CMR ENGINEERING COLLEGE

UGC AUTONOMOUS

(Approved by AICTE - New Delhi. Affiliated to JNTUH and Accredited by NAAC & NBA)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Index:

1. Department vision & mission
2. List of PEOs and Pos PSO's
3. Mapping of course out comes with POs
4. Syllabus copy
5. Individual time table
6. Session plan
7. Session execution log
8. Assignment Questions and innovative assignments
9. Sample assignment script
10. Mid exam question papers
11. Scheme of evaluation
12. Sample mid answer script
13. Unit-wise course material
14. Material collected from Internet/Websites
15. Power point presentations
16. Innovation teaching methods (if any)
17. Previous question papers
18. References (Text books/websites/Journals)

HOD

1) Department vision & mission:

VISION OF THE DEPARTMENT:

To promote excellence in technical education and scientific research in electronics and communication engineering for the benefit of society.

MISSION OF THE DEPARTMENT

M1: To impart excellent technical education with state of art facilities inculcating values and lifelong learning attitude.

M2: To develop core competence in our students imbibing professional ethics and team spirit.

M3: To encourage research benefiting society through higher learning.

2) List of PEOs, Pos and PSOs:

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Establish themselves as successful professionals in their career and higher education in the field of Electronics & Communication Engineering and allied domains through rigorous quality education.

PEO 2: Develop Professionalism, Ethical values, Excellent Leadership qualities, Communication Skills and teamwork in their Professional front and adapt to current trends by engaging in lifelong learning

PEO 3: Apply the acquired knowledge & skills to develop novel technology and products for solving real life problems those are economically feasible and socially relevant

PEO 4: To prepare the graduates for developing administrative acumen, to adapt diversified and multidisciplinary platforms to compete globally

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, embedded systems, IoT and allied technologies.

PSO2: Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills.

Program Outcomes (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: Design/Development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6:The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3) Mapping of course out comes with POs:

Course Code.CO No	Course Outcomes (CO's)	Blooms Level's
At the end of the course student will be able to		
EC503PC.**1**	**Understand** the LTI system characteristics and **Perform** time, frequency, and Z - Transform analysis on signals and systems.	**BL2**
EC503PC.**2**	**Understand** the inter-relationship between DFT and various transforms.	**BL2**
EC503PC.**3**	**Design** a digital IIR filter for a given specifications.	**BL6**
EC503PC.**4**	**Design** a digital FIR filter for a given specifications.	**BL6**
EC503PC.**5**	**Understand** the significance of various filter structures and effects of round off errors	**BL2**
EC503PC.**6**	**Compare** the tradeoffs between normal and multi rate DSP techniques and can explore the finite length word effects.	**BL4**

CO-PO Matrix:

Course Outcomes (CO)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
EC503PC.1	3	3	2	2		-	-	-	-	-	3	-
EC503PC.2	3	3	3	2	-	-	-	-	-	-	3	-
EC503PC.3	3	3	3	2	-	-	-	-	-	-	3	2
EC503PC.4	3	3	3	2	-	-	-	-	-	-	3	2
EC503PC.5	3	3	2	2	-	-	-	-	-	-	3	2
EC503PC.6	3	2	1	2	-	-	-	-	-	-	3	2

Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:

Course Outcomes (CO's)	PSO1	PSO2
EC503PC.1	3	3
EC503PC.2	3	3
EC503PC.3	3	3
EC503PC.4	3	3
EC503PC.5	3	3
EC503PC.6	2	2

4. Syllabus copy

III YEAR B.TECH ECE-I SEM L/T/P C
3/ 1/- 4

Digital Signal Processing

UNIT-I

Introduction: Introduction to DSP, Discrete time signals & Sequences, conversion of continuous to discrete signal, Normalized frequency, Linear shift invariant systems, stability, Causality, Linear constant coefficient difference equations, Frequency domain representation of discrete time signals and systems.

Realization of digital filters: Application of Z-transforms, Solution of difference equations of digital filters, System function, Stability criterion, Frequency response of stable systems, Realization of digital filters- Direct, canonic, cascade and parallel forms

UNIT-II

Discrete Fourier series: DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series, Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT, Computation of DFT: Over-Lap Add Method, Over-Lap Save Method, Relation between DTFT, DFS, DFT and Z Transform.

Fast Fourier Transforms: Fast Fourier Transforms (FFT), Radix-2 DIT FFT, DIF FFT, Inverse FFT, FFT with general radix-N

UNIT-III

IIR digital filters: Analog filter approximations-Butterworth, chebychev, Design of IIR digital filters from Analog filters, Step & Impulse invariant method, Bilinear transformation method, Spectral transformations

UNIT-IV

FIR digital filters: Characteristics of FIR digital filters, frequency response, Design of FIR filters using Fourier method, Digital filters using Window techniques, Frequency Sampling technique, Comparison of IIR & FIR filters

UNIT-V:

Multi rate digital signal processing: Introduction, Down sampling, decimation, Up sampling, interpolation, Sampling rate conversion

Finite word length effects: Limit cycles, over flow oscillations, round off noise in IIR digital filters, Computational output round off noise, methods to prevent over flow, Trade off between round off and overflow noise, Dead band effects.

5. Individual time table

	1	2	3	4	5	6	7
MON		**DSP LAB-D**			**D**		**C**
TUE	**D**					**C**	
WED		**DSP LAB-D**			**C**		**D**
THURS			**D**			**C**	
FRI		**C**		**D**		**D**	
SAT	**C**					**D**	**SAC**

6. Session plan

Name of the topic	Sub topics	No. of classes	Text books	Remarks
UNIT I				
Introduction	Introduction to DSP	L1	T1,R1	1
	Discrete time signals & Sequences, conversion of continuous to discrete signal,	L2,L3	T1,R1	1
	Normalized frequency, Linear shift invariant systems, stability	L4,L5	T1,R1	1
	Causality, Linear constant coefficient difference equations	L6,L7	T1,R1	1
	Frequency domain representation of discrete time signals and systems	L8,L9	T1,R1	2
	Application of Z-transforms	L10	T1,R1	1
	Solution of difference equations of digital filters	L11	T1,R1	1
	System function	L12	T1,R1	1
	Frequency response of stable systems	L13	T1,R1	1
	Realization of digital filters-Direct, canonic,	L14	T1,R1	1
	cascade and parallel forms	L15	T1,R1	1
	Stability criterion	L16	T1,R1	1
		No. of classes required		**12**

UNIT II				
Discrete Fourier Series	DFS representation, Properties	L17,L18	T1,R1,T2	2
	DFT, Properties	L19,L20	T1,R1,T2	2
	Linear Convolution of sequences using DFT	L21	T1,R1,T2	1
	Overlap add method, Overlap save method	L22,L23	T1,R1,T2	2
	Relation between DTFT,DFS,DFT and Z-Transform	L24	T1,R1,T2	1
Fast Fourier Transforms	Fast Fourier Transforms(FFT)	L25,L26	T1,R1,T2	1
	Radix-2 DIT FFT	L27,L28	T1,R1,T2	1
	DIF FFT	L29,L30	T1,R1,T2	1
	Inverse FFT	L31	T1,R1,T2	1
	FFT with general radix-N	L32	T1,R1,T2	1
No. of classes required				**12**
UNIT III				
IIR digital filters	Analog filter approximations-Butterworth, chebychev	L33,L34	T1,R1	2
	Design of IIR digital filters from analog filters	L35,L36	T1,R1	2
	Step & Impulse invariant method	L37	T1,R1	1
	Bilinear transformation method	L38,L39	T1,R1	2
	Spectral transformations	L40	T1,R1	1
	No. of classes required			**8**
UNIT IV				
FIR digital filters	Characteristics of FIR digital filters, frequency response	L41,L42	T1,R1	2
	Design of FIR filters using Fourier method	L43,L44	T1,R1	1
	Digital filters using Window techniques	L45,L46	T1,R1	2
	Frequency Sampling technique	L47	T1,R1	1
	Comparison of IIR & FIR filters	L48	T1,R1	1

		No. of classes required		**8**
UNIT V				
Multi rate DSP	Introduction	L49,L50	T1,R1	2
	downsampling	L51	T1,R1	1
	decimation	L52	T1,R1	1
	Upsampling, Interpolation	L53 ,L54	T1,R1	1
	I/D sampling rate conversion	L55,L56	T1,R1	2
Finite word length effects	Finite word length effects	L57	T1,R1	1
	Limit cycles, over flow oscillations, round off noise in IIR digital filters	L58	T1,R1	1
	Computational output round off noise, methods to prevent over flow	L59	T1,R1	1
	Trade off between round off and overflow noise	L60	T1,R1	1
	Measurement of coefficient quantization effects through pole-zero movement	L61	T1,R1	1
	Dead band effects	L62	T1,R1	1
		No. of classes required		**12**
		Total No. of Classes		**52**

7. Session execution log

S.NO	Units	No. of Lectures Taken	Covered/ Not Covered
1	**Unit I**	16	Covered
2	**Unit II**	10	Covered
3	**Unit III**	9	Covered
4	**Unit IV**		
5	**Unit V**		

8. Assignment Questions and innovative assignments

DSP ASSIGNMENT -1

SET-1:

1. Determine whether each of the following systems defined below is linear, dynamic and Time invariant i) $y(n)=\sum_{k=n-3}^{n} e^{x(k)}$ (ii) y(n)=x(-n-2) (CO-1)

2. Perform the linear convolution of two sequences x(n)={-1,1,-2,2,-3,3,-4,4} ,h(n)={1,-1} using a) Over-Lap add method b) Over-Lap save method? (CO-2)

3. What is an LTI System? Explain the stability of a system. (CO-1)

4. An 8-Ponit sequence is given by x(n)={2,2,2,2,1,1,1,1} ,compute 8-point DFT of x(n) by radix-2 DIT FFT . (CO-2)

5. List the Properties of DFS. (CO-2)

SET-2:

1. Determine the response of discrete time LTI system governed by the difference equation y(n)=-0.8y(n-1)+x(n) ,when the input is unit step and initial condition ,y(-1)=0, b) y(-1)=2/9 ? (CO-1)

2.Compute the linear convolution of the sequences x1(n)={1,-1,1} ,x2(n)={2,2,1} using DFT approach? (CO-2)

3. Obtain the Direct form-I and Direct form-II realization for the system

$$H(z)=\frac{2z^3-4z^2+11z-8}{(z-8)(z^2-z+3)}$$ (CO-1)

4. Define DFT and IDFT. How many Multiplications and Additions are required to compute N point DFT using radix-2 FFT and Direct DFT. (N=64) (CO-2)

5. What are the Differences and similarities between DIF and DIT Algorithms? (CO-2)

DSP-INNOVATIVE

1. How to design multiband fir filter design with transition bands? (essay type-journal)(CO.3,CO.4,CO.5))
2. Design IIR filter using elliptic filter and Bessel filter? (basic knowledge)(CO.2CO.3,CO.4)
3. Give a case study on digital filters? (case study)?(CO.1,CO.2,CO.3,CO.4,CO.5)
4. To find discrete cosine transforms using matlab (project based)?(CO.2)
5. Problem based (CO.1,CO.3)

For each system shown below, design an efficient implementation. Take "efficient" to mean having a small number of multiplications per input sample and a small number of delay elements. Make block diagram manipulations in a step-by-step manner with brief justifications of your steps. Make sure to to fully specify any filters, *i.e.*, write out the transfer functions.

(a) $x_a[n] \rightarrow \boxed{H_a(z) = a_0 + a_1 z^{-1} + a_2 z^{-2} + a_3 z^{-3} + a_4 z^{-4}} \rightarrow \boxed{\downarrow 3} \rightarrow y_a[n]$

(b) $x_b[n] \rightarrow \boxed{H_b(z) = b_0 + b_1 z^{-6} + b_2 z^{-12}} \rightarrow \boxed{\downarrow 3} \rightarrow \boxed{\uparrow 3} \rightarrow \boxed{\downarrow 2} \rightarrow y_b[n]$

(c) $x_c[n] \rightarrow \boxed{H_c(z) = c_0 + c_1 z^{-2} + c_2 z^{-6} + c_3 z^{-12}} \rightarrow \boxed{\downarrow 6} \rightarrow \boxed{\uparrow 3} \rightarrow y_c[n]$

9. Sample assignment script

10. Mid exam question papers

CMR ENGINEERING COLLEGE
UGC AUTONOMOUS
(Approved by AICTE - New Delhi. Affiliated to JNTUH and Accredited by NAAC & NBA)
Kandlakoya (V), Medchal (M), Medchal - Malkajgiri (D)-501401

III.B.TECH- I-SEM (R20)-I MID EXAMINATIONS-AUGUST-2022 **Date: 07/09/2022**
Subject: Digital Signal Processing **Time: 10:00 TO 11:30 A.M**

Branch: ECE **Marks: 25 M**

Answer All Questions In Part-A& Part-B

I. Answer all the below questions each question carry two marks 5*2=10

1. What is an LTI System? Explain the stability of a system. (CO-1)
2. List the Properties of DFS. (CO-2)
3. Define DFT and IDFT. (CO-2)
4. How many Multiplications and Additions are required to compute N point DFT using radix-2 FFT and Direct DFT. (N=64) (CO-2)
5. What are the Differences and similarities between DIF and DIT Algorithms? (CO-2)

II. Answer any three questions from the following 3*5=15

6. Determine whether each of the following systems defined below is linear, dynamic and Time invariant i) $y(n)=\sum_{k=n-3}^{n} e^{x(k)}$ (ii) y(n)=x(-n-2) (CO-1)

(Or)

7. Determine the response of discrete time LTI system governed by the difference equation y(n)=-0.8y(n-1)+x(n) ,when the input is unit step and initial condition ,y(-1)=0, b) y(-1)=2/9 ? (CO-1)
8. Perform the linear convolution of two sequences x(n)={-1,1,-2,2,-3,3,-4,4} ,h(n)={1,-1} using a) Over-Lap add method b) Over-Lap save method? (CO-2)

(Or)

9. Compute the linear convolution of the sequences x1(n)={1,-1,1} ,x2(n)={2,2,1} using DFT approach? (CO-2)
10. An 8-Ponit sequence is given by x(n)={2,2,2,2,1,1,1,1} ,compute 8-point DFT of x(n) by radix-2 DIT FFT . (CO-2)

(Or)

11. Obtain the Direct form-I and Direct form-II realization for the system (CO-1)

$$H(z)=\frac{2Z^3-4Z^2+11Z-8}{(Z-8)(Z^2-Z+3)}$$

11. Scheme of Evaluation:

PART	S.NO	QUESTIONS	MARKS	TOTAL
I	1	LTI System Definition stability of a system	1 1	2
	2	Properties of DFS	2	2
	3	Define DFT and IDFT	2	2
	4	Computations of FFT Computations of DFT	1 1	2
	5	DIF Vs DIT	2	2
II	6	Linear Dynamic Time Invariance	2 1 2	5
	7	Without initial condition With initial condition	2 3	5
	8	Over-Lap add method Over-Lap save method	2.5 2.5	5
	9	DFTs of sequences IDFT of intermediate result	3 2	5
	10	DIT FFT Flow graph for N=8 Calculations	2 3	5
	11	Direct Form-1 realization Direct Form-2 realization	2.5 2.5	5

12. Sample mid answer script

13. Unit-wise course material

14. Material collected from Internet/Websites

DSP-TOTAL.rar

1. NPTEL VIDEO LECTURES:

https://nptel.ac.in/courses/117/102/117102060/

2. COURSERA:

https://www.coursera.org/specializations/digital-signal-processing#howItWorks

3. MIT OPEN COURSEWARE:

http://ocw.mit.edu/resources/res-6-008-digital-signal-processing-spring-2011/

4. EDX:

https://www.edx.org/course/discrete-time-signal-processing-4

4. UDEMY:

https://www.udemy.com/course/signal-processing-dft-fft/

15. Power point presentations

fwddsptotalsubjectppts1 (1).zip

17. Previous question papers

QUESTION BANK-JNTUH-MODEL.rar

18. References (Text books/websites/Journals)

TEXT BOOKS:

1. Discrete Time Signal Processing – A. V. Oppenheim and R.W. Schaffer, PHI, 2009

2. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis, Pearson Education / PHI, 2007.

REFERENCES:

1. Digital Signal Processing – Fundamentals and Applications – Li Tan, Elsevier, 2008

2. Fundamentals of Digital Signal Processing using MATLAB – Robert J. Schilling, Sandra L.

Harris, Thomson, 2007

3. Digital Signal Processing – S. Salivahanan, A. Vallavaraj and C. Gnanapriya, TMH, 2009

4. Digital Signal Processing - A Practical approach, Emmanuel C. Ifeachor and Barrie W. Jervis,2nd Edition, Pearson Education, 2009