

GANPAT UNIVERSITY
B. TECH SEM- III(Biomedical Engineering)
REGULAR EXAMINATION- NOV.-DEC. 2016
2BM302 Biomedical Transducers & Biosensors

TIME: 3 HRS

TOTAL MARKS: 60

- Instructions:** (1) This Question paper has two sections. Attempt each section in separate answer book.
 (2) Figures on right indicate marks.
 (3) Be precise and to the point in answering the descriptive questions.

SECTION: I

- Q.1** (10)
 (a) What is RTD? Give necessary equation, commonly used material as RTD elements and characteristics curve with disadvantages of RTD. (5)
 (b) For voltage divider strain gauge signal conditioning circuit, derive the voltage sensitivity equation $S_e = 1/4 G E$. (5)

OR

- Q. 1** (10)
 (a) Describe the various form of thermistor construction. Discuss thermistor linearizing techniques for narrow range of temperature variation for voltage and current source. (5)
 (b) A blood pressure transducer is constructed using full bridge Wheatstone bridge. The sensitivity of the pressure transducer is $50 \mu V/V/mmHg$. Find the output voltage if the bridge excitation is 10V dc when a blood pressure of 120 mmHg is being measured. If the GF of the strain gauges is 2, calculate the strain on the gauges. (5)

- Q.2** (10)
 (a) Draw equivalent of piezoelectric transducer and derive the expression of its frequency response characteristics. (5)
 (b) What is diaphragm? Explain diaphragm type strain gauge transducer for pressure measurement. (5)

OR

- Q.2** (10)
 (a) Enlist the resistive type displacement transducer principle; also discuss any one principle in detail for displacement measurement. (5)
 (b) A blood pressure transducer is designed using piezoelectric disc of 2.5 mm thick and diameter of 8 mm. If the voltage sensitivity of the crystal is $0.06 V/N/m$, find the output voltage when the systolic pressure is 130mmHg. ($1mmHg = 133.322 N/m^2$) (5)

- Q.3** (10)
 (a) Describe Ultrasonic transduction principles with application and diagram. (3)
 (b) How metal wire type strain gauge is different from metal foil type? Write note on metal foil type strain gauge. (3)
 (c) Distinguish between active and passive types of transducers. (3)
 (d) Define "Poisson's ratio". (1)

SECTION: II

Q.4 (10)

- (a) Describe different types of electrodes used for the measurement of Biopotentials giving neat diagram. (5)
- (b) Discuss Dynamic Performance Characteristics & Reliability Characteristics (5)

OR

Q.4 (10)

- (a) Enumerate and discuss various types of errors (5)
- (b) How $p\text{CO}_2$ can be measured by pH electrode? Explain giving neat diagram. (5)

Q.5 (10)

- (a) Define following terms : (5)
 - (ii) Measurement
 - (iii) Hysteresis
 - (iv) Accuracy
 - (v) Error Band
 - (vi) Signal to Noise Ratio
- (b) If resistivity for a physiological saline liquid is $70\Omega\text{Cm}$. if the tip radius of electrode is $0.5\mu\text{m}$ for a $1\mu\text{m}$ electrode. Calculate R_s (spreading resistance) for $1\mu\text{m}$ electrodes. (3)
- (c) Enumerate the requirement of in vivo biochemical transducer. (2)

OR

Q.5 (10)

- (a) Discuss Electrode – Electrolyte interface. (5)
- (b) Draw basic block diagram for instrumentation system & explain. (5)

Q.6 Answer the following questions. (10)

- (a) Distinguished between bonded and unbonded strain gauge. (4)
- (b) Explain the principle of thermistor by giving the name of material used for thermistor. (3)
- (a) Draw generalized block diagram of instrumentation system and explain the function of each part. (3)

----- END OF PAPER -----