

17442

16172

3 Hours / 100 Marks

Seat No.

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- Instructions* –
- (1) All Questions are *Compulsory*.
 - (2) Answer each next main Question on a new page.
 - (3) Illustrate your answers with neat sketches wherever necessary.
 - (4) Figures to the right indicate full marks.
 - (5) Assume suitable data, if necessary.
 - (6) Use of Non-programmable Electronic Pocket Calculator is permissible.
 - (7) Mobile Phone, Pager and any other Electronic Communication devices are not permissible in Examination Hall.

Marks

1. a) Attempt any SIX of the following: 12
- (i) List any four sources of biomedical signals.
 - (ii) List four constraints of Man Instrumentation system.
 - (iii) Describe the principle of electromagnetic blood flowmeter with the help of Faraday's law of electromagnetic induction.
 - (iv) Draw the constructional diagram of RTD.
 - (v) Draw diagram of pO₂ electrode and label its parts.
 - (vi) State function of electrode jelly used to place an electrode on the patient's body.
 - (vii) State four materials used for manufacturing of thermocouple.
 - (viii) State seebeck effect.

P.T.O.

- b) **Attempt any TWO of the following:** **8**
- (i) Define Accuracy, Precision, Calibration, Linearity w.r.t. measurement system.
 - (ii) Describe working of Radiation Thermometry with a neat diagram.
 - (iii) State the basic requirements of a bio-amplifier. (any eight points)
2. **Attempt any FOUR of the following:** **16**
- a) Describe Polarizable and Nonpolarizable electrodes.
 - b) With help of a neat labelled diagram give constructional details of GaAS semiconductor temperature probe.
 - c) Draw block diagram of Man Instrumentation system. State the function of any two blocks.
 - d) Describe working of ultrasonic flow meter.
 - e) An unbounded strain gauge has a resistance of 2000Ω and gauge factor of 3.2, what will be the change in resistance due to 1000 microstrain?
 - f) Describe $p\text{CO}_2$ electrode with a neat labelled diagram.
3. **Attempt any FOUR of the following:** **16**
- a) Define:
 - (i) Bio-magnetic signals
 - (ii) Bio-chemical signals
 - (iii) Bio-mechanical signals
 - (iv) Bio-acoustic signals
 - b) Describe phase sensitive amplifier.
 - c) Describe electrode skin interface with neat diagram.
 - d) Differentiate between Thermister and RTD.
 - e) Describe how pressure can be measured using Piezoelectric transducer.
 - f) Describe electrode used to measure hydrogen ion concentration in the blood with suitable diagram.

- 4. Attempt any FOUR of the following:** **16**
- a) Describe how thermal convection method is used to measure blood flow.
 - b) Why output voltage is not zero at null displacement in the characteristics of LVDT? Justify.
 - c) Describe suction electrode and needle electrode with the help of diagrams.
 - d) Describe working of thermister with a neat diagram.
 - e) Differentiate between Active and Passive transducer.
 - f) Describe importance of measuring electrode and reference electrode.
- 5. Attempt any FOUR of the following:** **16**
- a) Draw a labelled diagram of C shape Bourdon tube. Describe its working for pressure measurement.
 - b) Describe Plethysmography technique used for measurement of flow.
 - c) With help of a neat labelled diagram give constructional details of PMT and describe its working.

- d) Calculate the gain of the configuration shown in Fig. No. 1
Also calculate the output voltage if $V_a = 2\text{mv}$ and $V_b = 1\text{mv}$.

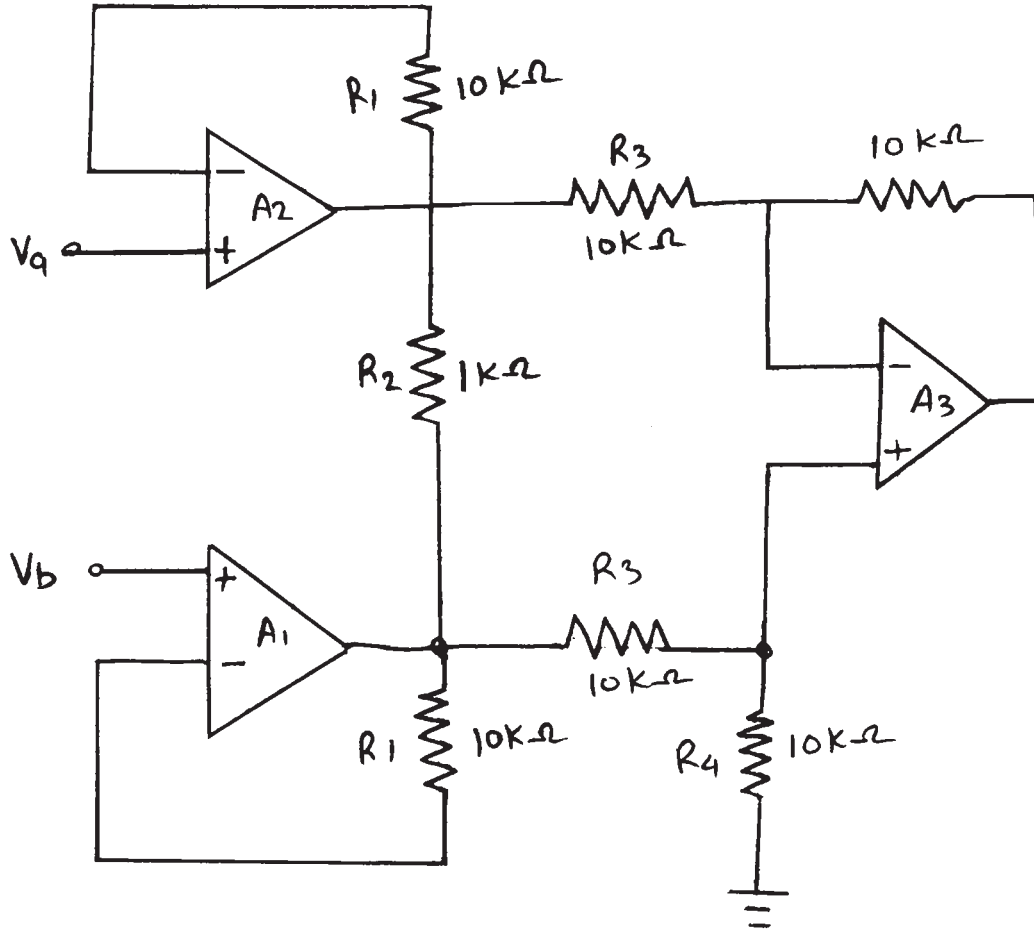


Fig. No. 1

- e) Classify transducers based on:
- Process used
 - Physical or chemical principle used.
 - Applications.
- f) Describe any four factors that should be considered while designing any Man Instrumentation System.

6. Attempt any FOUR of the following:**16**

- a) Describe how Wheatstone's bridge can be used for the measurement of linear and angular displacement with suitable diagram.
 - b) Describe how Wheatstone's bridge can be used for temperature measurement with suitable diagram.
 - c) Describe Indicator dilution method of flow measurement.
 - d) Describe construction and working of ISFET.
 - e) What are motion artifacts? How it can be reduced?
 - f) A platinum RTD has a resistance of 100Ω at 25°C .
 - (i) Find its resistance at 50°C . The resistance temperature coefficient of platinum is $0.00392\Omega/\Omega^\circ\text{C}$.
 - (ii) If the RTD has resistance of 150Ω , calculate the temperature.
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