Signals and Systems

Course Code: BEECE2C006, BEECA2C006

Course Title: Signals and Systems

Semester: III

Credits: 03

Course Outcomes

At the end of the course students will be able to:

CO1	Classify various signals and their mathematical representation
CO2	Develop insights into discrete-time systems and their realization
CO3	Analyze the characteristics of LTI systems with the help of impulse response and convolution.
CO4	Design the system properties in frequency domain
CO5	Analyze random signals and justify their usefulness in engineering systems

Rationale

To describe various signals and systems mathematically and understand how to perform mathematical operations on them. Also familiar with commonly used signals such as the unit step, ramp, and impulse function, sinusoidal signals, complex exponentials and their operations. Analysis using Fourier series and Fourier transform for a given signal.

Course Outlines

Contents	**No. of Lectures**
Unit – I Classification of Signals, continuous-time and discrete-time signals, deterministic and random signals, periodic signals, even and odd signals, exponential and sinusoidal signals, unit step and unit impulse signals, systems with and without memory, time-varying, time-invariant, stationarity, causality, homogeneity, linearity, stability of systems.	**10**

Unit – II Properties of linear time-variant systems, continuous-time LTI systems, relationship between linear differential equations with constant coefficients, transfer function, state space models, convolution integrals from transfer function and state space models, discrete-time LTI systems, relationship between linear difference equations with constant coefficients, pulse transfer function, discrete-time state space models, convolution sum from transfer function and state space models, connections between time- invariance, causality, stationarity.	**10**
Unit -III Fourier series representation of continuous-time periodic signals, Parseval formula for continuous-time periodic signals, continuous time Fourier transform, discrete-time Fourier transforms, connection between the Fourier transform and Laplace transform, connection between the z-transform and discrete- time Fourier transform.	**10**
Unit - IV **Laplace transform:** Laplace transform, ROC, Inverse Laplace transform, Filter design by placements of poles and zeros of system functions, properties of Laplace transform, analysis and characterization of LTI systems using Laplace transform, unilateral Laplace transform..	**10**
Unit – V **Z-Transform:** Z- transform, properties of z- transform, Frequency response from pole-zero location, analysis and characterization of LTI systems using z-transform, unilateral z-transform. Sampling and Reconstruction: The Sampling Theorem and its implications. Spectra of sampled signals. Nyquist criterion for stability.	**10**

Text Books

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.
2. J. G. Proakis and D. G. Manolakis, "Digital Signal Processing: Principles, Algorithms, and Applications", Pearson, 2006.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.

Reference books

1. S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
2. A. V. Oppenheim and R. W. Schafer, "Discrete-Time Signal Processing", Prentice Hall, 2009.
3. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
4. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.