Ex/BESUS/ EE-604/ 06

B.E. (EE) Part-Ill 6th Semester Examination, 2006

Instrumentation
(EE-604)

Time : 3 hours   Full Marks : 100

Use separate answerscript for each half.
Answer SIX questions, taking THREE from each half.
Two marks are reserved for neatness in each half.

FIRST HALF

a)   Discuss four important properties both for static & dynamic performances of a good instrumentation system.

b)   How linear displacement can be measured by potentiometer type transducer? Discuss its constructional features.

c)   How loading of a potentiometer type transducer affects its linearity? How it _,^_,4s overcome?

[6+6+4]

2.   a)   What is an LVDT? What is the basis of selection of its primary supply frequency?

b)   How null compensation is done in LVDT by design consideration and by circuit compensation?

c)   How LVDT can be used to measure pressure? Explain with suitable diagram.

[4+6+6]

3.   a)   What is a strain gauge? Discuss its working principle and find the sensitivity. Why semiconductor type strain gauges have very large gauge factor?

b)   How proving ring type load cell can be used to measure vertical force?

c)   A proving ring type load cell has the following dimensions :

Radius of the ring = 5 cm

Thickness of ring = 2 mm

Breadth of ring = 2 cm

Young's Modulus of ring material - 2000 N/cm^2

A 0.5 m long cylindrical brass rod of 1 cm diameter and density 15 gras/cm^3, hanging from the ring is dipped into a water tank to measure its level. If four

(EE-604)   ~~ (2)

     identical strain gauges of gauge factor 2 are mounted on the ring and connected in full bridge configuration, calculate the change in out of balance voltage of the bridge for a change of 1 cm of water level. Take bridge supply voltage = 5 V. Also draw the schematic diagram of the system.   [6+2+8]

4. a) How displacement is measured by using inductive transducers? Comment on its linearity.

  b) What are the advantages of using push-pull type variable reluctance type transducers? Draw its schematic diagram.

  c) How very small displacement can be measured using capacitance transducers?

                          [6+6+4]

5. a) Write short notes on <u>any two</u> :
    i) Diaphragm type pressure transducer
    ii) Absolute measurement of acceleration
    iii) Active transducers for temperature measurement

  b) The resistance of a thermistor at 50°C is 1 kQ and 4 kQ at ice point. Calculate the characteristic coefficients P and a at an ambient of 25°C. [(2x6)+4]

SECOND HALF

6. a) Explain with circuit diagram the use of instrumentation amplifier in connection with load cell.

  b) Give pin detail of uA 725 chip.

  c) Draw and explain circuit diagram for a fixed frequency sawtooth generator.

                          [6+2+8]

7. a) How can you distinguish between the following pairs of filters -
    i) Digital/Analog filter ii)
    Passive/Active filter iii)
    Audio/Radio freq. filter

  b) Draw the circuit diagram of a 1 st order Butterworth low pass filter and explain its operation.

  c) Explain with circuit diagram the operation of a DAC with binary weighted resistors.   [3+5+8]

(EE-604)   (3)

8. a) How an op-amp based comparator can be used as a building block of an ADC.

    b) Draw and explain the circuit diagram of a V/I converter with grounded load.

    c) Draw the circuit diagram of an astable multivibrator using op.amp. and propose the circuit for seperate control of ON time & OFF time.   [4+4+8]

9. a) Draw the circuit diagram of a 3-op.amp. configured instrumentation amplifier and find out the expression of its gain. Discuss the advantages and disadvantages of this circuit and suggest the solution to overcome disadvantages.

    b) With the help of a circuit diagram, enlist the gains of a 2-bit programmable gain instrumentation amplifier using analog multiplexers.   [8+8]

10. Write short notes on <u>any two</u> :   [8+8]

    a) Generalised Analog/Digital Close-loop Instrumentation scheme showing different stages from transducer to actuator through DAS, Data logger (Recorder & Display), Controller.

    b) CMOS 4-channel MUX-cum-DMUX and its utilisation in instrumentation system.

    c) Operation of the single channel digital display system where the input is from an analog transducer circuit (i) using V/f converter, (ii) using V/T converter.

    d) Single bit Programmable Gain Bipolar Amplifier with same magnitude of gain.