

GUJARAT TECHNOLOGICAL UNIVERSITY**BE- VIth SEMESTER-EXAMINATION – MAY- 2012****Subject code: 160404****Date: 17/05/2012****Subject Name: Instrumentation and Process Control****Time: 10:30 am – 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.

Q.1 (a)1) Define and explain the following terms. **04**

- i) Time Constant ii) First order system
- iii) Step forcing functions iv) Damping parameter

2) Invert the following function by Laplace Transform. **03**

$$y(s) = \frac{1}{(s^2 + 1)^2}$$

- (b) A thermometer having a time constant of 10 second is placed in a temperature bath. After the thermometer reaches steady state temperature of 30 °C it is suddenly placed into a hot fluid at 60 °C. Sketch the response of the thermometer. **07**

Q.2 (a) Define Interacting and Non-interacting system. Derive the transfer function for Interacting multi capacity control system in series. **07**

- (b) Derive 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**

OR

- (b) Derive the response equation for under-damped second order system for step forcing function. **07**

Q.3 (a) The overall transfer function of the control system is given as, **07**

$$G(s) = \frac{10}{1.25s^2 + 2s + 15}$$

A step change of magnitude 5 is introduced into the system. Determine,

- 1) Response time. 2) Rise time

- (b) What are the different types of controllers? Explain in details all types of the controllers. **07**

OR

Q.3 (a) What are static characteristic of an instrument? Define **07**
 1) Accuracy 2) Reproducibility 3) Sensitivity

- (b) Discuss the various instruments and their ranges of functioning for temperature measurement and explain the calibration method used for thermocouple. **07**

Q.4 (a) Mention the different liquid level measuring instruments and explain in detail the Float and shaft liquid level unit. **07**

- (b) Describe the construction and working of the Bellows pressure element with neat figure. 07

OR

- Q.4 (a) A proportional controller having gain k_c is used to control two first order non-interacting liquid level tanks having time constant 1 and 0.5. For the unity feedback control system. Determine the stability of the system using Routh criterion. 07

- (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 first order non-interacting control system. 07

- (b) What are the criteria for stability of linear system? Explain in detail the steps to plot the Root-locus diagram. 07

OR

- Q.5 (a) What are the different types of the manometer? Explain in detail the enlarged lag manometer with the help of neat figure. 07

- (b) Explain in detail the principle, construction and working of Venture-meter for flow measurement. 07
