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BE-513: Biomedical Electronics

Course Objectives:

This course aims to enable the students to analyse a problem from both an engineering and biological perspective; apply the concepts of Biomedical Electronics, its principles and technologies to provide a wide range of possible approaches to solutions.

Course Outcomes/ Learning:

- Identify, formulate, and solve multi-disciplinary problems in the area of biomedical engineering by applying principles and technologies learned in BE-513.
- Design a system, component, or process, and synthesise solutions to achieve desired needs for solving a problem in biomedical engineering.
- Acquire and apply new knowledge as needed to work in the area of biomedical engineering.

Approach:

- Class lectures and discussion.
- Case study presentations.
- Individual and group assignments.

Syllabus:

Physiological systems and Signals: Biology of the heart, circulatory and respiratory systems, auditory systems, physiology of nerve and muscle cells, fundamental organization of brain and spinal cord. Biosignals: Origin of bioelectric signals, electrocardiogram (ECG), phonocardiogram (PCG), encephalogram (EEG) and electromyogram (EMG).

Physiological Transducers: Electrodes: silver-silver chloride electrodes, electrodes for ECG, EEG, EMG, Microelectrodes. Performance characteristics of transducers, classification of transducers based on Electrical principle involved: Resistive position transducer, resistive pressure transducer, inductive pressure transducer, capacitive pressure transducer; Self generating inductive transducer: linear variable differential transformer (LVDT), Piezoelectric Transducer.

Recording Systems: Preamplifier, Signal conditioning: Differential amplifier, current to voltage converter, instrumentation amplifier; biomedical filters: LPF, HPF, bandpass, band stop (Notch filter); source of noise in low level measurement, Recording systems for ECG, PCG, EEG and EMG.

Medical Imaging Systems: X-ray imaging, Computed tomography, ultrasonic imaging systems, Magnetic resonance imaging system, thermal imaging systems. Therapeutic equipments: Cardiac pacemaker, cardiac defibrillators, haemodylysis machine.

Text/ Reference Books:

1. L. Cromwell, F. J. Weibell, E.A. Pfeeiffer. “Biomedical Instrumentation and Measurement” Pearson Education, 2003

2. R.S. Khandpur, “Handbook of Biomedical Instrumentation” TATA McGRAW HILL, 2005 3. J. Enderle, S. Blanchard, J. Bronzino. ”Introduction to Biomedical Engineering” Academic Press, 2000