Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE – SEMESTER- V EXAMINATION-SUMMER 2023

Subject Code: 3150504 Date: 03/07/2023

Subject Name: Instrumentation and Process Control

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)**	Give Significance of Damping co-efficient.	**03**
	(b)	Write the statements for initial value theorem and final value theorem.	**04**
	(c)	Discuss Servo and Regulatory mechanism.	**07**
Q.2	**(a)**	Explain Impulse input in detail.	**03**
	(b)	Derive transfer function of the Mixing process.	**04**
	(c)	Differentiate Interacting and Non interacting systems.	**07**
		OR	
	(c)	A mercury thermometer having a time constant of 0.1 min is placed in a temperature bath at 100°F and allowed to come to equilibrium with the bath. At time t = 0, the temperature of the bath begins to vary sinusoidally about its average temperature of 100°F with an amplitude of 2°F. If the frequency of oscillation is 10/Π cycles/min, plot the ultimate response of the thermometer reading as a function of time. What is the phase lag?	**07**
Q.3	**(a)**	Place the following transfer function in standard first-order form, and identify the time constant and the steady state gain. $$\frac{Y(s)}{X(s)} = \frac{2}{s + (\frac{1}{3})}$$	**03**
	(b)	Explain the statement for sinusoidal response. “The output lags behind the input by an angle frequency f and the signal is attenuated”.	**04**
	(c)	Derive equation of Offset for PI controller.	**07**
		OR	
Q.3	**(a)**	Discuss ON/OFF controller.	**03**
	(b)	Explain difference between Negative and Positive feedback control system.	**04**
	(c)	Derive the transfer function for the liquid level which exhibits first-order dynamics as the Head responds to changes in the Flow input to the tank.	**07**
Q.4	**(a)**	Define: Accuracy, Span, Drift	**03**
	(b)	Explain difference between Air to open and Air to close valve.	**04**
	(c)	Explain component parts of Block diagram of a simple control system with figure.	**07**
		OR	

Q.4 **(a)** Explain Phase margin and Gain Margin. **03**

(b) Write the statements of Routh Theorem. **04**

(c) A step change of magnitude 4 is introduced into a system having the transfer function **07**

$$\frac{Y(s)}{X(s)} = \frac{16}{1.5s^2 + 2.4\,s + 6}$$

Determine

(a) Percent overshoot

(b) Rise time

(c) Period of oscillation

(d) Natural period of oscillation

Q.5 **(a)** Discuss working of Bourdon Gauge. **03**

(b) Give Classification of liquid level measurement systems. **04**

(c) Discuss Ziegler-Nichols method for Controller tuning. **07**

OR

Q.5 **(a)** Discuss Dip effect in filled system thermometer. **03**

(b) Explain PLC (Programable Logic Controller) and DCS (Distributed Control System). **04**

(c) Discuss construction and working of Rota meter. **07**

****