

PBM6I101 BIOMEDICAL SIGNAL PROCESSING

Module I (15 Hours)

Bio-Medical signals: The nature of bio-medical signals, Examples of biomedical signals: Action potential, Electroneurogram (ENG), Electromyogram (EMG), Electrocardiogram (ECG), Electroencephalogram (EEG), Event related potentials (ERPs), Electrogastrogram

(EGG), Phonocardiogram (PCG), Carotid pulse (CP), Vibromyogram (VMG),

Vibroarthrogram (VAG), Speech signals,

Objectives of biomedical signal analysis, Difficulties in biomedical signal analysis, Computer – aided Diagnosis.

Sources of Artifacts: Physiological Interference, Stationary Verses Non-Stationary Processes, High Frequency Noise in ECG, Motion Artifacts in ECG, Power Line

Interference in ECG, Maternal Interference in fetal ECG, Muscle Contraction Interference in VAG Signals.

(Text Book – I – Chapter 1& 3)

Module II (12 Hours)

Concurrent Couples & Correlated Processes:

Problem Statement, Illustration of the problem with case studies: The ECG & PCG, The

PCG & Carotid Pulse, The ECG & Atrial Electrogram, Cardio-Respiratory Interaction,

The EMG & Vibromyogram, The Knee Joint and muscle vibration signals, Applications: Segmentation of the PCG.

Removal of Artifacts: Adaptive Noise Canceller, Cancellation of 60 Hz (power line) interference in ECG, Canceling Donor-Heart Interference in Heart Transplant ECG,

Cancellation of ECG signal from the electrical activity of chest muscle.

(Text Book – I – Chapter 2 & Text Book – II – Chapter 6)

Module III (13 Hours)

Removal of Artifacts: Canceling of Maternal ECG in fetal ECG, Cancellation of High Frequency noise in Electro-surgery.

Event Detection:

Problem Statement, The PQRS & T waves in ECG, First & Second Heart Sounds, EEG Rhythms, waves and transients. Derivative Methods for QRS Detection, The Pan-Tompkins Algorithm for QRS detection, Detection of the Dicrotic Notch, Detection of P wave. Applications: ECG rhythm Analysis, Identification of heart sounds, Detection of Aortic components of second heart sounds

(Text Book – II – Chapter 6 & Text Book – I : Chapter 4)

Text Books:

1. Biomedical Signal Analysis – A case Study Approach- Rangaraj M. Rangayyan – John Willey & Sons Inc-2002.
2. Biomedical Signal processing – Principles & Techniques – D.C Reddy – Tata McGraw Hill Companies – 2005

BIOMEDICAL SIGNAL PROCESSING LAB

1. Display of Static and Moving ECG
2. Detection of QRS complex
3. Auto-Correlation and Cross-Correlation of ECG signals
4. Convolution of 2 signals
5. Reduction of ECG signal using Turning Point algorithm
6. Reduction of ECG signal using AZTEC algorithm
7. Reduction of ECG signal using ADM coding
8. Reduction of ECG signal using SAPA algorithm
9. Adaptive filtering of corrupted ECG signal

10. DCT and IDCT of ECG signal
11. Down sampling of ECG signal
12. Up sampling of bio-medical signals
13. FFT and IFFT of ECG signals
14. LPF and HPF of ECG signals
15. Frequency response and phase response of FIR filter using KAISER window method