Sub Code: R2322024 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
II B. TECH II SEMESTER SUPPLIMENTRY EXAMINATIONS NOV -2025
CONTROL SYSTEMS
(EEE)

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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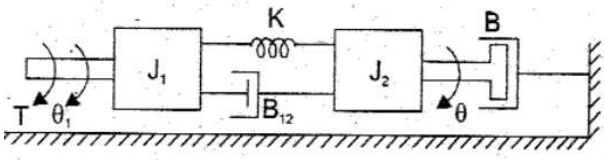
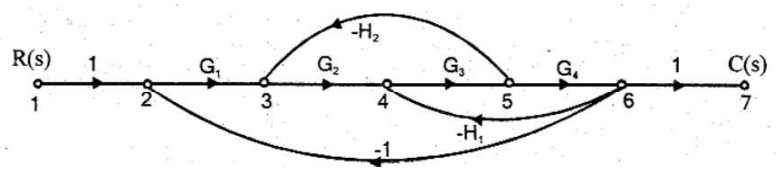
1		PART-A	(20Marks)
	a)	What are the two major types of control systems ?	[2]
	b)	Write the force balance equation of ideal mass element .	[2]
	c)	What is transient state and steady state response ?	[2]
	d)	The damping ratio of a system is 0.75 and natural frequency of oscillation is 12rad/sec. Determine the 1) peak overshoot and 2)peak time.	[2]
	e)	Define phase margin .	[2]
	f)	What is polar plot ?	[2]
	g)	What are the advantages of the lag compensator ?	[2]
	h)	Explain the limitations of lead compensator ?	[2]
	i)	What do you mean by homogenous and non-homogenous state equations ?	[2]
	j)	What are the advantages of state-space analysis ?	[2]
		PART-B	(50Marks)
		Question from **Unit - I**	
2	a)	Explain the Mathematical model of a Control System .	[5]
	b)	Explain the advantages and disadvantages of closed loop control system.	[5]
		(OR)	
3	a)	Write the differential equations governing the mechanical rotational system shown in the figure.	[5]



	b)	Find the overall gain $\frac{C(S)}{R(S)}$ for the signal flow graph shown below.	[5]



Question from **Unit - II**

4	a)	Derive the response of a first-order system subjected to the following (i) unit-impulse signal and (ii) unit-step signal	[5]

b) Obtain the response of unity feedback system whose open loop transfer function is $G(S) = \frac{4}{S(S+5)}$ and when the input is unit step. [5]

(OR)

5 a) Construct Routh array and determine the stability of the system represented by the characteristic equation , [5]
$s^5 + s^4+2s^3+2s^2+3s+5=0$.

b) Write the steps involved in constructing root locus. [5]

Question from **Unit - III**

6 a) What are advantages of frequency response analysis ? [5]

b) The loop transfer function of a system is given by [5]
$G(s)H(s) = \frac{2}{s(s+1)(s+0.2)}$. Sketch the Bode plot for the given system.

(OR)

7 a) What are the steps involved to check the stability of the system based on Nyquist stability criterion. [5]

b) The open loop transfer function of a unity feedback system is given by [5]
$G(S) = \frac{1}{s(s+1)^2}$. Sketch the polar plot .

Question from **Unit - IV**

8 a) Explain series compensation with the help of block diagram. [5]

b) What are the steps involved in designing a phase-lag compensator? [5]

(OR)

9 a) Compare lead and lag compensation. [5]

b) Consider a TYPE 1 system with open-loop transfer function $G(s) = \frac{K}{s(s+1)(s+4)}$. Design a lag compensator to meet the following specifications : [5]
Damping ratio **ζ =** 0.707
Setting time t_s = 10 sec and Velocity error constant K= $5sec^{-1}$.

Question from **Unit - V**

10 a) Determine the state representation of a continuous-time LTI system with system function $G(s) = \frac{s+7}{(s+2)(s+3)}$ in observable canonical form. [5]

b) The transfer function of the system is given by $\frac{C(S)}{R(S)} = \frac{s^2+3s+3}{s^3+2s^2+3s+1}$. [5]
Determine the state space model of the system .

(OR)

11 a) Write a short note on observability. [5]

b) Check the following system for controllability. [5]
$A = \begin{bmatrix} -2 & 1 \\ 1 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$, $C = [1 \quad -1]$

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