

Unit - V

5. a) Draw the block diagram of a closed loop control system.
- b) Explain transfer function of a linear system.
- c) Describe open loop control system with suitable examples.
- d) Explain briefly the transient and steady state response of control systems.

OR

Explain modelling of thermal systems in detail.

Roll No

ME-503

B.E. V Semester

Examination, December 2016

Mechanical Measurement and Control

Time : Three Hours

Maximum Marks : 70

- Note:** i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.
- ii) All parts of each question are to be attempted at one place.
- iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.
- iv) Except numericals, Derivation, Design and Drawing etc.

Unit - I

1. a) What is meant by accuracy and precision?
- b) Distinguish between analog and digital type instruments.
- c) Explain static calibration, dynamic calibration and static error.
- d) A mercury thermometer has a capillary tube of 0.25 mm diameter. If the bulb and capillary tube are made of a zero expansion material, what volume must it have if a sensitivity of 2.5 mm/°C is desired? Assume that the operating temperature is 20°C and co-efficient of volumetric expansion of mercury is $0.181 \times 10^{-3}/^{\circ}\text{C}$.

OR

Explain the following terms:

- i) Range
- ii) Sensitivity
- iii) Sequential and random tests
- iv) Noise
- v) Zero order system
- vi) Interference
- vii) Bias error

Unit - II

- 2. a) Define variance and standard deviation.
- b) Explain briefly uncertainty analysis in measurement.
- c) Explain normal distribution.
- d) The data given below are expected to follow a linear relationship:

$$v = a.u + b$$

| | | | | | | |
|---|-----|-----|-----|-----|------|------|
| u | 1.8 | 4.6 | 6.6 | 9.0 | 11.4 | 13.4 |
| v | 2.2 | 3.2 | 5.2 | 6.4 | 8.0 | 10.0 |

- i) Obtain the best linear relation, and
- ii) Calculate the standard deviation.

OR

Explain least square regression analysis and data outlier detection.

Unit - III

- 3. a) What is the working principle of rotameter?
- b) Discuss bi-metallic thermometer with neat sketch?
- c) Describe briefly the construction and working of venturimeter.
- d) The flow of cooling water in a manufacturing process is measured by a horizontal venturimeter with 400 mm inlet and 150 mm throat. The U-tube mercury manometer connected between inlet and throat shows a differential pressure of 250 mm of mercury. Calculate the water flow rate, assuming that specific gravity of mercury is 13.6, coefficient of discharge 0.98 and density of water 1000 kg/m³.

OR

Explain constructional details of RTD with a neat sketch.

Unit - IV

- 4. a) What are mechanical strain gauges?
- b) Explain the method of calibration of strain gauges.
- c) Explain the working of a load cell.
- d) Explain different types of strain gauges.

OR

Explain construction and working of LVDT with neat sketch.