BIOMEDICAL SIGNAL AND IMAGE PROCESSING
(Core Subject)

Course Code:	15M1WEC231	Semester:	2th Semester, M. Tech (ECE)
Credits:	3	Contact Hours:	L-3, T-0, P-0

Course Objectives

The objectives are to:

1. Introduce various bioelectric signals and medical imaging modalities.
2. Implementation of different signal and image processing techniques on the acquired biomedical signals and images.

Course Outcomes

After studying this course the students would gain enough knowledge

1. Able to understand different types of bioelectric signals and their acquisition from human body.
2. Able to understand different types of medical imaging modalities and would be able to differentiate them with respect to their advantages and limitations.
3. Acquire an ability to analyze and process bioelectric signals.
4. Acquire an ability to analyze and process medical images.
5. Understand different feature extraction techniques and classifiers used for image classification.

Course Contents

Unit	Topics	References (chapter number, page no. etc)	Lectures
1.	Bioelectric signals: Electrical activities of the cell and propagation of electric potential as a wave, Acquisition of bioelectric signals, Electrocardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), other biomedical signals: blood pressure, blood flow, Electrooculogram, respiratory signals, and ERG.	Kayvan: Chapter 8-12	12
2.	Medical Imaging modalities: Working principle, application and limitation of Computed tomography (CT), X-ray, Magnetic resonance imaging (MRI) , Ultrasound imaging, and Positron emission tomography (PET).	Kayvan: Chapter 13-17	8
3	Digital Signal Processing: Introduction to processing and transformation of signals, Data Acquisition: Sampling in time, aliasing,	Kayvan: Chapter 1-2 Tamal: Chapter 1-2	10

	interpolation, and quantization, Difference equations, FIR and IIR filters, basic properties of discrete-time systems, convolution, Discrete-time Fourier transform and its properties. FIR filter design using windows, discrete Fourier transform and its properties, fast Fourier transform (FFT), Sampling and aliasing in time and frequency, spectral analysis.		
4	Image Processing I: Extension of filtering and Fourier methods to 2-D signals and systems, Image enhancement and restoration, Edge Detection and Image Segmentation Techniques.	Kayvan: Chapter 3-4	10
5	Image Processing II: Introduction to feature extraction techniques, Clustering and classification of images.	Kayvan: Chapter 7	5
		Total Number of Lectures	45

Evaluation Scheme

1. Test 1 : 15 marks
2. Test 2 : 25 marks
3. Test 3 : 35 marks
4. **Internal Assessment** : 25 marks
   - 10 Marks : Class performance, Tutorials & Assignments
   - 10 Marks : Quizzes
   - 5 marks : Attendance

Text Books

1. Kayvan Najarian, Robert Splinter: Biomedical Signal and Image Processing. CRC Press, 2012

2. Tamal Bose: Digital Signal and Image Processing. John Wiley & Sons, 2004

Reference Books

1. Biomedical Image Analysis, Rangaraj M. Rangayyan, CRC Press, New York

2. Digital Image Processing, RC Gonzalez & RE Woods, Pearson Publishers, Third Edition