IV B.Tech – I Semester
(20EE7333) DIGITAL SIGNAL PROCESSING

Int. Marks	Ext. Marks	Total Marks	L	T	P	C
30	70	100	3	-	-	3

Pre-Requisite: Signals & Systems

Course Objectives

1. To use Z - transforms and Discrete Time Fourier Transforms to analyze a digital system.
2. To know the importance of FFT algorithm for computation of Discrete Fourier Transform.
3. To learn the IIR and FIR Filter design procedures and understand the various implementations of
4. digital filter structures.
5. To learn the design procedures used for Filter bank.
6. To program a DSP processor for signal filtering.

Syllabus

Unit – 1: Introduction

Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of discrete time systems, stability and causality of LTI systems, Response of LTI systems to arbitrary inputs, Solution of linear constant coefficient difference equations, Discrete-time Fourier Transform (DTFT), Frequency domain representation of discrete time signals and systems. Review of Z-transforms, Applications of Z – transforms, solution of difference equations using Z-transforms, System Function.

Unit – 2: Discrete Fourier Series & Fourier Transforms

Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear convolution of sequences using DFT, Computation of DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT, Applications of FFT, Circular convolution and linear convolution using DFT.

Unit – 3: Design of IIR and FIR Digital Filters and Realizations

Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples: Analog-Digital transformations, Basic structures of IIR systems, Transposed forms.

FIR Digital Filters: Characteristics of FIR Digital Filters, frequency response, Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters, Basic structures of FIR systems, Lattice structures, Lattice-ladder structures, Finite word length effects.

Unit – 4: Multirate Digital Signal Processing

Introduction, Decimation, interpolation, sampling rate conversion, Implementation of sampling rate conversion. Applications – Sub-band Coding of Speech Signals, Implementation of Digital Filter Banks, Trans-multiplexers.

Unit – 5: Introduction to DSP Processors

Introduction to programmable DSPs: Multiplier and Multiplier Accumulator (MAC), Modified Bus Structures and Memory Access schemes in DSPs Multiple access memory, multiport memory, VLSI, architecture, Pipelining, Special addressing modes, On-Chip Peripherals. Architecture of TMS 320C5X: Introduction, Bus Structure, Central Arithmetic Logic Unit, Auxiliary, Register, Index Register, Block Move Address Register, Parallel Logic Unit, Memory mapped registers, program controller, some flags in the status registers, on-chip registers, On-chip peripherals.

Course Outcomes

S. No	Course Outcomes	BTL
1.	Analyse Discrete time signals and systems in time and frequency domain	L3
2.	Use the FFT algorithm for solving the DFT of a given signal.	L2
3.	Design a Digital IIR & FIR filter from the given specifications and realize the corresponding IIR & FIR structures from the designed digital filter.	L4
4.	Understand the concept of Multirate signal processing and Filter banks.	L2
5.	Understand the key architectural features of DSP Processors.	L2

Mapping of COs with POs and PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	**3**	**3**	**2**										**3**	
CO 2	**3**	**3**	**2**										**3**	
CO 3	**3**	**3**	**3**										**3**	
CO 4	**2**	**2**	**1**										**2**	
CO 5	**1**													

1 – Weak, 2 – Moderate and 3 - Strong

Text Books:

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris
2. Discrete Time Signal Processing – A.V.Oppenheim and R.W. Schaffer, PHI,
3. Digital Signal Processors – Architecture, Programming and Applications, B.Venkataramani, M.Bhaskar, TATA McGraw Hill, 2002.
4. Digital Signal Processing – K Raja Rajeswari, I.K. International Publishing House.

Reference Books:

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006.
2. Digital Signal Processing: MH Hayes, Schaum's Outlines, TATA McGraw Hill, 2007.
3. DSP Primer - C. Britton Rorabaugh, Tata McGraw Hill, 2005.
4. Fundamentals of Digital Signal Processing using Matlab – Robert J. Schilling, Sandra L. Harris, Thomson, 2007.
5. Digital Signal Processing – Alan V. Oppenheim, Ronald W. Schafer, PHI Ed., 2006