Sub Code: R2322041 **R23** **Set No. 1**

JAWAHARLAL NEHRUTECHNOLOGICAL UNIVERSITY-GURUJADA VIZAINAGARAM
II B. Tech II Semester Supplementary Examinations November-2025
LINEAR CONTROL SYSTEMS
(ECE)

Time: 3 hours **Max. Marks: 70**

The Question paper consists of Part A & Part B.
Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.
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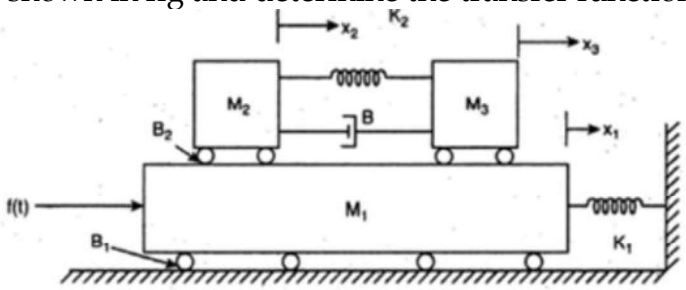
1		PART-A	(20Marks)
	a)	What are advantages of closed loop control system?	[2]
	b)	What are the basic elements used for modeling Rotational mechanical system?	[2]
	c)	Define Velocity error constant	[2]
	d)	Define PID Controller	[2]
	e)	Define absolute stability	[2]
	f)	Plot the zeros and poles of below transfer function $G(s) = \frac{S+2}{S(S+1)}$	[2]
	g)	Define gain Margin.	[2]
	h)	Draw the phase plot of Lag compensator.	[2]
	i)	Define state variable.	[2]
	j)	What is controllability	[2]
		PART-B	(50Marks)
		Question from **Unit - I**	
2	a)	Write the differential equations governing the mechanical systems shown in fig and determine the transfer function.	[5]



	b)	Determine the transfer function for the block diagram shown in Figure 1.	[5]

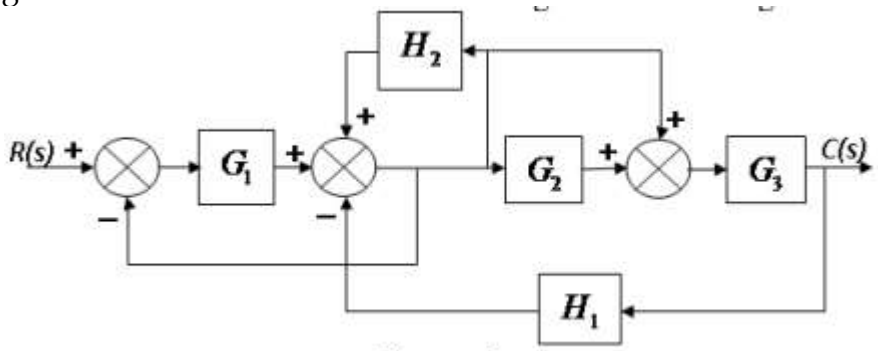
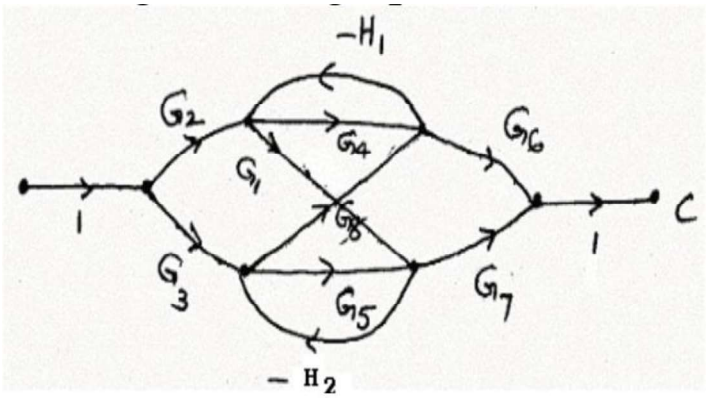


Figure: 1

(OR)

3	a)	find the overall transfer function C/R from the signal flow graph shown in below figure	[5]



b) Explain DC Servomotor and obtain its transfer function. [5]

Question from **Unit - II**

4 a) Derive the expression for peak overshoot and settling time of second order system subjected to a step input [5]

b) Define a steady state error? Derive the static error components for Type 0, Type 1 &Type 2 systems? [5]

(OR)

5 a) Damping factor and natural frequency of the system are 0.12 and 84.2 rad/sec respectively. Determine the rise time (tr), peak time (tp). [5]

b) Discuss the response of a standard under damped second order system for unit step input. [5]

Question from **Unit - III**

6 a) Determine the range of K for stability of unity feedback system using Routh stability criterion whose transfer function [5]

$$\frac{C(s)}{R(s)} = \frac{K}{S(S^2 + 4S + 13)}$$

b) Sketch the root locus plot of a unity feedback system whose open loop transfer function is $G(s) = k/s(s+1)(s+3)$ [5]

(OR)

7 a) By means of RH criterion determine the stability of the system represented by the characteristic equation $S^4 + 2S^3 + 8S^2 + 4S + 3 = 0$. [5]

b) Discuss the effects of adding poles and zeros to G(s) H(s) on the root locus. [5]

Question from **Unit - IV**

8 a) Sketch the polar plot for $G(s) = \frac{1}{s(1+sT1)(1+sT2)}$ [3]

b) Sketch the Bode Magnitude plot for the transfer function [7]

$$G(s) = \frac{K}{S(S+1)(S+50)}.$$

(OR)

9 Design a phase lag network for a plant with the open loop transfer function $G(s) = \frac{5}{S(1+0.1S)^2}$ to have a phase margin of 45^0. Verify the performance of the compensated system with the specification. [10]

Question from **Unit - V**

10 a) Define state transition matrix and explain its properties with examples. [5]

b) Transfer function of a system is given by: [5]

$$\frac{Y(s)}{U(s)} = \frac{2}{s^3 + 6s^2 + 11s + 6}$$

find controllability and observability

(OR)

11 a) What are the advantages and limitations of state space analysis over conventional methods? [5]

b) Consider the following system with differential equation is given by [5]

$$\dddot{y} + 4\ddot{y} + 9\dot{y} + 4y = u = 0$$

Find the state space model in diagonal canonical form.

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