# GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– IV(NEW) EXAMINATION – SUMMER 2023
Subject Code:2141708   **Date:11-07-2023**
Subject Name:Control System
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 and closed loop control system.	**03**
	(b)	Classify systems. Explain any one in detail.	**04**
	(c)	Explain rules for block diagram reduction techniques.	**07**
Q.2	**(a)**	Find inverse Laplace transform of $1/(s+1)^2$.	**03**
	(b)	Find transfer function for the below given mechanical system.	**04**
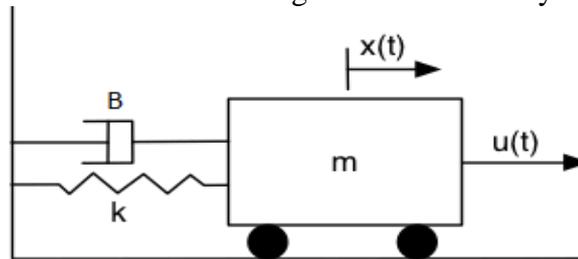
	(c)	Derive the response of second order linear system for unit impulse input.	**07**

OR

	(c)	Derive the response of first order linear system for unit ramp input.	**07**
Q.3	**(a)**	Explain loop, forward path and self loop with respect to signal flow graph.	**03**
	(b)	Explain type and order of the system with suitable example.	**04**
	(c)	Find gain margin and phase margin for the system given below using bode plot.	**07**

$$G(s)H(s) = \frac{4}{(s+1)(s+4)}.$$

OR

Q.3	**(a)**	Discuss the effect of time delay on the system stability.	**03**
	(b)	Compare modern control theory with conventional control theory.	**04**
	(c)	Derive the expression of delay time and rise time for under damped second order system.	**07**
Q.4	**(a)**	Explain negative feedback system with suitable example.	**03**
	(b)	Find stability for the system with characteristic equation $Q(s)=s^4+2s^3+12s^2+4s+2$ using Routh's stability criteria.	**04**
	(c)	Explain force-voltage and force-current analogy with suitable example.	**07**

OR

Q.4	**(a)**	Explain relative stability with suitable example.	**03**
	(b)	Draw polar plot for the system given below.	**04**

$$G(s)H(s) = \frac{10}{(s+1)(s+10)}.$$

(c)	Explain rules to construct root locus.	**07**

Q.5	**(a)**	Explain state variables, state equation and state space.	**03**
	(b)	State the properties of state transition matrix.	**04**
	(c)	Draw Nyquist plot for the system given below.	**07**

$$G(s)H(s) = \frac{12}{s(s+2)(s+3)}.$$

OR

Q.5	**(a)**	Discuss the need of frequency response analysis.	**03**
	(b)	Derive expression for the transfer function from the state space model.	**04**
	(c)	Find transfer function C(s)/R(s) for system shown in figure below using mason gain formula.	**07**