Registration no:

B.TECH
PCEI4302

5th Semester Regular / Back Examination 2016-17
INSTRUMENTATION DEVICES AND SYSTEMS - I
BRANCH(S): AEIE,EIE
Time: 3 Hours
Max Marks: 70
Q.CODE: Y240
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1   **Answer the following questions:**   **(2 x 10)**

a)   Define linearity and sensitivity and hysteresis of a measurement system.

b)   A thermo couple having time constant 10S is suddenly drop into a hot fluid from 20^0C to 80^0C. What will be the change in temperature at time 't' and draw the response characteristic graph

c)   For a thermister temperature sensor, draw the resistance temperature characteristics graph.

d)   The dynamic equation of a sensor is given by 0.1 d^2x/dt^2 + 1.0dx/dt + 10.0x = u(t), where u is the input and x is the output. Is the system overdamped, underdamped or critically damped?

e)   Draw the schematic of differential reluctance displacement sensor. Write the relationship between reluctance and displacement.

f)   Draw the circuit diagram of an instrumentation amplifier and write the expression of the output voltage.

g)   What is residual voltage in LVDT? Draw the DC characteristic of LVDT

h)   What do you mean by phase sensitive demodulator?

i)   What is input offset voltage and how it will be reduced?

j)   Explain the law of intermediate temperature of thermocouple.Explain using schematic diagram

Q2 a)   What is a strain gauge? Derive Gauge factor of a strain gauge.   **(5)**

(b)   Derive step response of a second order system operating under various damping condition.   **(5)**

Q3 **a)** What is inductive sensing element? Discuss how a variable inductance displacement sensor used for displacement measurement. **(5)**

b) A load cell consists of an elastic cantilever and a displacement transducer. The cantilever has a stiffness of 10^2 Nm^{-1}, mass of 0.5kg and a damping constant of 2Nsm^{-1}. The displacement transducer has a steady state sensitivity of 10Vm^{-1}. A package of mass 0.5kg is suddenly dropped on to the load cell. Derive a numerical equation describing the corresponding time variation of the output voltage (g = 9.81ms^{-2}). **(5)**

Q4 Write the working principle of thermocouple and also explain different laws of thermocouple. **(10)**

Q5 **a)** Describe construction of a LVDT and explain principle of displacement measurement. **(5)**

b) Draw the schematic diagram of variable separation, variable area and variable dielectric capacitive sensors. Derive the expression of change in capacitance of these sensors when used for displacement measurement. **(5)**

Q6 **a)** In a resistive deflection bridge find the relationship between the resistances in a balanced wheat stone bridge and the output voltage for single element strain gauge Bridge. **(5)**

b) Explain operation of phase sensitive demodulator circuit and describe its applications in instrumentation. **(5)**

Q7 **a)** Write the working principle of Variable reluctance tachogenarator for angular velocity measurement **(5)**

b) Describe construction and principle of operation of Electromagnetic flow meter. **(5)**

Q8 **Write short notes on any two:** **(5 x 2)**
a) Instrumentation Amplifier
b) Turbine flow meter
c) I.C. temperature sensor
d) Capacitive sensing element