Seat No. : _____

GANPAT UNIVERSITY

B.TECH SEM. III BIOMEDICAL & INSTRUMENTATION ENGINEERING

REGULAR EXAMINATION NOVEMBER / DECEMBER - 2011

2BM303: BIOMEDICAL TRANSDUCERS AND BIOSENSORS

TIME : 3 HOURS **TOTAL MARKS: 70**

INSTRUCTION:

1. Write each section in separate answer books.
2. All questions are compulsory.
3. Draw figures and assume data wherever necessary.
4. Conventional terms / notations are used.
5. Figure to the right indicate marks.

Section – I

Q.1 **[12]**

a) Define transduction principle. Explain reluctive and electromagnetic transduction principles (6)

b) Describe different types of errors in detail (4)

c) Write a note on calibration (2)

OR

Q.1 **[12]**

a) Explain static performance characteristics with figures (6)

b) If a circular shaped quartz crystal having voltage sensitivity of 0.05 V/N/M is used as blood pressure transducer. The piezo-crystal is having thickness of 3mm and diameter 5mm. Calculate the output voltage and surface charge developed when systolic pressure is 120 mm Hg. Note charge sensitivity = 2.3×10^{-12} (4)

c) Explain piezoelectric and electrostriction phenomenon (2)

Q.2 **[11]**

a) Draw equivalent circuit and derive the output voltage (v) expression for piezoelectric transducer $\left|\frac{V}{\Delta t}\right| = k\left(\frac{\tau\omega}{\sqrt{1+\tau^2\omega^2}}\right)$, where Δt denotes thickness deformation (6)

b) Explain in detail about the electrical excitation applied to piezoelectric ultrasonic transducer (5)

OR

Q.2 **[11]**

a) Define gauge factor (G.F.). What is its value for metal and metal alloys? Obtain expression $G.F. = 1 + 2\mu + \frac{\Delta\rho/\rho}{\Delta l/l}$ (5)

b) Obtain the expression and draw circuit for two active arm strain gauge bridge circuit (4)

c) Define: (i) strain (ii) poison's ratio (2)

Q.3 Write shot note on (Any three) [12]

a) Infrared temperature probe
b) Quartz resonator
c) Thermistor sensors and thermistor characteristics
d) Four lead wire RTD bridge circuit

Section – II

Q.4 [12]

a) Explain in detail the working of the LVDT and draw its schematic diagram. Also draw its characteristic curve. (6)
b) Describe any one type of optical encoder used as Angular displacement digital transducer. (3)
c) With the help of neat diagram explain coupled core type inductive displacement transducer (3)

OR

Q.4 [12]

a) Describe the working of variable separation type differential capacitive transducer with figure. Derive the expression for difference of two capacitance ($C_1 - C_2$) (6)
b) Explain capacitive angular displacement transducer with figure. (4)
c) State merits and demerits of capacitive displacement transducers. (2)

Q.5 [11]

a) With the help of neat diagrams describe the needle and wire electrodes used for EMG electrodes (6)
b) Write a note on Thermistor linearization circuit (4)
c) What is electrode offset potential (1)

OR

Q.5 [11]

a) Describe electrode/ electrolytic interface in detail. (6)
b) Draw the temperature variation compensation circuit for cold junction of thermocouple (4)
c) What is effect of motion artifacts in bio-potential measurement (1)

Q.6 Write shot note on (Any three) [12]

a) Micro-electrodes
b) Glucose biosensor
c) Pulse oximeter
d) Ag – Agcl electrode

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