

# GUJARAT TECHNOLOGICAL UNIVERSITY

## M.E. Bio-Medical Engineering

### Semester: I

Subject Name: **Bio-Signal Processing (Major Elective – I)**

Sr.No	Course content
1.	Signal conversion: Sampling basics, simple signal conversion system, conversion requirements for biomedical signals, signal conversion circuits. Basics of digital filters: Digital filters, the z transform,
2.	Elements of digital filters, types of digital filters, Transfer function of a differential equation, Z-plane pole zero plot. The rubber membrane concept.
3.	Finite impulse response. Filters Characteristics, Smoothing Filters, Notch Filters, Derivatives, window design, Frequency sampling minimax design. Infinite impulse response filters : Generic equation of HR filter simple one pole example, integrator, Design method of two pole filters, HR. filter for ECG Analysis.
4.	Integer filter: Basic Design Concept, LP, HP BP and Band reject filters, The effects of filter cascades, Other applications of adaptive filtering. Adaptive filters: Principle of noise canceler model, 60 Hz adaptive canceling using a sine wave model, other applications of adaptive filtering.
5.	Signal Averaging: Basics of Signal Averaging, Signal averaging as a digital filter, a typical averager, software for signal averaging, limitations of signal averaging. Data reduction techniques:
6.	Turning point algorithm, AXEC algorithm, CORTES, Fan algorithm, Huffman algorithm.
7.	ECG QRS Detection: Power spectrum of ECG, Bandpass filtering Techniques, Differentiation techniques, Template matching techniques, QRS detection algorithm.
8.	ECG Analysis System: ECG interpretation, ST segment analyzer, portable arrhythmia monitor,

### Reference Books:

1. Biomedical Signal processing, Tompkins, PHI (2009)
2. Biomedical Signal Analysis, A Case Study Approach by Rangaraj M. Rangayyan, IEEE Press Series on Biomedical Engineering, John Wiley & Sons, INC.
3. Digital Signal Processing: Principles, Algorithms and Applications - John G. Proakis Dimitris K Manolakis ,PHI (3rd Edition)
4. Discrete-Time Signal Processing - Alan V. Oppenheim, (2nd Edition) PHI