Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

B. E. - SEMESTER – VI • EXAMINATION – WINTER 2012

Subject code: 160404 **Date: 05/01/2013**

Subject Name: Instrumentation and Process

Time: 02.30 pm - 05.00 pm **Total Marks: 70**

Instructions:

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

Q.1 **(a)** Derive the transfer function of mercury thermometer. Determine the response equation of mercury thermometer for impulse forcing function. **07**

(b) Define and explain the following terms. **07**
1) Time Constant 2) First order system 3) Forcing Functions

Q.2 **(a)** Define interacting and non-interacting system. Derive the transfer function for interacting systems. **07**

(b) Mention different examples of the first order systems and derive the expression for the transfer function for liquid level in a tank. **07**

OR

(b) Define second order systems. Determine the transfer function for U-tube manometer in which the pressure P is applied on one arm and second arm is open to the atmosphere. **07**

Q.3 **(a)** Write short notes on **07**
(i) Bimetallic thermometer (ii) Bubbler system for liquid level measurement.

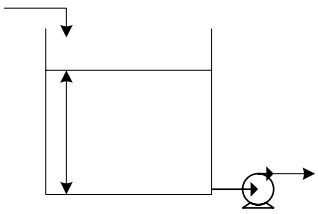
(b) What are static characteristic of an instrument? Define **07**
Accuracy 2) Reproducibility 3) Sensitivity

OR

Q.3 **(a)** Define Servo problem and Regulator problem. 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**

(b) Describe the principle, construction and working of thermocouple used for temperature measurement. **07**

Q.4 **(a)** Derive the transfer function H(s)/Q(s) for the following liquid-level system. **07**



(b) The open loop transfer function of a control system is given as **07**

$$G(s) = \frac{K_C(S+1)}{S(S+2)(S+3)}$$

Determine the stability of system and find the location of a pair of root of the

characteristic equation lie on the imaginary axis.

OR

Q.4 **(a)** The open loop transfer function of a control system is given as, **07**

$$G(s) = \frac{K_c}{S(S+1)(S+2)}$$

Sketch the root locus diagram of the system.

Q.4 **(b)** Describe the principle, construction and working of orifice flow meter. What are its advantages and limitations? **07**

Q.5 **(a)** Define amplitude ratio and phase angle. Plot the Bode diagram for the proportional Integral controller. **07**

(b) (1) Give merits and demerits of P, PI and PID controller. **03**
(2) Explain Servo and Regulator control with suitable examples **04**

OR

Q.5 **(a)** Write short notes on Bellows pressure elements. **07**

(b) Describe the principle, construction and working of radiation pyrometer. **07**

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