53 (IE 701) ININ

2013

(December)

INDUSTRIAL INSTRUMENTATION

Paper : IE 701

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Define the following : 1.5×6=9

   (i) Viscosity

   (ii) Fluidity

   (iii) Newtonian fluid

   (iv) Boiling point

   (v) Absolute zero

   (vi) Barometric pressure.

(b) Explain, with a neat sketch the construction and working of a Mcleod gauge. 8

(c) Write *any two* uses of pressure switch. What do you mean by the term 'deadband' in a pressure switch ? 2+1=3

2. (a) What is a thermocouple ? On what principle, the thermocouple works ? Describe the construction and working of a thermocouple type pyrometer with suitable sketch. 10

(b) Describe the working of a strain gauge load cell. Compare the strain gauge load cell with elastic load cell. 6+4=10

3. (a) A strain gauge is bonded to a beam which is $12cm$ long and has a cross-sectional area of $3.8\,cm^2$. The unstrained resistance and gauge factor of the strain gauge are 220Ω and 2.2 respectively. On the application of load, the resistance of the gauge changes by 0.015Ω. If the modulus of elasticity for steel is $207\,GN/m^2$, calculate

(i) The change in length of the steel beam

(ii) The amount of force applied to the beam. 5

(b) Briefly describe the construction and working of Inductive Torque Transducer with suitable sketch. 3+3=6

(c) Explain the construction and working of piezo-electric type accelerometer. Mention its advantages. 7+2=9

4. (a) The lens of an optical pyrometer is clouded so that the transmission factor is 0.8. The instrument indicates a temperature of 1480°C. What is the true temperature ? 3

(b) Which of the force-balance type pressure gauge is used for the measurement of low differential pressures of the order of a few inches of water gauge ? Describe the construction and working of the pressure gauge. 1+6=7

(c) What are the sources of errors in Filled-system thermometers ? Explain. 5

(d) Briefly describe the construction and working of Seismic Transducer. 5

5. (a) The accuracy specified for a pressure gauge of range (0-10) *kPa* is 2%. Find the maximum error in measurement (in Pascal) if it gives a reading of 4.0 *kPa* ? 4

(b) What is the need of compensation in thermocouples ? Explain with neat sketch, the cold junction compensation technique. 2+6=8

(c) How is angular velocity measured ? Briefly describe *any one* technique. Also mention its advantages and disadvantages. 1+5+2=8

6. (a) How is flow rate related to Reynold's number for Laminar and non-Laminar flows ? 2

(b) Briefly describe the construction and principle of operation of ultrasonic densitometer. 6

(c) Fill in the blanks : 2

(i) $256°R =$ _____ $°F$

(ii) $45°C =$ _____ $°F$

(d) At what conditions, red oil is used as the indicating fluid in manometers ? 2

(e) Describe the construction and working of Ionization gauge with neat sketch. Also mention its advantages and disadvantages. 6+2=8

7. Write short notes on : ***(any four)*** 5×4=20

(a) Rotameter

(b) Dead Weight Tester

(c) Hydrometer

(d) Resistance thermometer

(e) Thermoelectric Laws.

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