Total No. of printed pages = 5

CAI-602/T&SC/6th Sem/2016/N

TRANSDUCER AND SIGNAL CONDITIONING

Full Marks – 70

Pass Marks – 28

Time – Three hours

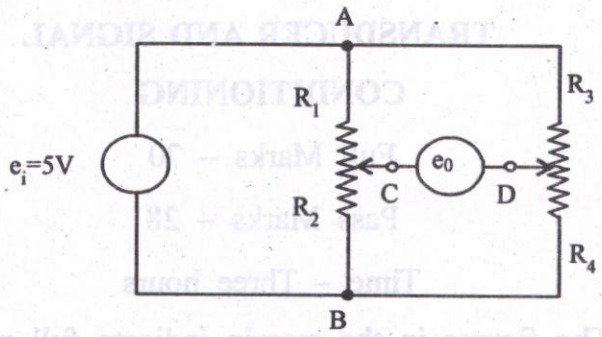
The figures in the margin indicate full marks for the questions.

Answer any *five* questions.

1. (a) What are the advantages of electric transducers ? Enumerate the desirable characteristics of a quality transducer.

A resistive potential divider R_1, R_2 with a resistance of 5000Ω and a shaft stroke of 125 mm is used in an arrangement as shown below. Potentiometer R_3, R_4 has a resistance of 5000Ω and e_i = 5V. The initial position to be used as reference point is such that $R_1 = R_2$ i.e. the wiper is at midstroke. At the start of the test potentiometer R_3, R_4 is

adjusted so that the bridge is balanced and $e_o = 0$. Assuming that the displacement being measured will move a maximum distance of 12.5 mm towards A. 2+3+5=10



(b) Is strain gauge an active transducer ? Explain the theory of operation of strain gauge. 1+3=4

2. (a) Find the linear approximation for resistances of RTD between 30°C and 60°C having $R_{30} = 4.5\Omega$, $R_{45} = 5.2\Omega$ and $R_{60} = 6.0\Omega$. 4

(b) What are the different forms of construction of thermistors ? Explain the working principle of thermistor with necessary mathematical expression and its characteristic between resistance and temperature. 1+4=5

(c) Describe the construction and working of thermocouple. 5

3. (a) Explain the principle of operation of LVDT. 5

(b) How a capacitive transducer can be used to measure displacement ? 4

(c) A pressure measuring instrument uses a capacitive transducer having a spacing of 4 mm between its diaphragm. A pressure of 600 kN/m^2 produces an average deflection of 0.3 mm of diaphragm of the transducer. The transducer which has a capacitance of 300 pF before application of pressure and is connected in an oscillator circuit having a frequency of 100 KHz. Determine the change frequency of oscillator after pressure is applied to the transducer. 5

4. (a) A piezo-electric crystal having dimensions of 5 mm × 5 mm × 1.5 mm and a voltage sensitivity of 0.0555 Vm/N is used for force measurement. Calculate the force if the voltage developed is 100V. 4

(b) Describe how current can be measured using a Hall effect transducer. 5

(c) Explain the working principle of ultrasonic transducer. 5

5. (a) Write an application of photo transistor with necessary circuit diagram. 5

(b) What are the different types of encoder ? Explain each of them. 1+4=5

(c) Describe how photodiode can be used as a high quality light meter ? 4

6. (a) With the help of block diagram, describe how voltage to time A/D converter works. 4

(b) Explain the operation of V-I converter and I-V converter uisng OPAMP. 4

(c) Describe the different components of digital data acquisition system (DAS). 6

7. (a) What are the different types of filters used in signal conditioning circuits ? 2

(b) Write short notes on any *three* of the following : 3×4=12

(i) Digital multiplexer

(ii) Synchro

(iii) Hot wire anemometer

(iv) Sample and Hold circuit.