

Total No. of Questions : 8]

SEAT No. :

P2220

[5331]-202

[Total No. of Pages : 3

M.Sc.

ELECTRONIC SCIENCE

EL2UT06 : Instrumentation and Measurement Techniques  
(2013 Pattern) (Credit System) (Semester - II)

Time : 3 Hours]

[Max. Marks : 50

Instructions to the candidates:

- 1) Answer any five questions.
- 2) All questions carry equal marks.
- 3) Figures to the right indicate full marks.
- 4) Neat diagrams must be drawn wherever necessary.
- 5) Use of non - programmable calculator is allowed.

Q1) a) List the pressure sensing Devices.

Two strain gauges attached to the surface of a cylindrical pressure vessel, one in axial and one in circumferential. direction gave the strain of 0.00018 and 0.00072 respectively. Calculate the hoop and longitudinal stress values. The cylinder is of steel having modulus of elasticity of 200 GN/m<sup>2</sup> and Poisson's ratio of 0.29. [4]

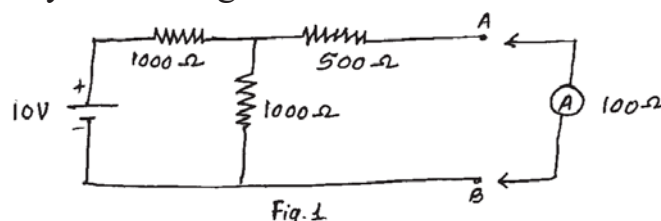
b) Explain the following characteristics parameters of measurement system. [3]

- i) Precision
- ii) Repeatability and
- iii) Hysteresis

c) A parallel circuit having two branches. The current in one branch is  $I_1 = 100 \pm 2A$  and in the other branch is  $I_2 = 200 \pm 5A$ . Determin the value of total current by- [3]

- i) Considering the errors in the currents as limiting errors.
- ii) Considering the errors as standard deviation. Comment on the result.

Q2) a) Explain the loading effect due to series connected instruments. It is desired to measure the value of current in 500Ω resistor as shown in fig.1 by connecting 100Ω ammeter. [4]



P.T.O.

Find

- i) The actual value of current
  - ii) Measured value of current and
  - iii) Percentage error in the measurement and accuracy.
- b) What is transducer? Give the advantages of electrical/electronic transducers. List the transducers used for temperature measurement. [3]
- c) List the characteristics of transducer that are considered while choosing a transducer for the measurement of physical parameter. What is transfer characteristic of transducer. [3]
- Q3)** a) What is strain gauge? List the different types of strain gauges. State advantages and applications of strain gauges. [4]
- b) Write working principle of capacitive transducer. Compute the capacitance of parallel plate capacitive transducer having area of plate is  $500 \text{ mm}^2$  and separation distance is  $200 \text{ mm}$ . The transducer used in air with permittivity is  $8.85 \times 10^{-12} \text{ F/m}$ . Calculate the change in capacitance if the distance between the plates is reduced to  $180 \text{ mm}$  by displacement also, calculate the sensitivity. [3]
- c) Describe working principle of [3]
- i) Thermocouple and
  - ii) Radiation pyrometer
- Q4)** a) List the displacement transducers. Describe LVDT transducer used for displacement measurement. State advantages and limitations of it. [4]
- b) Compare the following measurement systems. [3]
- i) Deflection and null type
  - ii) Direct and indirect measurement
- c) State the different methods of flow measurement. Describe the working principle of ultrasonic flow meter. [3]

- Q5)** a) Describe piezoelectric transducer and its different modes of operations. Give advantages and applications of it. [4]  
b) An LVDT is used in an accelerometer to measure seismic mass displacement. The spring constant is 240 N/M and core mass is 0.05kg. The LVDT and signal conditioning output is 0.31 mV/mm with  $\pm 20$  mm core displacement. [3]  
Find  
i) Relation between acceleration in  $\text{m/s}^2$  and the output voltage.  
ii) Natural frequency and maximum acceleration measurable.  
c) A temperature sensing devices can be modified as a first order system with time constant of 6 sec. It is suddenly subjected to a step input of  $25^\circ\text{C}$  to  $150^\circ\text{C}$ , what temperature will it be indicated in 10 sec after the process has started? [3]
- Q6)** a) Explain zero order system with suitable example. [4]  
b) A platinum resistance thermometer has a resistance of  $100\Omega$  at  $25^\circ\text{C}$ . Find the resistance at  $65^\circ\text{C}$  temperature and find temperature for  $150\Omega$  resistance. The temperature co-efficient is  $0.00392^\circ\text{C}$ . [3]  
c) A beam type load cell of width 200 mm and thickness 50 mm is mounted with four strain gauges, which enables measuring a maximum load of 100kN. If the strain gauges are to be mounted at the root of the cantilever, determine the approximate length of the beam.  
Determine  $(\Delta E_0 / V)_{\max}$  and sensitivity to this load cell. Given:  $E = 70$  GPa,  $\nu = 0.33$ ,  $\sigma_f = 150$  MPa,  $S_g = 2$  and  $R_g = 120 \Omega$ . [3]
- Q7)** a) Give detail classification of transducers. List the resistive transducer with measured. [5]  
b) State the types of microphones. Define sound pressure level and sound power level. Explain sound level meter. [5]
- Q8)** a) Describe dynamic performance of measurement system. Describe first order electrical system for unit step input. [5]  
b) What is thermistor? Give its different forms of construction. Compare its performance with resistance thermometer. State the salient features of thermistor. [5]

