GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV (NEW) EXAMINATION – SUMMER 2021

Subject Code:3141708   **Date:04/09/2021**
**Subject Name:Control Theory**
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)**	Define following terms: (i) Poles (ii) characteristic equation iii) order of the system	**03**
	(b)	Find the inverse Laplace transform of $F(s)\ \dfrac{2}{s(s+3)(s+4)}$	**04**
	(c)	Explain any application of closed loop control system with block diagram.	**07**
Q.2	**(a)**	Explain liquid level systems in brief	**03**
	(b)	Define Following Terms: (I) Transfer Function (II) Summing point (III) Self Loop (IV) Source Node	**04**
	(c)	Using Block Diagram reduction technique, find closed loop transfer function of system shown in figure.	**07**
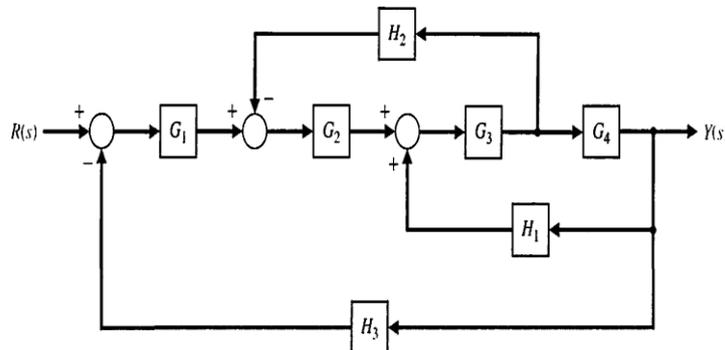
OR

	(c)	Obtain differential equations of mechanical system shown in given figure and find out the transfer function.	**07**
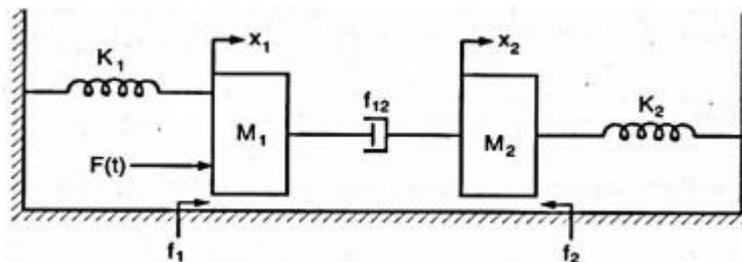
Q.3	**(a)**	Mention difference between transfer function approach and state space approach.	**03**
	(b)	Find the state transition matrix of	**04**

$$A = \begin{bmatrix} 0 & -6 \\ -1 & -5 \end{bmatrix}$$

(c)	Define various static Error constants and derive expression of each one.		**07**

OR

Q.3	**(a)**	Find the unit step response of system with transfer function $\frac{C(s)}{R(s)} = \frac{10}{(s+10)}$	**03**
	(b)	Derive state space representation of series RLC circuit.	**04**
	(c)	Draw second order unit step response and explain associated specification terms.	**07**

Q.4	**(a)**	What is Performance index ? Define various performance indices for closed loop control system.	**03**
	(b)	What is the sensitivity of feedback control system explain in brief.	**04**
	(c)	Draw the root locus for the open loop transfer function of a unity feedback control system is $G(s) = \frac{k}{s(s+2)(s+3)}$	**07**

OR

Q.4	**(a)**	Discuss the effect of time delay on the stability of the process	**03**
	(b)	$s^4 + 10s^3 + 20s^2 + 30s + 50 = 0$ Check the stability of the given characteristic equation using Routh array.	**04**
	(c)	Draw the root locus for the open loop transfer function of a unity feedback control system is $G(s) = \frac{k}{s(s+2)(s^2+2s+2)}$	**07**

Q.5	**(a)**	What is M circle and N circles in Nyquist plot	**03**
	(b)	Explain polar plot in brief.	**04**
	(c)	Sketch Bode plot of a unity feedback control system having open loop transfer function as given below $G(s) = \frac{20}{s(s+2)}$	**07**

OR

Q.5	**(a)**	Explain standard test signals.	**03**
	(b)	State Nyquist stability criteria.	**04**
	(c)	Define and explain following terms with respect to frequency response. Gain margin, Phase margin, Gain crossover frequency and phase cross over frequency.	**07**

****