PVP 23

Code: 23EE3403

II B.Tech - II Semester – Regular / Supplementary Examinations
APRIL 2026

CONTROL SYSTEMS
(ELECTRICAL & ELECTRONICS ENGINEERING)

Duration: 3 hours Max. Marks: 70

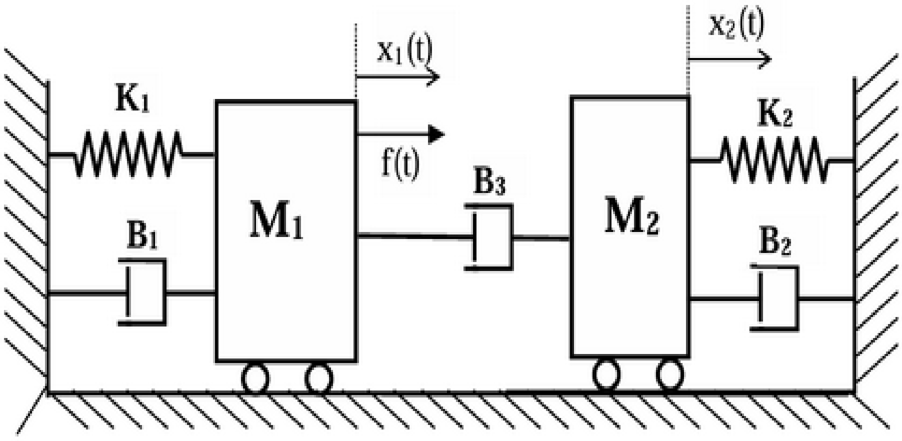
Note: 1. This question paper contains two Parts A and B.
2. Part-A contains 10 short answer questions. Each Question carries 2 Marks.
3. Part-B contains 5 essay questions with an internal choice from each unit. Each Question carries 10 marks.
4. All parts of Question paper must be answered in one place.

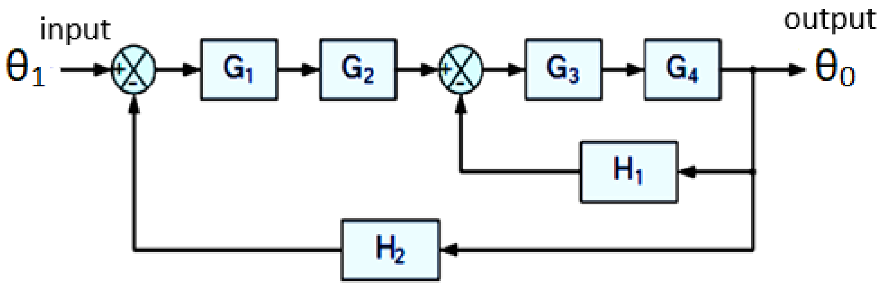
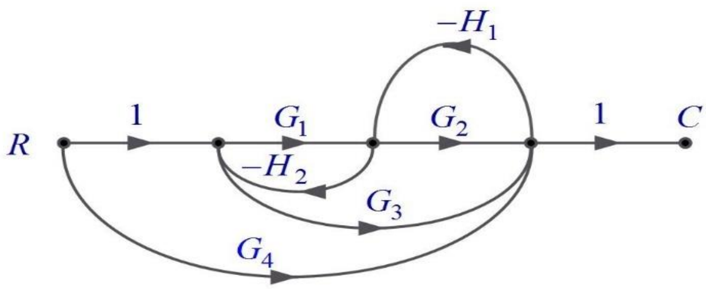
BL – Blooms Level CO – Course Outcome

PART – A

		BL	CO
1.a)	Define transfer function.	L2	CO1
1.b)	What are the basic elements used for modeling mechanical translational system.	L2	CO1
1.c)	Write the Masons Gain formula to determine the overall gain of the transfer function.	L2	CO1
1.d)	List the standard test signals used in control system.	L2	CO1
1.e)	What is the effect of PD controller on system performance?	L3	CO2
1.f)	What is centroid?	L2	CO1
1.g)	Draw the pole-zero plot of a lag compensator.	L3	CO3
1.h)	Define resonant peak.	L2	CO1
1.i)	List any two advantages of state space analysis over transfer function approach.	L2	CO1
1.j)	What is the need for Observability test?	L4	CO5

PART – B

			BL	CO	Max. Marks
UNIT-I					
2	a)	Write the governing differential equations for a series RLC electrical network and determine the transfer function considering capacitor voltage as output and supply voltage as input.	L3	CO2	5 M
	b)	Distinguish between open loop and closed loop system.	L3	CO2	5 M
OR					
3	Perform the following for the mechanical translational system shown in Figure 1.  Figure 1 i. Write the differential equations governing the mechanical system with the help of free body diagram. ii. Determine the transfer function $T(S) = X_1(S)/F(S)$.		L3	CO2	10 M
UNIT-II					
4	a)	Determine the transfer function for the block diagram shown in Figure 2 using block diagram reduction technique.	L4	CO4	5 M

		 Figure 2			
	b)	Formulate an expression for the rise time of second order system considering a unit step input for the underdamped system.	L3	CO3	5 M
OR					
5	a)	Determine the transfer function for the signal flow graph shown in Figure 3 using Masons gain formula.  Figure 3	L4	CO4	5 M
	b)	Explain the pole locations of underdamped, overdamped and critically damped second-order systems.	L3	CO3	5 M
UNIT-III					
6		Sketch the root-locus plot for the given transfer function and determine the range of values of 'K' for the system to be stable. $G(s)H(s) = \frac{K}{S\,(S+1)(S+3)}$	L4	CO4	10 M
OR					
7	a)	Explain the Proportional–Integral–Derivative (PID) controller with its mathematical model and block diagram.	L3	CO2	5 M

	b)	Consider the characteristic equation of a closed loop control system is represented by the following equation: $$S^4 + 8S^3 + 18S^2 + 16S + K = 0$$ Apply the Routh Hurwitz criterion to determine the range of values of 'K' for the system to be stable.	L4	CO4	5 M
UNIT-IV					
8	Discuss the frequency-domain specifications of a control system and explain their significance.		L4	CO4	10 M
OR					
9	Sketch the Bode plot for the following transfer function to determine the phase margin and gain margin. Comment on stability. $$G(s)H(s) = \frac{20}{S\,(1+S)\,(1+0.01\,S)}$$		L4	CO4	10 M
UNIT-V					
10	a)	Explain Kalman's controllability and observability criteria with mathematical formulation.	L4	CO5	5 M
	b)	List the properties of State Transition Matrix.	L3	CO2	5 M
OR					
11	Determine the controllability and observability of a control system which is represented by the state space model given below: $$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix} = \begin{bmatrix}0 & 1\\ -2 & -3\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix} + \begin{bmatrix}1\\ 0\end{bmatrix}[u]$$ $$Y = [0 \quad 1]\begin{bmatrix}x_1\\ x_2\end{bmatrix}$$		L4	CO5	10 M