Seat No.: _____   Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV(NEW) EXAMINATION – WINTER 2022
Subject Code:3141708   **Date:14-12-2022**
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)**	Compare open loop control system with closed loop control system.	**03**
	(b)	Find the inverse Laplace transform of F(s) $\frac{2}{s(s+1)(s+4)}$	**04**
	(c)	Explain block diagram of close loop control system with any application.	**07**
Q.2	**(a)**	Define the following terms: Poles, Zeros, characteristic equation	**03**
	(b)	Define Following Terms: (I) Transfer Function (II) Summing point (III) Self Loop (IV) Source Node	**04**
	(c)	Find the transfer function using Mason's gain formula.	**07**
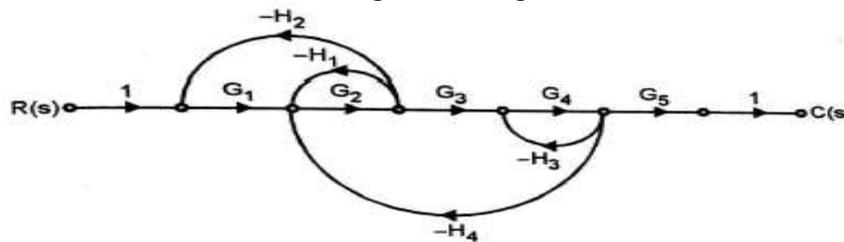
OR

	(c)	List out the rules for block diagram Reduction technique.	**07**
Q.3	**(a)**	Find the unit impulse response of system with a transfer function $$\frac{C(s)}{R(s)} = \frac{10}{(s+5)}$$	**03**
	(b)	Derive the state model for series RLC circuit.	**04**
	(c)	Draw second order unit step response and derive the equation for Maximum peak overshoot and peak time.	**07**

OR

Q.3	**(a)**	Mention difference between transfer function approach and state space approach.	**03**
	(b)	Define state transition matrix using an equation.	**04**
	(c)	A unity feedback system has G(s) =$\frac{40\,(s+2)}{s(s+1)(s+4)}$ determine all error coefficient and error for ramp input.	**07**
Q.4	**(a)**	What is Performance index? Define various performance indices for closed loop control system.	**03**
	(b)	Explain standard test signals.	**04**
	(c)	Draw the root locus for the open loop transfer function of a unity feedback control system is	**07**

$$G(s) = \frac{k}{s(s+2)(s+4)}$$

OR

Q.4 **(a)** What is M circle and N circles in Nyquist plot.   **03**

(b) $s^6 + 3s^5 + 5s^4 + 9s^3 + 8s^2 + 6s + 4 = 0$ Check the stability of the   **04**
given characteristic equation using Routh array.

(c) A unity control system has   **07**

$$G(s) = \frac{80}{s(s+2)(s+20)}$$

Draw the bode plot and comment on stability .

Q.5 **(a)** Draw the step response of second order systems for critical damped,   **03**
overdamped and underdamped.

(b) State Nyquist stability criteria.   **04**

(c) Explain root locus technique rules.   **07**

OR

Q.5 **(a)** Define the following terms with respect to frequency response (i) Gain   **03**
Margin (ii) Phase Margin (iii) Gain crossover frequency

(b) Derive the transfer function of the phase lead network.   **04**

(c) What is polar plot ? Explain polar plot for Type 0,1 and 2 system.   **07**

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