

AKASH

Hi-Tech Institute of Engineering & Technology	
DEPARTMENT OF ELECTRICAL ENGINEERING	
MODEL PAPER-2 CONTROL SYSTEM 2023-24,	
Semester: FIFTH	Course/Branch: BTECH / EE
Subject Code: KEE502	Subject Name: CONTROL SYSTEM
Faculty Name: AAKASH DHAWAN	
Time: 3: 00 Hours	Total Marks: 100

Note: Attempt all Sections. If you require any missing data, then choose suitably.

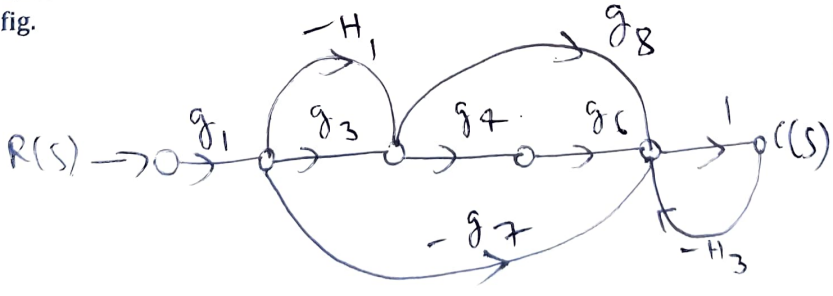
**SECTION A**

1. Attempt all questions in brief.

Q No.	Question	Marks	CO
a.	What is the difference between gain margin and phase margin?	2	
b.	Explain velocity error coefficient and position error coefficient.	2	
c.	Write a note on stability.	2	
d.	Describe Routh Hurwitz criteria.	2	
e.	How do you check the controllability and observability of the system? Explain the process.	2	
f.	What is the difference between Nyquist Plot and Bode Plot?	2	
g.	Derive the expression of state transition matrix.	2	
h.	Write a note on Bode Plot.	2	
i.	Derive the expression for lag compensation network.	2	
j.	Write description on settling time, peak overshoot and damping.	2	

**SECTION B**

2. Attempt any three of the following:

Q No.	Question	Marks	CO
a.	Explain the detailed process of signal flow graph.	10	
b.	Obtain the transfer function C/R from the signal flow graph shown in fig.	10	
			
c.	Write a note on analogy between electrical and mechanical system.	10	
d.	Describe about synchronous motor and stepper motor in detail.	10	
e.	Write a detailed note on Proportional, Derivative, Integral and PID controller.	10	

**SECTION C**

3. Attempt any one part of the following:

Q No.	Question	Marks	CO
a.	Explain time response of first order system with unit ramp input.	10	
b.	Derive the expression for time response of second order system for unit step input.	10	

4. Attempt any one part of the following:

Q No.	Question	Marks	CO
a.	Derive the expressions for output equation and state equation for state model.	10	
b.	Determine the state transition matrix from the given equation: $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 1 & 3 \\ -1 & 2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 2 \\ 3 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}$ $y = \begin{bmatrix} 1 & 3 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$	10	

5. Attempt any one part of the following:

Q No.	Question	Marks	CO
a.	Derive the expression of transfer function from state model and also check the observability of a control system given by: $\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} 2 & -6 \\ 4 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 1 \\ 1 \end{bmatrix} \begin{bmatrix} u_1 \\ u_2 \end{bmatrix}, y = \begin{bmatrix} 2 & 4 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$	10	
b.	Write state model to following differential equation: $\ddot{y} + 2\dot{y} + 3y + 5y = 6u$	10	

6. Attempt any one part of the following:

Q No.	Question	Marks	CO
a.	Write state model from the transfer function: $Y(S)/U(S) = 2/(S^3 + 2S^2 + 4S + 1)$	10	
b.	Explain lead, lag and lead-lag compensation networks.	10	

7. Attempt any one part of the following:

Q No.	Question	Marks	CO
a.	Determine the range of values of k for the system to be stable. a) $S^4 + 20ks^3 + 5s^2 + 10s + 15 = 0$ b) $S^3 + 2ks^2 + (k+2)s + 4 = 0$	10	
b.	Write a note on Bode plot, Nyquist plot, Gain margin and phase margin.	10	

*Akash*