U.S.N.										

B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

May 2023 Semester End Main Examinations

Programme: B.E. **Semester: III**
Branch: Medical Electronics Engineering **Duration: 3 hrs.**
Course Code: 22MD3PCBSM **Max Marks: 100**
Course: Biomedical Sensors and Measurements **Date: 15.05.2023**

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1 a) A second order instrument is subjected to a sinusoidal input undamped natural frequency of 3 Hz and damping ration of 0.5. Calculate amplitude ratio and phase angle for an input frequency of 2Hz. **08**

b) Define Error and classify different types of errors **07**

c) Define following terms **05**
i) Accuracy ii) Precision iii) Linearity
Iv) Dead band v) Drift

UNIT - II

2 a) With the help of neat diagram, explain the following types of active transducers **08**
i) Electro dynamic
ii) Electro magnetic

b) A quartz crystal has charge sensitivity of 2P C/N, dielectic constant 4.5 and Young's modulus 9 $X10^{10}$Pa. Find the voltage sensitivity constant. **06**

c) With relevant diagram explain the working of catheter tip pressure sensor that utilizes stain gauge **06**

UNIT - III

3 a) By employing thermistor, explain how catheter type probe can be used to measure temperature with relevant diagram and equations **10**

b) With relevant diagram explain the working of different types of thermal detectors used for measurement of temperature **10**

OR

4 a) Justify how temperature can be precisely measured using magnetic resonance imaging for deep tissue **06**

b) With help of circuit diagram explain how temperature is measured by employing telemetry technique **08**

c) Briefly discuss how temperature can be measured using P-N junction diode and transistor **06**

UNIT - IV

5	a)	By utilizing Standard Hydrogen Electrode, explain how electrode potential is measured with help of a neat diagram.	**06**
	b)	With help of a neat diagram explain the voltage generated for action potential	**08**
	c)	Briefly discuss about the principle and working of flux magnetometer with relevant diagram.	**06**

OR

6	a)	Explain the different types of artifact that can be seen in ECG recording and also the techniques to minimize them	**06**
	b)	Explain 10-20 electrode placement of EEG recording with a neat diagram.	**08**
	c)	Briefly discuss the electrodes used for EMG measurement.	**06**

UNIT - V

7	a)	With relevant diagram explain the working of ion selective FET	**06**
	b)	By utilizing antigen- antibodies reaction, explain the working of chemical sensor	**08**
	c)	By employing impedance or electrical conductivity, explain how chemical quantities are measured with relevant diagram	**06**

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