Sri Indu Institute of Engineering & Technology

Recognized Under 2(f) of UGC Act 1956
Approved by AICTE, New Delhi
Affiliated to JNTUH, Hyderabad.

COURSE FILE

ON

DIGITAL SIGNAL PROCESSING

Course Code - EC602PC

III B.Tech II-SEMESTER

A.Y.: 2022-2023

Prepared by

Mr. Y.RAJU
Assistant Professor

Head of the Department
Electronics and Communication Engg. Dept
SRI INDU INSTITUTE OF ENGG & TECH
Sheriguda(V), Ibrahimpatnam(M), R.R.Dist-501 510

PRINCIPAL
Sri Indu Institute of Engineering & Tech
Sheriguda(Vill), Ibrahimpatnam
R.R. Dist. Telangana-501 510.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Academic Year	2022-2023
Course Title	DIGITAL SIGNAL PROCESSING
Course Code	EC602PC
Programme	B.Tech
Year & Semester	III year II-semester
Branch & Section	ECE-A
Regulation	R18
Course Faculty	Mr. Y. RAJU, Assistant Professor

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INSTITUTE VISION AND MISSION

Vision:

To become a premier institute of academic excellence by providing the world class education that transforms individuals into high intellectuals, by evolving them as empathetic and responsible citizens through continuous improvement.

Mission:

IM1: To offer outcome-based education and enhancement of technical and practical skills.

IM2: To Continuous assess of teaching-learning process through institute-industry collaboration.

IM3: To be a centre of excellence for innovative and emerging fields in technology development with state-of-art facilities to faculty and students' fraternity.

IM4: To Create an enterprising environment to ensure culture, ethics and social responsibility among the stakeholders.

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

DEPARTMENT VISION AND MISSION

Vision:

To become a recognized center in the field of Electronics and Communication Engineering by producing creative engineers with social responsibility and address ever-changing global challenges.

Mission:

DM1: To facilitate an academic environment that enables student's centric learning.

DM2: To provide state-of-the-art hardware and software technologies to meet industry requirements.

DM3: To continuously update the Academic and Research infrastructure.

DM4: To Conduct Technical Development Programs for overall professional caliber of Stake Holders.

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PROGRAM EDUCATIONAL OBJECTIVES

Program Educational objectives are to Promote:

PEO1: Graduates with a strong foundation in Electronics and Communication Engineering, Science and Technology to become successful in the chosen professional career.

PEO2: Graduates with ability to execute innovative ideas for Research and Development with continuous learning.

PEO3: Graduates inculcated with industry based soft-skills to enable employability.

PEO4: Graduates demonstrate with ability to work in interdisciplinary teams and ethical professional behavior.

PROGRAM SPECIFIC OUTCOMES

PSO 1: Design Skills: Design, analysis and development a economical system in the area of Embedded system & VLSI design.

PSO 2: Software Usage: Ability to investigate and solve the engineering problems using MATLAB, Keil and Xilinx.

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PROGRAM OUTCOMES

1. **ENGINEERING KNOWLEDGE**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **PROBLEM ANALYSIS**: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **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.

4. **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.

5. **MODERN TOOL USAGE**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. **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.

7. **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.

8. **ETHICS**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **INDIVIDUAL AND TEAM WORK**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **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, give and receive clear instructions.

11. **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.

12. **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.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY
HYDERABADB.Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING

III YEAR COURSE STRUCTURE AND SYLLABUS (R18)
Applicable From 2018-19 Admitted Batch

III YEAR I SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC501PC	Microprocessors & Microcontrollers	3	1	0	4
2	EC502PC	Data Communications and Networks	3	1	0	4
3	EC503PC	Control Systems	3	1	0	4
4	SM504MS	Business Economics & Financial Analysis	3	0	0	3
5		Professional Elective - I	3	0	0	3
6	EC505PC	Microprocessors & Microcontrollers Lab	0	0	3	1.5
7	EC506PC	Data Communications and Networks Lab	0	0	3	1.5
8	EN508HS	Advanced Communication Skills Lab	0	0	2	1
9	*MC510	Intellectual Property Rights	3	0	0	0
		Total Credits	**18**	**3**	**8**	**22**

III YEAR II SEMESTER

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC601PC	Antennas and Propagation	3	1	0	4
2	EC602PC	Digital Signal Processing	3	1	0	4
3	EC603PC	VLSI Design	3	1	0	4
4		Professional Elective - II	3	0	0	3
5		Open Elective - I	3	0	0	3
6	EC604PC	Digital Signal Processing Lab	0	0	3	1.5
7	EC605PC	e – CAD Lab	0	0	3	1.5
8	EC606PC	Scripting Languages Lab	0	0	2	1
9	*MC609	Environmental Science	3	0	0	0
		Total Credits	**18**	**3**	**8**	**22**

***MC - Environmental Science – Should be Registered by Lateral Entry Students Only.**

Note: Industrial Oriented Mini Project/ Summer Internship is to be carried out during the summer vacation between 6th and 7th semesters. Students should submit report of Industrial Oriented Mini Project/ Summer Internship for evaluation.

Professional Elective – I

EC511PE	Computer Organization & Operating Systems
EC512PE	Error Correcting Codes
EC513PE	Electronic Measurements and Instrumentation

Professional Elective – II

EC611PE	Object Oriented Programming through Java
EC612PE	Mobile Communications and Networks
EC613PE	Embedded System Design

EC602PC: DIGITAL SIGNAL PROCESSING

B.Tech. III Year II Semester

L	T	P	C
3	1	0	4

Prerequisite: Signals and Systems

Course Objectives:

1. To provide background and fundamental material for the analysis and processing of digitalsignals.
2. To understand the fast computation of DFT and appreciate the FFT processing.
3. To study the designs and structures of digital (IIR and FIR) filters and analyze and synthesizefor a given specifications.
4. To acquaint in Multi-rate signal processing techniques and finite word length effects**.**

Course Outcomes: Upon completing this course, the student will be able to

1. Understand the LTI system characteristics and Multirate signal processing.
2. Understand the inter-relationship between DFT and various transforms.
3. Design a digital filter for a given specification.
4. Understand the significance of various filter structures and effects of round off errors.

UNIT - I:

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences,conversion of continuous to discrete signal, Normalized Frequency**,** Linear Shift Invariant Systems,Stability, and Causality, linear differential equation to difference equation**,** Linear Constant CoefficientDifference Equations, Frequency Domain Representation of Discrete Time Signals and Systems.

Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling,Interpolation, Sampling Rate Conversion.

UNIT - II:

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation**,** 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 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

UNIT - III

IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

UNIT - IV

FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparison of IIR & FIR filters.

UNIT - V

Realization of Digital Filters: Applications of Z – Transforms, Solution of Difference Equations of Digital Filters, System Function, Stability Criterion, Frequency Response of Stable Systems, Realizationof Digital Filters – Direct, Canonic, Cascade and Parallel Forms.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

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

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Website: https://siiet.ac.in/

COs and Mapping with PO/PSO

Course: Digital Signal Processing(C322) **Class: III ECE-A**

Course Outcomes

After completing this course the students will be able to:

C322. 1 Analyze the LTI system characteristics and Multirate signal processing. (Analysis)

C322. 2 Compare the inter-relationship between DFT and various transforms. (Evaluation)

C322.3 Design IIR digital filters for a given specification. (Synthesis)

C322.4 Design FIR digital filters for a given specification. (Synthesis)

C322.5 Express Z-transform analysis on signals and systems. (Comprehension)

C322.6 Interpret the significance of various filter structures and effects of round off errors. (Applications)

Mapping of course outcomes with program outcomes:

High -3 Medium -2 Low-1

PO / CO	PO 1	PO2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
C322. 1	3	3	1	2	2	1	-	-	1	-	-	-	1	2
C322. 2	3	3	3	1	2	2	1	-	1	-	-	-	1	3
C322. 3	3	3	3	1	2	2	1	-	1	-	-	-	1	2
C322. 4	3	3	3	1	2	2	1	-	1	-	-	-	1	3
C322. 5	3	1	-	1	2	2	-	-	1	-	-	-	1	2
C322. 6	3	1	-	-	1	-	-	-	1	-	-	-	1	3
C322	3	3	3	1	1.83	2.2	1	-	1	-	-	-	1	**2.50**

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CO- PO/PSO Mapping - Justification

Course: Digital Signal Processing(C322) **Class: III ECE-A**

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, 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 considerations 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.

PO9. **INDIVIDUAL AND TEAM WORK:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PSO 1: **Design Skills:** Design, analysis and development a economical system in the area of Embedded system & VLSI design.

PSO 2: **Software Usage:** Ability to investigate and solve the engineering problems using MATLAB, Keil and Xilinx.

CO-PO mapping Justification

C322. 1 Analyze the LTI system characteristics and Multirate signal processing.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to analyze the LTI system. (Level 3)
PO2	Analyze the problems on LTI system and Multirate Signal Processing.
PO3	Developing Solutions for LTI system Characteristics.
PO4	Analyzing and interpretation on LTI system Characteristics.
PO5	MATLAB tool used to predict and model the LTI system.
PO6	The responsibilities of LTI system towards the society
PO9	LTI signals and systems with MATLAB Tool.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C322. 2 Compare the inter-relationship between DFT and various transforms.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to compare the DFT and various transforms
PO2	Analyze the problems on DFT and various transforms.
PO3	Develop a Solutions for DFT and various transforms.
PO4	Analyzing and interpretation on DFT and various transforms.
PO5	MATLAB tool used to convert DFT to IDFT and Vice versa.
PO6	DFT and IDFT are the powerful tool which enable us to find the spectrum of finite duration signal
PO7	Human speech and hearing of signals are encoded with help of DFT, which is most useful for society.
PO9	DFT and IDFT system can be executed with help of MATLAB Tool.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C322.3 Design IIR digital filters for a given specification.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to design the IIR digital filters.
PO2	Analyze the problems on IIR digital filters.
PO3	Design and Develop a Solutions for IIR digital filters.
PO4	Analyze and interpretation on IIR digital filers.
PO5	MATLAB tool used to design the IIR digital filters.
PO6	IIR digital filter is used in Telecommunication, which is most important to the society.
PO7	Knowledge of IIR digital filter applied to environment.
PO9	IIR digital filter can be executed with help of MATLAB Tool.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C322.4 Design FIR digital filters for a given specification.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to design the FIR digital filters.
PO2	Analyze the problems on FIR digital filters.
PO3	Design and Develop a Solutions for FIR digital filters.
PO4	Analyzing and interpretation on FIR digital filers.
PO5	MATLAB tool used to design the FIR digital filters.
PO6	FIR digital filter is used in Telecommunication, which is most important to the society.
PO7	Knowledge of FIR digital filter applied to environment.
PO9	FIR digital filter can be executed with help of MATLAB Tool.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C322.5 Express Z-transform analysis on signals and systems.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to Z transforms analysis on signals and systems.
PO2	Problems on Z Transforms.
PO4	Interpretation on Z transform on signals and systems.
PO5	MATLAB tool used to interpret the Z transform on signals and systems.
PO6	Z transform is used in digital filter relevant to professional engineering practice.
PO9	Analysis of Z transforms on signals and systems can be done with help of MATLAB Tool.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C322.6 Interpret the significance of various filter structures and effects of round off errors.

PO1	Apply the knowledge of mathematics, science and engineering fundamentals to various filter structures.
PO2	Analyze various filter structures and effects of round off errors.
PO5	MATLAB tool used to analyze the various filter structures and effects of round off errors.
PO9	MATLAB Tool used to analyze the various filter structures and effects of round off errors.
PSO1	Student can design, analysis and development a system in the area of DSP
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

ACADEMIC CALENDAR 2022-23

B. Tech./B. Pharm. III YEAR I & II SEMESTERS

I SEM

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	**09.09.2022**	
2	1st Spell of Instructions (including Dussehra Recess)	09.09.2022	10.11.2022 (9 Weeks)
3	Dussehra Recess	03.10.2022	08.10.2022 (1 Week)
4	First Mid Term Examinations	11.11.2022	17.11.2022 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	24.11.2022	
6	2nd Spell of Instructions	18.11.2022	12.01.2023 (8 Weeks)
7	Second Mid Term Examinations	16.01.2023	21.01.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	23.01.2023	28.01.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	30.01.2023	
10	End Semester Examinations	30.01.2023	11.02.2023 (2 Weeks)

Note: No. of Working/ instructional days: 92

II SEM

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	**13.02.2023**	
2	1st Spell of Instructions	13.02.2023	08.04.2023 (8 Weeks)
3	First Mid Term Examinations	10.04.2023	15.04.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	22.04.2023	
5	2nd Spell of Instructions (including Summer Vacation)	17.04.2023	24.06.2023 (10 Weeks)
6	**Summer Vacation**	15.05.2023	27.05.2023 (2 Weeks)
7	Second Mid Term Examinations	26.06.2023	01.07.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	03.07.2023	08.07.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	08.07.2023	
10	End Semester Examinations	10.07.2023	22.07.2023 (2 Weeks)

Note: No. of Working/ instructional days: 90

REGISTRAR

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

Class Timetable

CLASS: III-B.Tech ECE-A A.Y:2022-23 SEMESTER: II LH: C-201

TIME/ DAY	I 9:40-10:30	II 10:30 -11:20	III 11:20-12:10	IV 12:10-1:00	1:00-1:30	V 1:30-2:20	VI 2:20-3:10	VII 3:10-4:00
MON	A&P	DSP LAB / e-CAD LAB			LUNCH	VLSID	ESD	LIB
TUE	IM	DSP	FAI	ESD		DSP(T)/VLSID(T)	A&P	SPORTS
WED	ESD	IM	A&P	A&P(T)/DSP(T)		FAI	DSP	COUN
THU	IM	DSP	VLSID	VLSID(T)/A&P(T)		e-CAD LAB / DSP LAB		
FRI	FAI	DSP	A&P	VLSID		ESD	CO-CU/DAA	
SAT	VLSID	ESD	VLSID(ADJUNCT)			SL LAB		A&P

*(T) – Tutorial Concern Faculty

Course Code	Course Name	Name of the Faculty	Course Code	Course Name	Name of the Faculty
EC601PC	A&P-Antennas and Propagation	P.Krishna Rao	EC604PC	DSP LAB-Digital Signal Processing Lab	Y.Raju/Dr.T.Ramakrishna/ Dr.S.Anjaneyulu
EC602PC	DSP-Digital Signal Processing	Y.Raju	EC605PC	e-CAD LAB-e – CAD Lab	S.Alekhya/P.Rajendra/P.Krishna
EC603PC	VLSID-VLSI Design	S.Alekhya	EC606PC	SL LAB-Scripting Languages Lab	D.Nagaraju/P.Krishna Rao/ K.Bhaskar Reddy
EC613PE	ESD-Embedded System Design(Professional Elective-II)	A.Vaani	-	FAI-Fundamentals of Artificaial Intelligence	P.Meena
VLSID (ADJUNCT)	VLSID(ADJUNCT)	G.Chandrasekhar	COUN	Counseling	Y.Raju/K.Padma/G.Swathi
MT600OE	IM-Industrial Management (Open Elective-I)	K.V.Nagamani	SPORTS	Sports	P.Srilatha/B.Ashwini
			CO-CU/DAA	Co-Curricular/Dept. Assoc.Activities	S.Alekhya/S.Naresh/K.Bhaskar Reddy
			LIB	Library	G.Nirmala/A.Swetha

Class Incharge Head of The Department

Head of the Department
Electronics and Communication Engg. Dept
INSTITUTE OF ENGG & TECH.

Principal
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LESSON PLAN

Programme: B.Tech	Academic Year: 2022-23
Year: III	Semester: II
Course Title: DIGITAL SIGNAL PROCESSING	Course Code: EC602PC
Name of Faculty: Y.RAJU	

Unit-I Syllabus

Introduction: Introduction to Digital Signal Processing: Discrete Time Signals & Sequences, conversion of continuous to discrete signal, Normalized Frequency, Linear Shift Invariant Systems, Stability, and Causality, linear differential equation to difference equation, Linear Constant Coefficient Difference Equations, Frequency Domain Representation of Discrete Time Signals and Systems Multirate Digital Signal Processing: Introduction, Down Sampling, Decimation, Up sampling, Interpolation, Sampling Rate Conversion.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
3	Introduction to Digital Signal Processing: Discrete Time Signals & Sequences	T1, R 1,W1	BB
2	conversion of continuous to discrete signal, Normalized Frequency	T1, R 1, W1	BB
3	Linear Shift Invariant Systems, Stability, and Causality	T1, R 1	BB
2	linear differential equation to difference equation, Linear Constant Coefficient Difference Equations	T1, R 2	BB
2	Frequency Domain Representation of Discrete Time Signals and Systems	T1, R2	BB
2	Multirate Digital Signal Processing: Introduction to Multirate sampling	R3	BB
2	Down sampling and Decimation	T1, R 2	BB
2	Up sampling and Interpolation	T1, R 2	BB
2	Sampling Rate Conversion	T1, R 3	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Analyze the LTI system characteristics and Multirate signal processing.			

*Session Duration: 50 minutes

*Total Number of Hours/Unit: 20

Unit-II Syllabus

Discrete Fourier series: Fourier Series, Fourier Transform, Laplace Transform and Z-Transform relation**,** 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 Decimation-in-Time and Decimation-in-Frequency FFT Algorithms, Inverse FFT.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	**Discrete Fourier series:** DFS Representation of Periodic Sequences, Properties of Discrete Fourier Series	R1	BB
2	Discrete Fourier Transforms: Properties of DFT, Linear Convolution of Sequences using DFT,	R1,R2,W3	BB
1	Computation of DFT: Over-Lap Add Method,	T1, R 1	BB
1	Over-Lap Save Method,	T1, R 2	BB
2	Relation between DTFT, DFS, DFT and Z- Transform.	T1, R 1	BB
2	Related Problems	T1, R 2	BB
2	**Fast Fourier Transforms:** Fast Fourier Transforms (FFT) - Radix-2 Decimation-in-Time	T1,R2	BB
2	Decimation-in-Frequency FFT Algorithms, Inverse FFT.	T1, R 3	BB
1	FFT with General Radix-N	T1, R 2	BB
1	Related Problems	T1, R2	BB
Gap beyond syllabus (if any):			
Gap within the syllabus (if any)			
Course Outcome 1: Compare the inter-relationship between DFT and various transforms.			

*Session Duration: 50 minutes

*Total Number of Hours/Unit: 15

Unit-III Syllabus

IIR Digital Filters: Analog filter approximations – Butterworth and Chebyshev, Design of IIR Digital Filters from Analog Filters, Step and Impulse Invariant Techniques, Bilinear Transformation Method, Spectral Transformations.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
2	**IIR Digital Filters:** Analog filter approximations – Butterworth	R3	BB
3	Chebyshev, Design of IIR Digital Filters from Analog Filters,	R2	BB
2	Step and Impulse Invariant Techniques,	T1, R1	BB
2	Bilinear Transformation Method,	T1, R 1,W4	BB
2	Spectral Transformations.	T1, R2	BB
2	Related Problems -1	T1, R1	BB
2	Related Problems -2	T1, R 3	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Design IIR digital filters for a given specification.			

*Session Duration: 50minutes

*Total Number of Hours/Unit: 15

Unit-IV Syllabus

FIR Digital Filters: Characteristics of FIR Digital Filters, Frequency Response. Design of FIR Filters: Fourier Method, Digital Filters using Window Techniques, Frequency Sampling Technique, Comparisonof IIR & FIR filters.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
2	**FIR Digital Filters:** Characteristics of FIR Digital Filters,	R2,W5	BB
2	Frequency Response	T1, R2	BB
2	Design of FIR Filters: Fourier Method,	T1, R3	BB
2	Digital Filters using Window Techniques,	R2	BB
1	Frequency Sampling Technique,	R3	BB
1	Comparisonof IIR & FIR filters	R3	BB
2	Related Problems -1	R4	BB
2	Related Problems -2	T1, R3	BB
1	Related Problems -3	T1, R 4	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Design FIR digital filters for a given specification.			

*Session Duration: 50minutes

*Total Number of Hours/Unit: 15

Unit-V Syllabus

Realization of Digital Filters: Applications 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.

Finite Word Length Effects: Limit cycles, Overflow Oscillations, Round-off Noise in IIR Digital Filters, Computational Output Round Off Noise, Methods to Prevent Overflow, Trade Off Between Round Off and Overflow Noise, Measurement of Coefficient Quantization Effects through Pole-Zero Movement, Dead Band Effects.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	**Realization of Digital Filters:** Applications of Z – Transforms,	R3,R4	BB
1	Solution of Difference Equations of Digital Filters,	R4,R2	BB
1	System Function, Stability Criterion,	R3	BB
2	Frequency Response of Stable Systems, Realization of Digital Filters – Direct, Canonic, Cascade and Parallel Forms.	R4,W6	BB
1	**Finite Word Length Effects:** Limit cycles,	T1, R 4	BB
1	Overflow Oscillations,	T1, R 2	BB
1	Round-off Noise in IIR Digital Filters,	T1, R 3	BB
1	Computational Output Round Off Noise,	T1, R 4	BB
1	Methods to Prevent Overflow,	T1, R 4	BB
1	Trade Off Between Round Off and Overflow Noise,	T1, R 3	BB
1	Measurement of Coefficient Quantization Effects through Pole-Zero Movement,	T1, R 4	BB
1	Dead Band Effects	T1, R 3	BB
1	Related Problems -1	T1, R 3	BB
1	Related Problems -2	T1, R 4	BB
Gap beyond syllabus(if any):			
Gap within the syllabus(if any)			
Course Outcome 1: Express Z-transform analysis on signals and systems. **Course Outcome 2:** Interpret the significance of various filter structures and effects of round off errors.			

*Session Duration: 50minutes

*Total Number of Hours/Unit: 15

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

WEB REFERENCES:

+

S.No.	Web Link
1	https://nptel.ac.in/courses/117102060/
2	https://www.elprocus.com/fir-filter-for-digital-signal-processing/
3	https://www.tutorialspoint.com/digital_signal_processing/dsp_discrete_fourier_transform_introduction.htm
4	https://www.mikroe.com/ebooks/digital-filter-design/bilinear-transformation
5	https://www.telecomtrainer.com/fir-finite-impulse-response/
6	https://www.dsprelated.com/freebooks/filters/Four_Direct_Forms.html

Lecture notes

Unit 1 link:

https://drive.google.com/file/d/1bqqwaB6DMSwHI6Yz_vzJf0-eDKQQAHfL/view?usp=sharing

Unit 2 link:

https://drive.google.com/file/d/1zXSHaApRX3egnrd25cx-9OS39eOGqqAD/view?usp=sharing

Unit 3 link:

https://drive.google.com/file/d/1DE8WgmyVtLOWqY3Ya6lGJlG8s4ZmY038/view?usp=sharing

Unit 4 link:

https://drive.google.com/file/d/1BOOk9ALJL0u67HZ3-b9uluQeAgkDXazs/view?usp=sharing

Unit 5 link:

https://drive.google.com/file/d/1HCabbgVAdpjv4SIuo2gidZG5fdLJplHC/view?usp=sharing

Power point presentation

PPT link:

https://drive.google.com/file/d/1so3BreCt4gViED68LkH2nui9UoNkx5Yq/view?usp=sharing

Code No: 156AR **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, August/September - 2021
DIGITAL SIGNAL PROCESSING
(Common to ECE, EIE)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Calculate the total response of the system described by $y(n)-4y(n-1)-12y(n-2)=x(n)$, $y(-1)=1$, $y(-2)=2$.

b) Calculate the transfer function of the system defined by $y(n)-2y(n-1)=x(n)$. [10+5]

2.a) Describe with mathematical equations, how sampling rate can be decreased by a factor of D.

b) Briefly introduce the concepts of Multirate Digital Signal Processing. [10+5]

3.a) Derive the following properties of DFS.
i) Time shifting
ii) Time reversal
iii) Convolution.

b) Draw the butterfly diagram for DITFFT algorithm. [10+5]

4. Calculate the 8 point DFT of the sequence $x(n)=\{1,-2,3,1,-1,2\}$ using DIF-FFT and DIT-FFT. [15]

5.a) Write the differences between bilinear transform and impulse invariant method.

b) Write the differences between analog and digital filters. [8+7]

6. Design butterworth high pass filter for the given specifications:
$\alpha_p=3dB$, $\alpha_s=15dB$, $\Omega_p=1000\,rad/\sec$, $\Omega_s=500\,rad/\sec$. [15]

7. Given the filter specifications as

$$H_d(e^{i\omega}) = e^{-j2\omega} \quad for\ 0 \le |\omega| \le \frac{\pi}{2}$$
$$= 0 \quad \frac{\pi}{2} \le |\omega| \le \pi$$

using rectangular window, calculate causal impulse response coefficients. [15]

8.a) Realize the following system equation in direct form-I and direct -form II

$$y(n)+3/4y(n-1)=x(n)-2x(n-1)$$

b) Write the differences between direct form-I and canonical form. [10+5]

---ooOoo---

CodeNo: 156AR **R18**

JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITY HYDERABAD
B.TechIIIYearIISemesterExaminations, February/March-2022 DIGITAL SIGNAL PROCESSING
(CommontoECE,EIE)

Time:3Hours **Max.Marks: 75**

Answer any five questions
Allquestionscarryequalmarks
---

1. a) Whataretheconditions forstabilityand causalityof anLTIsystem?Explain.
   b) Explainin detailthe classificationofdiscrete-time systems.
   c) What is the need for multi-stage implementation of sampling rate converters? Explain with an example. [5+5+5]

2. a) Find8-pointDFTX(K)ofthereal sequence.
   (n)={0.707,1,0.707,0,−0.707, −1, −0.707,0} byusingDIF radix-2 FFT
   b) FindtheN-point DFT of$(n)=b^n\cos an$usingthelinearityproperty. [8+7]

3. a) Stateandproveanytwoproperties ofDiscrete Fourier series.
   b) Givenx(n)= $2^n$and N=8, find X(k)usingDIT-FFT algorithm. [6+9]

4. a) Design a digital low pass filter using Chebyshev filter that meets the following specifications: Passband magnitude characteristics that is constant to within 1dB for recurrences below $\omega = 0.2\pi$ and stopband attenuation of atleast 15dB for frequencies between $\omega = 0.3\pi$ and π. Use bilinear transformation.
   b) Derivetherelationbetweendigitalandanalogfrequenciesinbilineartransformation. [10+5]

5.a) DesignaButterworthanaloghighpass filterthatwillmeetthefollowingspecifications
   i) Maximumpassbandattenuation=2dB
   ii) Passbandedgefrequency=200rad/sec
   iii) Minimumstopbandattenuation=20dB
   iv) Stop band edgefrequency=100rad/sec.
   b) Provethat foralinearphaseFIRfiltertheimpulseresponseis symmetric. [8+7]

6. a) ExplainthetypeIIfrequencysamplingmethodof designinganFIRdigital filter.
   b) Design a band pass filter which approximates the ideal filter with cutoff-frequencies at 0.2rad/secand0.3rad/sec.ThefilterorderisM=7.UsetheHanningwindowfunction. [5+10]

7 . a) ExplaincoefficientquantizationofIIR filters.
   b) WhatisRound-offNoisein IIRDigitalFilters?Discussitseffectsin IIRfilters. [7+8]

8. a) DescribevariousStructuresof IIRfilterswithsuitablediagrams.
   b) Explainthelimit cycleoscillationsduetoproductround-off andoverflowerrors.[10+5]

---ooOoo---

Code No: 156AR **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech III Year II Semester Examinations, August - 2022
DIGITAL SIGNAL PROCESSING
(Common to ECE, EIE)

Time: 3 Hours **Max.Marks:75**

Answer any five questions
All questions carry equal marks
- - -

1. Find the impulse response $h[n]$ of the system described by the difference equation $8y[n] + 6y[n-1] = x[n]$
   b) Discuss the sampling rate conversion by a factor I with the help of a neat block diagram.
   c) Define time invariant system. Show that the interpolator is a time-variant system. [5+5+5]

2.a) Check the following filter for time invariant, causal and linear.
   (i) $y(n) = (n-1)x^2(n+1)$ (ii) $y(n) = n^2x(n-2)$
   b) Explain the frequency domain representation of discrete time signals.
   c) Explain the terms: i) Up – sampling ii) Down- sampling. [5+5+5]

3.a) Determine the Inverse Z-Transform of $X(Z) = \frac{1}{(1-Z^{-1})(1-Z^{-1})^2}$.
   b) Find the linear convolution of the sequences x[n] = {1,4,0,9, -1} and h[n]= {-3, -4,0,7}.
   c) Compute the DFT of the sequence x(n) = sin[nπ/4], where N=8 using DIT FFT algorithm. [5+5+5]

4.a) Write five properties of DFS.
   b) Find the Laplace transform of the following function $f(t) = te^{2t}Sin(3t)$.
   c) Given x(n) = {1,2,3,4,4,3,2,1}, find X(k) using DIF FFT algorithm. [5+5+5]

5.a) Design a Chebyshev filter with a maximum passband attenuation of 2 dB; at Ωp=20rad/sec and the stopband attenuation of 35 dB at Ωs=50 rad/sec.
   b) Obtain the impulse response of digital filter to correspond to an analog filter with impulse response ha(t) = 0.5 e^{-2t} and with a sampling rate of 1.0kHz using impulse invariant method. [7+8]

6.a) Differentiate "maximally flat magnitude response" and "equiripple magnitude response" filters.
   b) Convert the analog filter to a digital filter whose system function is $H(S) = \frac{1}{(S+2)^2(S+1)}$, Use bilinear transformation. [8+7]

7.a) What is a Kaiser window? In what way is it superior to other window functions?
   b) Using a rectangular window technique, design a low pass filter with pass band gain of unity, cut-off frequency of 1000Hz and working at a sampling frequency of 5 KHz. The length of the impulse response should be 7. [7+8]

8.a) Using the z-transform, find the total solution to the following difference equation with initial conditions, for discrete time $n \geq 0$.
   $5y[n+2] - 3y[n+1] + y[n] = (0.8)^n u[n]$, $y[0] = -1$, $y[1] = 10$
   b) Determine direct form I and cascade realization of the following system: [8+7]

$$H(z) = \frac{2\left(1 - z^{-1}\right)\left(1 + \sqrt{2}z^{-1} + z^{-2}\right)}{\left(1 + 0.5z^{-1}\right)\left(1 - 0.9z^{-1} + 0.81z^{-2}\right)}$$

---ooOoo---

Sri Indu Institute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

I- Mid Examinations, MAY-2023

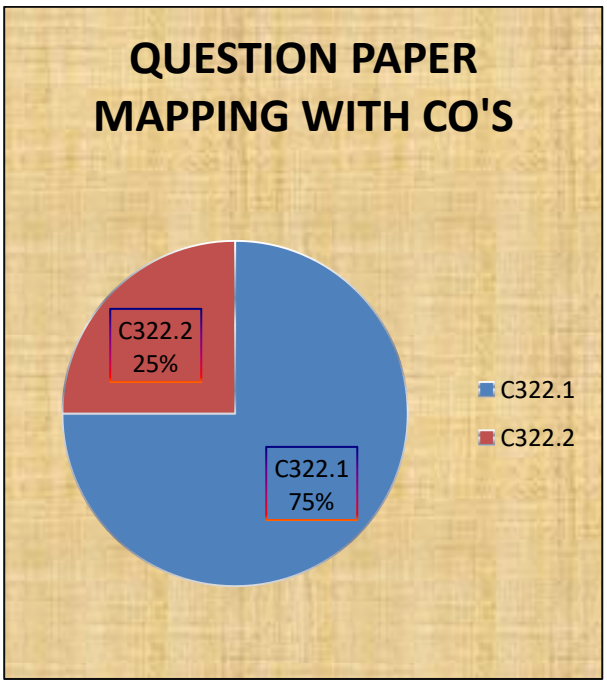
Set – I

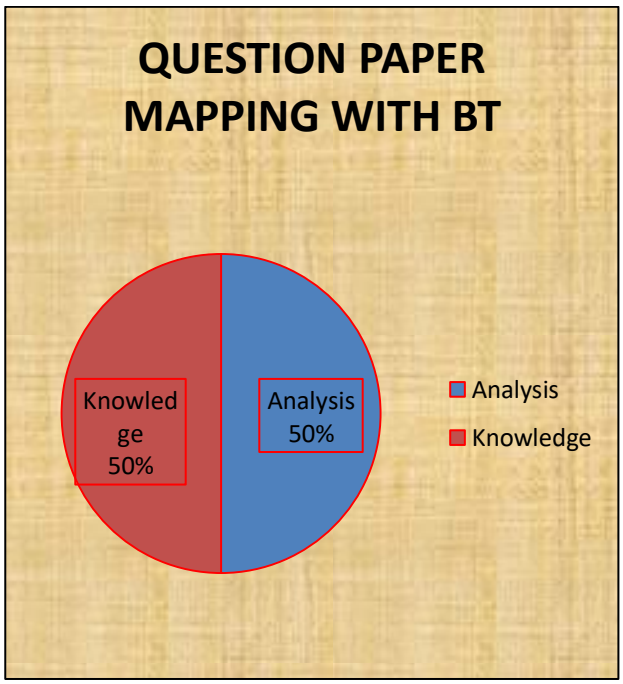
Year & Branch: III ECE Date: 08/05/2023(AN)

Subject: DSP (A, B&C) Max.Marks: 10 Time:60 mins

Answer any **TWO** Questions. All Question Carry Equal Marks 2*5=10 marks

1. Explain digital signal processing system with the help of a neat block diagram, list the advantages, limitations and some applications of digital signal processing.(C322.1)	5	Knowledge
2.Find the Forced Response of the system described by difference Equation, $y(n)-4y(n-1)+4y(n-2)=x(n)-x(n-1)$ for the input $x(n)=(1/2)^n u(n)$. (C322.1)	5	Analysis
3.Determine the Convolution sum of two sequence X(n)={3,2,1,2},h(n)={1,2,1,2}. (C322.1)	5	Analysis
4.Find 8 –Point DFT of the given sequence x(n)= {1,1,1,1,1,1,0,0}.(C322.2)	5	Knowledge





Sri InduInstitute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

II- Mid Examinations, JUNE-2023

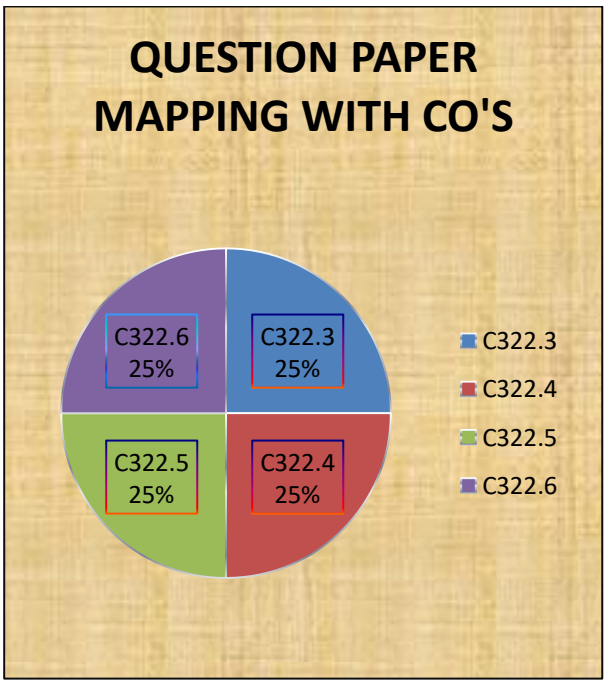
Set – II

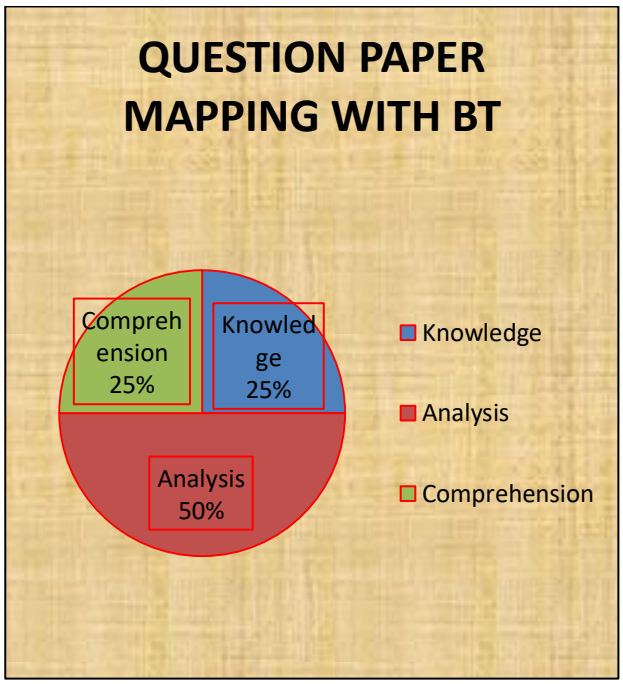
Year & Branch: III ECE — Date: 26/06/2023(AN)

Subject: DSP (A, B&C) — Max.Marks: 10 — Time: 60 mins

Answer any **TWO** Questions. All Question Carry Equal Marks — 2*5=10 marks

1.An analog filter has a transfer function $H(s)=10/s^2+7s+10$ Design a digital filter equivalent to their using impulse invariant method. (C322.3)	5	Knowledge
2 Design an ideal high pass filter with a frequency response $H_d(e^{j\omega})= 1,$ for $-\pi/4 \le \lvert\omega\rvert \le \pi$ $0,$ for $\lvert\omega\rvert \le \pi/4$ Find the values of h(n)for N=11.Find H(z) and plot the magnitude response. (C322.4)	5	Analysis
3. Determine the impulse response of the described by the difference equation, y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1)using z-transform. (C322.5)	5	Analysis
4. Discuss about finite word length effects on Implementation of IIR filters. (C322.6)	5	Comprehension





SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ECE

B.Tech III Year II Sem I Mid –Term Examination, May 2023

DIGITAL SIGNAL PROCESSING

(Objective Exam)

DATE: 08/05/2023 (AN) **TIME: 20 Min** **MAX.MARKS: 10**

NAME..... **ROLL NO.....**

I. Choose the Correct Answers

1. If a signal satisfies x (N+n) = x (n) for all n, then the signal is [ ]
   a) periodic b) non-periodic c) Symmetric d)Asymmetric

2. For a causal LTI system to be stable, all the poles of H(Z) must lie …… in the Z-plane. [ ]
   a) Inside the unit circle b) outside the unit circle c) either a or b d) None of the above

3. Zero state response is also known as [ ]

a) Free response b) Forced Response c) Natural Response d) None of these

4. Zero input response is also known as [ ]

   a) Free response b) Forced Response c) Natural Response d) None of these

5. FFT may be used to calculate [ ]
   a) DFT& IDFT b) Direct Z transform c)In Direct Z transform d)None of these

6.The number of complex additions of direct DFT is [ ]

   a)N (b) N (N-1) (c) N (N+1) (d) N^2

7. The system described by the input-output equations y (n) =x^2(n) [ ]

   a)Causal b)linear c)Non-linear d)All Of These

8. If the system has bounded output for bounded input, it is called as [ ]

   a) Causal b) linear c) Non-linear d) Stable

9. DTFT is the representation of [ ]

   a. Periodic Discrete time signals b. Aperiodic Discrete time signals
   c. Aperiodic continuous signals d. Periodic continuous signals

10. The total solution of difference equation [ ]

a)$y_p(n)-y_h(n)$ b)$y_p(n)+y_h(n)$ c)$y_p(n)=y_h(n)$ d) None of the above

II. Fill in The Blanks:

11. If the response of the system depends on the past or future samples then the system is called …….....

12. The DFT supports only ……..... convolution.

13. DFT{ x(n)} =X(K)=.....…….....

14. Bit reversal is required for ……..... algorithm.

15. Twiddle factor $W_{N=}$ …….....

16. What is the relationship between DFT and Z-transform……

17. Compute the 2- point DFT of given sequence x(n)= {1,0}, X(K)=…….

18. The linear time invariant system is said to be stable if its impulse response is……

19. Linear convolution of two sequences of length L and N produces an output sequence of length …….

20. State the Convolution Property of DFT …….

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY
DEPARTMENT OF ECE
B.Tech III Year II Sem II Mid –Term Examination, JUNE-2023

DIGITAL SIGNAL PROCESSING

(Objective Exam)

DATE: 26/06/2023 (AN) **TIME: 20 Min** **MAX.MARKS: 10**

NAME :_____ ROLL NO:_____

I. Choose The Correct Answers

1 What is the value of gain at the pass band frequency, i.e., what is the value of K_P? [ ]
a)$-10\log[1-(\Omega P/\Omega C)^{2N}]$ b)$-10\log[1+(\Omega P/\Omega C)^{2N}]$
c)$10\log[1-(\Omega P/\Omega C)^{2N}]$ d) $10\log[1+(\Omega P/\Omega C)^{2N}]$

2 Which of the following equation is True? [ ]
a) $[\Omega P/\Omega C]^{2N}=10^{-KP/10}+1$ b) $[\Omega P/\Omega C]^{2N}=10^{KP/10}+1$
c) $[\Omega P/\Omega C]^{2N}=10^{-KP/10}-1$ d) None of the mentioned

3 What is the order N of the low pass Butterworth filter in terms of K_P and K_S? [ ]
a) $[\log((10^{KP/10}-1)/(10^{Ks/10}-1))]/2\log(\Omega P/\Omega S)$
b) $[\log((10^{KP/10}+1)/(10^{Ks/10}+1))]/2\log(\Omega P/\Omega S)$
c) $[\log((10^{-KP/10}+1)/(10^{-Ks/10}+1)]/2\log(\Omega P/\Omega S)$
d) $[\log((10^{-KP/10}-1)/(10^{-Ks/10}-1))]/2\log(\Omega P/\Omega S)$

4 What is the lowest order of the Butterworth filter with a pass band gain K_P=-1 dB at Ω_P=4 rad/sec and stop band attenuation greater than or equal to 20dB at Ω_S = 8 rad/sec? [ ]
a)4 b)5 c)6 d) 3

5 What is the value of chebyshev polynomial of degree 0? [ ]
a) 1 b) 0 c) -1 d) 2

6 Which of the following substitution is done in Bilinear transformations? [ ]
a)$s= 1/2T[1+z^{-1}/1-z^{-1}]$ b)$s= 2/T[1+z^{-1}/1+z^{-1}]$ c) $s= 2/T[1-z^{-1}/1+z^{-1}]$
d) None of the mentioned

7 In FIR Filter design, which among the following parameters is/are separately controlled by using Kaiser window_____ [ ]
a) order of filter(M) b) Transition width of main lobe
c) both a &b d) None of the above

8 For a linear phase filter, if Z_1 is zero then what would be the value of Z_1^{-1} OR $1/Z_1$ [ ]
a) Zero b) unity c) infinity d) unpredictable

9 In barlett window, the triangular function resembles the tapering of rectangular window sequence from the middle to the ends [ ]
a) linearly b) elliptically
c) hyperbolically d) parabolically

10 In linear phase realization, equal valued coefficients are taken continuous are taken common for reducing the requisite number of [ ]
a)adders (b) subtractors (c) multipliers (d) dividers

II. Fill in The Blanks:

1. FIR Stands.....
2. IIR Stands_____
3. Chebyshev polynomials of odd orders are _____
4. If the factor of the form (s-a) in H(s) is mapped into $1-(e^{aT}z^{-1})$ in the z-domain, the that kind of transformation is called as_____
5. ROC does not have_____
6. Magnitude Response of Butterworth filter has_____
7. _____are the values of z for which the value of $X(z)=\infty$
8. If all the poles of H(z) are outside the unit circle, then the system is said to be _____
9. If M and N are the orders of numerator and denominator of rational system function respectively, then_____ Number of multiplications are required in direct form-I realization of that IIR filter.
10. In the practical A/D converters, if the differences between transition values are not all equal or uniformly changing, then such error is known as_____

Sri Indu Institute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

B-Tech I - Mid Examinations, MAY-2023

Year &Branch: III –ECE-A, B&C **Date: 08/05/2023(AN)**

Subject: DSP

ANSWER KEY

Descriptive paper key link:

https://drive.google.com/file/d/1fK3hd79073-alzePiXwUF4YEoe_-c7xf/view?usp=sharing

Objective Key Paper

I. Choose the correct alternative:

1. a) periodic
2. c) either a or b
3. b) Forced Response
4. c) Natural Response
5. a) DFT& IDFT
6. d) N^2
7. c) Non-linear
8. d) Stable
9. a) Periodic Discrete time signals
10. b) $y_p(n)+y_h(n)$

Fill in the blanks:

1. Non causal
2. Linear and Circular
3. $\sum x(n)\, e^{-j2\pi kn/N}$
4. FFT
5. Exp (-j2pi/N)
6. R = 1
7. (1,1)
8. Less than infinity
9. L+N-1
10. $X(\omega)Y(\omega)$

Sri Indu Institute of Engineering & Technology

Sheriguda (V), Ibrahimpatnam (M), R.R.Dist-501 510

B-Tech II - Mid Examinations, JUNE-2023

Year &Branch: III –ECE-A, B&C **Date: 26/06/2023(AN)**

Subject: DSP

ANSWER KEY

Descriptive paper key link:

https://drive.google.com/file/d/1FOEl3Lk0qwrpFwT6l3R8aDkL3RV7Wbjp/view?usp=sharing

Objective/Quiz Key Paper

I. Choose the correct alternative:

1. b)-10 log$[1+(\Omega P/\Omega C)^{2N}]$
2. c) $[\Omega P/\Omega C]^{2N}=10^{-KP/10}-1$
3. d) $[\log((10^{-KP/10}-1)/(10^{-Ks/10}-1))]/2\log(\Omega P/\Omega S)$
4. b)5
5. a) 1
6. c) $s= 2/T[1-z^{-1}/1+z^{-1}]$
7. c) both a &b
8. a) Zero
9. **a)** linearly
10. c) multipliers

Fill in the blanks:

1. Finite Impulse response
2. Infinite Impulse response
3. Odd functions
4. Matched Z-transform
5. Poles
6. Flat stop band and Flat pass band
7. Poles
8. Neither causal or BIBO stable
9. M+N+1
10. Linearity Error.

ASSIGNMENT- 1 **SUBJECT: DSP**

1. Determine the 8- Point DFT of the sequence x (n) = { 1, 1, 1, 1, 1, 1, 0, 0}.(C322. 2) (Analysis)

2. Find DFT of the given sequence x (n) = { 1, 2, 3, 4, 4, 3, 2, 1 } using DIT algorithm. (C322. 2) (Knowledge)

3. Find 8-point IDFT of the given sequence X (K) = { 5,0, 1-j, 0, 1, 0, 1+j, 0}. (C322. 2) (Knowledge)

4. Determine the convolution sum of two sequence x(n) = {3, 2, 1, 2 }, h(n) = { 1,2,1,2 }. (C322. 1) (Analysis)

5. Find the Total Response of the system described by difference equation.the input

y (n) – 4y (n-1) + 4 y(n-2) = x (n) - x(n-1) for input x(n) = $(1/2)^n$ u(n) with initial conditions y(-1) = y(-2) = 1. (C322. 1) (Analysis)

6. Define linear and Non linear systems and test the system y (n) = a x(n) + b x (n-1).

(C322. 1) (Knowledge)

ASSIGNMENT- 2 **SUBJECT: DSP**

1. Apply Bilinear transformation to H(S)=2/(S+1)(5+2) with T=1sec and find H(Z). (C322.3) (Application)

2. Design an ideal low pass filter with a frequency response.

$H_d(e^{jw}) = 1$, for $-\pi/2 \le w \le \pi/2$

$= 0$, for $\pi/2 \le w \le \pi$

Find the values of h(n) for N=11. find H(Z) and plot the magnitude response.(C322.4) (Analysis)

3. $H(S) = 10/S^2+7S+10$ Design a digital fitter using impulse invariant method (T=1 sec). (C322.3) (Analysis)

4. $H(S) = (S+ 0.2)/(s+0.2)^2 +9$ Design a digital filter using impulse invariant method. (T=1 sec). (C322.3) (Analysis)

5. A digital filter has following frequency specification.

Passband frequency $Wp = 0.2\pi$

Stopband frequency $Ws = 0.3\pi$

find analog specifications Ωp and Ωs using i) Impulse invariant method (ii) Bilinear method. (C322.3) (Knowledge)

6. Design an ideal low pass filter with a frequency response.

$H_d(e^{jw}) = 1$, for $-\pi/4 \le w \le \pi$

$= 0$, for $|w| \le \pi/4$

Find the values of h(n) for N=11.find H(Z) and plot the magnitude response. (C322.4) (Analysis)

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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(Approved by AICTE, New Delhi and Affiliated to JNTUH, Hyderabad)
Khalsa Ibrahimpatnam, Sheriguda (V), Ibrahimpatnam (M), Ranga Reddy Dist., Telangana – 501 510
Website: https://siiet.ac.in/

TUTORIAL TOPICS **SUBJECT:DSP**

S.NO	Unit	TOPIC	Number of Sessions Planned	Teaching method/Aids
1.	1	Find the linear convolution of two sequences x(n)={1,2,3,4} & h(n)={3,4,5,6}	1	**BB**
2.		Determine whether the following system are linear, time-invariant y(n)=A x(n) + B	1	BB
3.	2	Find the IDFT of Y (k) = {1, 0, 1, 0}	1	BB
4.		Determine the Discrete Fourier transform x (n) = {1, 1, 1, 1}	1	BB
5	3	Apply Bilinear transformation to $H(S)= 2/(S^2+3S+2)$ with T=1 sec and find H(Z).	1	BB
6		$H(S)= 10/(S^2+7S+10)$ Design a digital filter using impulse invariant method.	1	BB
7	4	Design an ideal lowpass filter with a frequency response $H_d(e^{j\omega})= 1$, for $-\pi/2 \le \|\omega\| \le \pi/2$ $= 0$, for $\pi/2 \le \|\omega\| \le \pi$ Find the values of h(n)for N=11.Find H(z) and plot the magnitude response.	1	BB
8		Design an ideal high pass filter with a frequency response $H_d(e^{j\omega})= 1$, for $-\pi/4 \le \|\omega\| \le \pi$	1	BB

		= 0,for $\|\omega\| \leq \pi/4$ Find the values of h(n)for N=11.Find H(z) and plot the magnitude response.		
9	5	Determine the impulse response of the described by the difference equation, y(n)-3y(n-1)-4y(n-2)=x(n)+2x(n-1)using z-transform.	1	BB
10		Discuss about finite word length effects on Implementation of FIR filters.	1	BB

Course Title	DIGITAL SIGNAL PROCESSING
Course Code	EC602PC
Programme	B.Tech
Year & Semester	III year II-semester, A sec
Regulation	R18
Course Faculty	Y.RAJU, Assistant Professor, ECE

Slow learners:

S No	Roll no	No of backlogs	Internal-I Status	Internal-II Status
1	20X31A0402	3	23	19
2	20X31A0403	8	14	14
3	20X31A0406	4	20	17
4	20X31A0408	4	19	17
5	20X31A0410	5	15	14
6	20X31A0411	3	18	20
7	20X31A0412	5	20	14
8	20X31A0416	4	21	20
9	20X31A0418	8	14	15
10	20X31A0420	4	19	17
11	20X31A0423	5	20	19
12	20X31A0424	3	21	18
13	20X31A0427	3	22	19
14	20X31A0431	5	17	19
15	20X31A0435	5	17	16
16	20X31A0436	5	19	17
17	20X31A0440	3	22	19
18	20X31A0450	5	21	19
19	20X31A0454	5	14	14

20	20X31A0455	6	21	19
22	20X31A0456	6	21	19
23	20X31A0458	3	23	22

Advanced learners:

S.NO	ROLL.NO.	Assigned work
1	20X31A0404	Advanced Concepts material is provided for advanced learners, Subject seminars are presented by advanced learners in the class., and Advanced learners are encouraged to support slow learners.
2	20X31A0407	
3	20X31A0409	
4	20X31A0414	
5	20X31A0415	
6	20X31A0417	
7	20X31A0421	
8	20X31A0422	
9	20X31A0425	
10	20X31A0428	
11	20X31A0429	
12	20X31A0432	
13	20X31A0434	
14	20X31A0437	
15	20X31A0438	
16	20X31A0439	
17	20X31A0442	
18	20X31A0444	
19	20X31A0446	
20	20X31A0447	
21	20X31A0449	
22	20X31A0451	

23	20X31A0452	
24	20X31A0459	
25	20X31A0460	

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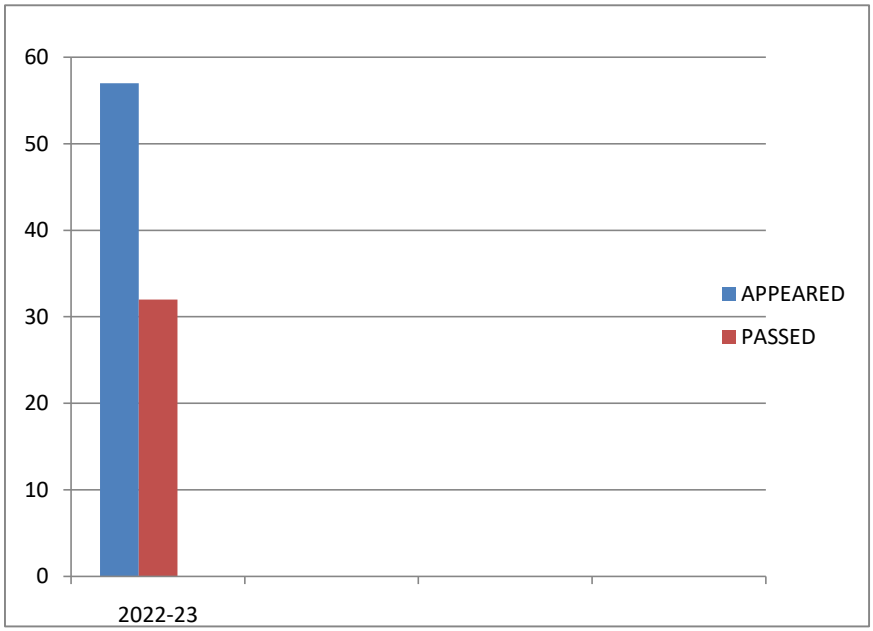
Website: https://siiet.ac.in/

BATCH ECE-III BTECH II SEM ECE-A RESULT ANALYSIS

ACADAMIC YEAR	COURSE NAME	NUMBER OF STUDENTS		QUESTION PAPER SETTING		PASS%
		APPEARED	PASSED	INTERNAL	EXTERNAL	
2022-23	DIGITAL SIGNAL PROCESSING	57	32	COURSE FACULTY	JNTUH	56.14

DIGITAL SIGNAL PROCESSING (C322) RESULT ANALYSIS



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Website: https://siiet.ac.in/

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

REMEDIAL CLASSES TIME TABLE

A.Y 2022-23 **SEMESTER-II**

BRANCH/ SEC	MON 4.00 PM- 5.00 PM	TUE 4.00 PM- 5.00 PM	WED 4.00 PM- 5.00 PM	THUR 4.00 PM- 5.00 PM	FRI 4.00 PM- 5.00 PM
II ECE-A	EMF&W	LTNM	A&DC	LICA	ECA
II ECE-B	LICA	A&DC	EMF&W	ECA	LTNM
III ECE-A	DSP	VLSID	A&P	ESD	IM
III ECE-B	A&P	ESD	DSP	IM	VLSID
III ECE-C	IM	A&P	ESD	VLSID	DSP
IV ECE-A	WSN	ML	LPVLSID	-	-
IV ECE-B	ML	LPVLSID	WSN	-	-
IV ECE-C	LPVLSID	WSN	ML	-	-

HOD
Head of the Department
Electronics and Communication Engg. Dept
SRI INDU INSTITUTE OF ENGG & TECH
Sheriguda(V), Ibrahimpatnam(M), R.R.Dist-501 510

PRINCIPAL
PRINCIPAL
Sri Indu Institute of Engineering & Tech
Sheriguda(Vill), Ibrahimpatnam
R R Dist Telangana -501 510

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (Internal Examination-1)

Name of the faculty : Y RAJU Academic Year: 2022-23

Branch & Section: ECE - A Examination: I Internal

Course Name: DIGITAL SIGNAL PROCESSING Year: III Semester: II

S.No	HT No.	Q1a	Q1b	Q2a	Q2b	Q3a	Q3b	Q4a	Q4b	Obj1	A1
Max. Marks ==>		5		5		5		5		10	5
1	20X31A0401					3				8	5
2	20X31A0402			5				5		8	5
3	20X31A0403					4				5	5
4	20X31A0404					5		2		9	5
5	20X31A0405					5		2		9	5
6	20X31A0406					4		3		8	5
7	20X31A0407					4		2		8	5
8	20X31A0408			2		5				7	5
9	20X31A0409			5		5				9	5
10	20X31A0410					5				5	5
11	20X31A0411					1		3		9	5
12	20X31A0412			2		4				9	5
13	20X31A0413			4		1				9	5
14	20X31A0414			4				3		9	5
15	20X31A0415			5		4				9	5
16	20X31A0416					5		2		9	5
17	20X31A0417			5		5				9	5
18	20X31A0418					5				4	5
19	20X31A0419			3				2		9	5
20	20X31A0420			3				2		9	5
21	20X31A0421					5		3		9	5
22	20X31A0422	5		5						9	5
23	20X31A0423			2		4				9	5
24	20X31A0424			2		5				9	5
25	20X31A0425			2		5				9	5
26	20X31A0426					5		3		9	5
27	20X31A0427					5		3		9	5
28	20X31A0428			3		5				9	5
29	20X31A0429					5		2		9	5
30	20X31A0430					5		3		9	5
31	20X31A0431							3		9	5
32	20X31A0432					1		4		9	5
33	20X31A0433	1						2		9	5
34	20X31A0434	1						4		9	5
35	20X31A0435	1						2		9	5
36	20X31A0436			1		5				8	5
37	20X31A0437			4		5				9	5
38	20X31A0438			5		5				9	5
39	20X31A0439					5		3		9	5
40	20X31A0440					5		3		9	5

41	20X31A0441					5		3		9	5
42	20X31A0442					5		4		9	5
43	20X31A0444					5		4		9	5
44	20X31A0445					5		2		9	5
45	20X31A0446					5		5		9	5
46	20X31A0447			5		5				9	5
47	20X31A0448			5		5				9	5
48	20X31A0449			5		5				9	5
49	20X31A0450					5		2		9	5
50	20X31A0451					5		5		9	5
51	20X31A0452					5		5		9	5
52	20X31A0453			3		5				9	5
53	20X31A0454					5				4	5
54	20X31A0455			3		5				8	5
55	20X31A0456			3		5				8	5
56	20X31A0458			4		5				9	5
57	20X31A0459			5		5				9	5
58	20X31A0460			4		5				9	5
59	20X31A0461			4		5				9	5
60	20X31A0462			4		5				9	5
Target set by the faculty / HoD		3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	6.00	3.00
Number of students performed above the target		1	0	23	0	48	0	19	0	56	60
Number of students attempted		4	0	29	0	51	0	30	0	60	60
Percentage of students scored more than target		25%		79%		94%		63%		93%	100%

CO Mapping with Exam Questions:

CO - 1	y		y		y				y	y
CO - 2							y		y	y
CO - 3									y	y
CO - 4										
CO - 5										
CO - 6										

% Students Scored >Target %	25%		79%		94%		63%		93%	100%

CO Attainment based on Exam Questions:

CO - 1	25%		79%		94%				93%	100%
CO - 2							63%		93%	100%
CO - 3									93%	100%
CO - 4										

CO - 5										
CO - 6										

CO	Subj	obj	Asgn	Overall	Level
CO-1	66%	93%	100%	86%	3.00
CO-2	63%	93%	100%	86%	3.00
CO-3		93%	100%	97%	3.00
CO-4					
CO-5					
CO-6					

Attainment Level	
1	40%
2	50%
3	60%

Attainment (Internal 1 Examination) = **3.00**

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (Internal Examination-2)

Name of the faculty : Y RAJU | Academic Year: 2022-23

Branch & Section: ECE - A | Examination: II Internal

Course Name: DIGITAL SIGNAL PROCESSING | Year: III | Semester: II

S.No	HT No.	Q1a	Q1b	Q2a	Q2b	Q3a	Q3b	Q4a	Q4b	Obj2	A2
Max. Marks ==>		5		5		5		5		10	5
1	20X31A0401	4								7	5
2	20X31A0402	5								9	5
3	20X31A0403	4								5	5
4	20X31A0404	5								9	5
5	20X31A0405	5		3						9	5
6	20X31A0406	5								7	5
7	20X31A0407	2		2						8	5
8	20X31A0408	3		2						7	5
9	20X31A0409	5		5						10	5
10	20X31A0410	4								5	5
11	20X31A0411	5								10	5
12	20X31A0412			2						7	5
13	20X31A0413	5								8	5
14	20X31A0414	4		5						9	5
15	20X31A0415	5		5						10	5
16	20X31A0416	5		2						8	5
17	20X31A0417	4		4						9	5
18	20X31A0418	5								5	5
19	20X31A0419			3		2				7	5
20	20X31A0420			5						7	5
21	20X31A0421	5								8	5
22	20X31A0422	5				4				9	5
23	20X31A0423	5				2				7	5
24	20X31A0424	5								8	5
25	20X31A0425	5								7	5
26	20X31A0426	5								10	5
27	20X31A0427	5				2				7	5
28	20X31A0428	5								8	5
29	20X31A0429	5		1						7	5
30	20X31A0430	5		3						10	5
31	20X31A0431	5		1						8	5
32	20X31A0432	5		4						10	5
33	20X31A0433	4								5	5
34	20X31A0434	5		4						9	5
35	20X31A0435	4								7	5
36	20X31A0436	4		1						7	5
37	20X31A0437	5		2						8	5
38	20X31A0438	5		5						10	5
39	20X31A0439	5								9	5
40	20X31A0440	5								9	5
41	20X31A0441	5		4						8	5
42	20X31A0442	5		5						10	5
43	20X31A0444	5		5						10	5
44	20X31A0445	5		4						7	5

45	20X31A0446	5		5						9	5
46	20X31A0447	5		5						9	5
47	20X31A0448	3		5						7	5
48	20X31A0449	5		5						10	5
49	20X31A0450	5		2						7	5
50	20X31A0451	5		5						10	5
51	20X31A0452	5		5						10	5
52	20X31A0453	5		3						8	5
53	20X31A0454			4						5	5
54	20X31A0455	3		4						7	5
55	20X31A0456	5		2						7	5
56	20X31A0458	5		4						8	5
57	20X31A0459	5		5						10	5
58	20X31A0460	4		4						7	5
59	20X31A0461	5		5						9	5
60	20X31A0462	5		3						7	5
Target set by the faculty / HoD		3.00	0.00	3.00	0.00	3.00	0.00	3.00	0.00	6.00	3.00
Number of students performed above the target		55	0	29	0	1	0	0	0	55	60
Number of students attempted		56	0	39	0	4	0	0	0	60	60
Percentage of students scored more than target		98%		74%		25%				92%	100%

CO Mapping with Exam Questions:

CO - 1										
CO - 2										
CO - 3	y								y	y
CO - 4			y						y	y
CO - 5					y				y	y
CO - 6							y		y	y

CO Attainment based on Exam Questions:

CO - 1										
CO - 2										
CO - 3	98%								92%	100%
CO - 4			74%						92%	100%
CO - 5					25%				92%	100%
CO - 6									92%	100%

CO	Subj	obj	Asgn	Overall	Level
CO-1					
CO-2					
CO-3	98%	92%	100%	97%	3.00
CO-4	74%	92%	100%	89%	3.00
CO-5	25%	92%	100%	72%	3.00
CO-6		92%	100%	96%	3.00

Attainment Level	
1	40%
2	50%
3	60%

Attainment (Internal Examination-2) = **3.00**

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment (University Examinations)

Name of the faculty : Y RAJU Academic Year: 2022-23

Branch & Section: ECE - A Year / Semester: III / II

Course Name: DIGITAL SIGNAL PROCESSING

S.No	Roll Number	Marks Secured
1	20X31A0401	8
2	20X31A0402	10
3	20X31A0403	
4	20X31A0404	32
5	20X31A0405	14
6	20X31A0406	0
7	20X31A0407	6
8	20X31A0408	14
9	20X31A0409	32
10	20X31A0410	4
11	20X31A0411	7
12	20X31A0412	0
13	20X31A0413	4
14	20X31A0414	12
15	20X31A0415	26
16	20X31A0416	11
17	20X31A0417	17
18	20X31A0418	
19	20X31A0419	7
20	20X31A0420	7
21	20X31A0421	26
22	20X31A0422	30
23	20X31A0423	0
24	20X31A0424	5
25	20X31A0425	26
26	20X31A0426	35
27	20X31A0427	7
28	20X31A0428	10
29	20X31A0429	17
30	20X31A0430	16
31	20X31A0431	26
32	20X31A0432	30
33	20X31A0433	32
34	20X31A0434	43
35	20X31A0435	16
Max Marks		75

S.No	Roll Number	Marks Secured
36	20X31A0436	10
37	20X31A0437	36
38	20X31A0438	44
39	20X31A0439	33
40	20X31A0440	33
41	20X31A0441	33
42	20X31A0442	33
43	20X31A0444	30
44	20X31A0445	9
45	20X31A0446	27
46	20X31A0447	46
47	20X31A0448	26
48	20X31A0449	48
49	20X31A0450	5
50	20X31A0451	29
51	20X31A0452	32
52	20X31A0453	26
53	20X31A0454	
54	20X31A0455	39
55	20X31A0456	26
56	20X31A0458	47
57	20X31A0459	54
58	20X31A0460	36
59	20X31A0461	30
60	20X31A0462	30

Class Average mark	26
Number of students performed above the target	32
Number of successful students	57

Attainment Level	% students
1	40%
2	50%

Percentage of students scored more than target	56%
Attainment level	**2**

3	60%

SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

Course Outcome Attainment

Name of the faculty Y RAJU
Academic Year: 2022-23
Branch & Section: ECE - A
Course Name: DIGITAL SIGNAL PROCESSING
Year: III
Semester: II

Course Outcomes	1st Internal Exam	2nd Internal Exam	Internal Exam	University Exam	Attainment Level
CO1	3.00		3.00	2.00	2.25
CO2	3.00		3.00	2.00	2.25
CO3	3.00	3.00	3.00	2.00	2.25
CO4		3.00	3.00	2.00	2.25
CO5		3.00	3.00	2.00	2.25
CO6		3.00	3.00	2.00	2.25
Internal & University Attainment:			3.00	2.00	
Weightage			25%	75%	
CO Attainment for the course (Internal, University)			0.75	1.50	
CO Attainment for the course (Direct Method)			2.25		

Overall course attainment level **2.25**

SRI INDU INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Electronics and Communication Engineering

Program Outcome Attainment (from Course)

Name of Faculty:	Y RAJU	Academic Year:	2022-23
Branch & Section:	ECE - A	Year:	III
Course Name:	DIGITAL SIGNAL PROCESSING	Semester:	II

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	2	2	1	-	-	1	-	-	-	1	2
CO2	3	3	3	1	2	2	1	-	1	-	-	-	1	3
CO3	3	3	3	1	2	2	1	-	1	-	-	-	1	2
CO4	3	3	3	1	2	2	1	-	1	-	-	-	1	3
CO5	3	1	-	1	2	2	-	-	1	-	-	-	1	2
CO6	3	1	-	-	1	-	-	-	1	-	-	-	1	3
Course	**3.00**	**3.00**	**3.00**	**1.00**	**1.83**	**2.20**	**1.00**	**-**	**1.00**	**-**	**-**	**-**	**1.00**	**2.50**

CO	**Course Outcome Attainment**
CO1	2.25
CO2	2.25
CO3	2.25
CO4	2.25
CO5	2.25
CO6	2.25
Overall course attainment level	**2.25**

PO-ATTAINMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO Attainment	**2.25**	**2.25**	**2.25**	**0.75**	**1.37**	**1.65**	**0.75**	**-**	**0.75**	**-**	**-**	**-**	**-**	**-**

CO contribution to PO - 33%, 67%, 100% (Level 1/2/3)

ASSIGNMENTS AND REGISTERS

Assignment 1 script link:

https://drive.google.com/file/d/1K-ipZ1bqn1qkpe0a_UK9Wceysq4jPhSa/view?usp=sharing

Assignment 2 script link:

https://drive.google.com/file/d/1A7fkijfgjsTHvikqff7Tlhmf4rzmeODU/view?usp=sharing

Attendance register link:

https://drive.google.com/file/d/1INDqV75RSvPZ6AoXmiHVaxixTorgj5BP/view?usp=sharing