GANPAT UNIVERSITY

B. Tech. Semester: III Biomedical & Instrumentation Engineering
Regular Examination November – December 2014
2BM303: Biomedical Transducers & Biosensors

Time: 3 Hours   Total Marks: 70

Instruction:

1. All the questions are compulsory.
2. Answer of each section must be written in separate answer books.
3. Figure to the right indicate marks.
4. Assume data, if needed.
5. Conventional terms / notations are used.

SECTION - I

Que. – 1   **12**

a) Define and describe the error. Based on occurrence and sources give the classification of errors and explain it.

b) Distinguish between Accuracy and Precision. Give the methods prescribing 'accuracy' in terms of specifications.

OR

Que. – 1   **12**

a) What is calibration? For calibration define following terms:
   a) Calibration cycle   b) Static calibration   c) Dynamic calibration

b) What is transduction principle? Give the list of various transduction principles used and explain any one of them with example

Que. – 2   **11**

a) What is thermocouple? How they are formed? Derive the thermoemf equation for thermocouple.

b) How the metal foil strain gauge is differ from metal wire strain gauge? Mention the advantages of metal foil strain gauge.

OR

Que. – 2   **11**

a) Platinum RTD has resistance of 50Ω at 15°C. Calculate the length of platinum wire of diameter 2.0mm. The temperature co-efficient of platinum is $0.0039\Omega/\Omega/°C$ at 0°C. Also find the value of resistance of platinum RTD at 0 °C and 100 °C.

b) Sketch the standard configuration of bonded strain gauge and name its various parts. Also sketch the different Rosette patterns for directional strain sensing.

Que. – 3   Answer any three.   **12**

a) Explain the importance of transducers in the field of Biomedical Engineering?

b) Write short note on RTD PT-100.

c) Describe the merits and demerits of thermistor as temperature sensor.

d) Explain the seeback effect for thermocouple with type of thermocouple and material used for that.

SECTION – II

Que.-4   12

    a) Explain the piezoelectric phenomena. Discuss about various piezoelectric materials and their properties.

    b) Write short note on LVDT.

OR

Que.4   12

    a) A quartz crystal has charge sensitivity $2*10^{-12}$ C/N, and dielectric constant 4.5. Young' modules is $9*10^{10}$ Pa. Calculate its voltage sensitivity.

    b) Explain variable separation type differential capacitance transducers. Obtain the expression of differential voltage sensitivity for it.

Que.5   11

    a) Discuss microbial biosensors.

    b) What are the advantages of floating electrodes? Discuss.

OR

Que.5   11

    a) Explain the principle of clark PO2 electrode giving neat diagram.

    b) Draw and explain different types of microelectrodes.

Que.6   **Answer Any Three.**   12

    a) Discuss merits and demerits of Piezoelectric transducers.

    b) An LVDT output voltage is amplified by an amplifier of 200 gain, When core is displaced 2mm, the output of 5.0mv is obtained on a digital voltmeter, find the sensitivity of LVDT and the whole set up.

    c) Enumerate the requirement of in vivo biochemical transducers.

    d) Define: 1). Biopotential
                   2). Half cell potential
                   3). Non-polarizable electrodes
                   4). Motion artifacts

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