III Year II Semester	**L**	**T**	**P**	**C**
Code: 20EC6706	**3**	**1**	**0**	**4**

INTRODUCTION TO SIGNALS & SYSTEMS

Course Objectives:

1. Understand the fundamental characteristics of signals and systems.
2. Analyze continuous time signals in the time/frequency-domain using Fourier series and Fourier transforms.
3. Characterize the linear time invariant systems in time and frequency domain.
4. Development of the mathematical skills to solve problems involving convolution, correlation, filtering and sampling.
5. Analyze the signals with Laplace and Z -Transform.

UNIT- I: 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, orthogonality in complex functions. Classification of signals and systems, exponential and sinusoidal signals, concepts of impulse function, unit step function, signum function.

UNIT-II: FOURIER SERIES AND FOURIER TRANSFORM:

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

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.

UNIT-III: SIGNAL TRANSMISSION THROUGH LINEAR SYSTEMS:

Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant (LTV) system, Transfer functions of 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.

UNIT-IV: SAMPLING THEOREM:

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.

UNIT-V: LAPLACE TRANSFORM AND Z-TRANSFORM:

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.

Course Outcomes:

A student who successfully fulfils this course requirement will be able to:

S. No	Course Outcome	BTL
1.	Apply the knowledge of linear algebra topics like vector space, basis, dimension, inner product, norm and orthogonal basis to signals.	L3
2.	Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis.	L4
3.	Classify systems based on their properties and determine the response of LTI system using convolution.	L2
4.	Interpret the process of sampling and the effects of under sampling.	L2
5.	Understand and apply the Laplace transform and Z- transform to the analysis of continuous-time and discrete-time signals respectively.	L3

Correlation of Cos with Pos & PSOs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO 2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
CO 3	3	2	-	-	-	-	-	-	-	-	-	-	3	-
CO 4	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 5	3	2	-	-	-	-	-	-	-	-	-	-	3	-

Text Books:

1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn.
3. Signals & Systems- Narayan Iyer and K Satya Prasad, Cenage Pub.

Reference Books:

1. Signals & Systems - Simon Haykin and Van Veen, Wiley, 2nd Edition.
2. Principles of Linear Systems and Signals – BP Lathi, Oxford University Press, 2015.
3. Signals and Systems – K Raja Rajeswari, B Visweswara Rao, PHI, 2009.
4. Fundamentals of Signals and Systems- Michel J. Robert, MGH International Edition, 2008.
5. Signals and Systems – T K Rawat, Oxford University press, 2011.