

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V (NEW) EXAMINATION – WINTER 2023****Subject Code:2150909****Date:05-12-2023****Subject Name: Control System Engineering****Time:10:30 AM TO 01:00 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 transfer function and write its advantages and disadvantages.	03
	(b) Give difference between open loop and close loop control system.	04
	(c) Simplify the block diagram shown in Fig. I using block diagram reduction technique and obtain $C(S)/R(S)$.	07
Q.2	(a) Name the analogous electrical elements in force-voltage analogy for the elements of mechanical translational system.	03
	(b) Explain Mason's gain formula.	04
	(c) Find the transfer function of the mechanical system shown in Fig. II .	07
	OR	
	(c) Given the network of Fig. III find the transfer function $V_o(s) / V_i(s)$.	07
Q.3	(a) State the advantages of frequency response method.	03
	(b) Explain Hurwitz stability criterion.	04
	(c) Consider characteristic equation of closed loop control system as $S^3+3KS^2+(K+2)S+4=0$ Find range of K Using R-H criterion so that system is stable.	07
	OR	
Q.3	(a) Explain standard test signals used in the control system	03
	(b) Define the following terms 1) Delay time 2) Rise time 3) Peak time 4) Maximum overshoot.	04
	(c) Derive steady state error constants of the Type-0 system for a step input.	07
Q.4	(a) Define the following terms. (1) State 2) State variable 3) State vector	03
	(b) Briefly explain about Polar plots.	04
	(c) Draw the root locus plot for $G(s)/H(s) = \frac{K}{S(S+5)(S+10)}$	07
	OR	
Q.4	(a) Define: Phase margin and Gain margin	03
	(b) State the advantages of bode plot.	04
	(c) The closed loop transfer function of unity feedback control system is given by $C(s) / R(s) = 100 / (s^2+8s+100)$ Determine 1) Damping ratio 2) Natural undamped resonance frequency 3) Percentage peak overshoot	07
Q.5	(a) Write short note on PID controller	03
	(b) Draw and explain the pole zero plot and bode plot of a lead compensator.	04
	(c) Sketch the Bode plots for the transfer function given below:	07

$$G(s)H(s) = 200 / s(s + 2)(s + 10)$$

OR

- | | | |
|-----|--|----|
| (a) | List at least three advantages and three disadvantages of a lead compensator | 03 |
| (b) | Explain Nyquist stability criterion. | 04 |
| (c) | Derive Overall transfer function of armature controlled DC motor. | 07 |

Figure: I

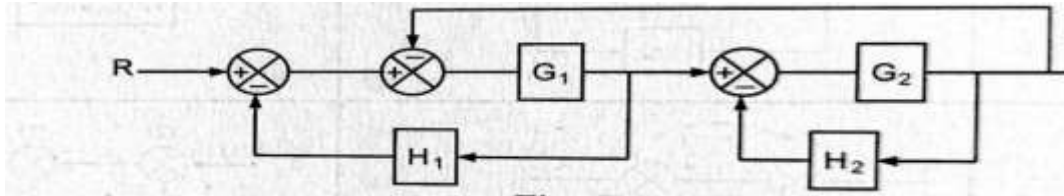


Figure: II

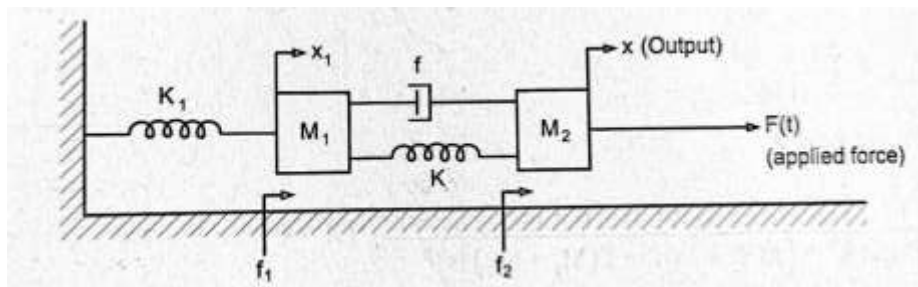


Figure-III

