Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2022

Subject Code:3141708   **Date:27-06-2022**
**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)**	Enlist advantages and disadvantages of closed loop control system over open loop control system.	**03**
	(b)	Find the impulse response of a system whose transfer function is $G(s)= \frac{1}{s+4}$	**04**
	(c)	Draw second order unit step response and explain associated Time domain specification terms.	**07**
Q.2	**(a)**	Define following terms: (i)Transfer Function (ii) Poles (iii) Zeros	**03**
	(b)	Explain any four rules of block diagram reduction.	**04**
	(c)	Using Block Diagram reduction technique, find closed loop transfer function of system shown in figure.	**07**
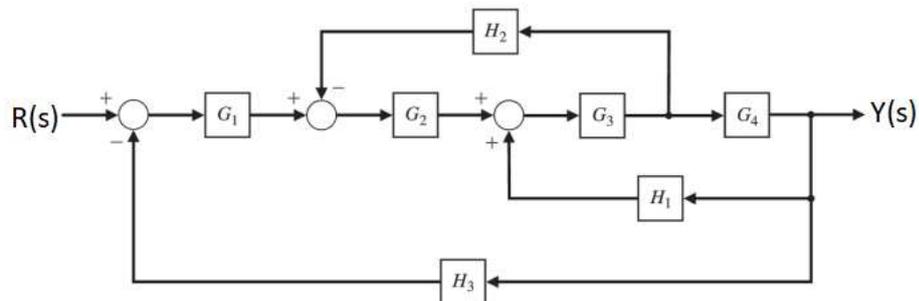
OR

	(c)	Find the mathematical model of the mechanical network	**07**
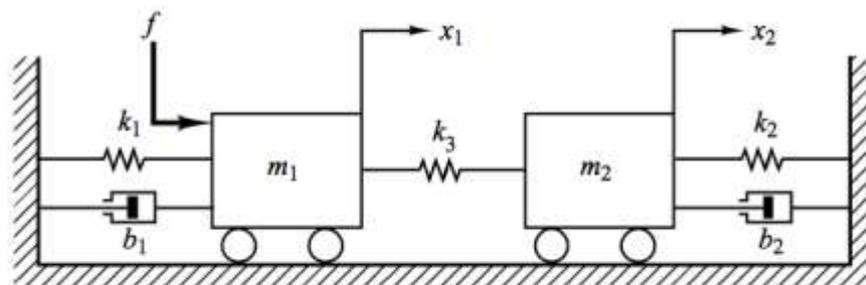
Q.3	**(a)**	Explain bounded input bounded output (BIBO) stability criterion.	**03**

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(b) By means of Routh criterion, determine the stability of the system and location of the roots described by characteristic equations. **04**

$$S^5 + 2S^4 + 3S^3 + 6S^2 + 10S + 15 = 0$$

(c) Obtain the overall transfer function using Mason's gain formula for the signal flow graph shown in Fig. **07**
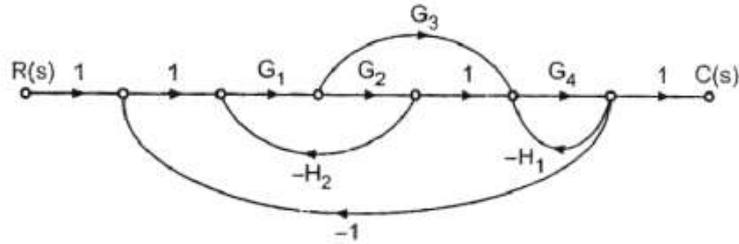
OR

Q.3
(a) Explain state, state variables and state vector **03**
(b) Explain relation between location of poles in s plane & impulse responses with diagram only. **04**
(c) Derive transfer function of field controlled dc motor. **07**

Q.4
(a) What is Performance index ? Define various performance indices for closed loop control system. **03**
(b) Explain gain margin and phase margin. **04**
(c) Sketch the root locus for the given open loop transfer function **07**

$$G(S)H(S) = \frac{k}{s(s+1)(s+3)}$$

OR

Q.4
(a) What is the sensitivity of feedback control system explain in brief. **03**

(b) Find Centroid & Angle of asymptotes of Root Locus for the given system **04**

$$G(s) = \frac{k}{s(s^2+8s+32)}$$

(c) Sketch Bode plot of a unity feedback control system having open loop transfer function as given below $G(s)H(s) = \frac{100}{s(s+1)(s+2)}$. Find GM,PM. **07**

Q.5
(a) Explain self loop, forward path and loop gain with respect to signal flow graph. **03**
(b) Explain the Nyquist stability criterion. **04**
(c) Derive state space representation of series RLC circuit. **07**

OR

Q.5
(a) Mention difference between transfer function approach and state space approach. **03**

(b) Find the polar plot of $G(s) = \frac{1}{1+sT}$ **04**

(c) Find state transition matrix if $A = \begin{bmatrix} 0 & -2 \\ 1 & -3 \end{bmatrix}$ **07**

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