Total No. of printed pages = 4

EE 131704

Roll No. of candidate

2017

B.Tech. 7th Semester End-Term Examination

Electrical

MODERN INSTRUMENTATION ENGINEERING

Full Marks – 100 Time – Three hours

The figures in the margin indicate full marks for the questions.

Answer Question No. 1 and any *six* from the rest.

1. Answer the following questions : (10 × 1 = 10)

   (a) What is residual voltage in case of LVDT?

   (b) Why Platinum is widely used as RTD material?

   (c) What is sensitivity of an instrument?

   (d) Define 'step angle' in a stepper motor.

   (e) Find the resolution of a 6-bit DAC?

   (f) What is Seebeck effect?

   (g) Why pressure sensors are always act as secondary transducer?

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(h) What is the difference between accuracy and precision?

(i) Which temperature sensor is used for high temperature measurement?

(j) What is thermopile?

2. (a) What is Piezo-resistive effect? (2)

(b) Describe the working principle of Strain Gauge and derive the expression of Gauge factor in case of Strain Gauge? (8)

(c) A strain gauge is bonded to a beam of 0.1m long and has a cross-sectional area of $4cm^2$. The Young modulus for steel is 207 GN/m^2. Strain gauge has an unstrained resistance of 240Ω and Gauge factor of 2.2. When a load is applied the resistance of gauge changed by 0.13Ω. Calculate the change in length of the steel beam and the amount of force applied to the beam. (5)

3. (a) What is the difference between Transducers and Sensors? (2)

(b) What are primary and secondary sensing elements? Give example with illustrations. (3)

(c) What are the basic blocks of a generalised instrumentation system? Draw the basic blocks for a system and explain them. (10)

4. (a) Explain the Laws of intermediate temperature and intermediate metal in case of Thermocouple. (6)

(b) Describe the working of C-type Bourdon tube with neat diagram. (5)

(c) For a certain thermistor $\beta = 3140$ and the resistance at 27°C is known to be 1050Ω. The thermistor used for temperature measurement and resistance measured is as 2330Ω. Find the measured temperature. (4)

5. (a) Explain the working of LVDT? What is the difference between LVDT and RVDT? (6)

(b) Describe the working of Hall Effect transducer. (4)

(c) A Hall Effect transducer is used for the measurement of magnetic field of 0.5 Wb/m^2, the 2 mm thick slab is made of Bismuth for which the Hall Effect co-efficient is 1×10^{-6} V-m/A-Wb-m^2 and current is 3 Amp. Find the output voltage? (5)

6. (a) Explain the working of Ultrasonic flow transducer. (4)

(b) Describe the working principle of Piezo-electric transducer? (5)

(c) A quartz piezo-electric crystal having a thickness of 2mm and voltage sensitivity of 0.055 V-m/N is subjected to a pressure of 1.5 MN/m^2. Calculate the output voltage if the permittivity of quartz is 40.6×10^{-12} F/m and calculate the charge sensitivity. (6)

7. (a) Describe the working principle of resistive POT? Derive the output voltage equation for resistive potentiometer. (10)

(b) Write short note on 'Instrumentational amplifier'. (5)

8. (a) What is Synchros? What are the basic types of Synchros? Explain briefly. (10)

(b) Explain any one method of Digital to Analog conversion technique. (5)

9. (a) Describe the different methods of data transmission? Explain the block diagram of general telemetry system? (10)

(b) What is modulation? Give a comparison between Amplitude modulation and Frequency modulation? (5)
