

GUJARAT TECHNOLOGICAL UNIVERSITY**BE – SEMESTER- V EXAMINATION-SUMMER 2023****Subject Code: 2150909****Date: 23/06/2023****Subject Name: Control System Engineering****Time: 02:30 PM TO 05:00 PM****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed

		MARKS
Q.1	(a) Explain control system and enlist the advantages of closed loop control system over open loop control system.	03
	(b) Write the four limitation of transfer function based performance analysis of any system.	04
	(c) Obtain the overall transfer function of Fig.1 using block diagram reduction technique.	07
Q.2	(a) Explain the types of feedback systems.	03
	(b) Derive the transfer function of the phase lag network shown in Fig: 2	04
	(c) Obtain the transfer function using mason gain formula shown in fig:3	07
	OR	
	(c) Find the state space model of armature controlled DC motor.	07
Q.3	(a) Define the following terms: Source Node, Chain Node, and Non Touching Loop.	03
	(b) Define the following terms related to time response of system: Delay time, Rise Time, Peak time, Settling time.	04
	(c) Derive the equations for time response of first order system with unit step signal.	07
	OR	
Q.3	(a) Write a short note on standard test signals.	03
	(b) Derive the steady state error constant for type-0 system.	04
	(c) Draw the free body diagram and write the differential equations describing the dynamics of the system shown in fig (4)	07
Q.4	(a) Explain the magnitude plot and phase plot of bode plot.	03
	(b) Using Routh's stability criterion, determine the stability of a system which has the characteristic equation as: $S^4 + 2S^3 + 11S^2 + 18S + 18 = 0$	04
	(c) Sketch the root loci of figure shown in figure: 5	07
	OR	
Q.4	(a) Write a short note on marginally stable system.	03
	(b) Determine the stability of the system having the Characteristic equation as : $S^6 + 5S^5 + 11S^4 + 25S^3 + 36S^2 + 30S + 36 = 0$	04
	(c) The open loop transfer function of unity feedback system is $G(s) = \frac{4}{s(s+1)}$	07
	Determine the nature of response of the closed loop system for unit step input. Also, determine the rise time, peak time, peak overshoot, and settling time.	

- Q.5 (a)** List out the types of compensation and explain any one detail. **03**
(b) Explain PD control using appropriate equations. **04**
(c) Construct the bode plots for the unity feedback control system having **07**

$$G(S) = \frac{2000}{S(S+1)(S+100)}$$

Determine gain crossover frequency, phase crossover frequency, gain margin and phase margin.

OR

- Q.5 (a)** Write down the advantages of bode plot. **03**
(b) Explain significance of PID Controller. **04**
(c) The transfer function of the system is given by **07**

$$\frac{Y(s)}{U(s)} = \frac{S^2 + 3S + 4}{S^3 + 2S^2 + 3S + 2}$$

Obtain the state model.

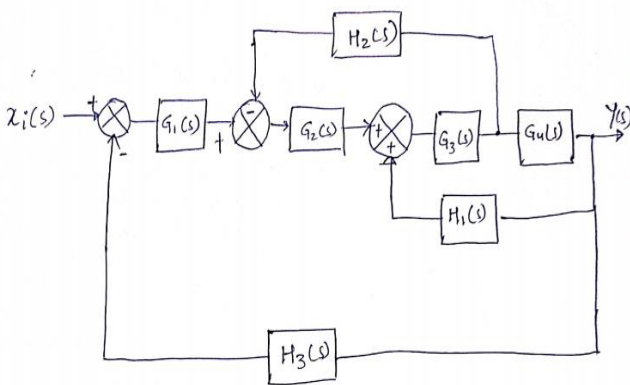


Fig: 1

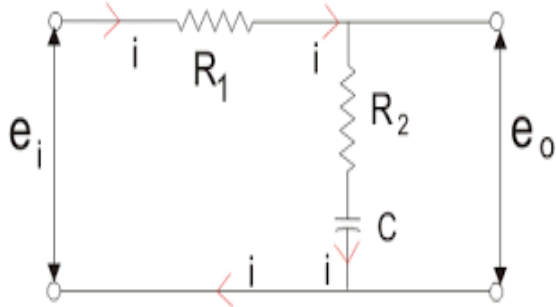


Fig:2

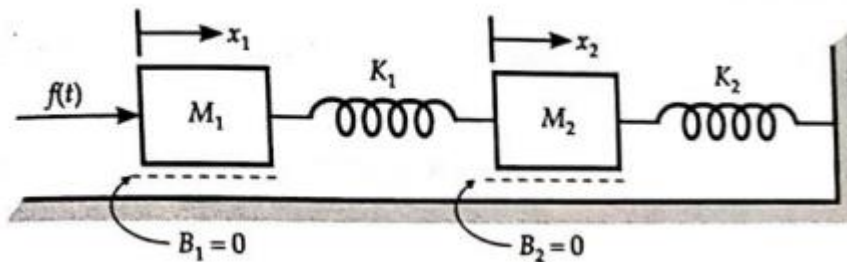


Fig:4

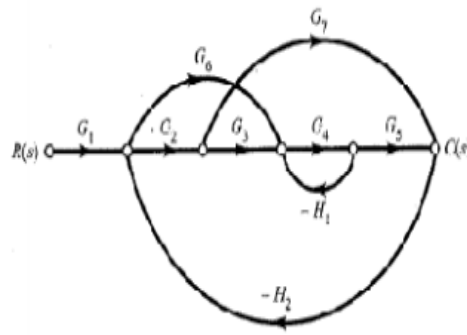


Figure: 3

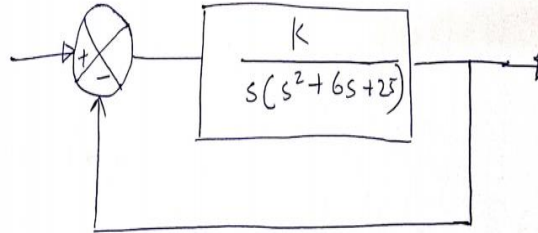


Figure: 5

***It is advisable to put fundamental questions of respective subject in Q1, as it is compulsory question.**
