

GANPAT UNIVERSITY
B. TECH SEM- III(Biomedical & Instrumentation Engineering)
REGULAR EXAMINATION- NOV.-DEC. 2015
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

- (a) What is an error in instrument? Give their types and explain their assurance and nature. (10)
 (b) Explain the principle of RTD giving necessary equation. Why Platinum is preferred as RTD element? (5)

OR

Q.1

- (a) What are transduction principles? Give the types of transduction principles and explain any one transduction principles with application and diagram (10)
 (b) Discuss thermistor linearizing techniques for narrow range of temperature variation. Calculate the linearizing resistance for a thermistor probe has the temperature range 35°C to 40°C. Its resistance at 37.5°C is 50k Ω and $\beta=4000K$. (5)

Q.2

- (a) What is Strain Gauge? Enlist the types of strain gauges and explain any one type with diagram. (10)
 (b) Obtain the expression of O/P voltage of a four active arms strain gauge bridge circuit. What are the advantages of using full active arm bridge? (5)

OR

Q.2

- (a) Explain the capacitive displacement transducer principle; also discuss any one principle in detail for displacement measurement. (10)
 (b) A column load cell of 2.5 cm radius has one active strain gauge and dummy strain gauge, each of 120 Ω resistance and gauge factor is 2.17. The strain gauges are connected in a bridge formation with other two arm resistors of 120 Ω each. Determine the bridge O/P voltage for a load of 22240 Nw, when excitation voltage is 10 V DC. Modulus of elasticity is 6.89X10¹⁰ M/m² (5)

Q.3

- (a) Derive the expression of O/P voltage of a piezo crystal in terms of its dimension and applied force. (10)
 (b) Explain the principle of non-contact type infrared thermometer. (3)
 (c) Explain the terms 1) Calibration cycle 2) Accuracy 3) Measurand (3)
 (d) What do you mean by NTC thermistor? (1)

SECTION: II

Q.4 (10)

- (a) Describe the piezo electric phenomenon. Give the advantages and disadvantages of piezo electric transducers. (5)
- (b) Describe working principle and construction of transcutaneous pO₂ sensor. (5)

OR

Q.4 (10)

- (a) Describe fiber optic type catheter tip pressure transducer for direct blood pressure measurement. (5)
- (b) Explain the principle construction, advantages and disadvantages of Thermocouple. (5)

Q.5 (10)

- (a). Describe the indirect method of blood pressure measurement using pressure cuff sensing. (5)
- (b). Draw & Explain different types of electrodes used in Biopotential measurements. (5)

OR

Q.5 (10)

- (a). Draw and describe a catheter end type wire strain gauge type blood pressure transducer for direct pressure measurement of the right atrium. (5)
- (b). Explain ionic transfer across electrode/electrolyte interface. (5)

Q.6 Answer the following questions. (10)

- (a). Write notes on: Polarographic Clark pO₂ sensor. (4)
- (b). Describe the principal of pH measurement of blood. (3)
- (c). Discuss Systolic, Diastolic & Mean blood pressure. (3)

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