Total No. of printed pages = 7

TRANSDUCER AND SIGNAL CONDITIONING

Full Marks – 70

Time – Three hours

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

PART – A

All the questions of Part–A are compulsory.

1. Define the following terms : Linearity, Precision,
   Resolution, Sensitivity and Error.   1×5=5

2. Choose the correct answer :   1×10=10

   (a) The function of a transducer is primarily to
       convert

       (i) Electrical signal into non-electrical
           signal

       (ii) Non-electrical signal into electrical
            signal

[Turn over

(iii) Electrical signal into mechanical signal

(iv) None of the above

(b) Which of the following is not an analog sensor ?

(i) Potentiometer

(ii) Force sensing resistor

(iii) Accelerometer

(iv) None of the above

(c) A thermocouple converts the temperature into

(i) resistance

(ii) voltage

(iii) capacitance

(iv) inductance

(d) The ability to give the same output reading when same input is applied repeatedly is called

(i) stability

(ii) accuracy

(iii) sensitivity

(iv) repeatability

(e) A shaft encoder gives the measurement of which parameter

(i) angular displacement

(ii) linear displacement

(iii) digital voltage

(iv) analog voltage

(f) The following is an detector used in optical sensor

(i) LED

(ii) photodiode

(iii) transistor

(iv) All of the above

(g) Thermistor is a transducer whose temperature coefficient is

(i) negative

(ii) positive

(iii) zero

(iv) None of the above

(h) Which of the following is not a component of data acquisition system ?

    (i) Encoder

    (ii) Multiplexer

    (iii) Honeywell

    (iv) Display

(i) Potentiometer transducers are used for the measurement of

    (i) Pressure

    (ii) displacement

    (iii) humidity

    (iv) both (i) and (ii)

(j) Which of the following operation does not fall under signal conditioning ?

    (i) Amplification

    (ii) Attenuation

    (iii) Measurement

    (iv) Filtering

3. Fill in the blanks :   1×5=5

    (a) Strain gauze converts strain into _____.

    (b) The piezoelectric transducer is used to measure _____.

    (c) Ratio of change in output to the change in input is called _____.

    (d) Successive approximation type converter is an example of _____ converter.

    (e) _____ (material) is mostly used in RTD because of its linearity.

4. Match the following :   1×5=5

(i)	Load cell	(a)	is an optical detector
(ii)	Ultrasonic transducer	(b)	is an active transducer
(iii)	Hall effect transducer	(c)	can be used for measurement of electric current
(iv)	Piezoelectric transducer	(d)	gives the measurement of force
(v)	Phototransistor	(e)	can give the measurement of depth of liquid

PART – B

Answer any *five* questions.

5. (a) What do you mean by temperature coefficient of resistance ? Explain the working of RTD as temperature transducer. 1+3=4

   (b) What do you mean by cold junction compensation ? Describe how a thermocouple works. 2+3=5

6. (a) Describe the working of synchro transmitter with the help of a neat diagram. 5

   (b) Briefly explain the working of LVDT. 4

7. (a) Illustrate how displacement can be measured with capacitive transducer. 4

   (b) Explain how liquid level can be measured using capacitive transducer. 5

8. (a) Note a few examples of piezoelectric material. Derive the expression of charge sensitivity of a piezoelectric transducer. 1+5=6

   (b) The thickness of a piezoelectric crystal is 3 mm, voltage sensitivity is 0.070 Vm/N. Calculate the voltage output and charge sensitivity if permittivity is 40×10^{12} F/m and applied pressure is 1.5×10^{6} N/m². 3

9. (a) Briefly explain the working principle of Hall effect transducer ? Illustrate how a Hall effect transducer can be used to measure electric current. 3+3=6

   (b) Explain a method to sense the seismic pick up. 3

10. (a) Describe how a DC tachogenerator works ? 5

    (b) How a photodiode can be used to measure light intensity ? 4

11. (a) Describe how V to I conversion is performed ? 3

    (b) Briefly explain the basic components of a Data Acquisition System with their functionalities. 6