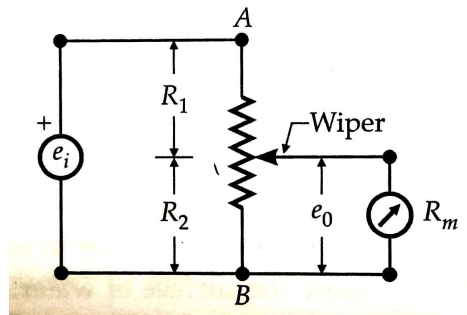


INSTRUCTIONS:

1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Tables/Data handbook/Graph paper etc., if applicable, will be supplied to the candidates

- Q.1(a) Explain the operation of an ultrasonic flow sensor. [4] CO1, BL2
CO4
- Q.1(c) A barium titanate piezoelectric crystal has dimensions of $5\text{mm} \times 5\text{mm} \times 1.25\text{mm}$. The force acting on it is 5N. Charge sensitivity of barium titanate is 150 pC/N and its permittivity is $12.5 \times 10^{-9} \text{ F/m}$. If modulus of elasticity of barium titanate is $12 \times 10^6 \text{ N/m}^2$, calculate the strain. Also calculate the charge and the capacitance. [6] CO2 BL3
- Q.2(a) A thermistor has a resistance of 3980Ω at the ice point (0°C) and 794Ω at 50°C . Calculate the range of resistance measured by the thermistor if the temperature varies between 40°C to 100°C . [5] CO2 BL3
- Q.2(b) A resistive displacement transducer with shaft stroke of 25mm is applied to the circuit shown below. The applied voltage is 10V. Assuming infinite resistance R_m of the output device, what is the displacement indicated for voltage readings of 3V, 5V and 8V? [5] CO2 BL3



- Q.3(a) List the basic components of a smart sensor. [2] CO5 BL1
- Q.3(b) Describe the HART protocol for data communication in sensors. [3] CO5 BL2
- Q.3(c) Explain with diagram how voltage is generated in photovoltaic cells. [5] CO1, BL2
CO3, CO4
- Q.4(a) Illustrate the operation of oxygen sensors in an automobile along with their appropriate location and function in a vehicle. [5] CO3, BL2
CO4
- Q.4(b) Explain the measurement principle of an air speed in an aircraft. [5] CO3, BL2
CO4
- Q.5(a) Differentiate between an isolator and a circuit breaker. [2] CO1 BL4
- Q.5(b) Describe the operation of a contactless displacement sensor which provides inherent digital signals. [3] CO1, BL2
CO3, CO4, CO5
- Q.5(c) Design a non-contact magnetic sensor for measurement of rotational speed and explain its operation with proper diagram. [5] CO1, BL6
CO3, CO4