

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER- IV(NEW) EXAMINATION – SUMMER 2023

Subject Code:3141708

Date:11-07-2023

Subject Name:Control Theory

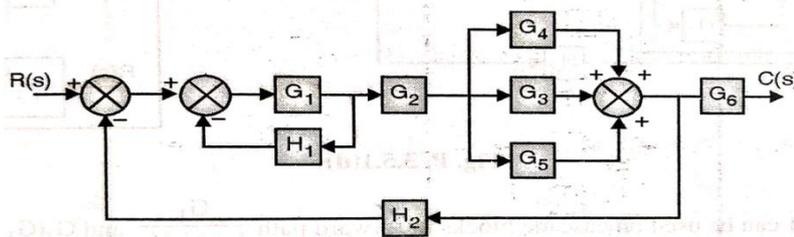
Time:10:30 AM TO 01:00 PM

Total Marks:70

Instructions:

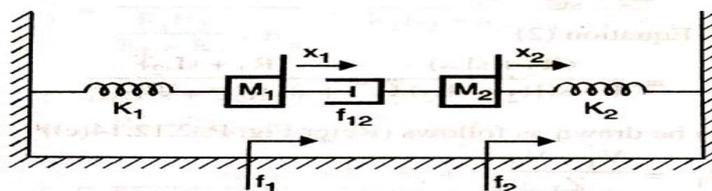
1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.
4. Simple and non-programmable scientific calculators are allowed.

		MARKS
Q.1	(a) Differentiate between open loop and close loop system.	03
	(b) Explain Green engineering with suitable example.	04
	(c) What is analogous system? Explain Force-Voltage and Force-Current Analogy with suitable Example.	07
Q.2	(a) Write mason's gain formula.	03
	(b) Define transfer function and Explain importance of Laplace transform in control system.	04
	(c) Using Block Diagram reduction technique, find closed loop transfer function of system shown in figure.	07

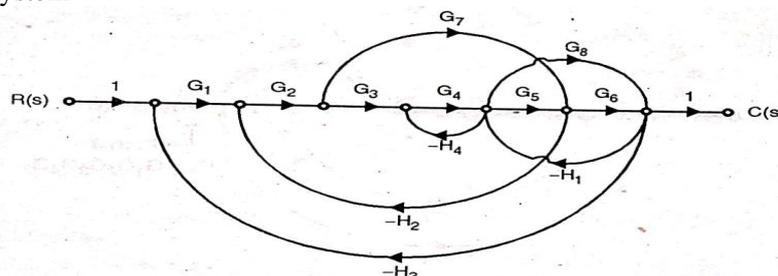


OR

	(c) Find the mathematical model and write differential equations of the mechanical network shown in figure.	07
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Q.3	(a) Mention difference between transfer function approach and state space approach.	03
	(b) Explain standard test signals.	04
	(c) Using Mason Gain formula find the transfer function for the following system	07



OR

Q.3 (a) Define the following terms: (1) Type of a system (2) BIBO stability (3) Time constant. **03**

(b) Obtain the state transition matrix e^{At} for the state model whose system matrix is given by **04**

$$A = \begin{bmatrix} 0 & -3 \\ 1 & -4 \end{bmatrix}$$

(c) By means of Routh criterion, determine the stability of the system represented by the characteristic equation. **07**

$$S^6 + 2S^5 + 8S^4 + 12S^3 + 20S^2 + 16S + 16 = 0$$

Q.4 (a) What is Performance index? Define various performance indices for closed loop control system. **03**

(b) State the properties of state transition matrix. **04**

(c) Sketch the root locus of a unity feedback control system with $G(S) = K / S(S+1)(S+3)$ and determine the value of k for marginal stability. **07**

OR

Q.4 (a) Find error constant and steady state error for type-1 system for unit step input. **03**

(b) For the system $G=25/S^2+4S+25$, find the natural frequency, damping ratio. Depending on the damping ratio, describe the system. **04**

(c) Sketch the root locus of given system having unity feedback. **07**

$$G(S) = K/S(S + 1)(S + 4)$$

Find the value of gain K at $s = -1 \pm 2j$.

Q.5 (a) Explain Gain margin and Phase margin. **03**

(b) Draw unit step response of a second order control systems. Describe all specification in detail. **04**

(c) Consider an open loop transfer function $G(s)H(s)=1/(s+2)(s+4)$ Draw the Nyquist plot and comment on the stability of the system. **07**

OR

Q.5 (a) Explain the Nyquist stability criterion. **03**

(b) Explain Gain Crossover frequency and Phase Crossover frequency. **04**

(c) Draw the Bode plot for a system having $G(S) H(s) = 100/ s(s + 1)(s + 2)$ Find Gain margin, Phase margin. **07**
