MOHAMED SATHAK A J COLLEGE OF ENGINEERING

Siruseri IT park, OMR, Chennai - 603103

LESSON PLAN

Department of Electronics and Communication Engineering

Name of the Subject	Discrete Time Signal Processing	Name of the handling Faculty	Dr.I.Manju
Subject Code	EC8553	Year / Sem	III/V
Acad Year	2022-2023	Batch	2020-2024

Course Objective

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

To study the concept of Multirate and adaptive filters

Course Outcome

CO1:To learn discrete fourier transform, properties of DFT and its application to linear filtering

CO2:To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands

CO3:To understand the effects of finite precision representation on digital filters

CO4:To learn about DSP architecture

CO5:Ability to differentiate the fixed and floating poit architecture

Lesson Plan

Sl. No.	Topic(s)	T / R* Book	Periods Required	Mode of Teaching (BB / PPT / NPTEL / MOOC / etc)	Blooms Level (L1-L6)	CO	PO
	UNIT I-DISCRETE FOURIER TRANSFORM						
1	Discrete Signals and Systems- A Review	T1	1	BB	L3	CO1	PO1, PO2
2	Introduction to DFT	T1,R1	1	BB	L3	CO1	PO1, PO2
3	Properties of DFT	T1	1	BB	L2	CO1	PO1
4	Circular Convolution	T1	1	BB	L3	CO1	PO1-PO3,PO5
5	Filtering methods based on DFT	T1	1	BB	L3	CO1	PO1-PO3,PO5
6	FFT Algorithms –Decimation in time Algorithms	T1,R1	1	BB,NPTEL	L3	CO1	PO1-PO3,PO5
7	FFT Algorithms - Decimation in frequency Algorithms	T1,R1	1	BB,NPTEL	L3	CO1	PO1-PO3
8	Use of FFT in Linear Filtering.	T1	1	BB	L2	CO1	PO1,PO3,PO12
9	IDFT	T1	1	BB	L3	CO1	PO1-PO3
10	Tutorials	T1,R1,R2	1	BB	L3	CO1	PO1,PO2
11	Tutorials	T1,R1,R2	1	BB	L3	CO1	PO1,PO2
12	Tutorials	T1,R1,R2	1	BB	L3	CO1	PO1,PO2
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any TUTORIALS							
Evaluation method :MARKS WILL BE GIVEN FOR CORRECT ANSWERS							
	UNIT II-IIR FILTER DESIGN						
13	Structures of IIR	T1	1	BB	L3	CO2	PO1-PO3
14	Analog filter design	T1	1	BB	L3	CO2	PO1-PO3,PO12
15	Butterworth filter design	T1	1	BB	L3	CO2	PO1-PO3,PO5
16	Chebyshev filter design	T1	1	BB	L3	CO2	PO1-PO3,PO5

17	Discrete time IIR filter from analog filter using IIT, BLT and Approximation of derivatives	**T1,R1**	**1**	**BB**	**L3**	CO2	PO1-PO3,PO5
18	Pole mapping rule of filter transformation from analog domain into digital	**T1**	**1**	**BB**	**L3**	CO2	PO1-PO3
19	IIR filter design by Impulse Invariance	**T1**	**1**	**BB,NPTEL**	**L3**	CO2	PO1,PO2,PO4
20	IIR filter design by Bilinear transformation	**T1,R1**	**1**	**BB**	**L3**	CO2	PO1-PO3
21	HPF, BPF & BRF filter design using frequency translation.	**T1**	**1**	**BB**	**L4**	CO2	PO1-PO3,PO5
22	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
23	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
24	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any **Implement and simulate the IIR filter for LPF,HPF ,BPF and BSF filters.**							
Evaluation method : BASED ON THEIR RESULTS AND REPORT							
UNIT III-FIR FILTER DESIGN							
25	Design of FIR filters-symmetric and asymmetric FIR filters	**T1**	**1**	**BB**	**L3**	CO2	PO1-PO3
26	Design of Linear phase FIR filter	**T1**	**1**	**BB,NPTEL**	**L3**	CO2	PO1,PO2,PO12
27	Filter design using Fourier Series method	**T1,R2**	**1**	**BB**	**L3**	CO2	PO1-PO5
28	Filter design using rectangular windowing techniques	**T1,R2**	**1**	**BB**	**L3**	CO2	PO1-PO5
29	Filter design using Hamming windowing techniques	**T1,R2**	**1**	**BB**	**L3**	CO2	PO1-PO5
30	Filter design using Hanning windowing techniques	**T1,R2**	**1**	**BB**	**L4**	CO2	PO1-PO5
31	Filter design using Frequency sampling techniques	**T1**	**1**	**BB**	**L3**	CO2	PO1-PO4
32	Structures of FIR	**T1**	**1**	**BB**	**L3**	CO2	PO1-PO4
33	Linear phase FIR filter-direct form realizations	**T1**	**1**	**BB**	**L3**	CO2	PO1-PO3,PO12
34	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
35	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
36	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO2	PO1,PO2
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any **Implement and simulate the FIR filter for LPF,HPF ,BPF and BSF filters using different types of windowing technique.**							
Evaluation method :BASED THE CONTENT SUBMISSION, MARKS WILL BE AWARDED.							
UNIT IV-FINITE WORD LENGTH EFFECTS							
37	Fixed point and floating point number representations	**T1**	**1**	**BB**	**L2**	CO3	PO1-PO3
38	ADC –Sampling-Quantization-Coding	**T1**	**1**	**BB**	**L2**	CO3	PO1
39	Truncation and Rounding errors - Quantization noise	**T1**	**1**	**BB,NPTEL**	**L2**	CO3	PO1
40	Input quantization error	**T1,R1**	**1**	**BB**	**L3**	CO3	PO1-PO3
41	Coefficient quantization error	**T1,R1**	**1**	**BB**	**L3**	CO3	PO1-PO3
42	Product quantization error	**T1,R1**	**1**	**BB**	**L3**	CO3	PO1-PO3
43	Overflow error – Limit cycle oscillations due to product round off and overflow errors	**T1**	**1**	**BB**	**L3**	CO3	PO1-PO4
44	Principle of scaling	**T1**	**1**	**BB**	**L3**	CO3	PO1-PO4
45	Realization with steady state output noise powers	**T1**	**1**	**BB**	**L3**	CO3	PO1-PO4
46	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO3	PO1,PO2
47	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO3	PO1,PO2
48	Tutorials	**T1,R1,R2**	**1**	**BB**	**L3**	CO3	PO1,PO2
Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any **QUIZ**							

Evaluation method :GOOGLE FORM

UNIT V-INTRODUCTION TO DSP PROCESSORS

49	DSP functionalities	**T2**	**1**	**BB**	**L2**	CO4	PO1
50	circular buffering	**T2**	**1**	**BB**	**L2**	CO4	PO1-PO3
51	circular buffering	**T2**	**1**	**BB**	**L2**	CO4	PO1-PO3
52	DSP architecture –Fixed point architecture	**T2**	**1**	**BB**	**L2**	CO4	PO1-PO3
53	DSP architecture –Fixed point architecture	**T2,R1**	**1**	**BB**	**L3**	CO4	PO1-PO3
54	DSP architecture –Floating point architecture	**T2**	**1**	**BB,NPTEL**	**L2**	CO5	PO1-PO4,PO6,PO12
55	DSP architecture –Floating point architecture	**T2,R2**	**1**	**BB**	**L2**	CO5	PO1-PO5,PO12
56	Programming	**T2**	**1**	**BB**	**L2**	CO5	PO1-PO3
57	Programming	**T2**	**1**	**BB**	**L2**	CO5	PO1-PO3,PO6
58	Application Examples	**T1,R1,R2**	**1**	**BB**	**L3**	CO5	PO1,PO2
59	Application Examples	**T1,R1,R2**	**1**	**BB**	**L3**	CO5	PO1,PO2
60	Application Examples	**T1,R1,R2**	**1**	**BB**	**L3**	CO5	PO1,PO2

Suggested Activity: Assignment / Case Studies / Tutorials/ Quiz / Mini Projects / Model Developed/others Planned if any
ASSIGNMENT

Evaluation method :BASED ON THEIR CONTENT SUBMISSION

Content Beyond the Syllabus Planned

1	Applications of FFT
2	Application of FIR filters

Text Books

1	John G. Proakis & Dimitris G.Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Fourth Edition, Pearson Education / Prentice Hall, 2007.

Reference Books

1	Emmanuel C..Ifeachor, & Barrie.W.Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2	Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3	A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.
4	Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

Website / URL References

1	**https://nptel.ac.in/courses/117/102/117102060/**
2	**https://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/video-lectures/lecture-17-design-of-fir-digital-filters/**
3	**https://freevideolectures.com/course/2339/digital-signal-processing-iitkharagpur/32**

Blooms Level

Level 1 (L1) : Remembering **Level 2 (L2) : Understanding** **Level 3 (L3) : Applying**	Lower Order Thinking	Fixed Hour Exams	**Level 4 (L4) : Analysing** **Level 5 (L5) : Evaluating** **Level 6 (L6) : Creating**		Higher Order Thinking	Projects / Mini Projects

Mapping syllabus with Bloom's Taxonomy LOT and HOT

Unit No	Unit Name	L1	L2	L3	L4	L5	L6	LOT	HOT	Total
Unit 1	**DISCRETE FOURIER TRANSFORM**	0	2	10	0	0	0	12	0	12
Unit 2	**IIR FILTER DESIGN**	0	0	**11**	**1**	**0**	**0**	11	1	12
Unit 3	**FIR FILTER DESIGN**	0	0	**11**	**1**	**0**	**0**	11	1	12
Unit 4	**FINITE WORD LENGTH EFFECTS**	0	3	**9**	**0**	**0**	**0**	12	0	12
Unit 5	**INTRODUCTION TO DSP PROCESSORS**	0	4	**8**	**0**	**0**	**0**	12	0	12
Total		0	9	49	2	0	0	58	2	60
Total Percentage		0	15	81.6667	3.33333	0	0	96.6667	3.33333	100

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	2	0	0	0	0	0	0	1	1	0
CO2	3	3	2	2	2	0	0	0	0	0	0	1	1	0

CO3	3	3	2	2	2	0	0	0	0	0	0	1	1	0
CO4	3	2	2	1	0	0	0	0	0	0	0	1	1	0
CO5	3	2	2	2	1	1	0	0	0	0	0	1	1	0
Avg	**3**	**3**	**2**	**2**	**2**	**0.2**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**0**

Justification for CO-PO mapping	
CO1	PO1(3) Graduates will learn the basic knowledge of discrete signals and systems,PO2(3) Graduates will able to analyze the problems in discrete fourier transform and Fast fourier transform,PO12(1),Graduates will be able to upgrades their knowledge in Linear filtering methods.
CO2	PO1(3) Graduates will be able to design the analog filters,PO2(3) Graduates will able to analyze the digital filters and their transformation,PO5(2),Graduates will be able to use modern tools usage in Matlab
CO3	PO2(3) Graduates will be able to design the Linear FIR filter.. PO3(2) Graduates will able to slightly gain the contextual knowledge in structures of FIR..PO4(2) Graduates will be able to discuss about various FIR designing methods .PO5(2) Graduates will be able to use recent tools in Matlab
CO4	PO4(1) Graduates will be able investigate at research level about quantization noise in digital systems.PO3(2) Graduates will be able to understand the signal scaling and limit cycle oscillation.
CO5	PO2(2) Graduates will be able to understand the concepts about DSP architecture. PO3(2) Graduates will able to know about the programming in application examples

3	**High level**	**2**	**Moderate level**	**1**	Low level

Name & Sign of Faculty Incharge :Dr.I.Manju ,PROFESSOR

Name & Sign of Subject Expert :

Head of the Department :

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