MOHAMED SATHAK A J COLLEGE OF ENGINEERING

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LESSON PLAN

Department of Electrical and Electronics Engineering

Name of the Subject	DIGITAL SIGNAL PROCESSING	Name of the handling Faculty	Mr.N.SURESH
Subject Code	EE8591	Year / Sem	III/V
Acad Year	2022-23	Batch	2019-23

Course Objective

To impart knowledge about the following topics: Signals and systems & their mathematical representation.

Discrete time systems.

Transformation techniques & their computation.

Filters and their design for digital implementation.

Programmability digital signal processor & quantization effects.

Course Outcome

Understand the importance of Signals & their mathematical representation,z-transform,Fourier transform, digital filters.

Understand and analyze the discrete time systems.

Analyze the transformation techniques & their computation.

Understand the types of filters and their design for digital implementation.

Acquire knowledge on programmability digital signal processor & quantization effects

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 INTRODUCTION							
1	Classification of systems: Continuous, discrete	T1,T2,R1	1	BB	L1	CO2	PO1
2	Linear systems	T1,T2,R1	1	BB	L2	CO2	PO1-PO3
3	Problems	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
4	Causal, stability, dynamic, recursive systems	T1,T2,R1	1	BB	L2	CO2	PO1-PO3
5	Time variance systems	T1,T2,R1	1	BB	L2	CO2	PO1-PO3
6	Problems	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
7	Classification of signals: continuous and discrete	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
8	Energy and power	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
9	Problems	T1,T2,R1	1	BB	L3	CO1	PO1-PO3
10	mathematical representation of signals; spectral density	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
11	sampling techniques,Nyquist rate, aliasing effect	T1,T2,R1	1	BB	L2	CO1	PO1
12	quantization, quantization error	T1,T2,R1	1	BB	L2	CO5	PO1

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
Analysis of **S**ignals and systems.

Evaluation method :
Assignments on signals and systems.

UNIT II DISCRETE TIME SYSTEM ANALYSIS

13	Z-transform	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
14	Problems	T1,T2,R1	1	BB	L3	CO1	PO1-PO3
15	Z-transform and its properties	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
16	inverse z-transforms	T1,T2,R1	1	BB	L2	CO1	PO1-PO3
17	Problems	T1,T2,R1	1	BB	L3	CO1	PO1-PO3
18	difference equation – Solution by ztransform	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
19	application to discrete systems - Stability analysis	T1,T2,R1	1	BB	L4	CO2	PO1-PO3
20	application to discrete systems - frequency response	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
21	Convolution	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
22	Problems	T1,T2,R1	1	BB	L3	CO2	PO1-PO3
23	Discrete Time Fourier transform , magnitude and phase representation.	T1,T2,R1	1	BB	L3	CO1	PO1-PO3
24	Problems	T1,T2,R1	1	BB	L3	CO1	PO1-PO3

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
In-class activity - Problems based on Z transform Circular and linear convolution.
Testing of frequency transformation and convolution problems using Matlab.

Evaluation method
Tutorials on Z transform circular and linear convolution.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION

25	Introduction to DFT,Discrete Fourier Transform-properties	T1,T2,R1	1	BB	L1	CO3	PO1-PO5,PO7
26	Discrete Fourier Transform- properties contd.	T1,T2,R1	1	BB	L2	CO3	PO1-PO5,PO7
27	Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
28	Computation of DFT using direct method- magnitude and phase representation	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
29	Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
30	Computation of DFT using Matrix method	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
31	DIT using radix 2 FFT- Derivation & Butterfly structure	T1,T2,R1	1	BB	L2	CO3	PO1-PO5,PO7
32	4 point DFT - Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
33	8 point DFT - Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
34	DIF using radix 2 FFT - Derivation & Butterfly structure	T1,T2,R1	1	BB	L2	CO3	PO1-PO5,PO7

35	4 point DFT - Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7
36	8 point DFT - Problems	T1,T2,R1	1	BB	L3	CO3	PO1-PO5,PO7

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
DFT, FFT problems.
DFT and FFT computation using a tool like Matlab.

Evaluation method
Tutorials on DFT and FFT.
Assignments on FFT - DIT and DIF.

UNIT IV DESIGN OF DIGITAL FILTERS

37	FIR & IIR filter realization – Parallel & cascade forms.	T1,T2,R1	2	BB	L4	CO4	PO1-PO5,PO7
39	FIR design: Windowing Techniques,Need and choice of windows	T1,T2,R1	2	BB	L2	CO4	PO1-PO5,PO7
41	Problems	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
42	Linear phase characteristics	T1,T2,R1	1	BB	L2	CO4	PO1-PO5,PO7
43	Analog filter design – Butterworth	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
44	Problems	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
45	Analog filter design-Chebyshev approximations	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
46	Problems	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
47	IIR Filters, digital design using impulse invariant	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
48	Problems	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
49	Bilinear transformation Warping, pre warping.	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7
50	Problems	T1,T2,R1	1	BB	L3	CO4	PO1-PO5,PO7

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
Analog filter design using Butterworth and Chebyshev approximation.

Evaluation method
Tutorials on FIR filter design & IIR filter structures and design.
Assignments on LPF,HPF, BRF, BRF filter design,

UNIT V DIGITAL SIGNAL PROCESSORS

51	Introduction	T1,T2,R4	1	BB,PPT	L2	CO5	PO1-PO3
52	Architecture	T1,T2,R4	2	BB,PPT	L2	CO5	PO1-PO3
54	Features	T1,T2,R4	1	BB,PPT	L2	CO5	PO1-PO3
55	Addressing Formats	T1,T2,R4	2	BB,PPT	L2	CO5	PO1-PO3
57	Functional modes	T1,T2,R4	2	BB,PPT	L2	CO5	PO1-PO3
59	Introduction to Commercial DS Processors.	T1,T2,R4	2	BB,PPT	L2	CO5	PO1-PO3, PO12

Suggested Activity: Assignment / Case Studies / Tuorials/ Quiz / Mini Projects / Model Developed/others Planned if any
DS processors

Evaluation method: MCQ/ Quizzes on DS processors

Content Beyond the Syllabus Planned

1	Application of DSP in Image/speech/audio processing
2	Overview on Wavelet and Contour Transforms

Text Books

1	J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms 69 and Applications', Pearson Education, New Delhi, PHI. 2003.
2	S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', McGraw Hill Edu, 2013.
3	Lonnie C.Ludeman ,"Fundamentals of Digital Signal Processing",Wiley,2013

Reference Books

1	Poorna Chandra S, Sasikala. B ,Digital Signal Processing, Vijay Nicole/TMH,2013.
2	Robert Schilling & Sandra L.Harris, Introduction to Digital Signal Processing using Matlab", Cengage Learning,2014.
3	B.P.Lathi, 'Principles of Signal Processing and Linear Systems', Oxford University Press, 2010 3. Taan S. ElAli, 'Discrete Systems and Digital Signal Processing with Mat Lab', CRC Press, 2009.
4	SenM.kuo, woonseng\s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson,2013
5	DimitrisG.Manolakis, Vinay K. Ingle, applied Digital Signal Processing,Cambridge,2012

Website / URL References

1	https://nptel.ac.in/courses/108/106/108106151/
2	https://swayam-uat-node1.appspot.com/practice_course1/preview
3	http://www.dspguide.com/

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	Introduction	1	8	3	0	0	0	12	0	12
Unit 2	Discrete Time System Analysis	0	3	8	1	0	0	11	1	12
Unit 3	Discrete Fourier Transform & Computation	1	3	8	0	0	0	12	0	12
Unit 4	Design of Digital Filters	0	3	9	2	0	0	12	2	14
Unit 5	Digital Signal Processors	0	10	0	0	0	0	10	0	10
Total		2	27	28	3	0	0	57	3	60
Total Percentage		3.33	45.00	46.67	5.00	0.00	0.00	95.00	5.00	100.00

CO PO Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									1		
CO2	3	3	3									1		
CO3	3	3	3	3	3		3					1		3

CO4	3	3	3	3	3		3					1		3
CO5	3	2	2	1	1							3		2
Avg	**3**	**2.6**	**2.6**	**1.4**	**1.4**		1.2					1.4		**1.6**

Justification for CO-PO mapping	
CO1	High correlation for PO1 and medium correlation for PO2,PO3 is given as the CO2 can be used to apply knowledge of engineering to Identify , formulate and provide solutions
CO2	High correlation for PO1-PO3 is given as the CO2 can be used to apply knowledge of engineering to Identify , formulate and provide solutions
CO3	High correlation for PO1-PO5 is given as the CO2 can be used to apply knowledge of engineering to Identify , formulate and provide solutions by using relevant techniques and tools. High Correlation for PO7 is given as the solutiond designed must be sustainable. High correlation for PSO2 is given as Transformations are used in the analysis of Electric vehicles.
CO4	High correlation for PO1-PO5 is given as the CO2 can be used to apply knowledge of engineering to Identify , formulate and provide solutions by using relevant techniques and tools.High correlation for PSO2 is given as filters are required for the analysis and design of Electric vehicles.
CO5	High correlation for PO1,medium correlation for PO2,PO3 and low correlation for PO4,PO5 is given as the CO2 can be used to apply knowledge of engineering to Identify , formulate and provide solutions by using relevant techniques and tools. Hgh correlation for PO12 is given as knowledge of new DS processors is required.High Correlation for PO7 is given as the solutiond designed must be sustainable.Medium correlation for PSO2 is given as filters are required for the design of Electric vehicles.

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

Name & Sign of Faculty Incharge : Mr.N.Suresh

Name & Sign of Subject Expert : Dr.J.Jeha

Head of the Department : Dr.J.Jeha

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