

17442

11718

3 Hours / 100 Marks

Seat No.

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- Instructions* – (1) All Questions are *Compulsory*.
- (2) Illustrate your answers with neat sketches wherever necessary.
- (3) Figures to the right indicate full marks.
- (4) Assume suitable data, if necessary.
- (5) Preferably, write the answers in sequential order.

Marks

1. a) **Attempt any SIX of the following:** **12**
- (i) Define:
- 1) Biometrics
 - 2) Biomedical signals
- (ii) Give any four specifications of medical instrumentation system.
- (iii) Describe plethysmography with neat diagram.
- (iv) Define transducer. List the types of fibre optic sensors.
- (v) Draw and label PO₂ electrode.
- (vi) Define polarizable and non-polarizable electrode.
- (vii) List two types of thermocouples. Also give materials used for each type.
- (viii) Draw neat labeled diagram of (PMT) photomultiplier tube.

P.T.O.

- b) **Attempt any TWO of the following:** **8**
- (i) Give classification of transducer based on process used. physical or chemical principle used and application.
 - (ii) Describe working of piezoelectric transducer.
 - (iii) Draw neat labeled of differential amplifier.
- 2. Attempt any FOUR of the following:** **16**
- a) Give classification of electrodes used to measure bioelectric event. Give application of each electrode.
 - b) Explain thermocouple with suitable diagram.
 - c) Describe any four objectives of medical instrumentation system.
 - d) Describe ultrasonic flow transducer for flow measurement.
 - e) An unbounded strain gauge has resistance of 2000Ω and gauge factor 3.6, what will be the change in resistance due to 1500 microstrain.
 - f) Describe Ion-sensitive field effect transistor (ISFET) with suitable diagram.
- 3. Attempt any FOUR of the following:** **16**
- a) Define and give the example of each signal.
 - (i) Bioelectric signal
 - (ii) Bioacoustic signal
 - (iii) Biomechanical signal
 - (iv) Biochemical signal
 - b) State basic requirements of bioamplifier. (any eight points)
 - c) Describe electrode-electrolyte interface with neat labeled diagram.
 - d) Describe the working of RTD with suitable diagram.
 - e) Describe how pressure can be measured using LVDT with suitable diagram.
 - f) Describe blood glucose sensor with neat labeled diagram.

4. Attempt any FOUR of the following: 16

- a) Describe indicator dilution method for flow measurement.
- b) What will be the capacitance of parallel plate capacitor when the two plates are separated by 2cm from each other and each of the area is 4cm^2 . ($K = 1$, $\epsilon_0 = 0.0885$)
- c) Describe micro-pipette microelectrode used for the measurement of bio-potential with suitable diagram.
- d) Explain radiation thermometry with various types of temperature sensors.
- e) Distinguish between Active and Passive transducer.
- f) Describe importance of measuring electrode and reference electrode.

5. Attempt any FOUR of the following: 16

- a) Draw neat labeled diagram of various types of bourdon tubes used for pressure measurement.
- b) Describe electromagnetic transducer used for flow measurement.
- c) With the help of neat labeled diagram give constructional details of GaAs semiconductor temperature probe.
- d) Describe phase sensitive amplifier with suitable diagram and waveforms.
- e) List the static characteristics of transducer any explain any four.
- f) Draw the block diagram of MIS and state the role of transducer in that diagram.

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

- a) Describe how the unbounded strain gauge can be used for pressure measurement with suitable diagram.
 - b) A platinum RTD has a resistance of 100Ω at 0°C :
 - (i) Find its resistance at 75°C
The co-efficient of temperature is $0.00392 \Omega/\Omega^\circ \text{C}$
 - (ii) If the RTD has resistance 150Ω , Calculate the temperature.
 - c) Describe flow measurement by thermal convection.
 - d) Describe PCO_2 electrode with neat labeled diagram.
 - e) What are motion artifacts? What are the effect of that artifacts?
How it can be reduced?
 - f) Give the advantages of fiber optic sensors. (any eight)
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