B.Tech II Year - II Semester Examinations, April-May, 2012
SENSORS AND SIGNAL CONDITIONING
(Instrumentation and Control Engineering)

Time: 3 hours   **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a)   Define the following static characteristics
       i) Accuracy   ii) Precision
       iii) Sensitivity   iv) Resolution.
  b)   Obtain the step response of second order system.   [8+7]

2.   Explain the functioning of following resistive sensors
     a) RTD
     b) Strain gauges.   [7+8]

3.a)   Resistors in a Wheatstone bridge are R1=R2=R3=120ohms and R4=121Ω. If the
       supply is 10V, Find voltage offset.
  b)   Explain the operation of Instrumentation amplifier.   [7+8]

4.a)   Explain the constructional features of Synchros.
  b)   Explain in detail the operation of parallel plate capacitor sensors.   [8+7]

5.a)   Derive an offset voltage relation for AC bridge under the bridge null condition.
  b)   Explain about resolver to digital converter.   [8+7]

6.a)   Explain in detail the principle of operation of Solar cell.
  b)   Explain briefly about the electrochemical sensors.   [7+8]

7.a)   Explain chopper amplifier with a neat sketch.
  b)   Explain the principle of operation of electrometer amplifier with a neat sketch.
                                                                            [8+7]

8.   Write short notes on the following
     a) Quartz digital thermometer
     b) Photo transistor
     c) Ultrasonic based sensors.   [5+5+5]

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1.a) What are static characteristics? Define them.
  b) Obtain the ramp response of First order system.   [8+7]

2.   Explain the working of following resistive sensors
      a) Thermistor
      b) LDR.   [7+8]

3.a) Derive an offset voltage relation for balanced DC bridge.
  b) Explain in detail the shunt calibration method.   [8+7]

4.a) Explain the operation of LVDT and mention its advantages.
  b) Explain in detail the operation of parallel plate capacitor sensors.   [10+5]

5.a) If Z_1=1Kohm, Z_2=2Kohm, Z_3=1K+ 1 / jωC, Z_x= R_x+1 / jωC_x and C= 1μF. Find
      the value of R_x and C_x when the bridge is nulled?
  b) Explain the need of carrier amplifier-application to LVDT?   [7+8]

6.   Describe the following self generating sensors
      a) Piezo-electric sensors
      b) Photo-voltaic sensors.   [8+7]

7.a) Explain the principle of operation of chopper amplifier with a neat sketch.
  b) Explain charge amplifier with a neat sketch.   [8+7]

8.   Write short notes on the following
      a) Vibrating wire stain gages
      b) Magneto transistors.
      c) Fibre optic sensors.   [5+5+5]

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1.a) Describe systematic errors and random errors.
  b) Obtain the step response of first order system.   [8+7]

2.a) Compare Metal and Semiconductor Strain gauges.
  b) Explain in detail the principle of operation of LDR.   [8+7]

3.a) Derive an offset voltage relation for balanced Wheatstone bridge.
  b) Explain the need of instrumentation amplifier.   [8+7]

4. Explain in detail the principle of operation of following sensors
    a) Electromagnetic sensors
    b) Hall effect sensors.   [8+7]

5.a) Derive a offset voltage relation for balanced AC bridge.
  b) Explain about digital to resolver converter.   [8+7]

6. Describe the following self generating sensors
    a) Electrochemical sensors
    b) Thermoelectric sensors.   [8+7]

7.a) Explain the principle of operation of charge amplifier with a neat sketch.
  b) Explain electrometer amplifier with a neat sketch.   [8+7]

8. Write short notes on the following
    a) Saw sensors
    b) Photo diodes
    c) CCD image sensors.   [5+5+5]

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1.a) Classify the sensors.
　b) Obtain the impulse and step response of first order system.　　　　[5+10]

2.a) Compare RTD and Thermistors.
　b) Obtain a relation for gage factor of a metal stain gage.　　　　[8+7]

3.a) Derive an offset voltage relation for Wheatstone bridge under the bridge null condition?
　b) Explain about interference types and reduction methods.　　　　[8+7]

4.　Explain in detail the principle of operation of following sensors
　　a) Magneto elastic sensors
　　b) Eddy current sensors.　　　　[8+7]

5.a) Explain briefly the carrier amplifier with a neat sketch.
　b) Explain the need of signal conditioning for reactance variation sensor.　　　　[10+5]

6.a) Mention the types of Self generating sensors. Explain their principle of operation and working.
　b) Explain in detail the principle of operation of Thermocouple.　　　　[5+10]

7.a) Explain briefly low drift amplifier with a neat sketch.
　b) Discuss about the noise in the amplifier.　　　　[8+7]

8.　Write short notes on the following
　　a) Position encoder
　　b) Magneto Diode
　　c) Charge coupled sensors.　　　　[5+5+5]

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