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**Presidency University**

**Bengaluru**

**SCHOOL OF ENGINEERING**

**SUMMER TERM** **END TERM EXAMINATION AUG-2024**

**Summer Term** : End Term

**Course Code**: ECE3034

**Course Name**: Biomedical Instrumentation

**Program & Sem**: B.Tech

**Date**: 05/AUG/2024

**Time**: 09:30 AM – 12:30 PM

**Max Marks**: 100

**Weightage**: 50%

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*
3. *Any tables/Chart/Graph or data books required, pl. mention here.*

**Part A [Memory Recall Questions]**

**Answer any 3 Questions. Each question carries 5 marks. (3Qx 5M= 15M)**

1. Transducers are devices that convert variations in physical quantity which is non-electrical. Describe the classification of Transducers giving examples for each. (C.O.No.1) [Comprehension]
2. The electromagnetic flowmeter uses Faraday's Law of electromagnetic induction to measure the process flow. Describe the working principle of Magnetic Blood Flow Rate Meter with the help of neat schematic diagram. (C.O.No.2) [Comprehension]
3. ECG is recorded between the single exploratory electrode and the central terminal. What is the Einthoven Triangle? Illustrate the concept of measurement details of ECG signal using Standard Limb Leads (Bipolar): I, II & III. (C.O.No.3) [Comprehension]
4. Medical x-rays are used to generate images of tissues and structures inside the body. What are X-rays and what are their properties? Explain the basis of diagnostic radiology with the help of a diagram. (C.O.No.4) [Comprehension]
5. The circulatory system is made up of blood vessels that carry blood away from and towards the heart. With a neat schematic diagram explain the Blood Circulation system, also illustrate the use of an Oximeter. (C.O.No.4) [Comprehension]

**Part B [Thought Provoking Questions]**

**Answer any 2 Questions. Each question carries 20 marks. (2Qx20M=40M)**

1. A piezoelectric transducer (also known as a piezoelectric sensor) is a device that uses the piezoelectric effect to measure changes in acceleration, pressure, strain, temperature, or force by converting this energy into an electrical charge. With the help of derivation illustrate how to calculate output voltage. (C.O.No.1) [Comprehension]
2. A sphygmomanometer, also known as a blood pressure monitor, is a medical device used to measure blood pressure. The pressure at which Korotkoff sounds start and stops are observed to note the pressures. Describe the procedure of the sphygmomanometer method of arterial blood pressure measurement.(C.O.No.2) [Comprehension]
3. In medical imaging, MRIs (magnetic resonance imaging) use radio waves and CT (computed tomography) scans use X-rays. What is MRI? Explain the technique with the help of a diagram. (C.O.No.4) [Comprehension]

**Part C [Problem Solving Questions]**

**Answer any 3 Questions. Each question carries 15 marks. (3Qx15M=45M)**

1. A typical ECG has three almost immediately distinguishable waves or deflections. Describe the basic waveform of the normal electrocardiogram indicating the depolarization and repolarization of the atria and ventricles.

In a certain measurement of ECG using bipolar electrodes, the following potentials were observed. Find the lead voltages developed. Verify Einthoven's Law. (C.O. No. 3) [Application]

* + 1. The right arm = -0.2 mV
    2. The left arm = 0.3 mV
    3. The left leg = 1 Mv

1. Brain waves are oscillating electrical voltages in the brain measuring just a few millionths of a volt. Describe the different brain waves, also describe the building blocks of the Block Diagram of Electroencephalograph. (C.O.No.3) [Application]
2. Ultrasound imaging (sonography) uses high-frequency sound waves to view the inside of the body.  Define ‘Resolution’ concerning ultrasound systems. What are the two types of resolution in an ultrasound system? Explain them. A 3 cm diameter transducer, excited at 1 MHz is used in water. The velocity of sound in water is 1480 m/s. How much does the near field extend to? What is the semi-divergence angle? (C.O.No.4) [Application]
3. MRI is an application of NMR (nuclear magnetic resonance). Explain the principle of nuclear magnetic imaging systems with the help of appropriate illustrations. Draw the Schematic diagram of an MRI scanner. (C.O.No.4) [Application]