

NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B. Tech. Electronics and Communication Engineering

OPEN ELECTIVE

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Course Code	
Course Title	Signal Processing and its Applications

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to –

1. Analyse the LTI system using time domain methods like convolution and correlation.
2. Analyse the signal and systems representation in frequency domain using Z-transform and Discrete Fourier Transform.
3. Design IIR and FIR digital filters for the given specifications and study its application for speech and biomedical signal processing.

Syllabus:

Teaching Hours:45

UNIT I : Introduction

Introduction to Signals and systems and overview of various DSP applications.

03

UNIT II : Digital Signals and Systems

Digital signals, linear time invariant, causal system, difference equations and impulse response, stability, digital convolution.

09

UNIT III : Discrete Fourier Transform and Signal Spectrum

DTFT, Discrete Fourier Transform and its properties, amplitude spectrum and power spectrum using Transform based methods.

09

UNIT IV : Signal Sampling and Quantization

Sampling of continuous signal, signal reconstruction, analog-to-digital conversion, digital-to-analog conversion, quantization.

02

UNIT V : z-Transform

Definition, properties of the z-transform, inverse z-transform, solution to difference equations using z-transform.

06

UNIT VI : Digital Filters

The difference equation and digital filtering, difference equation and transfer function, z-plane pole-zero plot and stability, digital filter frequency response, basic types of filtering, realization of digital filter, FIR filter design methods, IIR filter design methods, Finite word length effect.

10

UNIT VII : Applications of Signal Processing

Applications in communication systems, Speech signal processing, Biomedical signal processing, Remote Sensing and seismography.

06

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Assignments:

The students will be given 8- 10 programming/simulation/projects/assignments based on the above syllabus as mentioned below:

- i. Introduction to simulation tool
- ii. Basic signal generation
- iii. Operations on signals

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- iv. Digital convolution and correlation
- v. Z-transform
- vi. DTFT and DFT
- vii. FIR filter design
- viii. IIR filter design
- ix. Speech signal processing
- x. ECG signal processing and denoising

Suggested Readings:

1. Li Tan, Jean Giang, Digital Signal Processing: Fundamentals and Applications, Academic Press Publication
2. Proakis, Manolakis, Digital Signal Processing: Principles, Algorithm & Applications, PHI
3. Sanjit K Mitra, Digital Signal Processing, Tata McGraw-Hill
4. Emmanuel Ifetchor, Berrie Jarvis, Digital Signal Processing: A Practical Approach, Pearson Education India
5. Vinay K. Ingle, John G. Proakis, Digital Signal Processing Using MATLAB, Thomson Learning

L = Lecture, T = Tutorial, P = Practical, C = Credit

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