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GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER– V (New) EXAMINATION – WINTER 2019

Subject Code: 2150504   **Date: 21/11/2019**

Subject Name: Instrumentation & Process 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.**

			MARKS
Q.1	**(a)**	Give Laplace transform for **1**) u(t) **2**) e^{-at}u(t) **3**) cos kt u(t)	**03**
	(b)	Solve $$\frac{dx}{dt} + 2x = 2 \quad \text{given x (0) = 0.}$$	**04**
	(c)	Explain: 1) Set point 2) Controlled Variable 3) Manipulated Variable 4) Offset 5) Positive feedback 6) Error 7) Disturbances	**07**
Q.2	**(a)**	State the assumption used to derive the transform function for first order CSTR with first order reaction.	**03**
	(b)	Place the following transfer function in standard first-order form, and identify the time constant and the steady state gain using unit step input. $$\frac{y(s)}{x(s)} = \frac{2}{s + 1/3}$$	**04**
	(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 $10/\pi$ cycles/min, plot the ultimate response of the thermometer reading as a function of time. What is the phase lag?	**07**

OR

	(c)	Derive the transfer function for the first order liquid level system.	**07**
Q.3	**(a)**	Write the significance of Damping co efficient.	**03**
	(b)	Differentiate between interacting and non-interacting system.	**04**
	(c)	A step change of magnitude 4 is introduced into a system having the transfer function $$\frac{y(s)}{x(s)} = \frac{16}{1.5s^2 + 2.4\,s + 6}$$ Determine (a) Percent overshoot (b) Rise time (c) Period of oscillation (d) Natural period of oscillation	**07**

OR

Q.3	**(a)**	Write in brief about ON / OFF control.	**03**
	(b)	Write in detail about double seated control valve.	**04**
	(c)	Discuss Servo and Regulatory problems in control system.	**07**

Q.4 **(a)** Draw P and I diagram symbols for Pneumatic, Electrical and Software signals. **03**

(b) Define: Dead zone, Drift, Precision, Dead time lag **04**

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

OR

Q.4 **(a)** Explain Seeback effect of thermocouple. **03**

(b) Describe about Absolute scale and Vacuum scale for pressure measurement. **04**

(c) Discuss Phase margin and Gain margin using stability criteria for Bode diagram. **07**

Q.5 **(a)** List various direct methods for level measurement. **03**

(b) Discuss working of Rotameter. **04**

(c) Write the characteristic equation and construct the Routh array for the control system shown in fig. Is the system stable for Kc = 9.5? **07**
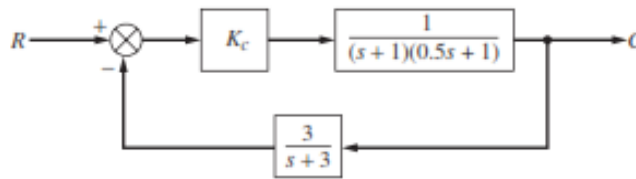
OR

Q.5 **(a)** Discuss sight glass method for level measurement. **03**

(b) Discuss working of U tube manometer. **04**

(c) Write in brief about Radiation Pyrometer. **07**

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