SIGNAL AND SYSTEMS

The focus of this course is to introduce you to the fundamental concepts and tools used in both analogue and digital signal processing (ASP and DSP) which are areas of interest if you are studying any program relating to electronic, communication and/or computer engineering.

COURSE CONTENTS:

Overview of signals: Basic definitions. Classification of signals, Continuous and discrete time signals, Signal operations and properties, discretization of continuous time signals, Signal sampling and quantization.

Continuous Time and Discrete Time System characterization: Basic system properties: Linearity, Static and dynamic, stability and causality, time invariant and variant system, invertible and non-invertible, representation of continuous systems.

Response of Continuous Time–LTI System: Impulse response and convolution integral, properties of convolution, signal responses to CT-LTI system.

z-Transform: Introduction, ROC of finite duration sequence, ROC of infinite duration sequence, Relation between Discrete time Fourier Transform and z-transform, properties of the ROC, Properties of z-transform, Inverse z-Transform, Analysis of discrete time LTI system using z-Transform, Unilateral z-Transform

Discrete Time System: Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system and its properties.

Fourier analysis of discrete time signals: Introduction, Properties and application of discrete time Fourier series, Representation of Aperiodic signals, Fourier transform and its properties, Convergence of discrete time Fourier transform, Fourier Transform for periodic signals, Applications of DTFT

Systems with Finite and infinite duration response: Recursive and non-recursive discrete time systems-realization structures-direct form-I, direct form-II, Transpose, cascade and parallel forms, state space analysis: Representation and solution for continuous and discrete time LTI system.

COURSE OUTPUT:

As an outcome of completing this course, students should be able to

1. Understand the terminology of signals and basic engineering systems.
2. Understand the role of signals and systems in engineering design and society.
3. Understand signal representation techniques and signal characteristics.
4. Understand the difference and the applications of analog versus discrete signals and the conversion between them.
5. Understand the process of sampling & Fourier transforms.

TEXT BOOKS

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, PearsonEducation.
2. A. Anandkumar signal and system 3rdEdition, PHI.
3. http://www.nptelvideos.in/2012/11/estimation-of-signals-and-systems.html

REFERENCES:

1. Edward W. Kamen & Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education.
2. H. P. Hsu, RakeshRanjan "Signals and Systems", Schaum's Outlines, Tata McGrawHill.
3. Simon Haykins and Barry Van Veen: Signals and Systems, John Wiley & sons.
4. Rawat: Signal and Systems, Oxford Publication.
5. Nagoorkani: signal and system (TMH).
6. Iyer: signal and system, Cengage learning.
7. Gabel, Roberts, "Signals and Linear Systems" Wiley India Pvt. Ltd, 2012.
8. Rao: Signal and system (TMH).

List of Experiments:

Introduction to MATLAB

1. To implement delta function
2. , unit step function, Ramp function.
3. To explore the commutation of even and odd symmetries in a signal with algebraic operations.
4. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time-shifting).
5. To explore the time variance and time invariance property of a given system.
6. To explore causality and non-causality property of a system.
7. To demonstrate the convolution and correlation of two continuous-time signals.
8. To demonstrate the convolution and correlation of two discrete-time signals.
9. To determine Magnitude and Phase Response of Fourier Transform of given signals.