Title: Signals and Systems

Code Number: EE2201

Credit Hours: 4 (3+1)

Prerequisites: NS1204 Complex Variables and Transforms

Semester: 4th

Course Objectives

The course will enable students to:

1. Demonstrate a comprehensive understanding of signals and systems, of both continuous and discrete time domains
2. Illustrate the response characteristics of continuous and discrete time LTI systems
3. Analyze transform techniques to solve continuous time LTI systems
4. Analyze Fourier series and Fourier transform techniques to interpret the frequency characteristics of continuous and discrete time signals.
5. Perform practical experiments on software tool involving various analysis techniques of both continuous and discrete time signals and systems to validate theoretical concepts

Contents

Unit 1: Fundamental Concepts of Signals & Systems

1. Introduction
2. Signals and their Classification
3. Basic Continuous and Discrete Time Signals
4. Sampling theorem and aliasing
5. Operations on Signals
6. Systems and Classification of Systems
7. Interconnections of Systems

Unit 2: Linear Time Invariant Systems

1. Response of a Continuous Time LTI System and Convolution Integral
2. Properties of Continuous and Discrete Time LTI System
3. Response of a Discrete Time LTI System and Convolution Sum
4. Eigen function of Continuous and Discrete Time LTI System
5. Correlation
6. Convolution and Properties of Convolution
7. Systems Described by Difference and Differential Equations

Unit 3: Laplace Transform and Continuous Time LTI Systems

1. The Laplace Transform
2. Laplace Transform of Some Common Signals
3. Properties of Laplace Transform
4. The Inverse Laplace Transform
5. The System Function
6. Unilateral Laplace Transform
7. Solving Differential Equations by Using Laplace Transform

Unit 4: The Z-Transform and Discrete Time LTI Systems

1. The z-Transform
2. z-Transform of some Common Signals
3. Properties of z-Transform
4. The Inverse z-Transform

5. The System Function of Discrete Time LTI System
6. The Unilateral z-Transform
7. Solving Difference Equations by Using z-Transform

Unit 5: Fourier analysis of Continuous Time Signals and Systems

1. Fourier Series Representations of Periodic Signals
2. The Fourier Transform
3. Properties of Continuous time Fourier Transform
4. Time and Frequency characterization of signals and systems
5. The Frequency Response of Continuous Time LTI Systems
6. Filtering and Bandwidth
7. Modulation

Unit 6: Fourier analysis of Discrete Time Signals and Systems

1. Discrete Fourier Series
2. Discrete Time Fourier Transform (DTFT)
3. Properties of Discrete Time Fourier Transform
4. The Frequency Response of Discrete time LTI Systems
5. Discrete Fourier Transform (DFT)
6. Properties of Discrete Fourier Transform (DFT)
7. Fast Fourier Transform (FFT)

Lab Work Outline

Investigation of signals in time and frequency domain, systems and its properties using MATLAB.

Assignments/Types and Number with calendar:

A minimum of four assignments to be submitted before the written exams for each term.

Assessment and Examinations:

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	It takes place at the mid-point of the semester.
2.	Sessional Assessment	25%	It is continuous assessment. It includes: classroom participation, attendance, assignments and presentations, homework, attitude and behavior, hands-on-activities, short tests, quizzes etc.
3.	Final Assessment	40%	It takes place at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

Recommended Books:

1. Alan V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals & Systems", Prentice Hall Ed: Current
2. B. P. Lathi, "Linear Systems and Signals", 2nd Edition, Oxford, 2004
3. M. J. Roberts, "Fundamentals of Signals and Systems", McGraw-Hill, 2007
4. S. Haykin and B. Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002
5. C. L. Phillips, J. M. Parr and E. A. Riskin, "Signals, Systems, and Transforms", 4th Edition, Prentice Hall, 2007.