CEN 340: Signals & Systems

- **Credit Hours** (Lectures, Lab, Tutorial): 3 (3 + 0 + 1).
- **Prerequisites**: Math 204

**Course Outline**

- **Introduction to MATLAB**
  - Introduction.
  - Characteristics of MATLAB.
  - MATLAB System.
  - Manipulating Matrices.
  - Graphics.
  - Generating M-file.
  - Summary.

- **Signals & Systems**
  - Introduction: What are Signals & Systems?
  - Basic types of signals.
  - Representation of CT & DT.
  - Basic Signal Operations.
  - Signals characteristics.
  - Some Basic Signals.
  - Sinusoidal Signals.
  - Complex Exponential Signals.
  - Continuous-Time Unit Step & Unit Impulse Functions.
  - Discrete-Time Unit Impulse & Unit Step Sequences.
  - Signal Energy & Power.
  - Continuous-Time and Discrete-Time Systems.
  - Basic System Properties.
  - Summary.

- **Linear Time-Invariant Systems**
  - Introduction.
  - Discrete-Time LTI Systems.
  - Continuous -Time LTI Systems.
  - Graphical Interpretation of Convolution.
  - Properties of LTI systems.
  - Causal LTI Systems Described by Differential and Difference Equations.
  - Summary.

- **Fourier Series Representation of Periodic Signals**
  - Introduction.
  - The response of LTI Systems to Complex Exponentials.
  - Fourier Series Representation of Continuous-Time Periodic Signals.
  - Convergence of the Fourier series.
  - Properties of Continuous-time Fourier series.
  - Fourier Series Representation of Discrete-Time Periodic Signals.
  - Properties of Discrete-time Fourier series.
  - Filtering.
  - Summary.

**Continuous-Time Fourier Transform**
- Introduction.
- Representation of Aperiodic Signals: Continuous-time Fourier Transform.
- Fourier Transform for Periodic Signals.
- Properties of the continuous-time Fourier Transform.
- Convolution Property.
- Tables of Fourier Properties and of Basic Fourier Transform Pairs.
- Systems Characterized by Linear Constant – coefficient Difference Equations.
- Summary.

**Discrete-Time Fourier Transform**
- Introduction.
- Representation of Aperiodic Signals: Discrete-time Fourier Transform.
- Fourier Transform for Periodic Signals.
- Properties of Discrete-time Fourier Transform.
- Convolution Property.
- Systems Characterized by Linear Constant – coefficient Difference Equations.
- Summary.

**Sampling Theorem**
- Introduction.
- Representation of a Continuous-time Signal by its Samples: Sampling Theorem.
- Reconstruction of a Signal from its Samples Using Interpolation.
- The Effect of Undersampling: Aliasing.
- Discrete-Time Processing of Continuous-Time Signals.
- Sampling of Discrete-time Signals.
- Summary.

**Laplace Transform**
- Introduction.
- Laplace Transform.
- Region Of Convergence “ROC” for L.T.
- Inverse L.T.
- Properties of L.T.
- Some L.T. Pairs.
- Analysis & Characterization of LTI System Using L.T.
- System Function Algebra & Block Diagram Representations.
- Unilateral L.T.
- Summary.

**z-Transform**
- Introduction.
- z-Transform.
- The Region of Convergence for the z-Transform.
- Inverse z-Transform.
- Properties of the z-Transform
- Some common z-Transform Pairs.
- LTI Systems Characterized by Linear Constant-Coefficient Difference Equations.
- System Function Algebra and Block Diagram Representations.
- Unilateral z-Transform.
- Summary.