PVP-19

BIOMEDICAL SIGNAL PROCESSING

Course Code	19EC4702B	**Year**	IV	**Semester**	I
Course Category	Program Elective-V	**Branch**	ECE	**Course Type**	Theory
Credits	3	**L-T-P**	3-0-0	**Prerequisites**	Nil
Continuous Internal Evaluation:	30	**Semester End Evaluation:**	70	**Total Marks:**	100

Course Outcomes	
Upon successful completion of the course, the student will be able to	
CO1	Analyse ECG, EEG, EMG and PCG waveforms by applying signal processing, reduction and filtering techniques (L4).
CO2	Analyse ECG, EEG, EMG and PCG signals using data acquisition, Data Reduction methods (L4).
CO3	Determine the disorders related to Neurological Advanced Signal processing techniques & Modelling of Biomedical Systems by using advanced signal processing techniques (L5).
CO4	Evaluate the medical signals by using advanced techniques (L5).
CO5	Analyse the various data compression methods (L4)

Mapping of course outcomes with Program outcomes (CO/ PO/PSO Matrix)

Note: 1- Weak correlation 2-Medium correlation 3-Strong correlation

* - Average value indicates course correlation strength with mapped PO

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2		3					2		2	3
CO2	3	3	3	2		3					2		2	3
CO3	3	3	3	2		3					2		2	3
CO4	3	3	3	2		3					2		2	3
CO5	3	3	3	2		3					2		2	3
Average* (Rounded to nearest integer)	3	3	3	2		3					2		2	3

Syllabus		
Unit No.	**Contents**	**Mapped CO**
I	**Introduction to Biomedical signals:** Bio-signal Characteristics of Electro Cardiogram (ECG), Electroencephalogram (EEG), Electromyogram (EMG), Phonocardiogram (PCG), Objectives of Biomedical signal analysis, Difficulties in Biomedical signal analysis, Computer-aided diagnosis	CO1 ,CO4
II	**ECG Signal Processing:** ECG data acquisition, ECG lead system, ECG parameters and their estimation, ECG QRS detection techniques: Template matching, differentiation based QRS detection techniques. Estimation of R-R Interval: Finite first difference method. The use of multi-scale analysis for parameter estimation of ECG waveforms, Arrhythmia analysis monitoring, long term continuous ECG recording	CO1,CO2, CO4

III	**ECG Data Reduction Techniques***:* Direct data compression techniques, direct ECG data compression techniques: Turing point algorithm, AZTEC algorithm and FAN algorithm, other data compression techniques: data compression by DPCM, data compression method comparison.	CO1,CO2, CO4,CO5
IV	**Neurological applications:** EEG rhythms & waveforms, EEG applications- Epilepsy, sleep disorders, brain computer interface. Modeling EEG- linear, stochastic models - Nonlinear modeling of EEG - artifacts in EEG & their characteristics and processing – Nonparametric spectral analysis, Model based spectral analysis - EEG segmentation - Joint Time-Frequency analysis - correlation analysis of EEG channels -coherence analysis of EEG channels. Evoked potentials- noise characteristics, Noise reduction by linear filtering.	CO1,CO3, CO4
V	**Advanced Signal processing techniques & Modeling of Biomedical Systems:** Optimal Signal Processing: Wiener Filters, Adaptive Signal Processing, Adaptive Noise Cancellation. Parametric system modeling, Autoregressive or All-Pole modeling, Pole-Zero Modeling.	CO1,CO3, CO4

Learning Resources
Text Books
1. Rangaraj M Rangayyan ,"Biomedical Signal Analysis" –, IEEE Press, 2001 2. Biomedical Digital Signal Processing – Willis J Tomkins, PHI, 1993
Reference Books
1. Biomedical Digital Signal Processing Principles and Techniques-D C Reddy, TMH, 2005
e- Resources & other digital material
1. http://www.biomedicahelp.altervista.org › Segnali 2.https://www.digimat.in/nptel/courses/video/108105101/L12.html