Roll No.											

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – MARCH 2026	
Date: 10 – 03- 2026	**Time:** 02:00pm – 03:30pm

School: SOE	**Program:** B. TECH-ECE, VLSI	
Course Code: EEE2510	**Course Name:** Control Systems Engineering	
Semester: IV	**Max Marks**:50	**Weightage**:25%

CO - Levels	CO1	CO2	CO3	CO4	CO5	CO6
Marks	12	14	24	-	-	-

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

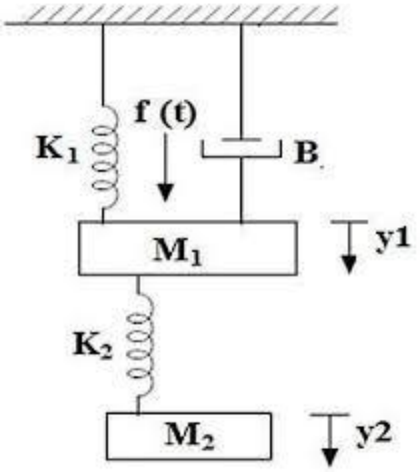
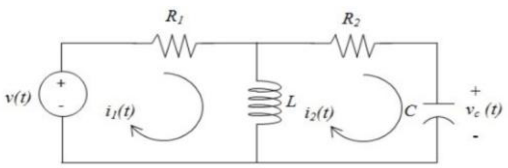
Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	Define the transfer function of a linear time invariant system.	2 Marks	L1	CO1
2	List the block diagram reduction rules for the cases given below. 1. Shifting a summing point after the block 2. Shifting a summing point before the block	2 Marks	L1	CO2
3	The Mason's Gain Formula (MGF) determines the transfer function of a linear system which is represented as signal flow graph. Explain the MGF.	2 Marks	L2	CO2
4	The performance characteristics of a control system are specified in terms of the transient response to unit step input. The transient response of a practical control system exhibits damped oscillations before attaining the steady state. Define the following performance indices that are used to characterize the step response to a second order system. (a) Rise time (b) Maximum Overshoot	2 Marks	L1	CO3

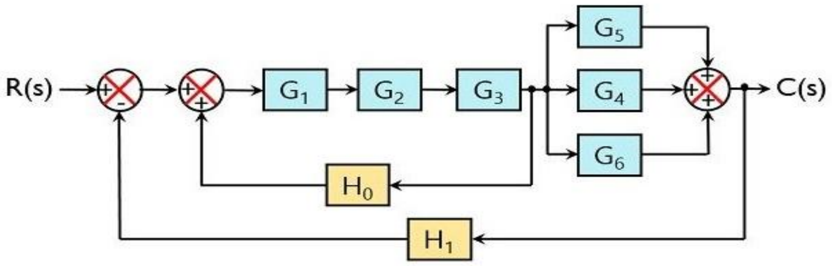
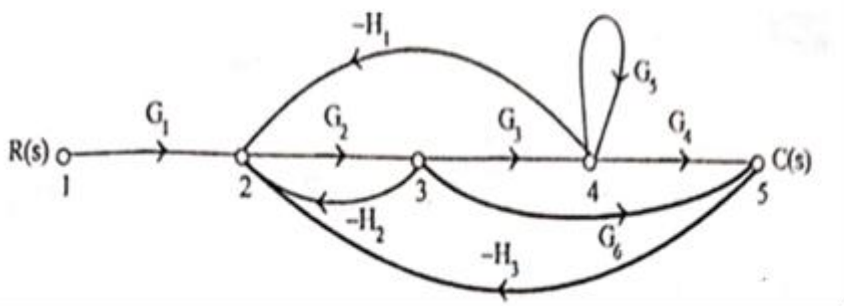
5	Explain with sketch the response of an undamped second order system for unit step input	2 Marks	L2	CO3

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	The mechanical system shown in Fig. represents a vehicle suspension–seat–passenger model, where M_1 denotes the vehicle body, M_2 represents the seat–passenger assembly, springs represent suspension stiffness, and the damper models shock absorption. Develop the transfer function $\frac{Y_1(s)}{F(s)}$. 	**10 Marks**	**L3**	**CO1**
Or					
7.	**a.**	The electrical network shown in Fig. represents a second-order RC ladder low-pass filter used in signal conditioning to suppress high-frequency noise in sensor and instrumentation systems. Develop the transfer function $\frac{V_o(s)}{V(s)}$ of the circuit 	**10 Marks**	**L3**	**CO1**

8.	**a.**	In an industrial process control system, the controller, actuator, and plant dynamics are represented by the blocks G_1, G_2, G_3,and G_4. The blocks G_5 and G_6 represent parallel feed-forward compensation paths used to improve transient response, while H_0 and H_1 represent internal and external feedback sensors used for stability and accuracy. The block diagram of the system is shown below. Applying block diagram reduction techniques, reduce the given system and obtain the overall transfer function $\frac{C(s)}{R(s)}$.	**10 Marks**	**L3**	**CO2**

					
Or					
9.	a.	The signal flow graph shown represents a multistage electronic amplifier with feedback and feed-forward paths used for gain stabilization and bandwidth improvement. Using Mason's Gain Formula, obtain the overall transfer function $\frac{C(s)}{R(s)}$ of the system. 	10 Marks	L3	CO2

10.	a.	The transfer function of a second-order closed-loop electronic control system used in a voltage-regulated power supply / amplifier circuit is given by $$G(s) = \frac{361}{s^2 + 16s + 361}.$$ Solve for the damping ratio $\boldsymbol{\zeta}$, natural frequency $\boldsymbol{\omega_n}$, rise time $\mathbf{t_r}$, peak time $\mathbf{t_p}$, settling time $\mathbf{t_s}$, and percentage overshoot of the system.	10 Marks	L3	CO3
Or					
11.	a.	Automated pick-and-place robotic systems used in electronics assembly require precise positioning of the gripper. The closed-loop position control system of the robot arm can be modelled as a second-order system with damping ratio $\zeta = 0.5$ and natural frequency $\omega_n = 4$ rad/s. When the system is subjected to a unit step input, solve for all the time-domain response specifications	10 Marks	L3	CO3

12.	**a.**	An open-loop control system used in a precision positioning system of an antenna tracking system has the transfer function $$G(s) = \frac{5(s^2+2s+100)}{s^2(s+5)(s^2+3s+10)}$$ 1. Identify the type and order of the system. 2. Examine the pole–zero locations and discuss their influence on system behavior. 3. Evaluate the static error constants for step, ramp, and parabolic inputs and interpret their significance. **4.** Analyze the resulting steady-state errors for step, ramp, and parabolic inputs when applied individually**.**	**10 Marks**	**L4**	**CO3**
Or					
13.	**a.**	A unity feedback system has the transfer function $$G(s) = \frac{K}{s(s+1)(s+10)}$$ 1. Analyze how the system type influences steady-state error. 2. Compute the static error constants. 3. Determine the steady-state error for a unit step and ramp input for $K = 50$.	**10 Marks**	**L4**	**CO3**