

EC416 BIOMEDICAL SIGNAL PROCESSING
(Dept. Elective - V)

Course Description and Objectives:

This course will introduce the students' fundamental concepts of Biomedical signals, properties and its digital processing for identification of diseases. Students will learn DFT, FFT, Filtering Techniques, ECG, EEG and its analysis.

Course Outcomes:

Upon successful completion of this course, students should be able to:

- Analyze the signals using DFT and FFT
- Develop the filters for processing biomedical signals
- Understand the ECG signal and its characteristics
- Understand the EEG signal and its characteristics
- Analyze the ECG and EEG signals for diagnosis purpose

UNIT I - Simple signal conversion systems :

conversion requirement for biomedical signals – signal conversion circuits. Discrete Fourier Transform (DFT) – Properties – circular and sectioned convolution – Filtering long duration sequences - FFT computation using DIT and DIF algorithms.

UNIT II – FIR and IIR design :

Windowing techniques – Need and choice of Windows – Linear phase characteristics. IIR design: Analog filter design –Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation– Warping, prewarping – Frequency transformation.

UNIT III - Adaptive filters :

Principle noise canceller model – 50 Hz adaptive cancelling using a sine wave model – Maternal ECG cancellation in fetal electrocardiography – ECG cancellation in EMG recording – High frequency noise cancellation in Electro surgery. Signal averaging – Basics and limitations.

UNIT IV - EEG Signal Characteristics :

EEG analysis - time and frequency domain methods – Parametric model – Phenomenological model–linear prediction theory – Autoregressive method.

UNIT V - ECG QRS Detection Techniques :

Estimation of R-R interval – Estimation of ST segment inclination – Arrhythmia analysis monitoring – Long term ECG recording – Basics of ECG data reduction techniques.

TEXT BOOKS :

1. P.Ramesh Babu, "Digital Signal Processing", Second Edition, Scitech publications, Chennai, 2003 (UNITS I & II)
2. DC Reddy, Biomedical Signal Processing – Principles and Techniques, Tata McGraw Hill Publishing company Ltd., 2005 (UNITS III,IV & V)

REFERENCES :

1. Willis J.Tompkins, Biomedical Digital signal processing, Prentice Hall of India Pvt. Ltd., 2000
2. Biomedical Signal Analysis A case study approach by Rangaraj M.Rangayyan, John Wiley publications.
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