Enrolment No./Seat No_____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2024

Subject Code:3153618 Date:31-05-2024

Subject Name:Process Instrumentation Dynamics & 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)**	Sketch the following functions: f(t) = u(t) - 2u(t - 1) + u(t - 3)	**03**
	(b)	What are the different types of forcing function? Explain any three forcing function.	**04**
	(c)	Solve the following function for x(t) $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + 2x = 2$ $x(0) = x'(0) = 0$	**07**
Q.2	**(a)**	Define and explain the Servo problem and Regulator problem.	**03**
	(b)	What are static characteristic of an instrument? Define 1) Accuracy 2) Reproducibility 3) Sensitivity	**04**
	(c)	Derive and explain the several features of step response of first order system.	**07**
		OR	
	(c)	Define Interacting and Non-interacting system. Derive the transfer function for interacting multi capacity control system in series.	**07**
Q.3	**(a)**	Explain the characteristic of damping paramount in second order system.	**03**
	(b)	Define and Explain the following terms for second order system: 1) Overshoot 2) Period of oscillation 3) Natural period of oscillation 4) Rise time	**04**
	(c)	A PD controller is used to control first order system with first order measuring element. Determine the expression for the offset for servo mechanism control system.	**07**
		OR	
Q.3	**(a)**	Describe the principle, construction and working of rotameter.	**03**
	(b)	Describe the principle, construction and working of thermocouple used for temperature measurement.	**04**
	(c)	Describe the principle, construction and working of electromagnetic flow meter. What are its advantages and limitations?	**07**
Q.4	**(a)**	Explain the dynamic characteristics of the instruments	**03**

	(b)	Derive the transfer function for non-interacting liquid level tank system.	**04**
	(c)	What is transfer function? Derive the transfer function for the Stirred tank heater.	**07**

OR

Q.4	**(a)**	Derive the dynamic response of first order system for step forcing fiction.	**03**
	(b)	Explain the different common parts of the instruments with neat figure.	**04**
	(c)	Derive the response equation for the under damped second order control system for step forcing function.	**07**
Q.5	**(a)**	Derive the dynamic characteristic equation for first order system, impulse forcing function.	**03**
	(b)	What is first order system? Derive the transfer function of Liquid level tank system.	**04**
	(c)	A proportional controller having gain K_c is used to control two non-interacting liquid level tanks having time constant $\tau_1=1$ and $\tau_2=0.5$. For the unit feedback control system. Determine the stability of the system using Routh criterion.	**07**

OR

Q.5	**(a)**	What is block diagram? Explain the parts of block diagram.	**03**
	(b)	What are the different types of the manometer? Explain in detail the enlarged lag manometer with the help of neat figure.	**04**
	(c)	Describe the construction and working of the optical pyrometer with neat figure.	**07**