

**GUJARAT TECHNOLOGICAL UNIVERSITY****B. E. Sem. - V - Examination – June- 2011****Subject code: 150302****Subject Name: Biomedical Transducers****Date: 22/06/2011****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) Draw block diagram of a generalized instrumentation scheme and explain role of each block. Enumerate any five important performance characteristics relevant to design of transducers. **07**
- (b) Distinguish between active and passive transducers. Give three examples of each type along with their transduction principle and one application **07**
- Q.2** (a) Explain the construction and principle of metallic strain gauge and derive expression for its gauge factor. **07**
- (b) Explain the principle of semiconductor strain gauge. Give an exhaustive comparison between metallic strain gauge and semiconductor strain gauge **07**
- OR
- (b) Explain a quarter bridge circuit using a strain gauge to produce an output voltage in response to applied strain. What is the significance of temperature compensation in such measurement and how can this be accomplished? **07**
- Q.3** (a) Compare three most commonly used temperature transducers with respect to their principle of transduction, material used, temperature range, merits and demerits. **07**
- (b) With the help of a neat circuit diagram, explain the working of a thermometer using a thermistor. What do you understand by self heating of a thermistor and how does it affect temperature measurement? **07**
- OR
- Q.3** (a) Explain the construction and working of LVDT with the help of a neat diagram. Draw the input- output characteristics of LVDT. Mention its advantages and limitations. **07**
- (b) Explain Piezoelectric effect. Enumerate any four piezoelectric materials. Derive expression for output voltage of a piezoelectric crystal in terms of its dimension and applied force. How can sensitivity of piezoelectric transducers be increased? **07**
- Q.4** (a) What do you understand by nuclear radiation? Explain the working of a nuclear radiation detector using ionization principle with the help of a neat diagram. **07**
- (b) Give the salient features and advantages of smart sensors. **07**
- OR
- Q.4** (a) How is an electrode different from a transducer? Draw the equivalent circuit of a twin electrode. Explain the terms: half cell potential, electrode polarization and non-polarizable electrode. **07**

- (b) Enumerate any four medical applications of electrodes. Distinguish between surface electrode and microelectrode from construction and application point of view. **07**
- Q.5** (a) Explain the working of an electromagnetic blood flow meter with the help of a neat diagram. Discuss any four sources of error in such measurement. **07**
- (b) What do you understand by direct blood pressure measurement? Compare catheter tip and catheter end transducers. Enumerate any four transducers used for direct blood pressure measurement. **07**
- OR
- Q.5** (a) Describe the principle of operation and application of an applanation tonometer **07**
- (b) Write a technical paragraph (comprising of 7 to 8 sentences) on the following **07**  
alongwith their medical applications
- i) Fibre optic transducer
  - ii) Elastoresistive transducer

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