Hi-Tech Institute of Engineering & Technology	
DEPARTMENT OF ELECTRICAL ENGINEERING	
MODEL PAPER-1 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.

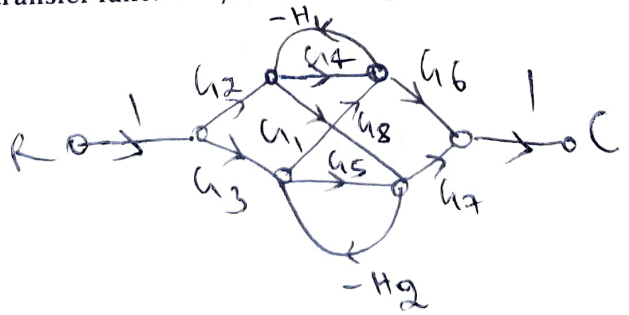
SECTION A

1. Attempt all questions in brief.

Q No.	Question	Marks	CO
a.	What is the difference between open loop and close loop control system?	2	
b.	Explain Mason's gain formulae.	2	
c.	Write a note on PID controller.	2	
d.	Define stability. What are the conditions for stable system?	2	
e.	How do you check the controllability and observability of the system? Explain the process.	2	
f.	What is the difference between gain margin and phase margin?	2	
g.	Derive the expression of transfer function with respect to state space analysis.	2	
h.	Write a note on polar plot.	2	
i.	Derive the expression for lead compensation network.	2	
j.	Write a note on steady state errors.	2	

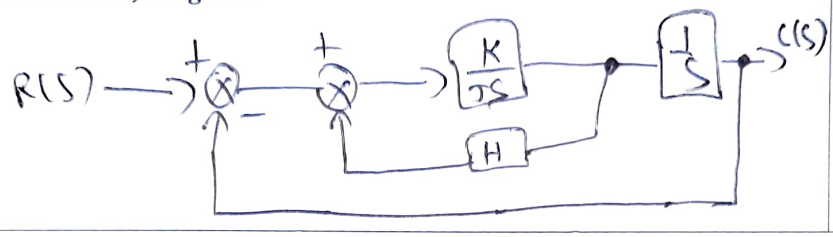
SECTION B

2. Attempt any three of the following:

Q No.	Question	Marks	CO
a.	Explain the construction and working principle of AC and DC servomotor.	10	
b.	Obtain the transfer function C/R from the signal flow graph shown in fig. 	10	
c.	Write a note on mathematical modelling of physical system (Electro-Mechanical).	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 second order system with unit step input.	10	
b.	Determine the value of K and H of the closed loop system so that the maximum overshoot in unit step response is 25% and the peak time is 2 sec. Assume J=1kgm^2. 	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: $\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}1 & 0\\ 1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 1\end{bmatrix}\begin{bmatrix}u_1\\ u_2\end{bmatrix}$ $y(t)=\begin{bmatrix}1 & 1\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}$	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 controllability of a control system given by: $\dot{x}=\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\end{bmatrix}=\begin{bmatrix}-1 & -1\\ 1 & 0\end{bmatrix}\begin{bmatrix}x_1\\ x_2\end{bmatrix}+\begin{bmatrix}1\\ 0\end{bmatrix}[u]$	10	
b.	Write state model to following differential equation: $\dddot{y}+2\ddot{y}+3\dot{y}+4y=5u$	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	