SIGNALS AND SYSTEMS

IV Semester: ECE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AECB14	Core	3	-	-	3	30	70	100
Contact Classes: 45	Tutorial Classes: Nil	Practical Classes: Nil				Total Classes: 45		

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, mathe- matical tools, correlation and convolution of signals, sampling techniques. It provides the necessary background needed for understanding the signal processing and communications.

II. OBJECTIVES:

The course should enable the students to:

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 to analyze the signals and systems

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

IV The sampling, quantization and reconstruction requirements for digital signalprocessing applications

III. COURSE OUTCOMES:

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

CO 1	**Describe** the concept of signals and signal properties for performing mathematical operations on signals.	Understand
CO 2	**Make use of** Fourier series and Fourier transforms for calculating spectral characteristics of periodic and periodic signals.	Apply
CO 3	**Utilize** the concept of convolution and correlation to determine theresponse of an LTI system.	Apply
CO 4	**Classify** the ideal lowpass, high pass, band pass, ban stop filters forobtaining the behavior` of linear time invariant system.	Remember
CO 5	**Apply** the Laplace and Z-transforms. for analyzing the frequency domain representation of continuous and discrete time signals and systems respectively	Apply
CO 6	**Demonstrate** the procedure for sampling and reconstruction of band limited signals by using various sampling techniques.	Understand

IV. SYLLABUS:

MODULE - I	SIGNAL ANALYSIS	Classes: 08

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

MODULE - II	FOURIER SERIES	Classes: 10

Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

Fourier Transforms:
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, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transforms.

MODULE - III	SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS	Classes: 10

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 characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics.

Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

MODULE - IV	LAPLACE TRANSFORM AND Z-TRANSFORM	Classes: 08

Laplace Transforms
Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis. **Z–Transforms** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

MODULE - V	SAMPLING THEOREM	Classes: 09

Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling. **Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

Text Books:

1. B.P. Lathi, “Signals, Systems & Communications”, BSP, 2013.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Edition 2010.

Reference Books:

1. Simon Haykin and Van Veen, “Signals and Systems” , Wiley Publications, 2nd Edition, 2010.
2. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.

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

E-Text Books:

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