Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – December 2025

Date: 08-12- 2025 **Time:** 01:00pm – 04:00pm

School: SOE	**Program:** B.Tech	
Course Code: EEE2007	**Course Name:** Control Systems Engineering	
Semester: V	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	24	16	26	12	22

Instructions:

(i) Read all questions carefully and answer accordingly.

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

Part A

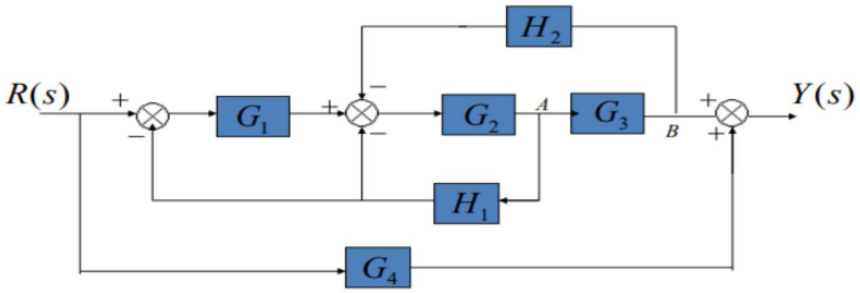
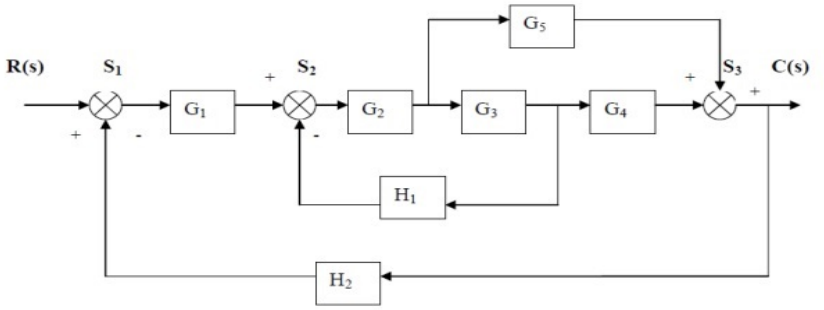
Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	The open loop and closed loop are two types of control systems. List the differences between Open loop and Closed loop control systems	**2 Marks**	**L1**	**CO1**
2.	Recall the block diagram of a positive and negative closed loop feedback system and their transfer functions	**2 Marks**	**L1**	**CO1**
3.	The transient response of a practical control system exhibits damped oscillations before attaining a steady state. Define the maximum overshoot and settling time of a system	**2 Marks**	**L1**	**CO2**
4.	The error constants Kp, Kv and Ka describe the ability of a system to reduce or eliminate steady state errors. Find the expressions for the various error constants and steady state error	**2 Marks**	**L1**	**CO2**
5.	Recall the response of an undamped second order system for unit step input	**2 Marks**	**L1**	**CO2**
6.	List the procedure to find asymptotes and centroid in Root locus.	**2 Marks**	**L1**	**CO3**
7.	Define gain cross over frequency and phase cross over frequency.	**2 Marks**	**L1**	**CO3**
8.	Recall the slope and angle contribution of a single pole at origin in Bode plot.	**2 Marks**	**L1**	**CO3**

9.	Recall the circuit diagram for Phase lag compensator	**2 Marks**	**L1**	**CO4**
10.	Relate the state model to Transfer function	**2 Marks**	**L1**	**CO5**

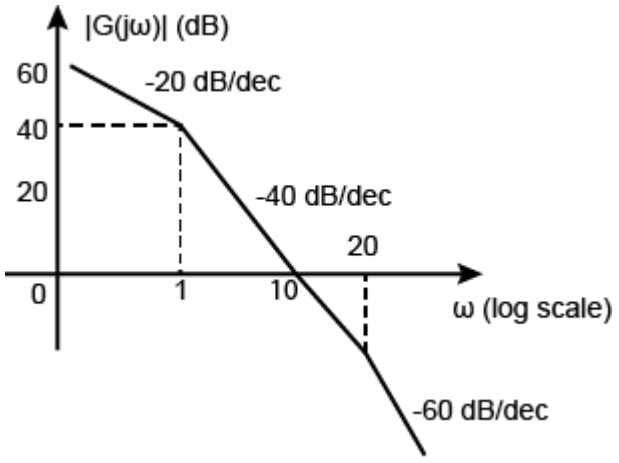
Part B

Answer the Questions. **Total Marks 80M**

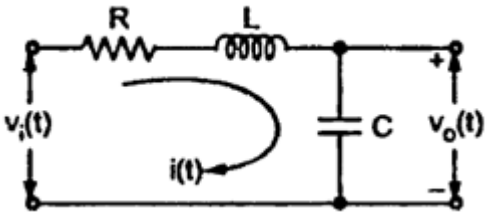
11.	**a.**	Draw the Signal Flow Graph and apply MGF to find the overall gain of the following block diagram 	**10 Marks**	**L3**	**CO1**
		Or			
12.	**a.**	An automobile shock absorber can be represented with single mass, damper and spring with an external force F acting on mass which produces a displacement of x. Summarize the various forces acting on the system and develop its transfer function	**5 Marks**	**L2**	**CO1**
	b.	With a sample signal flow graph, explain the following terms 1. Forward Path 2. Non touching loops 3. Forward path gain 4. Transmittance 5. Branch	**5 Marks**	**L2**	**CO1**
13.	**a.**	Explain the basic block diagram reduction rules with neat diagrams.	**10 Marks**	**L2**	**CO1**
		Or			
14.	**a.**	Applying Block diagram reduction techniques obtain the transfer function of the system given below. 	**10 Marks**	**L3**	**CO1**

15.	**a.**	Solve for ζ; ω_n; t_s; t_p; t_r, and %Overshoot for a system whose transfer function is $$G(s) = \frac{361}{s^2 + 16s + 361}.$$	**10 Marks**	**L3**	**CO2**
		Or			
16.	**a.**	For the open loop system whose transfer function is given below 1. Identify the type and order. 2. Find the location of poles and zeros 3. Determine the static error constants for step, ramp and parabolic (acceleration) inputs 4. Determine the steady state errors for step, ramp and parabolic (acceleration) inputs when applied separately. $$G(s) = \frac{5(s^2 + 2s + 100)}{s^2(s+5)(s^2 + 3s + 10)}$$	**10 Marks**	**L4**	**CO2**

17.	**a.**	Explain the construction, transfer function and frequency response of a phase lead compensator with suitable diagrams.	**10 Marks**	**L2**	**CO4**
		Or			
18.	**a.**	Explain the construction, transfer function and frequency response of a phase lag-lead compensator with suitable diagrams	**10 Marks**	**L2**	**CO4**

19.	**a.**	Apply R-H criteria to identify the stability of the system with the characteristic equation given below. $S^6 + 4S^5 + 3S^4 - 16S^2 - 64S - 48 = 0$	**10 Marks**	**L3**	**CO3**
	b.	Consider the magnitude plot of the open-loop T.F. given below and develop its transfer function 	**10 Marks**	**L3**	**CO3**
		Or			

20.	**a.**	Construct the root locus for the open loop transfer function of unity feedback control system given below $$G(s)H(s) = K/s(s+5)(s+10)$$ 1.Identify the breakaway point, Imaginary axis cross point 2. Comment on stability.	**20 Marks**	**L3**	**CO3**

21.	**a.**	Develop the state model of the electric circuit given below. 	**10 Marks**	**L3**	**CO5**
	b.	Compute the transfer function from the given state model $$\dot{x} = \begin{bmatrix} -4 & -1.5 \\ 4 & 0 \end{bmatrix} x + \begin{bmatrix} 2 \\ 0 \end{bmatrix} u(t)$$ $$y = [1.5 \quad 0.625]\, x$$	**10 Marks**	**L3**	**CO5**
		Or			
22.	**a.**	Explain the terms controllability and observability of a linear system and the method to determine the same	**10 Marks**	**L2**	**CO5**
	b.	While developing an automatic control system, its verified that system is stable and needs to check the controllability and observability. Suggest suitable methods for the same and ally the same to check the controllability and observability of the system given below. $$\dot{x} = \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} -1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 0 \end{bmatrix} [u]$$ $$Y = [0 \quad 1] \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$$	**10 Marks**	**L3**	**CO5**