Reg. No. : ☐☐☐☐☐☐☐☐☐☐☐☐☐

Question Paper Code : 71096

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2023.

Seventh Semester

Biomedical Engineering

OIC 751 – TRANSDUCERS ENGINEERING

(Common to: Electronics and Communication Engineering/Medical Electronics)

(Regulations 2017)

Time : Three hours   Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Define hysteresis and sensitivity.

2. Differentiate active and passive transducers.

3. What is zero drift, zonal drift and sensitivity drift?

4. Obtain the first order system's response for an impulse input.

5. What is the principle of operation potentiometer?

6. Draw the various configuration of strain gauge.

7. Determine the displacement sensitivity of a capacitive transducer with 2 parallel plates of diameter 3 cm each and separated by an air gap of 0.3 mm.

8. List the applications of carbon microphones.

9. What are the advantages of MEMS?

10. How do incremental encoder function?

11. (a) Elaborate in detail the different methods of calibration methods used in calibrating the measuring instruments. Explain in detail the classification of errors.

Or

(b) Elaborate in detail the selection criteria for the choices of active and passive transducers.

12. (a) Derive an expression for the output response of a second order system subjected to step input.

Or

(b) Obtain an expression for the output response of a first order system subjected to a sinusoidal unput.

13. (a) With a neat diagram, explain in detail the working principle of thermistor with necessary characteristics of thermistors.

Or

(b) Discuss in detail the following :

(i) expression for gauge factor   (4)

(ii) Working principle of strain gauge in the measurement of torque (4)

(iii) Humidity sensor.   (5)

14. (a) With a neat diagram explain in detail the working of LVDT with necessary derivation and the applications of LVDT.

Or

(b) Elaborate in detail the various types of capacitive transducers with a neat diagram and its applications.

15. (a) Discuss in detail the following with a neat diagram

(i) Hall effect transducer   (6)

(ii) Nano Sensors.   (7)

Or

(b) With a neat diagrams explain in detail the principle of operation of

(i) Magneto elastic sensors   (6)

(ii) Fibre optic sensors.   (7)

16. (a) A strain gauge with nominal resistance R = 100 ohms is installed in a branch of Wheatstone bridge having for unstrained strain gauge R1 = R2 = R3 = R4 = R and the supply voltage is 10 V. As a result of bending the beam, on which it is cemented, the strain gauge is subject to a strain. A digital voltmeter with input resistance R m = 10 Mega Ohms gives a reading of Vo = 5 mV.

Calculate the:

(i) change of the resistance ΔR   (7)

(ii) the strain ∈ for gauge factor G = 2.   (8)

Or

(b) Assume that a positioning measuring potentiometer (with total resistance R = 15.5 k Ω, total length L = 22 cm and input voltage Vi = 10 V) has the wiper at x =12cm. The voltage Vo of the potentiometer is measured with an analog voltmeter with input resistance Ro = 35 kΩ connected as load of a potentiometer. a) Calculate the voltage measured by the analog voltmeter; b) Calculate the error in analog voltmeter measurement of Vo with regard to the Vo measured by a digital voltmeter With Ro = 12 MΩ.

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