Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

BE - SEMESTER–V(NEW) EXAMINATION – SUMMER 2022

Subject Code:3153618 Date:07/06/2022

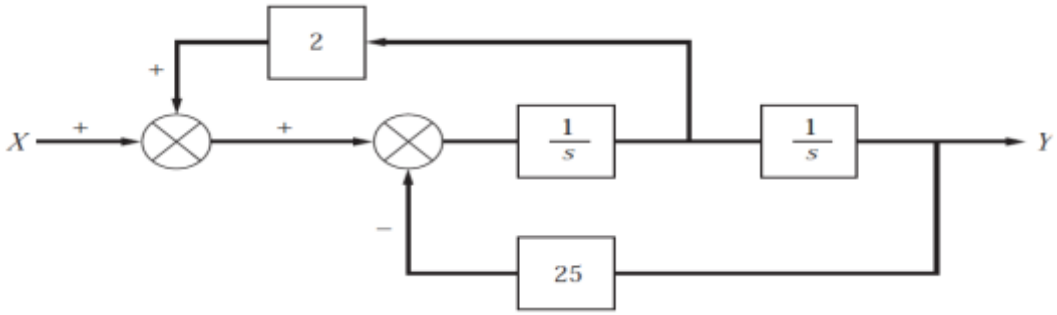
Subject Name:Process Instrumentation Dynamics & Control

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)**	Define: Controlled Variable, Manipulated variable, Disturbance	**03**
	(b)	Explain the term: (i) Transfer function (ii) Deviation variable	**04**
	(c)	Solve differential equation $\frac{d^2x}{dt^2} + 2\frac{dx}{dt} + x = 1; x(0) = x'(0) = 0$	**07**
Q.2	**(a)**	State and prove final value theorem.	**03**
	(b)	Differentiate Servo problem and regulator problem.	**04**
	(c)	Derive the transfer function of first order system of mercury in thermometer mentioning assumptions involved.	**07**
		OR	
	(c)	A thermometer with time constant 10 sec showing a steady temperature of 35 °C is suddenly immersed in heated oil bath at 200 °C. Find (i) Time required for temperature reading of 150 °C. (ii) Temperature reading on the thermometer after 25 sec. (iii) The percentage response after 40 sec.	**07**
Q.3	**(a)**	Find the Laplace transform of $e^{-t}\cos 2t$	**03**
	(b)	Determine the transfer function for given block diagram	**04**



	(c)	Derive the transfer function of U-Tube manometer.	**07**
		OR	
Q.3	**(a)**	Find the inverse Laplace of $f(s) = \frac{(s+1)}{s(s+2)}$	**03**
	(b)	Derive transfer function of PID Controller.	**04**
	(c)	A Control system is subjected to a step change of magnitude 10. The transfer function of control system is expresses as $G(s) = \frac{6}{0.9s^2+0.3s+10}$ Calculate overshoot, Decay ration, ultimate value of response, maximum value of response	**07**
Q.4	**(a)**	How stability is mentioned for linear systems with respect to Routh Test?	**03**

	(b)	Explain the following terms relating to control system: set point tracking	**04**
	(c)	The characteristic equation: $s^3 + 9s^2 + 26s + (24 + 48K_C) = 0$ Determine the value of K_C for which the system is stable by routh stability criteria.	**07**

OR

Q.4	**(a)**	List the assumption involved in liquid level system.	**03**
	(b)	Explain the component of control system	**04**
	(c)	Mention the procedure steps of Routh test used to check the stability of a control system	**07**
Q.5	**(a)**	Describe various static and dynamic characteristics of measuring instruments.	**03**
	(b)	Write a detailed classification of measuring instruments.	**04**
	(c)	Describe the working of any one thermocouple with a neat sketch.	**07**

OR

Q.5	**(a)**	Give the name of the property which can be measured by following instruments: (1) Pirani gauge (2) Pitot tube (3) flow nozzle.	**03**
	(b)	With neat sketch explain principle radiation pyrometer.	**04**
	(c)	Explain working and construction of bimetallic thermometers.	**07**

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