53 (IE 701) ININ

2013

(May)

INDUSTRIAL INSTRUMENTATION

Paper : IE 701

Full Marks : 100

Pass Marks : 30

Time : Three hours

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

*Answer **any five** questions..*

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

(b) What is load cell ? Give the type of it. 2

(c) What are the methods of vibration measurement ? 2

(d) What is the need of compensation in thermocouples ? 2

(e) Name different types of expansion thermometers. 2

(f) What is a thermocouple ? Name *any four* types of thermocouples. Describe, with the help of a diagram, the construction and working of a thermocouple type pyrometer. 10

2. (a) Explain briefly the construction and working of McLeod Gauge with suitable diagram. 8

(b) 'Seismic instrument as an accelerometer and vibrometer'. Justify. 7

(c) What is thermistor ? Explain with a neat sketch, the construction and working of a thermistor. 5

3. (a) Explain with neat sketch, the construction and working of piezoelectric pressure transducers. Also mention some applications of piezoelectric pressure transducers. 6+2=8

(b) Describe the operation of Ionization gauge with neat sketch. 6

(c) A platinum thermometer has a resistance of $100\,\Omega$ at $25^{\circ}C$. 6

(i) Find its resistance at $65^{\circ}C$ if the platinum has a resistance temperature co-efficient of $0.00392/^{\circ}C$.

(ii) If the thermometer has a resistance of 150Ω, calculate the temperature.

4. (a) Explain with neat sketches, the working, construction, advantages and disadvantages of a resistance thermometer. 6+1+1=8

(b) Explain the construction and working of potentiometric type accelerometer. 7

(c) A capacitive transducer uses two quartz diaphragms of area $750\,mm^2$ separated by a distance of $3.5mm$. A pressure of $900\ KN/m^2$, when applied to the top diaphragm, produces a deflection of $0.6mm$. The capacitance is $370\,pF$ when no pressure is applied to the diaphragms. Find the value of capacitance after the application of a pressure of $900\ KN/m^2$. 5

5. (a) Briefly describe the principle of operation of ultrasonic densitometer. 8

(b) Explain the working of strain gauge type torque transducers. Mention its advantages and disadvantages. 6+1+1=8

(c) An LVDT is used in an accelerometer to measure seismic mass displacements. The LVDT and signal conditioning outputs are $0.31\,mV/mm$ with a $\pm 20mm$ core displacement. The spring constant is $240\,N/m$ and the core mass is $0.05\,kg$. Find

(i) natural frequency

(ii) Maximum measurable acceleration. 4

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

(b) With neat sketch, explain the construction and working of DC Tachogenerator. 6

(c) In order to measure a speed higher than flashing rate of stroboscope the flashing rate was gradually reduced from the highest noting all the speeds at which single image is observed of a mark on the rotating object. These speeds are 20,000 ; 15,000; 12,000 and 10,000 *rpm*. Calculate the actual speed. 4

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

(a) Dead Weight Tester.

(b) Temperature Compensation.

(c) LVDT.

(d) Bimetallic thermometers.

(e) Stroboscope.
