IV Year I Semester	L	T	P	C
17EC741	3	1	0	3

DIGITAL SIGNAL PROCESSING
(Open Elective-II)

Learning objectives:

1. To analyze the discrete time signals and systems.
2. To apply FFT algorithm for the computation of discrete time Fourier transform.
3. To understand the various implementation of digital filter structures.
4. To learn the FIR and IIR filter design procedures.
5. To know the need of multi-rate processing.
6. To understand the concept of DSP processors.

Unit – I

Introduction

Introduction to Digital Signal Processing: Discrete time signals and sequences, Classification of Discrete time systems, stability of LTI systems, Invertibility, Response of LTI systems to arbitrary inputs, Solution of Linear constant coefficient difference equation, Frequency domain representation of discrete time signals and systems, Review of Z transform, Solution of difference equation using Z transforms, System function.

Unit – II

Discrete Fourier series and Fourier Transforms

Properties of Discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier Transform: Properties of DFT, linear filtering methods based on DFT, Fast Fourier Transform (FFT): Radix -2 decimation in time and decimation in frequency, FFT algorithm, Inverse FFT.

Unit – III

Design of IIR digital filters and realizations

Analog filter approximations: Butterworth and Chebyshev, Design of IIR digital filters from analog filters, Design examples, Analog and digital frequency transformation, Basic structure of IIR systems, Transposed forms.

Unit – IV

Design of IIR digital filters and realizations

Characteristics of FIR digital filters, frequency response, Design of FIR digital filters using windowing techniques and frequency sampling techniques, Comparison of IIR and FIR filters, Basic structure of FIR systems: Lattice structure, Lattice-Ladder structure.

Unit – V

Multi-rate Digital Signal Processing

Introduction, Decimation, Interpolation, Sampling rate conversion, Implementation of sampling rate converters, Applications: Sub band coding of speech signals, Implementation of digital filter banks, Trans-multiplexers.

Unit – VI

Introduction to DSP processors

Introduction to programmable DSPs: Multiplier and multiplier accumulator, Modified bus structures and memory access schemes in P-DSPs, Multiple access memory, Multi-ported memory, VLIW architecture, Pipelining, Special addressing modes, On-chip peripherals, Architecture of TMS320C5X: Introduction, Bus structure, Central Arithmetic Logic Unit, Auxiliary register ALU, Index register, Block move Address register, Parallel Logic unit, Memory mapped registers, Program controller, flags in the status register, On-chip memory, On-chip peripherals.

Learning outcomes:

1. Apply the difference equations concepts for the analysis of discrete time systems.
2. Use the FFT algorithm for solving the DFT of a given signal.
3. Design IIR and FIR digital filters for a given specifications.
4. Realize the IIR and FIR structures from the designed digital filters.
5. Use the multi-rate processing concepts in various applications (Ex: Design of phase shifters, interfacing of digital systems.)
6. Apply the signal processing concepts on DSP processors.

Text books:

1. Digital Signal Processing, Principles, Algorithms, and Application: John G. Proakis, Dimitris G. Manolakis, Pearson Education, PHI, 2007.
2. Discrete Time Signal Processing: A. V. Oppenheim and R.W. Schaffer, PHI
3. Digital Signal Processing A Computer-Based Approach: Sanjit K Mitra, 3rd Edition, McGraw Hill.

Reference books:

1. Digital Signal Processing: Andreas Antoniou, Tata McGraw-Hill Education India.
2. Schaums Outlines of Digital Signal Processing: M. H. Hayes, Tata MCGraw-Hill Education.
3. Digital Signal Processing: Alan V. Oppenheim, Ronald W. Schafer, PHI, 2006
4. Digital Signal Processing: Ramesh Babu, Sci Tech Publications.