Department Of Computer Science and Engineering
Kathmandu University
Dhulikhel, Kavre

Subject: Digital Signal Processing **Course: COMP 407**

Level: B.E. 4th Year 1st Semester **Credit Hours: 3**

Course Objective: To provide a thorough understanding of the signals, systems, and discrete-time signal processing for undergraduate computer engineering students. The goal of the course is to develop a complete working set of digital signal processing notions from the ground up.

Syllabus

1. **Introduction to signals and systems**
   - 1.1. Definition and uses of Signals, Classification, some common signals.
   - 1.2. Transformation of independent and dependent variables, Definition of Systems, System Properties.
   - 1.3. Signal Representation by pulses, DT LTI systems, Convolution Sum, Properties of LTI system.
   - 1.4. Frequency domain analysis of signal and systems, transfer functions, and frequency response.

2. **A sampling of Continuous-time signals**
   - 2.1. Sampling, Impulse Train
   - 2.2. Nyquist Theorem, Aliasing
   - 2.3. Signal Reconstruction

3. **Fourier Analysis**
   - 3.1. CT Fourier Series and Fourier Transforms.
   - 3.2. DT Fourier Series and DT Fourier Transform
   - 3.3. Definition and Properties. DTFT of some popular signals.

4. **Discrete Fourier Transform**
   - 4.1. Discrete Fourier Transform, Properties.
   - 4.2. Fast Fourier Transform
   - 4.3. Evaluation of DFT, FFT

5. Z-transform

5.1. Z- Transform, Definition, ROC, Z- Transform of popular signals
5.2. Properties of Z- transform
5.3. Inverse Z- Transform, Pole Zero relationships
5.4. System Function, pole-zero relationship.

6. Discrete Filters

6.1. Discrete filter structure, FIR – IIR Filters
6.2. Structure for FIR filters: Direct form Structures, Cascade
6.3. Structure for IIR filters: Direct form Structures.Cascade, Parallel
6.4. Lattice & Ladder Structure.

7. IIR Filter Design

7.1. Polynomial Approximation, Butterworth, Chebyshev
7.2. Design by matched Z-transform, Impulse Invariant Transform and Bilinear Transform

8. FIR Filter Design

8.1. FIR Design by Windows, Gibbs phenomena
8.2. Frequency Sampling.
8.3. Linear Phase FIR.

Reference Book:

1. J.G. Proakis and D.G. Manolakis, Digital Signal Processing, Prentice-Hall of India.
2. A.V. Oppenheim, Discrete-Time Signal Processing, Prentice-Hall, 1990.