

Total No. of Questions—12]

[Total No. of Printed Pages—4+1

**[4062]-163**

**S.E. (Instrumentation) (First Semester) EXAMINATION, 2011**

**PRINCIPLES OF SENSORS AND TRANSDUCERS**

**(2008 PATTERN)**

**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) Draw neat sketches wherever necessary.

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

**SECTION I**

1. (a) Define sensors and transducers. Explain in detail classification of transducers based on transduction principle. [6]
- (b) List the types of error in measurement. Give their causes and state the remedies. [6]
- (c) What is calibration ? Explain the standards available for calibration at various laboratories. [6]

*Or*

2. (a) Define Instrumentation. Draw and explain the basic stages of measurement system. [6]

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- (b) What do you mean by the order of a measuring system ?  
What are the different standards inputs given to the measuring system for evaluation of its parameters ? [6]
- (c) An experiment performed once gave a reading that showed a deviation of 10 percent. If it is repeated 65 times, what is the likely deviation ? [6]
3. (a) Explain with diagram bimetallic and fluid expansion system for temperature measurement. [8]
- (b) Define atmospheric pressure and absolute pressure. Give units of pressure. Explain with diagram capsules. [8]
- Or*
4. (a) Explain with diagram torsion bar for torque measurement. Explain in brief principle of gyroscope. [8]
- (b) Draw and explain force measurement using spring. List different types of load cells. [8]
5. (a) Define specific gravity. Explain with diagram air bubbler system for density measurement. [8]
- (b) Explain with neat diagram level to force convertor and viscosity to torque convertor. [8]

Or

6. (a) Explain working principle with neat diagram for flow measurement using Pitot tube. [8]
- (b) Write a short note on : [8]
- (i) Hydrometer
- (ii) Rotameter.

## SECTION II

7. (a) Explain the working principle of LVDT. State its advantages, disadvantages and applications. [9]
- (b) A capacitive transducer uses two quartz diaphragms of area  $750 \text{ mm}^2$  separated by distance of 3.5 mm. A pressure of  $900 \text{ kN/m}^2$  when applied to the top diaphragms produces a deflection of 0.6 mm. 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  $900 \text{ kN/m}^2$ . [9]

Or

8. (a) State the principle of strain gauge. Draw and explain different types of strain gauges (any two). [9]

- (b) Draw and explain moisture measurement using resistive transducer. Give its applications. [9]
9. (a) Describe the principle of operation of Hall-effect sensor. How can it be used in displacement sensing ? [8]
- (b) What are Peltier and Seebeck effect ? How are they responsible in thermo-emf generation ? Give the list of different types of thermocouples. [8]

*Or*

10. (a) Explain piezoelectric phenomena. List piezoelectric materials. Explain with neat diagram piezoelectric transducer for force measurement. [8]
- (b) Explain with neat diagram electromagnetic flow-meter. Distinguish between 'Photovoltaic', 'Photoemissive' and 'Photoconductive' cells. [8]
11. (a) List different digital input-output devices. Draw and explain magnetic tape recorder. [8]
- (b) Write short notes on : [8]
- (i) Analog and Digital readout system
- (ii) Data logger.

*Or*

**12.** (a) Explain with neat diagram Feedback transducer system. [8]

(b) Write short notes on : [8]

(i) Analog tape recorder

(ii) Self-balancing system.

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