PRINCIPLES OF SIGNALS AND SYSTEMS

VI Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AEEC26	Elective	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

Prerequisite: Mathematical Transform Techniques, Control Systems

I. COURSE OVERVIEW:

This course integrates the basic concepts of both continuous and discrete time signals and systems. It covers the linear time invariant systems and their analysis in time and frequency domain, mathematical tools, correlation and convolution of signals, sampling techniques. It provides the necessary background needed for understanding the signal processing and communications.

II. COURSE OBJECTIVES:

The students will try to learn:

I The representation, classification and analysis of continuous, discrete time signals in time and frequency domains.

II The Fourier transform, Laplace and Z- transforms and their properties toanalyze the signals and systems

III The temporal and spectral characteristics of Random process and the extraction of Signal from noise by filtering.

IV The signal processing concepts to analyze signals from diverse informationsources such as audio, image, medical, and remote sensing.

III. COURSE OUTCOMES:

After successful completion of the course, students should be able to:

CO 1	**Describe** the concept of signals and signal properties forperforming mathematical operations on signals.	Understand
CO 2	**Make use of** Fourier transforms for calculating spectral characteristics of periodic and periodic signals.	Apply
CO 3	**Utilize** the concept of convolution and correlation to determinethe response of an LTI system.	Apply
CO 4	**Illustrate** the ideal low pass, high pass, band pass, ban stop filters for obtaining the behavior of linear time in varinat system.	Understand
CO 5	**Describe** the linear time invariant systems using linear constant coefficient differential equations and their impulse response.	Apply
CO 6	**Compute** discrete Fourier transform and inverse discrete Fourier transform of a discrete signal using fast Fourier transform algorithms.	Apply

IV. COURSE SYLLABUS:

MODULE – I: SIGNAL ANALYSIS (09)

Signal Analysis: Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonally in Complex functions, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

MODULE – II: FOURIER TRANSFORM (09)

Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform

MODULE – III: SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS (09)

Linear System, Impulse response, Response of a Linear System, Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI system, Filter characteristics of Linear Systems, Distortion less transmission through a system, Signal bandwidth, System bandwidth, Ideal LPF, HPF and BPF characteristics

Convolution and Correlation of Signals: Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution, Convolution property of Fourier Transforms, Cross Correlation and Auto Correlation of functions, Properties of Correlation function, Relation between Convolution and Correlation.

MODULE- IV: INTRODUCTION TO DIGITAL SIGNAL PROCESSING (09)

Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems

MODULE- V: FAST FOURIER TRANSFORMS (09)

Fast Fourier transforms (FFT) - Radix-2 decimation-in-time and decimation-in-frequency FPT Algorithms, Inverse FFT and FFT with general Radix-N

V. TEXT BOOKS:

1. B.P. Lathi, "Signals, Systems & Communications", BS Publications, 2009.
2. A.V. Oppenheim, A.S. Willsky and S.H. Nawab, "Signals and Systems", PHI, 2nd Edition 2009.
3. John G. Proakis, Dimitris G. Manolakis, "Digital Signal Processing, Principles, Algorithms, and Applications" Pearson Education / PHI. 2007.

VI. REFERENCE BOOKS:

1. Simon Haykin and Van Veen, "Signals & Systems" Wiley, 2nd Edition, 2009.
2. Iyer and K. Satya Prasad, "Signals and Signals", Cengage Learning, 2nd Edition, 2009.
3. A. V. Oppenheim and R.W. Schaffer, "Discrete Time Signal Processing", PHI, 2009.
4. Loney Ludeman. John Wiley, "Fundamentals of Digital Signal Processing" PHI, 2009

VII. WEB REFERENCES:

1. https://www.edx.org/course/discrete-time-signal-processing-mitx-6-341x-1
2. https://www.mooc-list.com/course/digital-signal-processing-coursera

VIII. E-TEXT BOOKS:

1. http://onlinevideolecture.com/ebooks
2. http://www.freebookcentre.net/SpecialCat/Free-Signal-Processing-Boo