INSTITUTE OF AERONAUTICAL ENGINEERING
(Autonomous)
Dundigal - 500 043, Hyderabad, Telangana

COURSE CONTENT

PRINCIPLES OF SIGNALS AND SYSTEMS								
VI Semester: ECE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
AECD43	**Open Elective**	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		3	-	-	3	40	60	100
Contact Classes: 48	**Tutorial Classes: Nil**	**Practical Classes: Nil**				**Total Classes: 48**		
Prerequisite: Electrical Circuits								

I. COURSE OVERVIEW:
This course typically covers the analysis of signals in time and frequency domains, including Fourier analysis and transforms. It also explores into the properties of linear time-invariant systems, such as convolution, stability, and causality. Students learn techniques for system modeling, analysis, and design, essential for various applications in communication, control, and signal processing domains.

II. COURSES 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 temporal and spectral characteristics of signal and the extraction of Signal from noise by filtering
III. The sampling, quantization and reconstruction requirements for digital signal processing applications
IV. FFT algorithm in various domains, including digital signal processing, telecommunications, image processing.

III. COURSE OUTCOMES:
At the end of the course students should be able to:

CO 1 Utilize orthogonal spaces for efficient approximation, processing and manipulating signals accurately.
CO 2 Make use of Fourier series and Fourier transforms for calculating spectral characteristics of periodic and aperiodic signals.
CO 3 Explore the fundamentals of linear systems enabling them to analyze and design filters for distortion-free signal processing, considering bandwidth constraints.
CO 4 Utilize the concept of convolution and correlation to determine the response of an LTI system for different signals.
CO 5 Model systems through difference equations and their frequency domain representations for translate continuous signals to discrete form
CO 6 Apply FFT algorithms including Radix-n decimation-in-time and decimation-in-frequency, applying them to analyze signals and systems efficiently across various domains.

IV. COURSE CONTENT:

MODULE - I: SIGNAL ANALYSIS (09)

Signal Analysis: 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 TRANSFORMS (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. Nawabi, “Signals and Systems”, 2nd Edition 2010.
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.

VII. ELECTRONICS RESOURCES:

1. NPTEL :: Electrical , Electronics and Communication: Signals and Systems
2. NPTEL :: Electronics and Communication: Principles of Signals and Systems
3. NPTEL :: Electrical , Electronics and Communication: Electrical circuits.

VIII. MATERIALS ONLINE

1. Course template
2. Tutorial question bank
3. Tech talk topics
4. Open end experiments
5. Definitions and terminology
6. Assignments
7. Model question paper – I
8. Model question paper - II

9. Lecture notes
10. E-learning readiness videos (ELRV)
11. Power point presentation