*Total number of printed pages:2* **D/4/DIE402**

**2023**

# TRANSDUCERS AND SIGNAL CONDITIONING

*Full Marks : 100*

Time : Three hours

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

*Answer **any five** questions.*



1. a) Differentiate the following: 3+4+3=10

   (i) Primary and Secondary Transducer

   (ii) Resistive, Inductive and Capacitive Transducer.

   (iii) Transducers and Inverse Transducer

   b) Let at null position, the resistances of a potentiometer are $R_1 = 50\Omega$ and $R_2 = 150\Omega$ .It is connected to an external supply of 10V. Calculate the following: 5

   (i) Voltage across resistance $R_2$ (theoretically).

   (ii) Voltage across resistance $R_2$ when it is measured by a voltmeter of resistance $10k\Omega$.

   c) Describe the working of potentiometric accelerometer using a suitable diagram. 5



2. a) Show that the gauge factor of a strain gauge is given by 10

$$G_f = 1 + 2\upsilon$$

   b) A resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structured member, subjected to a stress of 20 $MN/m^2$. The modulus of elasticity of steel is $50GN/m^2$ .Calculate the percentage change in the value of the gauge resistance due to the applied stress. 5

   c) Differentiate between Resistance Temperature Detector (RTD) and thermistor. 5

3. a) Derive the relationship between inductance and reluctance in a magnetic circuit. 6

   b) Explain the basic principle of operation of inductive transducer. 5

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| | c) | Describe the construction and working of Linear Variable Differential Transformer (LVDT). | 9 |
| 4. | a) | What is the basic principle of operation of capacitive transducer? Explain. | 6 |
| | b) | Draw the diagram of differential capacitive transducer and derive the relationship between output voltage and displacement. | 8 |
| | c) | Explain the working of Hall effect transducer using a suitable diagram. | 6 |
| 5. | a) | What are the types of optical transducers? Discuss in brief the construction and basic principle of operation of different types of optical transducers. | 12 |
| | b) | What is the basic principle of operation of piezoelectric transducers? Name some materials which are used in piezoelectric transducers. Also, derive the relations for charge and voltages developed in a piezoelectric transducer with respect to an applied force. | 8 |
| 6. | a) | Write short notes on any three of the following:<br>i. Shaft Encoder<br>ii. Synchro<br>iii. Bonded and unbonded strain gauge<br>iv. Carbon Microphone | 6*3=18 |
| | b) | Determine the input and output variables for the following transducers:<br>i. Load cell.<br>ii. LVDT. | 2 |

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