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 & B Section**	
Subject Code and Subject:		**IT6502 – Digital Signal Processing**	
Periods / Week:	**4**	**No. of Credits:**	**4**
			Date: 26.12.2016

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	

Mapping of Course Outcomes with Program Outcomes

Course Outcomes / Program Outcomes													
Course Outcome:		**Program Outcomes**											
		a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**	**j**	**k**	**l**
CO1:	Understand signals, systems and basics of digital signal processing.	-	1	-	2	-	-	-	-	-	-	1	-
CO2:	Understand and apply DFT and FFT for the analysis of digital signals & systems.	-	-	1	2	-	-	1	-	-	-	1	-
CO3:	Design and realize Butterworth and Chebyshev IIR filters using impulse invariant and bilinear transformation techniques.	-	1	2	3	-	1	-	-	-	-	1	-
CO4:	Design and realize FIR filters using window techniques and frequency sampling method.	-	1	2	3	-	1	-	-	-	-	1	-
CO5:	Characterize finite Word length effect on digital filters	2	1	-	-	-	-	-	-	-	-	1	-

Program Outcomes:
a) Engineering knowledge: Our graduates will have the knowledge of mathematics, logic, probability and statistics, computer science and engineering, and the skill to apply them in the fields of computer software and hardware.
b) Problem analysis: Our graduates will have the knowledge and skill to identify, formulate, and solve hardware and software problems using sound computer science principles.
c) Experimentation: Our graduates will have the skill to design and conduct experiments, organize, analyze, and interpret data.
d) Design and development: Our graduates will have the skill to design and construct hardware and software systems, components, or processes as per needs and specifications.
e) Team work: Our graduates will have the interpersonal and communication skills to function as team players on multidisciplinary teams.
f) Modern tools usage: Our graduates will be able to use the techniques, skills, and modern hardware and software tools necessary for computer engineering practice.
g) Social and environmental responsibility: Our graduates will demonstrate knowledge related to social, ethical, legal, economical, health and safety, sustainability and environmental dimensions.
h) Communication skills: Our graduates will be able to effectively communicate technical information in speech, presentation, and in writing.
i) Contemporariness: Our graduates will have knowledge of contemporary issues in the practice of their profession.
j) Self-learning: Our graduates will develop confidence for self learning and ability for life-long learning.
k) Competitive exam preparedness: Our graduates will participate and succeed in competitive examinations such as GATE, IES, GRE.
l) Leadership: Our graduates are trained to enhance their managerial skills, leadership quality and entrepreneurial spirit.

3: Strongly agree	**2: Agree**	**1: Weakly agree**	- **: Do not agree**

Prepared By	Reviewed By	Approved By
(I.Nelson)	(ISO Coordinator)	(Dr. S. Radha, HOD / ECE)