

Ref. No.: Ex/MI202/2019

M.SC. INSTRUMENTATION SCIENCE FIRST YEAR SECOND SEMESTER EXAM 2019

SUBJECT: INDUSTRIAL INSTRUMENTATION & DAS

Time : Four hours

Use separate Answer Script for each Part

Full Marks : 100

Part - I

Any three from group A and two from group B

**Group A**

1. Explain any one from primary flow measurement instruments with details range and installation and advantages.  
Alcohol flows in a horizontal pipe 3.2-in diameter; the diameter of the pipe is reduced to 1.8 in. If the differential pressure between the two sections is 1.28 psi, what is the flow rate through the pipe? Neglect losses
2. Explain the construction and measurement of fluid flow through Coriolis flow meter
3. Explain the theory and construction of Bi-metallic thermometer? What are advantages and disadvantages of the instrument?
4. What are the salient features of RTDs? Explain 4 wire RTDs for temperature measurement in industrial application with neat sketch. Why platinum is mostly chosen in construction of RTDs?
5. Explain the law of thermocouple? What is cold junction compensation?  
A copper-constantan thermocouple was found to have linear calibration between 0 and 400<sup>o</sup>c with emf at maximum temperature (reference junction temperature 0<sup>o</sup>c ) equal to 20.68 mV.  
a) Determine the correction which must be made to the indicated emf if the cold junction temperature is 25<sup>o</sup>c.  
b) If the indicated emf is 8.92mV in the thermocouple circuit determine the temperature of the hot junction.
6. How can you measure level of liquid using bubbler tube ? How far below the surface of the water is the end of a bubbler tube, if bubbles start to emerge from the end of the tube when the air pressure in the bubbler is 148 kPa?
7. What is Hair hygrometer? Explain its construction and operation with neat sketch

**Group B**

8. Write the names of the pressure measuring devices those are used in the following situations; (i) Low pressure (ii) High and medium pressure (iii) Low vacuum and ultra Vacuum (iv) Very high pressure. Write on importance and applications of pressure gauges in industry. What is gauge pressure, absolute pressure and differential pressure. What is Piezometer? Explain its working principle.  
3+2+2+3
9. Write down the principle of McLeod gauge with necessary diagram. Why it is called indirect or inferential method of pressure measurement. Write its applications, advantages and Limitations. 5+1+4
10. What type of pressure is measured using Bourdon gauge? How do Bourdon tube pressure gauge work ? Write the types of Bourdon tubes are used and their range. Explain each part by necessary diagram. 1+5+4
11. Describe dead weight tester by suitable diagram. Explain its working principle. Write its application, advantages and limitations. 3+4+3

[ Turn over

## Part II

Answer any 5 of the following questions

1. What is Isolation Transformer? Explain how the coupling capacitor is reduced and how isolation transformer protect sensitive electronic circuits and instruments. [10]
2. Describe with circuit the function of a regulated DC power supply with 'foldback' overload protection [10]
3. Describe with circuit how a filter capacitor in a single phase rectifier introduces pulsating current and hence higher harmonics in the input current. [10]
4. Design a resistive potential divider of ratio 100:1 to measure 2000V DC in terms of 2 volts(0-2000mV) output. If the max current drawn by the potential divider is 1mA what should be the minimum impedance of the Voltmeter connected across low voltage arm to keep the measurement uncertainty within 1%. [4+6]
5. Design a 3 stage Amplifier (x2, x20 and x 200) using Op Amp and analog switches such that the amplification can be controlled by a micro controller, considering analog switch resistance as 170 Ohms in ON condition. [10]
6. Explain with Functional structure how single ended as well as differential analog multiplexers work. What is crosstalk in analog multiplexers. [7+3]
7. Describe how Sample And Hold circuit can be used to determine Capacitance of a capacitor by its discharge characteristics through high resistance with high accuracy. How sampling time window can affect the accuracy of measurement. [7+3]
8. Explain in details the working principle of a rotating Viscometer. [10]