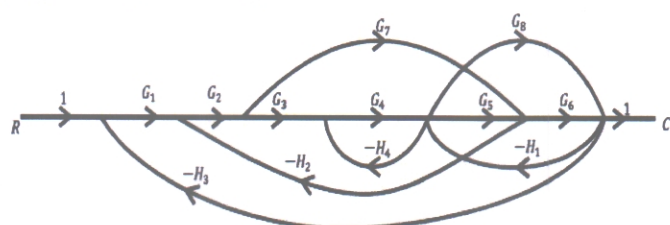
**PRAGATI ENGINEERING COLLEGE: SURAMPALEM**  
(AUTONOMOUS)  
III B.Tech I Semester Supplementary Examinations, May - 2024

**CONTROL SYSTEMS**  
(Electrical and Electronics Engineering)

Time: 3 hours

Max. Marks: 70 M

Answer ONE Question from each Unit  
All Questions Carry Equal Marks

Q. No.	Questions	BTL	CO	Marks
<b>UNIT – I</b>				
1.	<p>a) Write the differential equations governing the mechanical systems shown below.</p> 	K3	CO1	7 M
	b) Develop the transfer function for AC servomotor.	K3	CO1	7 M
<b>OR</b>				
2.	<p>a) By using block diagram reduction techniques, obtain the transfer function <math>\frac{C(s)}{R(s)}</math> for the system shown below.</p> 	K3	CO1	7 M
	<p>b) Obtain the overall transfer functions for the following signal flow graph using mason's gain formula.</p> 	K3	CO1	7 M
<b>UNIT – II</b>				
3.	a) Develop the expression for the unit step-response of a second-order under damped system	K3	CO2	7 M

	b)	unity-feedback system is characterized by the open loop transfer function $G(S) = \frac{1}{S(1+0.5s)(1+0.2s)}$ Determine the rise time, peak time, peak overshoot, and settling time of the unit-step response of the system.	K3	CO2	7 M
<b>OR</b>					
4.	a)	Construct Routh array and determine the stability of the system represented by the characteristics equation $S^5+S^4+2S^3+2S^2+3S+5=0$ . Comment on the location of the roots of characteristic equation	K3	CO2	7 M
	b)	Construct the root locus plot of unity feedback system having open loop transfer function given by $G(s) = \frac{K(S+1.5)}{S(S+1)(S+5)}$	K3	CO2	7 M
<b>UNIT – III</b>					
5.		Draw the Bode plot for a unity feedback system $G(s) = \frac{K}{s(1+0.2s)(1+0.02s)}$ and also determine K if Gain margin is 20dB	K3	CO3	14M
<b>OR</b>					
6.		The open loop transfer function of a unity feedback control system is: $G(S) = \frac{K}{(S+1)(2S+1)}$ Use Nyquist stability criterion to determine the critical value of gain 'K' for stability.	K3	CO3	14M
<b>UNIT – IV</b>					
7.	a)	Draw electrical network configuration for phase-lag compensator and hence develop the transfer function for the same.	K3	CO4	7 M
	b)	Design a lag compensator that will provide a phase lag of $50^\circ$ and alternation of 15 dB at 2rad/sec. Also determine the transfer function	K3	CO4	7 M
<b>OR</b>					
8.	a)	Explain the design procedure for lag- lead compensation in frequency domain	K3	CO4	7 M
	b)	Develop a suitable lead compensators for a system with unity feedback and having open loop transfer function $G(S) = K/ S(S+1) (S+4)$ to meet the specifications. (i)Damping ratio=0.5 (ii) Undamped natural frequency =2 rad/sec	K3	CO4	7 M
<b>UNIT – V</b>					
9.	a)	Define the term state variable. What are the advantages of state space representation	K3	CO5	7 M
	b)	Determine the state transition matrix for the system $\dot{X} = AX$ , where $A = \begin{bmatrix} -2 & 0 & 1 \\ 0 & -1 & 1 \\ 2 & 0 & 1 \end{bmatrix}$	K3	CO5	7 M
<b>OR</b>					

10.	a)	Explain about the concept of controllability and observability.	K2	CO5	7 M
	b)	<p>Check the controllability and observability of the system described by</p> $A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & -2 & -3 \end{bmatrix}$ $B = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$ $C = \begin{bmatrix} 3 & 4 & 1 \end{bmatrix}$	K3		7 M

