Total No. of Questions—12] [Total No. of Printed Pages—4+1

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S.E. (Instrumentation) (I Sem.) EXAMINATION, 2010

PRINCIPLES OF SENSORS AND TRANSDUCERS

(2008 COURSE)

Time : Three Hours **Maximum Marks : 100**

N.B. :— (*i*) Answer *three* questions from Section I and *three* questions from Section II.

(*ii*) Answers to the two Sections should be written in separate answer-books.

(*iii*) Neat diagrams must be drawn wherever necessary.

(*iv*) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

SECTION I

1. (*a*) State the objectives of Engineering measurements. Define measurement. [6]

(*b*) Distinguish between :

(*i*) Accuracy and Precision

(*ii*) Threshold and Resolution. [6]

(*c*) List the types of errors in measurement. Give their causes and state the remedies. [6]

P.T.O.

Or

2. (*a*) Define calibration. Distinguish between active transducers and passive transducers. [6]

(*b*) State and explain any *three* desirable static and dynamic characteristics of an instrument. [6]

(*c*) Classify transducers based on different transduction principles. [6]

3. (*a*) Convert 40°C into °F. Define Ice point and steam point. Draw and explain with principle the Bimetallic strip thermometer. [8]

(*b*) List different manometers. Draw and explain inclined tube manometer and state its advantages. [8]

Or

4. (*a*) Draw and explain force measurement using spring. List different types of load cells. [8]

(*b*) List diaphragm elements and state one application with diagram. Draw and explain torque measurement using flat spiral spring. [8]

5. (*a*) Define specific gravity. Draw and explain density measurement using U-tube weighing system. [8]

(*b*) Draw and explain level to force converter and viscosity to pressure converter. [8]

Or

6. (*a*) A submarine moves horizontally in the sea and has its axis much below the surface of sea water. A pitot tube properly placed just in front of the submarine is connected to a differential pressure gauge. The pressure differential between the pitot pressure and static pressure was found to be 20 kN/m^2. Find the speed of submarine if the density of sea water is 1026 kg/m^3. [8]

(*b*) Draw and explain static vane and rotating vane systems for flow measurement. [8]

SECTION II

7. (*a*) An RTD has α_0 = 0.0037 Ω/(Ω/°C) at T_0 = 50°C, R(50°C) = 350 Ω. Find R(75°C). If R(75°C) is measured by passing currents of 20 mA through the RTD and if RTD has P_D = 30 mW/°C power dissipation, find the temperature that will be indicated by the RTD. [9]

(*b*) Draw and explain with principle, capacitive moisture transducer. State its advantages and disadvantages. [9]

Or

8. (*a*) State principle of strain gauge. Define gauge factor. Draw and explain different types of strain gauges. [9]

(*b*) Draw and explain with principle inductive transducers for displacement measurement. State its advantages and disadvantages. [9]

9. (*a*) State piezoelectric phenomena and piezoelectric materials. Draw and explain piezoelectric transducers for force measurement. [8]

(*b*) State magnetostriction phenomenon. Draw and explain with principle Hall effect transducer and give its applications. [8]

Or

10. (*a*) Draw and explain radioactive gauges for thickness and vacuum measurement. [8]

(*b*) Explain photo-electric phenomenon. Draw and explain linear digital encoder for displacement measurement. [8]

11. (*a*) Draw and explain analog and digital readout systems. State its applications. [8]

(*b*) Draw and explain magnetic tape recorder and analog tape recorder. [8]

Or

12. (*a*) Draw and explain the block diagram of data logger. [8]

(*b*) Enlist different digital input-output devices. Draw and explain a servo-operated manometer. [8]