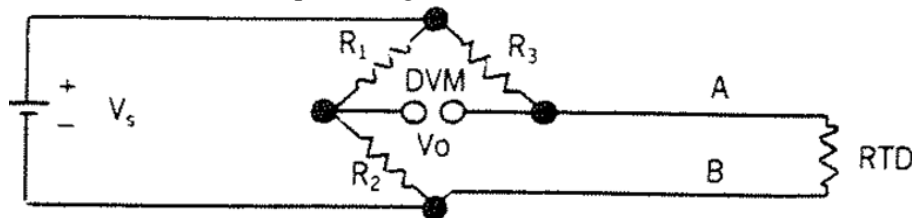


GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-V • EXAMINATION – WINTER 2013****Subject Code: 151702****Date: 04-12-2013****Subject Name: Sensors and Signal conditioning****Time: 10.30 am - 01.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** i) A 0 – 200 V voltmeter has an accuracy of $\pm 0.5\%$. What is accuracy when measuring 100 V and 20 V. **03**
- ii) A thermometer having a time constant of 10 s at room temperature of 35°C is suddenly dipped in cold water at 5°C . Estimate the time at which the thermometer reads 10°C **04**
- (b)** i) A first order instrument has a time constant of 2 sec. What is the span of frequencies for which it will respond within 5% accuracy? **03**
- ii) A platinum thermometer has a resistance of $100\ \Omega$ at 25°C . **04**
- Find its resistance at 65°C if the temperature co-efficient of $0.00392/^{\circ}\text{C}$.
 - If the thermometer has a resistance of $150\ \Omega$, calculate the temperature.
- Q.2 (a)** Define measurement, Instrument, Instrumentation and Calibration. Explain Why we do measurement? (what is need of measurement) **07**
- (b)** In given figure We use PT 100 RTD with temperature co-efficient of $0.385\ \Omega/^{\circ}\text{C}$ and the value of power supply is $V_s = 5\ \text{V}$ and the value of resistance of bridge are : $R_1, R_2=1\text{K}\ \Omega$, $R_3=116\ \Omega$ and $R_{\text{RTD}}=100\ \Omega$. **07**
- If galvanometer indicate zero then find out lead resistance (assume lead resistance of A,B are equal) and its equivalent temperature error in measurement.
 - If Lead resistance $R_a, R_b=5\ \Omega$, Temp the RTD measure is 80°C . Find the value of Output voltage V_o .

**OR**

- (b)** i) A hall effect transducer is used for the measurement of a magnetic field of $0.5\ \text{Wb/m}^2$. The 2 mm thick slab is made of bismuth for which the hall's co-efficient is $-1 \times 10^{-6}\ \text{V m}/(\text{A-Wb/m}^2)$ and the current is 3A. Find hall effect output voltage. **03**
- ii) A resistance wire strain gauge with a gauge factor of 2 is bonded to a steel structural member subject to a stress of $100\ \text{MN/m}^2$. The elastic modulus of steel is $200\ \text{GN/m}^2$. Calculate the percentage change in the value of the gauge resistance due to the applied stress. Give you comment on the result. **04**

- Q.3 (a)** Explain concept of Resistive Strain Transducer with its basic equation. Also Draw and Explain strain gauge whetstone bridge circuits for temperature compensation using one active and one dummy strain gauge, two active gauge on the same side, two active opposite sides. **07**
- (b)** List out various inductive transducer. Explain LVDT with displacement-voltage characteristic and necessary equation. **07**
- OR**
- Q.3 (a)** Explain Capacitive level transducer for use in insulating and conducting liquids, for use in conducting liquid only and give its equivalent capacitance circuit. **07**
- (b)** Explain hot wire resistive transducer. Also explain how hot wire resistive transducer can use for measurement of level with necessary figure and operation. **07**
- Q.4 (a)** Explain Magnetostrictive phenomenon with all details. List out various magnetostrictive transducer. **07**
- (b)** List out various piezoelectric transducer. Explain piezoelectric strain transducer. **07**
- OR**
- Q.4 (a)** Explain Hall Effect transducer and given it's application. **07**
- (b)** What you mean by electrochemical transducer? Explain how we measure pH with glass and reference electrode. **07**
- Q.5 (a)** Give the advantage of active filter over passive filter. Explain first order low pass butterworth active filter with necessary circuit diagram, frequency response and equation for gain and phase. **07**
- (b)** What is need of signal conditioning/processing circuit as next stage of sensors/transducers? Explain any one sensor/transducer with its appropriate signal conditioning. Justify you signal conditioning for your sensor/transducer. **07**
- OR**
- Q.5 (a)** Explain the basic concept of analog multiplexer and de-multiplexer with circuit and operation. Also list out it's application. **07**
- (b)** Explain oscillator principle with block diagram and necessary feedback gain condition. Given the application of various oscillator and signal generators in brief. **07**
