

Jadavpur University
M.Sc.(Instrumentation) Examination, 2018-19
1st year 1st semester
Paper-III(I-103)
Sensors, Transducer and Measurements

Use separate answer script for each group

Group- A

Full marks: 50

Time: 2 hours

Answer any 10 questions.

5 X 10

1. What are sensor, actuator and transducer? List the factors responsible in selection of a transducer ? 3+2
2. What is RTD? Discuss temperature – resistance relations in RTDs. What is pellistor? 1+3+1
3. Explain working principle of a thermistor. Discuss the general classification of thermistor. 3+2
4. Discuss Seebeck effect, Peltier effect and Thomson effect. What are the four common types of thermocouples used and range of temperature measurement? 3+2
5. Describe ionization gauge for low pressure measurement. What are the basic differences between a common ionization gauge and Bayard-Alpert gauge? 3+2
6. Describe Bourdon gauge and Diaphragm gauge. Is a Bourdon gauge a sensor or an actuator or a transducer? 4+1
7. Elucidate strain gauge as force sensor. Resistive strain gauge based on metallic and also semiconducting materials, what is difference between them. What is gauge factor. 2+2+1
8. What are non-intrusive methods of temperature measurement? Describe a basic radiation thermometer. 2+3
9. What are common light sensors? What are LDR, LED and Photodiode? 2+3
10. Describe how a typical photomultiplier tube work ? Name some common coating materials used for obtaining secondary electron emission in PMT. 4+1
11. Define pH of a solution. Explain working principle of pH electrodes with neat schematic diagram. What is pH of pure water at 25°C. 1+3+1
12. How do ultrasonic sensors work for measurement of liquid level? What are the advantages in ultrasonic sensors? Where ultrasonic should be avoided? 2+2+1
13. What is **piezoelectric effect** ? Write two example of piezoelectric material. How Piezoelectric transducer can be used for energy harvesting? 1+1+3
14. What is LVDT? What are the advantages and disadvantages of LVDT? What are the applications of LVDT? 1+2+2

[Turn over

Master of Science (Instrumentation) Examination, 2018-19
2nd year, 1st Semester
SUBJECT: SENSORS, TRANSDUCER AND MEASUREMENTS
PAPER: -III CODE -I103

Total Marks 100

Time :4hrs

For each group use separate answer script

GROUP B

Answer any five questions

5X10

1. What is the classification of transducer? Differentiate between accuracy and precision? A multimeter having sensitivity of 2000 ohm/volt is used for measurement of voltage across the circuit having an output resistance of 10 K ohm . The open circuit voltage of the circuits is 6 V. Find the reading of the multimeter when it is set to 10 V scale. Find the percentage of error. 2+4+4
2. What is loading effect? Define *fidelity* and *Measurement lag*. A temperature sensitive 1st order transducer is subjected to a sudden temperature change. It takes 10s for the transducer to reach equilibrium condition (5 time constant) . How long will it take for the transducer to read half of the temperature difference? 2+4+4
3. Derive an time response of output signal of RLC series circuit (2nd order) when the system is subjected to Unit step input signal. Explain the overdamped , critical damped and under damped condition with proper diagram. 7+3
4. Explain the working principle of moving coil galvanometer with schematic diagram. Derive an expression for current vs angular displacement of the pointer at steady state. 6+4
5. Discuss the effect of the temperature changes of Ammeter. With proper circuit diagram, explain in details how the voltmeter works. Simply draw the block diagram of Digital multimeter. 2+5+3
6. Draw the connection and phasor diagram of Schering Bridge under balance condition. Find an expression to determine the value of the unknown capacitor. How can you measure relative permittivity using Schering Bridge? 7+3
7. Derive the sensitivity of CRO ? Explain the electron lens phenomena at focusing anode. 7+3
8. Describe the construction of Spectrum Analyser and Measurement procedure using this device. 7+3