SSN College of Engineering, Kalavakkam – 603110

Department of Electronics and Communication Engineering

Degree and Programme		**B.E (Computer Science and Engineering)**	
Semester and Section:		**VI Semester / A Section**	
Subject Code and Subject:		**IT6502 – Digital Signal Processing**	
Periods / Week:	**4**	**No. of Credits:**	**4**
			Date: 23.12.2016

Course Objectives:

- To briefly review signals and systems
- To learn discrete Fourier transform and its properties
- To know the characteristics of IIR and FIR filters learn the design of infinite and finite impulse response filters for filtering undesired signals
- To understand Finite word length effects

Course Outcomes:

On successful completion of this course, the student will be able to

CO1: Understand signals, systems and basics of digital signal processing.

CO2: Understand and apply DFT and FFT for the analysis of digital signals & systems.

CO3: Design and realize Butterworth and Chebyshev IIR filters using impulse invariant and bilinear transformation techniques.

CO4: Design and realize FIR filters using window techniques and frequency sampling method.

CO5: Characterize finite Word length effect on digital filters.

Syllabus

UNIT I SIGNALS AND SYSTEMS 9

Basic elements of DSP – concepts of frequency in Analog and Digital Signals – sampling theorem – Discrete – time signals, systems – Analysis of discrete time LTI systems – Z transform – Convolution (linear and circular) – Correlation. (CO1)

UNIT II FREQUENCY TRANSFORMATIONS 9

Introduction to DFT – Properties of DFT – Circular convolution - Filtering methods based on DFT – FFT Algorithms Decimation – in – time Algorithms, Decimation – in – frequency Algorithms –Use of FFT in Linear Filtering – DCT – Use and applications of DCT. (CO2)

UNIT III IIR FILTER DESIGN 9

Structures of IIR – Analog filter design – Discrete time IIR filter from analog filter – IIR filter design by Impulse Invariance, Bilinear transformation, Approximation of derivatives– (HPF, BPF, BRF) filter design using frequency translation (CO3)

UNIT IV FIR FILTER DESIGN 9

Structures of FIR – Linear phase FIR filter – Filter design using windowing techniques (Rectangular window, Hamming window, Hanning Window), Frequency sampling techniques (CO4)

UNIT V FINITE WORD LENGTH EFFECTS IN DIGITAL FILTERS 9

Binary fixed point and floating point number representations – Comparison – Quantization noise – truncation and rounding – quantization noise power – input quantization error – coefficient quantization error – limit cycle oscillations – dead band – overflow error – signal scaling. (CO5)

Total= 45 Periods

Lesson Plan

Content delivery methods:

1. Lecture interspersed with discussion (chalk and board)
2. Presentation slides (PPT)

Assessment methods:

Continuous Assessment
Internal Model Assessment

Sl. No.	Course Content	CO	Knowledge level	Proposed Period & Number of Hours to be handled	Actual Period & Number of Hours handled
Unit I					
1	Introduction to Signals & Systems/ DSP	CO1	U	2	
2	Basic elements of DSP – concepts of frequency in Analog and Digital Signals, Sampling Theorem	CO1	U	1	
3	Discrete – time signals, systems	CO1	U	3	
4	Analysis of discrete time LTI systems – Z transform	CO1	U	4	
5	Convolution (linear and circular)	CO1	U & Ap	1	
6	Correlation	CO1	U & Ap	1	
7	Problems Solving	CO1	U & Ap	3	
Unit II					
1	Introduction to DFT	CO2	U	1	
2	Properties of DFT	CO2	U	2	
3	Filtering methods based on DFT	CO2	U, Ap	2	
4	Decimation – in – time Algorithms,	CO2	U, Ap	2	
5	Decimation – in – frequency Algorithms	CO2	U & Ap	2	
6	Use of FFT in Linear Filtering	CO2	U & Ap	2	
7	DCT & Applications	CO2	U	2	
8	Problems Solving	CO2	U & Ap	3	
Unit III					
1	Structures of IIR	CO3	U	2	
2	Analog filter design – Discrete time IIR filter from analog filter	CO3	U, Ap	3	

3	IIR filter design by Impulse Invariance	CO3	U, Ap	2	
4	Bilinear transformation, Approximation of derivatives	CO3	U & Ap	3	
5	(HPF, BPF, BRF) filter design using frequency translation	CO3	U & Ap	2	
6	Problem Solving	CO3	U & Ap	3	
Unit IV					
1	Structures of FIR	CO4	U	1	
2	Linear phase FIR filter	CO4	U	2	
3	Filter design using windowing techniques	CO4	U & Ap	4	
4	Frequency sampling techniques	CO4	U	3	
5	Problem Solving	CO4	U & Ap	3	
Unit V					
1	Binary fixed point and floating point number representations	CO5	U	2	
2	Quantization noise, truncation and rounding	CO5	U & Ap	2	
3	Quantization noise power – input quantization error – coefficient quantization error	CO5	U	2	
4	Limit cycle oscillations – dead band	CO5	U, Ap	1	
5	Overflow error – signal scaling.	CO5	U, Ap	2	