**Course Title: Digital Signal Processing**
**Course Code: ETEG 305**
**Credit Hours: 3**

**Course Description**:
This course intends to introduce digital signal processing techniques and applications.

**Course Contents:**

**Unit 1: Introduction of Digital Signal Processing**
Review of digital signals and systems, Introduction of Digital Signal Processing (DSP), Overview of DSP in real world application and Importance of mathematical model for DSP, Introduction of commonly used hardware and software for DSP

**Unit 2: Z-Transform**
Definition of the z-transform, z-transform Properties: linearity, Shifting, convolution, Scaling, Multiplication by K Vector sequences; Relation between the Z-transform and the Fourier transform of a sequence. Inverse z-transform: Direct division, Partial fraction expansions, the inverse integral; System response, Transfer function $H(z)$, Response to sinusoidal input - pole-zero relationships, Stability test of the discrete time system.

**Unit 3: The Discrete Fourier Transform and Signal Spectrum**
The Discrete Fourier Transform (DFT) derivation, Properties of the DFT, DFT of non-periodic digital signals, Signal spectrum, Spectral Estimation using window functions.

**Unit 4: Introduction of the Fast Fourier Transform (FFT)**
FFT computation algorithms: Redix- 2, Redix- 4 and Split Redix, Application of FFT algorithms, Spectral analysis and convolution using FFT

**Unit 5: Digital Filters and Realization**
Introduction of digital filter, Basic types of filtering, Transfer function, Frequency response, Adaptive filter and application, Realization of digital filter: Direct form - I, Direct form - II, Cascade, Parallel, Lattice and Ladder.

**Unit 6 : Finite Duration Impulse Response (FIR) Digital Filters**
FIR filter design by Fourier approximation, Gibbs phenomena in FIR filter Design approximations, Applications of window functions to frequency response smoothing; Window functions, Rectangular, Hanning, Hamming and Kaiser windows; FIR filter design by the frequency sampling method; FIR filter design using the Remez exchange algorithm; Linear phase FIR filters, Unit sample response symmetry, Group delay.

**Unit 7 : Infinite Impulse Response (IIR) Digital Filters**
Classical filter design using polynomial approximations, Butterworth, Chebychev, Elliptic and Bessel forms, IIR filter design by transformation-matched Z-transform, Impulse-invariant transform and bilinear transformation, Application of the bilinear transformation to IIR lowpass discrete filter design, Spectral transformation, Highpass, Bandpass and notch filters.

**Unit 8: Introduction to Digital Signal Processors**

Digital signal processor architecture, fixed point and floating point processors, Concept of real time processing, buffering technique.

**References:**

1. J. G. Proakis and D. G. Manolakis, *Digital Signal Processing: Principles, Algorithms, and Applications*, Pearson; 4th edition, 2006.
2. L. R. Rabiner & B. Gold, *Theory and Application of Digital Signal Processing*, Prentice Hall 1993
3. Woon-Seng S. Gan Sen M. Kuo, *Digital Signal Processors: Architectures, Implementations, and Applications*, Pearson, 2004
4. S. W. Smith, *Digital Signal Processing: A Practical Guide for Engineers and Scientists*, Newnes, 1st Edition, 2002.

**Evaluation:**

In-Semester Evaluation: 50%
End-Semester Evaluation: 50%