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CS/B.TECH(EE-NEW)/SEM-8/EE-802B/2010

2010

SENSORS & TRANSDUCERS

Time Allotted : 3 Hours Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any *ten* of the following : $10 \times 1 = 10$

   i) A thermocouple with reference juction temperature at 20°C gives an output of 5 mV. If the thermocouple sensitivity is 50 μV/°C, the measured temperature is

   a) 100°C b) 80°C

   c) 120°C d) 20°C.

   ii) Th capacitive proximity sensor is used to detect

   a) the capacitance of an object

   b) the position of the object w.r.t. the sensor

   c) the natural frequency of a system

   d) none of these.

   iii) The output of LVDT with the input mechanical motion of 10 Hz and excitation frequency of 400 Hz will contain frequency of

   a) 10 Hz and 400 Hz b) 10 Hz

   c) 400 Hz d) 390 Hz and 410 Hz.

iv) A quartz resonator is effective in measuring

a) speed b) flow of fluid

c) force d) temperature.

v) On resistance Thermometry platinum is widely used for

a) large temperature coefficient of resistance

b) greater temperature range coverage

c) non-reactive to other metals mostly used in electrical circuitry.

vi) Which of the following thermocouple combinations efficiently covers maximum temperature range ?

a) Copper-Constantan b) Platinum-Rhodium

c) Copper-Iron d) Chromel-Alumel.

vii) As regards spectral response, Which of the following metals has nearest approach to human eye ?

a) Caesium b) Potassium

c) Lithium d) Sodium.

viii) Considering illumination level change by about 1 : 1000 and spectral range coverage, which of the following materials is best suited ?

a) Lead sulphide b) Cadmium sulphide

c) Thallium sulphide d) Bismuth sulphide.

ix) Angular or Rotatory sensor can best be realized by

a) a modified version of LVDT

b) a piezoelectric sensor

c) a plunger in coil arrangement

d) a stretched diaphragm sensor.

x) An AD 590 sensor is generally used as
   a) a proportional to Absolute temperature (PTAT) sensor
   b) a magnetic flux sensor
   c) a force transducer
   d) an accelerometer.

xi) Venturimeter transducer works on the principle of
   a) pressure difference between two points of flowing fluid
   b) temperature difference in two points in fluid
   c) resistance change in fluid flow
   d) electrical potential gradient between two points in flow line.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Explain the operating principle of optical pyrometer with proper diagram. Also mention its range and advantages.
3. How can velocity of liquid through a pipeline be measured by using ultrasonic transducer ? Draw necessary diagram. What frequency range of ultrasonic wave is used by ultrasonic transducer ?
4. Discuss briefly the use of platinum in metal resistance thermometric sensor.
5. Give simple scheme of using quartz resonator piezoelectric arrangement for force seinsing.
6. What are the differences beetween Vilari effect and Wiedemann effect ? How are these two effects used in developing magneto-elastic sensors ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. What type of radiation can be detected by a Geiger-Müller counter ? Describe with neat diagram a Geiger-Müller counter and explain how it operates. What are the gases in these tubes and pressure range at which they operate ?

8. Describe the basic principle of a Hall Device. Show how it can be used for magnetic field sensor.

   On what factors and parameters of the sensor, does the hall voltage output depend for a given field condition ?

   How is the performance of a hall sensor evaluated ? What are its primary and secondary sensitivities ? 4 + 4 + 4 + 3

9. a) Explain what you understand by pH of a solution ?
   b) How is pH measured in the laboratory ?
   c) What are the precautions required to be taken in case of measurement of pH ? 2 + 10 + 3

10. How can the capacitive transducer be used to measure the level of non-conducting liquid ? What special arrangement should be done while measuring the level of conducting liquid ?

    What do you mean by frequency response of a capacitive transducer ?

    Mention different factors on which capacitive transducer depends. 7 + 5 + 3

11. Write short notes on any *three* of the following : 3 × 5
    a) Smart sensors
    b) Photovoltaic cell
    c) Thermistors
    d) IC temperature sensors
    e) LVDT.