Seat No.: _____ Enrolment No.

GUJARAT TECHNOLOGICAL UNIVERSITY

BE- SEMESTER–V (NEW) EXAMINATION – WINTER 2020

Subject Code:2150504 **Date:20/01/2021**

Subject Name:Instrumentation & Process Control

Time:10:30 AM TO 12:30 PM **Total Marks: 56**

Instructions:

1. **Attempt any FOUR questions out of EIGHT questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q-1 **(a)** State and prove initial value theorem. **03**

(b) Define: 1. Set point 2. Phase margin 3. Manipulated variable 4. Overshoot **04**

(c) Derive the sinusoidal response for mercury thermometer. What is phase lag and phase lead? **07**

Q-2 **(a)** Discuss and derive transfer function of Mixing process. **03**

(b) Define Unit pulse input function. Derive its transfer function. **04**

(c) Derive the transfer function for a system of two tanks in series in non interacting manner. **07**

Q.3 **(a)** Discuss servo problem and regulator problem. **03**

(b) Explain the general block diagram of any feedback control system with industrial example. **04**

(c) A control system having transfer function is expressed as **07**

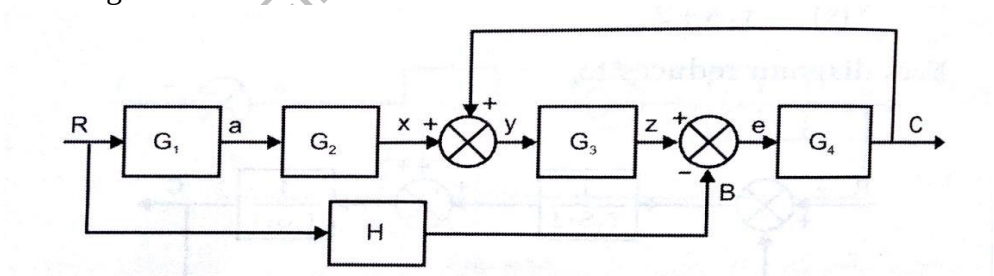
$$G(s) = \frac{Y(s)}{X(s)} = \frac{5}{\tau^2 s^2 + 2\theta\tau s + 1}$$

The radian frequency for control system is 1.9 rad/min. the time constant is 0.5 min. Calculate (1) Overshoot (2) Cyclical frequency (3) Maximum value of Y(t).

Q.4 **(a)** Write a short note on transfer function of control valve. **03**

(b) Write in brief about PI controllers and its transfer function. **04**

(c) Determine the overall transfer function C(s)/R(s) for the system shown in below figure. **07**



Q.5 **(a)** A pneumatic proportional controller is used to control temperature within the range of 60 to 100 °F. The controller is adjusted so that the output pressure goes from 3 psi (Valve fully open) to 15 psi (Valve fully closed) as the measured temperature goes for 71 to 75 °F with the set point held constant. Find the gain and the proportional band. **03**

(b) Discuss the characteristics of second order underdamped system. **04**

(c) Determine the stability of system whose characteristic equation is **07**

$$G(s) = 2s^5 + 3s^4 + 2s^3 + s^2 + 2s + 2$$

Q.6 **(a)** Explain the following static characteristics of an instrument. **03**

1. Accuracy 2. Precision 3. Drift

	(b)	Define stability of system. Discuss the general stability criteria.	**04**
	(c)	What is bode diagram? Explain bode diagram for first order system.	**07**
Q.7	**(a)**	Explain in short the air trap method for level measurement.	**03**
	(b)	Discuss the pitot tube for flow measurement.	**04**
	(c)	Give the classification for various temperature measurement instruments. Explain Bimetallic thermometer with neat sketch.	**07**
Q.8	**(a)**	Write a short note on temperature measurement by thermistor.	**03**
	(b)	Explain working of optical pyrometer with schematic.	**04**
	(c)	Explain the following pressure measurement instruments: 1. Inclined leg manometer 2. Capsule pressure gauge	**07**

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