

SIGNALS AND SYSTEMS

1. Introduction

Objective: The aim of the course is to introduce students to mathematical foundations of signals, systems and algorithms to process signals. At the end of the course students will be able to use MATLAB to generate signals and process the same using various types of filters and systems. The practical aspects will be explained through a series of lab assignments on MATLAB

Credits: 3-0-0

2. Course Outline

UNIT - I: Introduction to signals

Brief introduction to signals and their applications. Analog and digital signals.

Continuous and discrete signals. Types of signals: Constant, Step, Ramp, Impulse, Dirac, periodic, exponential. Operations on Signals: Magnitude Scaling, Time shifting, Sampling

UNIT - II: Introduction to systems

Properties: Memory less, stability, Linearity, Causality, Time invariance. Linear Time invariant systems, Causality and Causal Systems, system stability Integration of systems: Cascading, parallel, feedback.

UNIT - III: Mathematical Concepts

Review of probability, statistics and differential equations. Introduction to Random Variables, Probability and Cumulative distribution curves, Correlation, Covariance, Convolution of signals

UNIT - IV: Signal Processing Techniques

Fourier Transforms, Fourier Series, Z-Transforms and Laplace Transforms and their applications

UNIT - V: Digital signal Processing

Types of Filters, Signal responses to filters, Finite Impulse Response (FIR) and Infinite Impulse Response (IIR). Nyquist criterion, Fast Fourier Transform, Discrete Fourier Transforms, decimation-in-time (DIT) FFT, Inverse Fourier transforms, Types of window functions and frequency responses.

3. Reading Material

Text Books

1. Signals and Systems – by Simon Haykin (Author), Barry Van Veen (Author), 820 pages,
2. Fundamentals of Signals and Systems Using the Web and Matlab – by Edward W.Kamen (Author), Bonnie S Heck (Author), 632 pages, Publisher: Pearson Education (2007)

Reference Books:

1. **Communication Systems**– by Simon Haykin (Author), Michael Moher (Author), 436 pages Publisher: Wiley; Fifth edition (25 June 2009)
2. **Signals and Systems** – by Oppenheim Alan V. (Author), Willsky Alan S. (Author), Nawab S. Hamid (Author), 992 pages, PHI; 2 edition (1997)

Suggested Assignments

Weekly assignments based on MATLAB programming may be provided to help students to better understand design aspects and visualize results. Assignments may be designed around concepts like generation of different types of signals, processing them using functions provided in MATLAB, A brief introduction to Simulink Tool boxes (in MATLAB) may be provided. Assignments may be designed to augment topics taught in classroom.