GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–V (NEW) EXAMINATION – SUMMER 2021

Subject Code:3153618   **Date:13/09/2021**
Subject Name:Process Instrumentation Dynamics & Control
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)**	What is process control? Explain the applications of process control in chemical technologies.	**03**
	(b)	Explain and Derive transfer function for transportation lag.	**04**
	(c)	Solve the second-order initial-value problem using the Laplace transform method; $$\frac{d^2y}{dt^2} + 2\frac{dy}{dt} + 2y = e^{-t} \qquad y(0) = 0, \qquad y'(t) = 0$$	**07**
Q.2	**(a)**	State and prove final value theorem.	**03**
	(b)	Define unit impulse input function and derive its transfer function.	**04**
	(c)	Derive the transfer function for first order system, mercury in glass thermometer. State all assumptions involved. Also derive step response.	**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)**	Explain open loop control system with an example.	**03**
	(b)	Explain briefly the concept of PLC and SCADA.	**04**
	(c)	Derive the Step response of an Interacting system having same value of time constants.	**07**

OR

Q.3	**(a)**	Describe theorems of the Routh Test	**03**
	(b)	Explain the pneumatic controller mechanism of proportional control.	**04**
	(c)	A step change of magnitude 4 is introduced into a system having the transfer function $G(s) = \frac{10}{s^2+1.65s+4}$ Calculate overshoot, decay ratio, ultimate and maximum value of response, radian frequency and period of oscillation.	**0.7**

Q.4	**(a)**	Explain the static and dynamic characteristics of instrumentation.	**03**
	(b)	With neat sketch explain the importance of transfer function.	**04**
	(c)	Find the stability of system using Routh stability criteria for the following equation; $S^4 + 8S^3 + 18S^2 + 16S + 5 = 0$	**07**

OR

Q.4	**(a)**	Explain the working of Pirani vacuum gauge.	**03**
	(b)	Discuss the transfer function for PID controller.	**04**
	(c)	Explain rules for plotting root locus diagrams.	**07**

Q.5	**(a)**	Mention various temperature measurement methods.	**03**
	(b)	State various types of manometers and explain any one in brief.	**04**
	(c)	Discuss in brief indirect level measurement.	**07**

OR

Q.5	**(a)**	Classify the pressure measuring instruments.	**03**
	(b)	Explain with neat sketch the principle of Radiation Pyrometer.	**04**
	(c)	Discuss construction and working of Orifice meter.	**07**

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