Registration no: ☐☐☐☐☐☐☐☐☐☐

Total Number of Pages: 2   **B.TECH**
                                                                                     PCEI4302

5th Semester Regular / Back Examination 2015-16
INSTRUMENTATION DEVICES AND SYSTEMS – I
BRANCH(S): AEIE,EIE,IEE
Time: 3 Hours
Max marks: 70
Q.CODE: T372
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 gauge factor of a strain gauge.

   b) Write the Laplace transform of unit step and sine wave functions.

   c) What is the importance of standards in calibration?

   d) On which principle a thermocouple works? Why cold junction compensation is necessary?

   e) How elasticity is used for pressure measurement in a bourden tube?

   f) Illustrate laminar flow and turbulent flow using suitable diagram.

   g) Write down the values of an instrumentation amplifier parameters.

   h) What is CMRR? Draw the equivalent circuit for an open loop amplifier.

   i) Differentiate between an operational amplifier and an instrumentation amplifier?

   j) Why bridge circuits are used in signal processing?

Q2 a) Differentiate between RTD and thermistors. What do you understand   (5)
        by PTC and NTC of the above?

    b) The resistance $R(\theta)$ of a thermistor at temperature θ K is given by   (5)
        $R(\theta) = \alpha \exp(\beta/\theta)$. Given that the resistance at the ice point ($\theta = 273$ K)
        is 10KΩ and the resistance at the steam point is 1.0 KΩ, find the
        resistance at 40° C. (β=2946 K and α=1.86 x 10⁻⁴ KΩ)

Q3 a) Draw the block diagram of a measurement system and explain different blocks. (5)

b) Derive the expression for gauge factor of a strain gauge. (5)

Q4 a) Describe the various measurements that can be done using capacitive sensing element. (5)

b) A variable dielectric capacitive displacement sensor consists of two square metal plates, sides 10cm, separated by a gap of 2 mm. A sheet of dielectric material 2 mm thick and the same area as the plates can be slid between them to match the displacement. Calculate the capacitance of the sensor for a displacement of 2.0 and 5.0 cm. Dielectric constants of air and dielectric material are 1 and 4 respectively. (5)

Q5 a) Starting with Thevenin voltage E_{Th} derive the relationship among the resistances in a balanced Wheatstone bridge. Draw the circuit. (5)

b) Draw the operational amplifier circuits of inverting amplifier, non-inverting amplifier, differential amplifier and voltage follower. Write down the expression for V_{out} with respect to V_{in} for each. (5)

Q6 a) Describe the working of a turbine flow meter using a suitable diagram. (5)

b) List the general characteristics that should be borne in mind for selecting the most suitable differential pressure flow meters for a given application? (5)

Q7 a) With the help of a suitable diagram explain the working of a Doppler shift flow meter. (5)

b) How can you measure the velocity at a point in a fluid? Use suitable illustrations and expressions. (5)

Q8 Write short notes on any two. (5 x 2)

a) Errors in measurement system

b) LVDT sensors

c) Phase sensitive demodulators

d) Electromagnetic flow meter