



MARRI LAXMAN REDDY INSTITUTE OF TECHNOLOGY AND MANAGEMENT

(AN AUTONOMOUS INSTITUTION)

(Approved by AICTE, New Delhi & Affiliated to JNTUH, Hyderabad)

Accredited by NAAC with 'A' Grade & Recognized Under Section 2(f) & 12(B) of the UGC act, 1956

COURSE CONTENT

SIGNALS AND SYSTEMS								
III Semester: ECE								
Course Code	Category	Hours / Week			Credits	Maximum Marks		
2530402	Core	L	T	P	C	CIA	SEE	Total
		3	0	0	3	40	60	100
Contact Classes: 44	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 44			
Prerequisites: knowledge on signals and systems								

Course Overview:

This syllabus covers fundamental concepts in signal analysis and system behavior, including Fourier, Laplace, and Z-transforms. It explores signal representation, transmission through linear systems, and filtering techniques. Emphasis is also placed on sampling theory, signal reconstruction, and correlation methods for signal detection.

Course Objectives:

The students will try to learn

- Mathematical foundations of signal representation using orthogonal functions and to classify different types of signals and systems.
- Fourier series and Fourier transform for analyzing periodic and non-periodic signals in the frequency domain.
- Behavior of linear systems and their response to various signals, emphasizing the concept of convolution and filtering.
- Laplace transforms and correlation techniques for system analysis, signal detection, and spectral analysis.
- Principles of signal sampling and the application of Z-transforms in analyzing discrete-time systems.

Course Outcomes:

After successful completion of the course, students shall be able to

- Represent and approximate signals using orthogonal functions and identify different classes of signals and systems.
- Analyze signals in the frequency domain using Fourier series and Fourier transforms, including their properties and applications.
- Determine the output of linear systems using convolution and understand system characteristics like bandwidth and distortion.
- Apply Laplace transforms and correlation methods for system analysis, energy/power spectral estimation, and signal detection in noise.
- Understand sampling concepts and apply Z-transform techniques for analyzing and reconstructing discrete-time signals and systems.

Module – I: Signal Analysis**8L**

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

Module – II: Fourier series, Fourier Transforms**9L**

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

Fourier Transforms: Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal and standard signals, Fourier Spectrum, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Introduction to Hilbert Transform.

Module – III: Signal Transmission through Linear Systems**9L**

Classification of systems: Linear Time Invariant (LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Impulse response, Response of a Linear System, Concept of convolution, Graphical representation of Convolution, 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.

Module – IV: Laplace Transforms, Correlation**10L**

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 standard signals.

Correlation: Auto Correlation and Cross Correlation Functions, Relation between Convolution and Correlation, Properties of Correlation Functions, Energy Density Spectrum, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Parseval's Theorem.

Module – V: Sampling theorem, Z-Transforms**8L**

Sampling theorem: Graphical and analytical proof of Sampling Theorem for Base band/Band Limited Signals, Types of Sampling: Impulse Sampling, Natural and Flattop Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing,

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.

TEXT BOOKS:

1. Signals, Systems & Communications -B.P. Lathi, BS Publications.
2. Signals and Systems-A. Anand Kumar, PHI, 2nd edition, 2010.

REFERENCES:

1. Signals and Systems – Allan. V. Oppenheim, Allan. S. Will sky with S. Hamid. Nawab, 2nd Ed. Pearson

2. Signals and Systems–Simon Haykin, Barry Van Veen, 2nd Ed., Wiley.
3. Signals and Systems – A. Rama Krishna Rao, 2008, TMH.

REFERENCE LINK:

1. <https://nptel.ac.in/courses/117/104/117104074/>
2. <https://www.nptelprep.in/courses/117104074/videos>
3. <https://www.youtube.com/watch?v=M0mx8S05v60>
4. <https://www.youtube.com/watch?v=jNebPEW3ZNU>
5. https://www.youtube.com/watch?v=s8rsR_TStA

MATERIALS ONLINE:

1. Course template
2. Tutorial question bank
3. Tech Talk and Concept Video topics
4. Open-ended experiments
5. Definitions and terminology
6. Assignments
7. Model question paper–I
8. Model question paper–II
9. Lecture notes
10. Drshya Siksha Sangrah Videos(DSSV)