Reg. No. :

Question Paper Code: 43603

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Third Semester

Instrumentation and Control Engineering

14UIC303-SENSORS AND TRANSDUCERS

(Common to Electronics and Instrumentation Engineering)

(Regulation 2014)

Duration: Threehours   Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 1 = 10 Marks)

1. Strain gauge, LVDT and thermocouple are examples of

    (a) Active transducers   (b) Passive transducers
    (c) Analog transducers   (d) Primary transducers

2. Two capacitances, $C_1 = (150 \pm 2.4)\ \mu F$ and $C_2 = (120 \pm 1.5)\ \mu F$, are in parallel. What is the limiting error of the resultant capacitance C?

    (a) $0.9\ \mu F$ (b) $1.9\ \mu F$ (c) $3.9\ \mu F$ (d) $4.8\ \mu F$

3. A strain gauge is a passive transducer and is employed for converting

    (a) pressure into a change of resistance
    (b) force into a displacement
    (c) pressure into displacement
    (d) mechanical displacement into a change of resistance

4. The desirable static characteristic of a measuring system are

    (a) Accuracy and reproducibility   (b) Accuracy, sensitivity and reproducibility
    (c) Drift and dead zone   (d) Static error

5. Material used for the temperature range of operation (160-400)°C

      (a) platinum   (b) copper   (c) tungsten   (d)nickel

6. Capacitive transducers are normally employed for_____ measurements

      (a) Static   (b) Dynamic   (c) Transient   (d) Both static and dynamic

7. Quartz and Rochelle salt belongs to _____ of piezo-electric materials

      (a) Natural group   (b) Synthetic group
      (c) Natural or Synthetic group   (d) Fiber group

8. Fiber optic sensor can be used to sense

      (a) Displacement   (b) Power   (c) Current   (d) Resistance

9. Which sensor is used for the detection of objects in a moving conveyor?

      (a) vibration   (b) velocity   (c) piezoresistive   (d) proximity

10. Humidity sensor employed for determination of

      (a) Relative Humidity   (b) Bourdon tube
      (c) Temperature   (d) Nuclear radiation

<div align="center">PART - B (5 x 2 = 10 Marks)</div>

11. Distinguish passive and active transducers and give an example of each.

12. A thermometer has a time constant of 3.5 s. it is quickly taken from a temperature 0^0C to a water bath having a temperature 100^0C. What temperature will be indicated after 1.5 s?

13. What is Helipot? Write its salient features.

14. Define: Inverse Piezo Electric Effect.

15. What is a smart sensor?

<div align="center">.PART - C (5 x 16 = 80 Marks)</div>

16. (a) Discuss in detail the different types of errors occurring in measuring instruments and explain how to minimize them.   (16)

<div align="center">Or</div>

(b) (i) A test temperature is measured 100 times with variations in apparatus and procedures. After applying the corrections, the readings are:

<div align="center">2</div>

<div align="right">**43603**</div>

Temperature ^{0}C	397	398	399	400	401	402	403	404	405
Frequency of occurrence	1	3	12	23	37	16	4	2	2

Calculate: Arithmetic mean, mean deviation, standard deviation, probable error of one reading, probable error of the mean, standard deviation of the mean, standard deviation of the standard deviation. (10)

(ii) Discuss the various classifications of transducers with examples. (6)

17. (a) State in detail, various types of static characteristics of transducers with example. (16)

Or

(b) Obtain the equation for time response of first order system when subjected to

(i) Unit step input (8)

(ii) Unit ramp input and draw the response curves. (8)

18. (a) (i) With the basic principle of operation, derive the necessary conditions for loading effect of potentiometer under loading. (8)

(ii) Explain in brief about semiconductor strain gauges. (8)

Or

(b) Describe the construction, working, characteristics and uses of LVDT. (16)

19. (a) Define piezo-electric effect. Explain how a piezo-electric crystal is used for the measurement of force with necessary derivations. (16)

Or

(b) With neat sketches, extend your thoughts on the constructional details and operation of the following transducers.

(i) Fiber optic transducer (8)

(ii) SQUID sensor (8)

20. (a) With neat sketches and expressions, illustrate the constructional details and operation of seismic accelerometer. (16)

Or

(b) (i) Draw the architecture of MEMS sensor and explain its functioning. (8)

(ii) Write short notes on any one IC temperature sensor. (8)

3

43603

43603