NIRMA UNIVERSITY
SCHOOL OF TECHNOLOGY, INSTITUTE OF TECHNOLOGY
B.Tech. Electronics & Communication Engineering
Semester - V

L	T	P	C
3	-	2	4

Course Code	2EC502
Course Title	Digital Signal Processing

Course Outcomes (COs):

At the end of the course, the students will be able to
1. Analyse the LTI system using Z-transform to determine the effect of the pole and zero on the overall system response for one-dimensional signals.
2. Analyse the spectrum for one-dimensional signals using DFT and realize DFT using FFT algorithms.
3. Design IIR and FIR digital filters for the given specifications and analyse the finite word-length effect on a designed filter.
4. Interpret the Multirate system using the sampling rate converter in areas such as communication systems, signal compression, and sub-band signal processing

Syllabus: **Teaching Hours:45**

UNIT 1: Digital Processing of Continuous-Time Signals   **02**
Sampling of baseband and bandpass signals, Anti-aliasing filter, sample-and-hold circuit, Types of ADCs and DACs, Reconstruction filter

UNIT II : Discrete Fourier Transform (DFT) and Z Transform
Definition and properties/theorems, DFT symmetry relations, Circular shifting and circular convolution in DFT, Linear convolution using DFT, Applications of DFT, FFT algorithm, z-Transform: Definition and properties, ROC, The inverse-z transform, the transfer function   **10**

UNIT III: LTI Discrete-time Systems in the Transform Domain
Effect of the pole and zero of rational z-transform on the overall response, simple digital filters (LPF, HPF, BPF, Notch), Linear Phase digital filters, Complementary transfer functions, Inverse Systems, System identification, Comb filter, Digital resonator   **08**

UNIT IV: IIR and FIR Digital Filter Design
IIR filter design methods, FIR filter design methods,   computationally efficient FIR filter design   **12**

UNIT V: Digital Filter Structures
Basic FIR and IIR filter structures, Polyphase structure, Analysis of finite word-length effect in filter structure design   **04**

UNIT VI: Multirate DSP Fundamentals and Filter Banks
Decimation and interpolation definition and frequency-domain effects, noble identities, multistage design, fractional rate conversion, computationally efficient filters using polyphase decomposition   **07**

UNIT VII: DSP Processor Architecture   **02**
Salient features of DSP processor architecture

Self-Study:
The self-study content will be declared at the commencement of the semester. Around 10% of the questions will be asked from self-study content.

Laboratory Work:
Laboratory work will be based on the above syllabus with a minimum of 10 experiments to be incorporated.

Suggested Readings:
1. Sanjit K. Mitra, Digital Signal Processing, Tata McGraw Hill
2. Oppenheim, Schafer, Discrete-Time Signal Processing, Buck Pearson Education Publication
3. Emmanuel Ifeachor and Barrie Jervis, Digital Signal Processing: A Practical Approach, Pearson Education, India
4. Proakis, Manolakis, Digital Signal Processing: Principles, Algorithm & Application, PHI
5. Vinay K. Ingle, John G. Proakis, Brooks Cole, Digital Signal Processing Using MATLAB, Thomson Learning

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