

# 20VL027 - VLSI CIRCUITS FOR BIOMEDICAL APPLICATIONS

**Course objectives:** The course has the following objectives:

- To introduce an fundamental of transducers as applicable to physiology
- To explore the human body parameter measurements setups
- To make the students understand the basic concepts of Bio-potential Recording Systems.

**Course Outcomes:** The student will be able to

CO1: Understand the physiology of biomedical system

CO2: Apply knowledge of engineering and science to understand the principle of biomedical electronic circuits.

CO3: Understand how to apply, measure circuit performance, and solve problems in the areas of biomedical signals.

CO4: Investigate new developments in biomedical

## UNIT1

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 spinalcord.

## UNIT2

Biosignals: Origin of bioelectric signals, electrocardiogram (ECG), phonocardiogram (PCG), encephalogram (EEG) and electromyogram (EMG). Spectral characteristic of biosignals.

## UNIT 3

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. Transducers for body temp measurement, photoelectric transducers, pH measurement.

## UNIT4

Recording Systems: Preamplifier, Signal conditioning: Differential amplifier, current to voltage converter, instrumentation amplifier; biomedical filters: LPF, HPF, bandpass, band stop (Notch filter); 4-20ma transmitter, source of noise in low level measurement, Recording systems for ECG, PCG, EEG andEMG.

## UNIT5

Therapeutic equipments: Cardiac pacemaker, cardiac defibrillators, haemodylysis machine, lithotistsptors, ventilators, bionic ear.

LAB: According to theory (please include some experiments)

## 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