

# **COURSE FILE**

**ON**

## **SIGNALS AND SYSTEMS**

**Course Code - EC304PC**

**II B.Tech I-SEMESTER**

**A.Y.: 2022-2023**

**Prepared by**

**Mr. P.Rajendra**

**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(VIII), Ibrahimpatnam  
R.R. Dist. Telangana-501 510.



## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

<b>Academic Year</b>	2022-2023
<b>Course Title</b>	SIGNALS AND SYSTEMS
<b>Course Code</b>	EC304PC
<b>Programme</b>	B.Tech
<b>Year &amp; Semester</b>	II year I-semester
<b>Branch &amp; Section</b>	ECE-A
<b>Regulation</b>	R18
<b>Course Faculty</b>	Mr. P.Rajendra, Assistant Professor

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# Sri Indu Institute of Engineering & Technology

Recognized Under 2(f) of UGC Act 1956

Approved by AICTE, New Delhi  
Affiliated to JNTUH, Hyderabad.

## 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 HYDERABAD**  
**B.Tech. in ELECTRONICS AND COMMUNICATION ENGINEERING**  
**COURSE STRUCTURE & SYLLABUS (R18)**

**Applicable From 2018-19 Admitted Batch**

**I YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA101BS	Mathematics - I	3	1	0	4
2	AP102BS	Applied Physics	3	1	0	4
3	CS103ES	Programming for Problem Solving	3	1	0	4
4	ME104ES	Engineering Graphics	1	0	4	3
5	AP105BS	Applied Physics Lab	0	0	3	1.5
6	CS106ES	Programming for Problem Solving Lab	0	0	3	1.5
7	*MC109ES	Environmental Science	3	0	0	0
		Induction Programme				
		<b>Total Credits</b>	<b>13</b>	<b>3</b>	<b>10</b>	<b>18</b>

**I YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA201BS	Mathematics - II	3	1	0	4
2	CH202BS	Chemistry	3	1	0	4
3	EE203ES	Basic Electrical Engineering	3	0	0	3
4	ME205ES	Engineering Workshop	1	0	3	2.5
5	EN205HS	English	2	0	0	2
6	CH206BS	Engineering Chemistry Lab	0	0	3	1.5
7	EN207HS	English Language and Communication Skills Lab	0	0	2	1
8	EE208ES	Basic Electrical Engineering Lab	0	0	2	1
		<b>Total Credits</b>	<b>12</b>	<b>2</b>	<b>10</b>	<b>19</b>

**II YEAR I SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	EC301PC	Electronic Devices and Circuits	3	1	0	4
2	EC302PC	Network Analysis and Transmission Lines	3	0	0	3
3	EC303PC	Digital System Design	3	1	0	4
4	EC304PC	Signals and Systems	3	1	0	4
5	EC305ES	Probability Theory and Stochastic Processes	3	0	0	3
6	EC306PC	Electronic Devices and Circuits Lab	0	0	2	1
7	EC307PC	Digital System Design Lab	0	0	2	1
8	EC308ES	Basic Simulation Lab	0	0	2	1
9	*MC309	Constitution of India	3	0	0	0
		<b>Total Credits</b>	<b>18</b>	<b>3</b>	<b>6</b>	<b>21</b>

**II YEAR II SEMESTER**

S. No.	Course Code	Course Title	L	T	P	Credits
1	MA401BS	Laplace Transforms, Numerical Methods & Complex Variables	3	1	0	4
2	EC402PC	Electromagnetic Fields and Waves	3	0	0	3

**EC304PC: SIGNALS AND SYSTEMS****B.Tech. II Year I Sem.**

L	T	P	C
3	1	0	4

**Pre-requisite:** Nil**Course Objectives:**

- This gives the basics of Signals and Systems required for all Electrical Engineering related courses.
- To understand the behavior of signal in time and frequency domain
- To understand the characteristics of LTI systems
- This gives concepts of Signals and Systems and its analysis using different transform techniques.

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

- Differentiate various signal functions.
- Represent any arbitrary signal in time and frequency domain.
- Understand the characteristics of linear time invariant systems.
- Analyze the signals with different transform technique

**UNIT - I**

**Signal Analysis:** Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

**UNIT – II**

**Fourier series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction to Hilbert Transform.

**UNIT - III**

**Signal Transmission through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

**UNIT – IV**

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Z-Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

**UNIT - V**

**Sampling theorem:** Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

**Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parseval's Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution



and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

**TEXT BOOKS:**

1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.

**REFERENCE BOOKS:**

1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, 3 Ed., 2004, PE.
5. Signals and Systems – K. Deergha Rao, Birkhauser, 2018.





# 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/>

## CO- PO/PSO Mapping - Justification

Course: SIGNALS AND SYSTEMS (C214)

Class: II ECE-A

**P01.ENGINEERING KNOWLEDGE:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

**P02.PROBLEM ANALYSIS:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

**P03. 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.

**P05.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.

**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

C214.1: Explain any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function. [Knowledge]

	Justification
PO1	Students get the knowledge on arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.

PO2	Students calculate information of Mean Square Error.
PSO1	Student can design, analysis and development a system in the area of S&S
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C214.2: Express periodic signals in terms of Fourier series and express the spectrum and express the arbitrary signal (discrete) as Fourier transform to draw the spectrum. [Knowledge]

	<b>Justification</b>
PO1	Students get the knowledge on periodic signals in terms of Fourier series and express the spectrum and express the arbitrary signal(discrete) as Fourier transform to draw the spectrum.
PO2	Students can formulate the Fourier transform of standard signals
PO5	By using MATLAB tool students perform transform techniques like FS, FT
PSO1	Student can design, analysis and development a system in the area of S&S
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C214.3: Analyze the characteristics of linear time invariant systems. [Analysis]

	<b>Justification</b>
PO1	Students get the knowledge on the characteristics of linear time invariant systems
PO3	Students can design LPF and HPF
PSO1	Student can design, analysis and development a system in the area of S&S
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C214.4: Explain response can be obtained using Laplace transform and Z-Transform, properties and ROC of L.T and Z- Transform [Knowledge]

	<b>Justification</b>
PO1	Student get the knowledge on Laplace transform and Z- Transform.
PO2	Students calculate response can be obtained using Laplace transform and Z- Transform.

PO5	By using MATLAB tool students perform transform techniques like L.T and Z.T
PSO1	Student can design, analysis and development a system in the area of S&S
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C214.5: Analyze the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous time signals in discrete time. [Analysis]

	<b>Justification</b>
PO1	Student get the knowledge on Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous time signals in discrete time.
PO2	Students calculate Sampling theorem and Nyquist's theorem.
PSO1	Student can design, analysis and development a system in the area of S&S
PSO2	Students can able to investigate and solve the engineering problems using MATLAB

C214.6: Compare auto Correlation and cross correlation and concept of power density spectrum. [Evaluation]

	<b>Justification</b>
PO1	Student get the knowledge on auto Correlation and cross correlation and concept of power density spectrum.
PO2	Students calculate power density spectrum.
PO5	By using MATLAB tool students perform auto Correlation and cross correlation.
PSO1	Student can design, analysis and development a system in the area of S&S
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. II YEAR I & II SEMESTERS**

**I SEM**

S. No	Description	Duration	
		From	To
1	Commencement of I Semester classwork	<b>28.11.2022</b>	
2	1 <sup>st</sup> Spell of Instructions	28.11.2022	21.01.2023 (8 Weeks)
3	First Mid Term Examinations	23.01.2023	30.01.2023 (1 Week)
4	Submission of First Mid Term Exam Marks to the University on or before	04.02.2023	
5	2 <sup>nd</sup> Spell of Instructions	31.01.2023	29.03.2023 (8 Weeks)
6	Second Mid Term Examinations	31.03.2023	08.04.2023 (1 Week)
7	Preparation Holidays and Practical Examinations	10.04.2023	15.04.2023 (1 Week)
8	Submission of Second Mid Term Exam Marks to the University on or before	15.04.2023	
9	End Semester Examinations	17.04.2023	29.04.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 93

**II SEM**

S. No	Description	Duration	
		From	To
1	Commencement of II Semester classwork	<b>01.05.2023</b>	
2	1 <sup>st</sup> Spell of Instructions (including Summer Vacation)	01.05.2023	08.07.2023 (10 Weeks)
3	<b>Summer Vacation</b>	15.05.2023	27.05.2023 (2 Weeks)
4	First Mid Term Examinations	10.07.2023	15.07.2023 (1 Week)
5	Submission of First Mid Term Exam Marks to the University on or before	22.07.2023	
6	2 <sup>nd</sup> Spell of Instructions	18.07.2023	11.09.2023 (8 Weeks)
7	Second Mid Term Examinations	12.09.2023	16.09.2023 (1 Week)
8	Preparation Holidays and Practical Examinations	19.09.2023	23.09.2023 (1 Week)
9	Submission of Second Mid Term Exam Marks to the University on or before	23.09.2023	
10	End Semester Examinations	25.09.2023	07.10.2023 (2 Weeks)

Note: No. of Working / Instructional Days: 92

  
 24/11/22  
 REGISTRAR



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## DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

### Class Timetable

CLASS: II-B.Tech ECE-A

A.Y:2022-23

SEMESTER: I

LH: C-101

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	EDC	COI	EDC LAB / DSD LAB		L U N C H	DSD	NATL	SPORTS
TUE	PTSP	NATL	DSD	COI		EDC	SS	DSD(T)/SS(T)
WED	SS	PTSP	DSD LAB / BS LAB			DSD	SS(T)/EDC(T)	EDC
THU	NATL	PTSP	COI	EDC(T)/DSD(T)		SS	DSD	COUN
FRI	SS	EDC	COI	PTSP		LIB	CO-CU/DAA	
SAT	EDC	DSD	SS	NATL		PTSP	BS LAB / EDC LAB	

\*(T) – Tutorial Concern Faculty

Course Code	Course Name	Name of the Faculty	Course Code	Course Name	Name of the Faculty
EC301PC	EDC-Electronic Devices and Circuits	K.Rajender	EC306PC	EDC LAB - Electronic Devices and Circuits Lab	K.Rajender/B.Ashwini/M.Srilatha
EC302PC	NATL-Network Analysis and Transmission Lines	M.Nagaraju	EC307PC	DSD LAB - Digital System Design Lab	G.Anusha/T.Divya/P.Krishna Rao
EC303PC	DSD-Digital System Design	G.Anusha	EC308ES	BS LAB - Basic Simulation Lab	P.Rajendra/T.Naresh
EC304PC	SS-Signals and Systems	P.Rajendra	LIB	Library	B.Ashwini/Dr.K.Srinivasa Reddy
EC305ES	PTSP-Probability Theory and Stochastic Processes	T.Naresh	COUN	Counseling	K.Rajender/G.Anusha/G.Anitha
*MC309	COI-Constitution of India	S.Swapna	CO-CU/DAA	Co-Curricular/Dept.Assc.Act.	K.Rajender/T.Naresh/D.Aruna
			SPORTS	Sports	G.Anitha/P.Sumana

Class Incharge

Head of The Department

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## LESSON PLAN

Programme: B.Tech	Academic Year: 2022-23
Year: II	Semester: I
Course Title: <b>SIGNALS AND SYSTEMS</b>	Course Code: EC304PC
Name of Faculty: P.Rajendra	

### Unit-I Syllabus

**Signal Analysis:** Analogy between Vectors and Signals, Orthogonal Signal Space, Signal approximation using Orthogonal functions, Mean Square Error, Closed or complete set of Orthogonal functions, Orthogonality in Complex functions, Classification of Signals and systems, Exponential and Sinusoidal signals, Concepts of Impulse function, Unit Step function, Signum function.

No. of Sessions Planned	Topics	Reference	Teaching Method/Aids
1	Analogy between Vectors and Signals,	T1, R 5	BB
1	Orthogonal Signal Space,	T1, R 5	BB
1	Signal approximation using Orthogonal functions,	T1, R 5	BB
1	Mean Square Error,	T1, R 5	BB
1	Closed or complete set of Orthogonal functions,	T1, R 5	BB
1	Orthogonality in Complex functions,	R5,W1	BB
1	Classification of Signals,	T1, R 5	BB
1	Classification of systems,	T1, R 5	BB
1	Exponential signals,	T1, R 5	BB
1	Sinusoidal signals	T1	BB
1	Concepts of Impulse function, Unit Step function	T1	BB
1	Signum function.	T1	BB
<b>Gap beyond syllabus(if any):</b>			
<b>Gap within the syllabus(if any)</b>			
<b>Course Outcome 1:</b> Explain any arbitrary signals in terms of complete sets of orthogonal functions and understands the principles of impulse functions, step function and signum function.			

\*Session Duration: 50 minutes

\*Total Number of Hours/Unit: 12





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## Unit-II Syllabus

**Fourier series:** Representation of Fourier series, Continuous time periodic signals, Properties of Fourier Series, Dirichlet's conditions, Trigonometric Fourier Series and Exponential Fourier Series, Complex Fourier spectrum.

**Fourier Transforms:** Deriving Fourier Transform from Fourier series, Fourier Transform of arbitrary signal, Fourier Transform of standard signals, Fourier Transform of Periodic Signals, Properties of Fourier Transform, Fourier Transforms involving Impulse function and Signum function, Introduction To Hilbert Transform.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	<b>Fourier series:</b> Introduction to Fourier series,	R5	BB
1	Representation of Fourier series,	R 5	BB
1	Continuous time periodic signals,	T1, R 5	BB
1	Properties of Fourier Series,	T1, R 5	BB
1	Dirichlet's conditions,	T1, R 5	BB
1	Trigonometric Fourier Series,	T1, R 5	BB
1	Exponential Fourier Series,	T1, R 5	BB
1	Complex Fourier spectrum,	T1, R 5	BB
1	<b>Fourier Transforms:</b> Introduction to Fourier transforms,	T1, R 5	BB
1	Deriving Fourier Transform from Fourier series,	T1, R 5	BB
1	Fourier Transform of arbitrary signal,	T1, R 5	BB
1	Fourier Transform of standard signals,	T1, R 5, W2	BB
1	Fourier Transform of Periodic Signals,	T1, R 5	BB
1	Properties of Fourier Transform,	T1, R 5	BB
1	Fourier Transforms involving Impulse function,	T1, R 5	BB
1	Fourier Transform of Signum function,	T1, R 5	BB

1	Introduction To Hilbert Transform.	T1, R 5	BB
<b>Gap beyond syllabus (if any):</b>			
<b>Gap within the syllabus (if any)</b>			
<b>Course Outcome 1:</b> Express periodic signals in terms of Fourier series and express the spectrum and express the arbitrary signal (discrete) as Fourier transform to draw the spectrum.			

\*Session Duration: 50 minutes

\*Total Number of Hours/Unit: 17



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

## Unit-III Syllabus

**Signal Transmission through Linear Systems:** Linear System, Impulse response, Response of a Linear System, Linear Time Invariant(LTI) System, Linear Time Variant (LTV) System, Transfer function of a LTI System, Filter characteristic of Linear System, Distortion less transmission through a system, Signal bandwidth, System Bandwidth, Ideal LPF, HPF, and BPF characteristics, Causality and Paley-Wiener criterion for physical realization, Relationship between Bandwidth and rise time, Convolution and Correlation of Signals, Concept of convolution in Time domain and Frequency domain, Graphical representation of Convolution.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	<b>Signal Transmission through Linear Systems:</b>	R5	BB
1	Linear System,	R5	BB
1	Impulse response,	T1, R 5	BB
1	Response of a Linear System,	T1, R 5	BB
1	Linear Time Invariant(LTI) System,	T1, R 5,W3	BB
1	Linear Time Variant (LTV) System,	T1, R 5	BB
1	Transfer function of a LTI System,	T1, R 5	BB
1	Filter characteristic of Linear System,	T1, R 5	BB
1	Distortion less transmission through a system,	T1, R 5	BB
1	Signal bandwidth,	T1, R 5	BB
1	System Bandwidth,	T1, R 5	BB
1	Ideal LPF characteristics,	T1, R 5	BB
1	Ideal HPF, and BPF,	T1, R 5	BB
1	Causality and Paley-Wiener criterion for physical realization,	T1, R 5	BB
1	Relationship between Bandwidth and rise time,	T1, R 5	BB
1	Convolution and Correlation of Signals,	T1, R 5	BB
1	Concept of convolution in Time domain,	T1, R 5	BB
1	Frequency domain,	T1, R 5	BB
1	Graphical representation of Convolution.	T1, R 5	BB
<b>Gap beyond syllabus(if any):</b>			
<b>Gap within the syllabus(if any)</b>			
<b>Course Outcome 1:</b> Analyze the characteristics of linear time invariant systems.			

\*Session Duration: 50minutes

\*Total Number of Hours/Unit: 19



# SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

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Khalsa Ibrahimpatnam, Sheriguda (V), Ibrahimpatnam (M), Ranga Reddy Dist., Telangana – 501 510

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

## Unit-IV Syllabus

**Laplace Transforms:** Laplace Transforms (L.T), Inverse Laplace Transform, Concept of Region of Convergence (ROC) for Laplace Transforms, Properties of L.T, Relation between L.T and F.T of a signal, Laplace Transform of certain signals using waveform synthesis.

**Z-Transforms:** Concept of Z- Transform of a Discrete Sequence, Distinction between Laplace, Fourier and Z Transforms, Region of Convergence in Z-Transform, Constraints on ROC for various classes of signals, Inverse Z-transform, Properties of Z-transforms.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	Introduction to Laplace Transforms	R5	BB
1	Inverse Laplace Transform	T1, R 5	BB
1	Concept of Region of Convergence (ROC) for Laplace Transforms,	T1, R 5	BB
1	Properties of L.T,	R5	BB
1	Relation between L.T and F.T of a signal,	R5	BB
2	Laplace Transform of certain signals using waveform synthesis.	R2	BB
1	Concept of Z- Transform of a Discrete Sequence,	R5,W4	BB
1	Distinction between Laplace, Fourier and Z Transforms,	T1, R 5	BB
2	Region of Convergence in Z-Transform, Properties of Z-transforms.	T1, R 5	BB
1	Constraints on ROC for various classes of signals, Inverse Z-transform	T1, R 5	BB
<b>Gap beyond syllabus(if any):</b>			
<b>Gap within the syllabus(if any)</b>			
<b>Course Outcome 1:</b> Explain response can be obtained using Laplace transform and Z- Transform, properties and ROC of L.T and Z- Transform.			

\*Session Duration: 50minutes

\*Total Number of Hours/Unit: 12



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

## Unit-V Syllabus

**Sampling theorem:** Graphical and analytical proof for Band Limited Signals, Impulse Sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, Effect of under sampling – Aliasing, Introduction to Band Pass Sampling.

**Correlation:** Cross Correlation and Auto Correlation of Functions, Properties of Correlation Functions, Energy Density Spectrum, Parsevals Theorem, Power Density Spectrum, Relation between Autocorrelation Function and Energy/Power Spectral Density Function, Relation between Convolution and Correlation, Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.

No. of Sessions Planned	Topics	Reference	Teaching Method/ Aids
1	<b>Sampling theorem:</b> Graphical and analytical proof for Band Limited Signals,	R5	BB
1	Impulse Sampling,	R5,W5	BB
2	Natural and Flat top Sampling,	R5,W5	BB
1	Reconstruction of signal from its samples,	R5	BB
1	Effect of under sampling,	T1, R 5	BB
1	Aliasing, Introduction to Band Pass Sampling.	T1, R 5	BB
1	Cross Correlation and Auto Correlation of Functions,	T1, R 5	BB
1	Properties of Correlation Functions,	T1, R 5	BB
1	Parsevals Theorem,	T1, R 5	BB
1	Energy Density Spectrum, Power Density Spectrum,	T1, R 5	BB
1	Relation between Autocorrelation Function and ESD/PSD,	T1, R 5	BB
1	Relation between Convolution and Correlation,	T1, R 5	BB
1	Detection of Periodic Signals in the presence of Noise by Correlation, Extraction of Signal from Noise by Filtering.	T1, R 5	BB
<b>Gap beyond syllabus(if any):</b>			
<b>Gap within the syllabus(if any)</b>			
<b>Course Outcome 1:</b> Analyze the Sampling theorem, reconstruction, aliasing, and Nyquist's theorem to represent continuous time signals in discrete time.			
<b>Course Outcome 2:</b> Compare auto Correlation and cross correlation and concept of power density spectrum.			

\*Session Duration: 50minutes

\*Total Number of Hours/Unit: 14

**TEXT BOOKS:**

1. Signals, Systems & Communications - B.P. Lathi, 2013, BSP.
2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawabi, 2 Ed.

**REFERENCE BOOKS:**

1. Signals and Systems – Simon Haykin and Van Veen, Wiley 2 Ed.,
2. Signals and Systems – A. Rama Krishna Rao, 2008, TMH
3. Fundamentals of Signals and Systems - Michel J. Robert, 2008, MGH International Edition.
4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, 3 Ed., 2004, PE.
5. Signals and Systems – K. Deergha Rao, Birkhauser, 2018.

**WEB REFERENCES:**

S. N o.	+ Web Link
1	<a href="https://www.tutorialspoint.com/signals_and_systems/signals_analysis.htm#:~:text=Orthogonality%20in%20Complex%20Functions&amp;text=Where%20f%E2%88%972(t,of%20f2(t).&amp;text=The%20above%20equation%20represents%20orthogonality%20condition%20in%20complex%20functions.">https://www.tutorialspoint.com/signals_and_systems/signals_analysis.htm#:~:text=Orthogonality%20in%20Complex%20Functions&amp;text=Where%20f%E2%88%972(t,of%20f2(t).&amp;text=The%20above%20equation%20represents%20orthogonality%20condition%20in%20complex%20functions.</a>
2	<a href="https://www.tutorialspoint.com/signals_and_systems/fourier_transforms.htm">https://www.tutorialspoint.com/signals_and_systems/fourier_transforms.htm</a>
3	<a href="https://www.tutorialspoint.com/signals-and-systems-linear-time-invariant-systems">https://www.tutorialspoint.com/signals-and-systems-linear-time-invariant-systems</a>
4	<a href="https://www.tutorialspoint.com/what-is-z-transform">https://www.tutorialspoint.com/what-is-z-transform</a>
5	<a href="https://www.tutorialspoint.com/signals_and_systems/signals_sampling_techniques.htm">https://www.tutorialspoint.com/signals_and_systems/signals_sampling_techniques.htm</a>



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## Lecture notes

### Unit 1 link:

<https://drive.google.com/file/d/1f3sEJskqiskK2WetlHhrR2O6NUyU2udo/view?usp=sharing>

### Unit 2 link:

[https://drive.google.com/file/d/1ascD0w3B\\_X\\_o7fDAIuiAfXaI0s7JY0ol/view?usp=sharing](https://drive.google.com/file/d/1ascD0w3B_X_o7fDAIuiAfXaI0s7JY0ol/view?usp=sharing)

### Unit 3 link:

<https://drive.google.com/file/d/1rZeggGCDCNvmnpXhote-1-c9axHyZs5K/view?usp=sharing>

### Unit 4 link:

[https://drive.google.com/file/d/1i62p0bQMhZRVf\\_R9v1NoUbeBIE1GGYym/view?usp=sharing](https://drive.google.com/file/d/1i62p0bQMhZRVf_R9v1NoUbeBIE1GGYym/view?usp=sharing)

### Unit 5 link:

<https://drive.google.com/file/d/1lZja-3lkd5UAETWaA07PtLZxTK691EyQ/view?usp=sharing>







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## **Power point presentation**

**PPT link:**

**[https://docs.google.com/presentation/d/10n7yqgE8bIdEXXQ9y\\_HUmhmRBCCo1pur/edit?usp=sharing&oid=118102283322016005666&rtpof=true&sd=true](https://docs.google.com/presentation/d/10n7yqgE8bIdEXXQ9y_HUmhmRBCCo1pur/edit?usp=sharing&oid=118102283322016005666&rtpof=true&sd=true)**

Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, October - 2020

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 2 hours

Max. Marks: 75

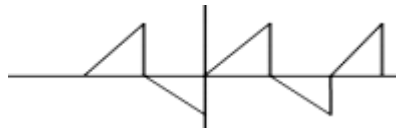
**Answer any five questions**  
**All questions carry equal marks**

- - -

- 1.a) Show that  $f(t)$  is orthogonal to signals  $\cos t, \cos 2t, \cos 3t, \dots \cos nt$  for all integer values of  $n, n \neq 0$ , over the interval  $(0, 2\pi)$  if  $x(t) = \begin{cases} 1, & \text{for } 0 < t < \pi \\ -1, & \text{for } \pi < t < 2\pi \end{cases}$
- b) Discover the analogy of vectors and signals in terms of orthogonality. [6+9]

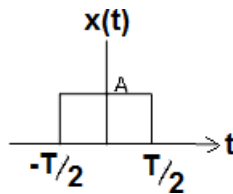
- 2.a) Estimate the mean square error value of a function  $f(t)$ .
- b) Sketch the following signals (i)  $r(t)-r(t-1)-r(t-3)+r(t-4)$  (ii)  $\pi \left(\frac{t-2}{2}\right) + \pi(2t - 3.5)$  [7+8]

- 3.a) Assume that  $T=2$ , determine the Fourier series expansion of the signal shown below figure 1 with amplitude of  $\pm 1$ .



**Figure: 1**

- b) Prove the following properties of the Fourier transform: (i) duality (ii) modulation. [8+7]
- 4.a) Determine the exponential Fourier series from trigonometric Fourier series.
- b) Solve the Fourier transform of the rectangular pulse. [6+9]
- 5.a) Find the convolution of the rectangular pulse given below figure 2 with itself.



**Figure: 2**

- b) Explain causality and physical realizability of a system and give Paley Wiener criterion. [8+7]
- 6.a) A system produces an output of  $y(t) = e^{-t} u(t)$  for an input of  $x(t) = e^{-2t} u(t)$ . Determine the impulse response and frequency response of the system.
- b) Compare the signals and system bandwidth. [9+6]
7. Evaluate the Laplace Transforms of the following functions:  
a) Exponential function      b) Unit step function      c) Damped sine function. [15]
- 8.a) Prove that for a signal, auto correlation and PSD form a Fourier transform pair.
- b) A function  $f(t)$  has a PSD of  $S(\omega)$ . Find the PSD of i) integral of  $f(t)$  and ii) time derivative of  $f(t)$ . [7+8]

CodeNo:153BT

R18

JAWAHARLALNEHRUTECHNOLOGICALUNIVERSITY HYDERABAD

B.TechIIYearISemesterExaminations, March-2021

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time:3hours

Max.Marks:75

Answer any five questions  
All questions carry equal marks

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- 1.a) State and prove the properties of Impulse Function.  
b) How to approximate the given signal using complete set of orthogonal functions? Explain with one example. [6+9]
- 2.a) Find the Exponential Fourier series of train of impulses.  
b) Find the Fourier Transform of the signal  $x(t) = e^{-at}$ . [7+8]
- 3.a) Find and sketch the impulse response of Ideal Bandpass Filter.  
b) Find the convolution between the following signals:  
 $x(t) = e^{-at}u(t); h(t) = e^{-bt}u(t)$  [7+8]
- 4.a) Find the impulse response of the system described by the differential equation.  
 $y'(t) + 5y'(t) + 4y(t) = 6x(t)$   
b) State and prove initial final value Theorems of Z-transform. [7+8]
- 5.a) State and prove Sampling theorem for band limited signals.  
b) Derive the relationship between Autocorrelation function and Power spectral density function. [9+6]
- 6.a) Find the Hilbert Transform of the signal  $x(t) = \cos(t) + \sin(t)$ .  
b) Check the stability of the system  $y(t) = tx(t)$ . [7+8]
- 7.a) Derive the conditions for distortionless transmission through a system.  
b) State and prove the multiplication theorem of Fourier Transform. [7+8]
- 8.a) State and prove time shifting property of Laplace Transform.  
b) State and prove convolution theorem of z-transform. [7+8]

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Code No: 153BT

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**

**B.Tech II Year I Semester Examinations, March - 2022**

**SIGNALS AND SYSTEMS**

(Common to ECE, EIE)

**Time: 3 Hours**

**Max. Marks: 75**

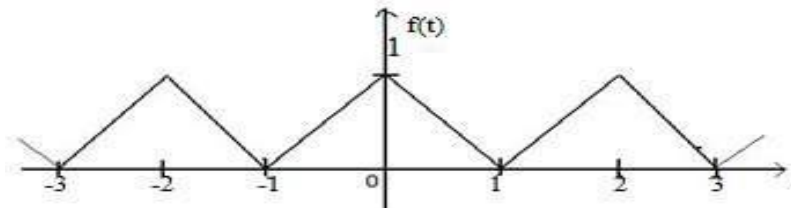
**Answer any five questions**  
**All questions carry equal marks**

- - -

1. a) Define Dirac Delta function, draw its waveform and Summarize its properties.
- b) Obtain the condition under which two real signals  $f_1(t)$  and  $f_2(t)$  are said to be orthogonal to each other. Hence, prove that  $\sin n\omega_0 t$  and  $\cos m\omega_0 t$  are orthogonal to each other for all integer values of  $m, n$ . [6+9]

2. Classify the signals under different categories and then explain the same. [15]

- a. State the existence conditions of fourier series.
- b) Find the Trigonometric Fourier series coefficients and build Fourier series for the following signal.



- c) Explain about Complex fourier spectrum. [4+7+4]

Obtain the Fourier transform of the following signals

- i)  $4 \cos 2\omega_0 t$                       ii)  $e^{-4t} u(t)$
- b) State and prove the following properties of Fourier transform.
  - i) Convolution in time domain              ii) Differentiation in time domain. [8+7]
- 5.a) With the help of plots, determine the convolution of the following two signals in time domain.  $x_1(t) = e^{-4t} u(t)$  and  $x_2(t) = u(t+4)$ .
- b) Explain about stability and causality of an LTI system. [10+5]
- 6.a) Perform the graphical convolution of the following signals:  
 $x_1(t) = e^{-at} u(t)$ ;  $x_2(t) = u(t) - u(t-3)$ .
- b) List and explain the properties of convolution and prove any one. [10+5]

Determine the Laplace transform of the following two signals.

- i)  $e^{-at} \sin(bt)u(t)$                       ii)  $x(t) = t e^{-at} u(t)$
- b) State and prove the following properties of z-transform
  - i) Time shifting                      ii) Convolution [8+7]
- 8.a) State and explain the sampling theorem for band limited signals with graphs analysis.
- b) Define cross correlation function? State and prove the properties of cross correlation function. [7+8]

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Code No: 153BT

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B.Tech II Year I Semester Examinations, August/September - 2022

SIGNALS AND SYSTEMS

(Common to ECE, EIE)

Time: 3 Hours

Max.Marks:75

Answer any five questions  
All questions carry equal marks

- - -

1. a) Compare continuous-time and discrete –time signals.  
b) Draw and explain the unit step signal and unit ramp signal.  
c) Explain the term complete orthogonal set using relevant expressions. [4+5+6]
- 2.a) Discuss about Orthogonal Signal Space and obtain the expression for mean signal error.  
b) What is signum function and explain its importance.  
c) Describe the functionality of Complex exponential signals and Sinusoidal signals. [7+4+4]
- 3.a) Discuss the Dirchlet's conditions and its significance to obtain Fourier series representation of any signal.  
b) State and prove the following properties of Fourier transform.  
(i) Multiplication in time domain (ii) Frequency shifting. [8+7]
- 4.a) Derive the expression for Fourier Transform from Fourier Series.  
b) State and prove the properties of Fourier series. [8+7]
- 5.a) When is a system said to be a Causal system?  
b) State Distributive properties of convolution.  
c) Explain the filter characteristics of ideal LPF, HPF and BPF using their magnitude and phase responses. [4+4+7]
- 6.a) List and explain the properties of Autocorrelation function.  
b) Determine whether the following systems are Linear or Nonlinear, Shift variant or Invariant, Causal or Non-causal, Stable or unstable.  
(i)  $y(t) = x(t + 10) + x^2(t)$  (ii)  $\frac{dy(t)}{dt} + 10y(t) = x(t)$  [7+8]
- 7.a) State and prove the time shifting, differentiation and integration properties of Z transform.  
b) Determine the inverse Laplace Transform of the following functions. [8+7]  
(i)  $\frac{1}{s(s+1)}$  (ii)  $\frac{3s^2 + 8s + 6}{(s+2)(s^2 + 2s + 1)}$
- 8.a) Explain the detection of periodic signals in the presence of noise by correlation.  
b) With the help of graphical example, explain sampling theorem for Band limited signals and also give the mathematical analysis. [7+8]

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# Sri InduInstitute of Engineering & Technology

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

I- Mid Examinations, JAN-2023

Set - I

Year & Branch: II ECE (A &B)

Subject: SIGNALS AND SYSTEMS (A &B)

Max.Marks: 10

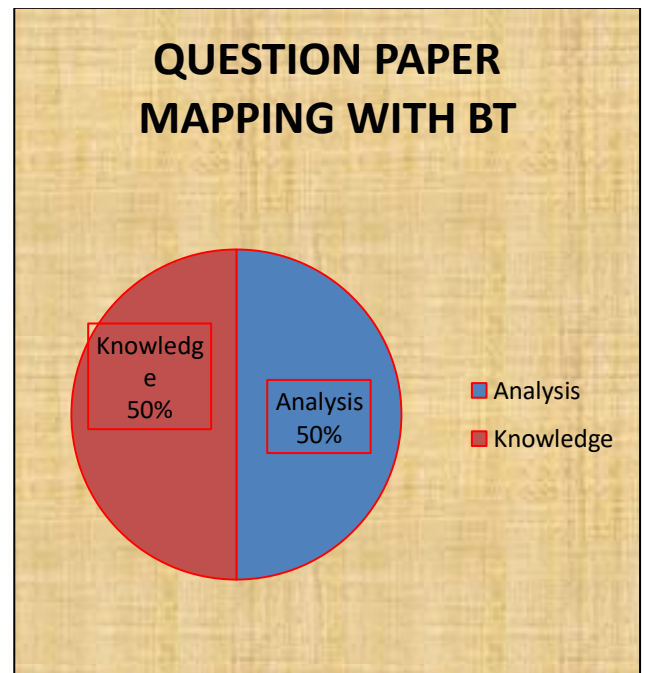
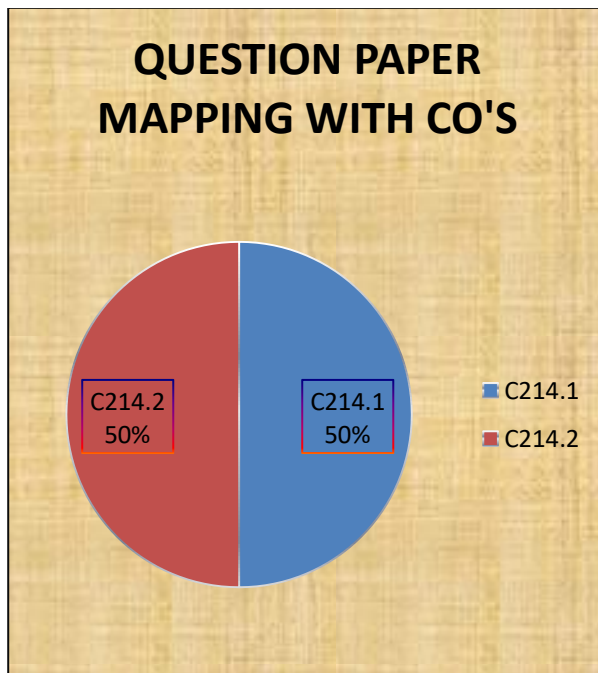
Date:24/01/2023(AN)

Time:60 mins

Answer any **TWO** Questions. All Question Carry Equal Marks

2\*5=10 marks

1.Draw and explain the Unit step signal, Unit impulse signal and Unit ramp signal. (C214.1)	5	Knowledge
2. State and Prove the following Properties of Fourier Transform (i) Multiplication in Time domain      (ii) Convolution in time domain (C214.2)	5	Analysis
3. Find Exponential Fourier series representation for a full wave rectified sine wave. (C214.2)	5	Analysis
4 Explain orthogonal concept in signals. (C214.1)	5	Knowledge



# Sri Indu Institute of Engineering & Technology

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

**II- Mid Examinations, MAY-2023**

**Set - I**

Year & Branch: II ECE (A& B)

Date: 01/05/2023 (AN)

Subject: SIGNALS AND SYSTEMS (A&B)

Max. Marks: 10

Time: 60 mins

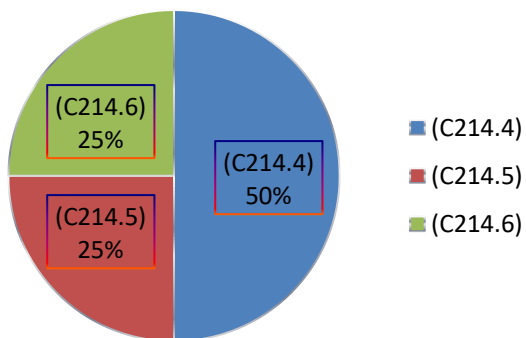
Answer any **TWO** Questions. All Questions Carry Equal Marks

2\*5=10 marks

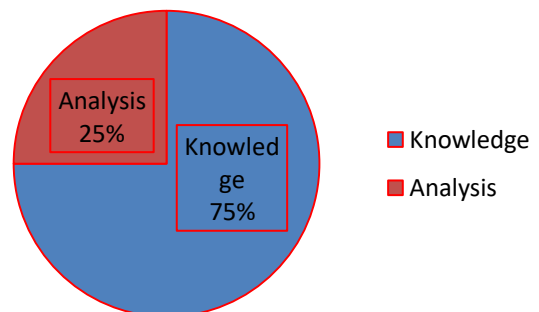
( This question paper is prepared with BT's mapping)

1. State and prove the initial and final value theorems of Laplace transform?  <div style="text-align: right;">(C214.4)</div>	5	(Knowledge)
2. Determine the Z transform of following sequence a) $x(n) = a^n u(n)$ b) $x(n) = -a^n u(-n-1)$  <div style="text-align: right;">(C214.4)</div>	5	(Analysis)  (Analysis)
3. Properties of Auto Correlation for energy signals.  <div style="text-align: right;">(C214.6)</div>	5	(Knowledge)
4. Define the sampling theorem and discuss any way of performing sampling?  <div style="text-align: right;">(C214.5)</div>	5	(Knowledge)

## QUESTION PAPER MAPPING WITH CO'S



## QUESTION PAPER MAPPING WITH BT



# SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

## DEPARTMENT OF ECE

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

### SIGNALS AND SYSTEMS

(Objective Exam)

DATE: 24/01/2023 (AN)

TIME: 20 Min

MAX.MARKS: 10

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

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#### I. Choose the Correct Answers

1. Fourier Series could be applied to. [ ]  
a) Power signals    b) Energy signals    c) periodic signals    d) Unit step signal
2. Dirichlet's condition is [ ]  
a) The function  $x(t)$  has finite number of finite discontinuities  
b) The function  $x(t)$  has finite number of maxima  
c) The function  $x(t)$  has finite number of minima    d) All of the above
3. The Trigonometric Fourier Series of an even function of time does not have [ ]  
a) The dc term    b) The cosine term    c) The sine term    d) None of these
4. The derivative of an ideal step function is [ ]  
a) An impulse function    b) zero    c) sinc function    d) Undefined
5. A signum function is [ ]  
a) Zero for  $t > 0$     b) Zero for  $t < 0$     c) unity for  $t > 0$     d)  $2u(t)-1$
6. Even signal satisfies [ ]  
a)  $x(-t)=x(t)$     b)  $x(-t)= -x(-t)$     c)  $x(-n)=-x(n)$     d) None of these
7. A system whose output depends up on future input's is [ ]  
a) Dynamic system    b) Static system    c) Non causal system    d) Both a&c
8. Which condition determines the causality of the LTI system in terms of its impulse response? [ ]  
a) Only if the value of an impulse response is zero for all negative values of time  
b) Only if the value of an impulse response is unity for all negative values of time  
c) Only if the value of an impulse response is infinity for all negative values of time  
d) Only if the value of an impulse response is negative for all negative values of time
9. A LTI system is said to be initially relaxed system only if \_\_\_\_ [ ]  
a) Zero input produces zero output    b) Zero input produces non-zero output  
c) Zero input produces an output equal to unity    d) None of the above
10. Frequency and time period are \_\_\_\_\_ [ ]  
a) Proportional to each other    b) Inverse of each other  
c) Same    d) equal



II. Fill in The Blanks:

- 1 The impulse function is denoted by .....
2. The relation between  $u(t)$  and  $\text{sgn}(t)$  is .....
3. ....system satisfies the superposition principle
4. A signal is a power signal when the signal has.....
5. Fourier transform of  $e^{-at}u(t)$  is .....
6. Time shifting property of Fourier series is .....
7. A system is said to be stable if the bounded input to the system produces.....
8. Time scaling property of Fourier transform is ... ..
9. Fourier transform of 1 (or ) constant functions is .....
- 10.The sum of periodic signals will also be periodic if the ratio of their fundamental periods is a .....number.

**SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

**DEPARTMENT OF ECE**

**B.Tech II Year II Sem II Mid –Term Examination, MAY-2023**

**SIGNALS AND SYSTEMS**

(Objective Exam)

DATE: 01/05/2023 (AN)

TIME: 20 Min

MAX.MARKS: 10

NAME : \_\_\_\_\_ ROLL NO: \_\_\_\_\_

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**I.Choose The Correct Answers**

1. Which of the following is the process of ‘aliasing’? [   ]  
a. Peaks overlapping                      b. Phase overlapping  
c. Amplitude overlapping                d. Spectral overlapping
2. Determine the Nyquist rate of the signal  $x(t) = 1 + \cos 2000\pi t + \sin 4000\pi t$  [   ]  
a. 2000 Hz    b. 4000 Hz    c. 1 Hz    d. 6000 Hz
3. Laplace transform of unit step function is [   ]  
a.  $1/s$                       b.  $s$                       c.  $e^{-s}$                       d.  $1/s^2$
4. The spectral density of white noise is \_\_\_\_\_ [   ]  
a. Exponential    b. Uniform    c. Poisson    d. Gaussian
5. Find the initial value of  $f(t)$  if  $F(s) = \frac{s}{[(s+a)^2 + \omega^2]}$  [   ]  
a. 0                      b. -1                      c.  $\infty$                       d. 1
6. The auto correlation of  $x(t) = e^{-at} u(t)$  is \_\_\_\_\_ [   ]  
a.  $\frac{e^{-at}}{a^2}$                       b.  $e \frac{e^{-at}}{2a}$                       c.  $e \frac{e^{-at}}{a^2}$                       d.  $\frac{e^{-at}}{2a}$
7. Inverse z transform of  $X[z/a]$  is [   ]  
a.  $x[n/a]$                       b.  $x[n]/a$                       c.  $a^n x[n]$                       d.  $a x[n]$
8. The filter which passes all frequencies above  $f_c$  by attenuating significantly, all frequencies below  $f_c$  is \_\_\_\_\_ [   ]  
a. Low-pass                      b. High-pass                      c. Band-pass                      d. Band-stop
9. The process of converting continuous time signals into discrete time signals is called [   ]  
a. Analog to Digital conversion                      b. Digital to Analog Conversion  
c. Sampling                      d. All of the above
10. If there is no similarity between  $x(t)$  and  $x(t-\tau)$  then autocorrelation will be\_\_\_\_ [   ]  
a. One                      b. Zero                      c. Infinite                      d. None of the above

## II. Fill in The Blanks:

11. Distortionless transmission ensures \_\_\_\_\_ phase response
12. Laplace transform of  $\delta(t)$  is \_\_\_\_\_
13. ROC does not contain any \_\_\_\_\_
14. Z transform of  $a^n u(n)$  is \_\_\_\_\_
15. Laplace transform of  $e^{at} u(t)$  \_\_\_\_\_  $\text{Re}[s] > a$
16. ROC can be used to determine \_\_\_\_\_ and \_\_\_\_\_ of the system.
17. \_\_\_\_\_ sampling works based on the multiplication.
18. An LTI system acts as a \_\_\_\_\_
19. Nyquist rate frequency \_\_\_\_\_
20. For a two-sided sequence region of convergence is entire z-plane except at \_\_\_\_\_

# Sri Indu Institute of Engineering & Technology

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

B-Tech I - Mid Examinations, JAN-2023

Year & Branch: II –ECE-A & B

Date: 24/01/2023 (AN)

Subject: SIGNALS AND SYSTEMS

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## ANSWER KEY

Descriptive paper key link:

<https://drive.google.com/file/d/1AO0HGhk27K-8C3qkQPOY1dYRGQPcOOqG/view?usp=sharing>

Objective/Quiz Key Paper

I. Choose the correct alternative:

- 1) C
- 2) D
- 3) C
- 4) A
- 5) C
- 6) A
- 7) C
- 8) A
- 9) A
- 10) B

Fill in the blanks:

- 11)  $\delta(t)$
- 12)  $\text{sgn}(t)=2u(t)-1$
- 13) Linear
- 14) finite average power
- 15)  $e^{-at}u(t) \leftrightarrow F.T1/(a+j\omega)$
- 16)  $z(t)=x(t-t_0) \leftrightarrow z(k)= e^{-jkw_0t_0} X(K)$
- 17) Bounded output
- 18)  $y(t)=x(at) \leftrightarrow Y(W)=(1/|a|)X(w/a)$
- 19)  $2\pi \delta(w)$
- 20) a rational number

# Sri Indu Institute of Engineering & Technology

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

B-Tech II - Mid Examinations, May 2023

Year & Branch: II - ECE-A & B

Date: 01 /05/2023 (AN)

Subject: SS

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## ANSWER KEY

Descriptive paper key link:

[https://drive.google.com/file/d/1yvmb9E\\_CTx-FrKUXrjTCTg\\_WBCIN7hEI/view?usp=sharing](https://drive.google.com/file/d/1yvmb9E_CTx-FrKUXrjTCTg_WBCIN7hEI/view?usp=sharing)

## Objective Key Paper

I. Choose the correct alternative:

1. D
2. B
3. A
4. B
5. D
6. D
7. C.
8. B
9. C
10. B

Fill in the blanks:

11. the phase response is a linear function of frequency
12. 1
13. Poles
14.  $\frac{1}{(1-az^{-1})}$
15.  $1/s-a$
16. Causality and Stability
17. Multiplication
18. Filter
19. 2W
20.  $z$  is equal to 0 and  $z$  is equal to  $\infty$



# SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Accredited by NAAC with A+ Grade, Recognized under 2(f) of UGC Act 1956

(Approved by AICTE, New Delhi and Affiliated to JNTUH, Hyderabad)

Khalsa Ibrahimpatnam, Sheriguda (V), Ibrahimpatnam (M), Ranga Reddy Dist., Telangana – 501 510

Website: <https://siet.ac.in/>

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## ASSIGNMENT- 1

## SUBJECT: SIGNALS AND SYSTEMS

1. State and Prove the following Properties of Fourier Transform

(i) Multiplication in Time domain (ii) Convolution in time domain

(C214.2) (Analysis)

2. Draw and explain the Unit step signal, Unit impulse signal and Unit ramp signal.

(C214.1) (Knowledge)

3. Find Exponential Fourier series representation for a full wave rectified sine wave.

(C214.2) (Analysis)

4. Explain orthogonal concept in signals. (C214.1) (Knowledge)

5. Obtain the Fourier Transform of signal  $x(t) = u(t)$ . (C214.2) (Analysis)



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## ASSIGNMENT- 2

## SUBJECT: SIGNALS AND SYSTEMS

1. State and prove the initial and final value theorems of Laplace transform?

(C214.4) (Knowledge)

2. Determine the Z transform of following sequence

a)  $x(n) = a^n u(n)$

b)  $x(n) = -a^n u(-n-1)$  (C214.4) (Analysis)

3. Write the Properties of Auto Correlation for energy signals. (C214.6) (Knowledge)

4. Define the sampling theorem and discuss any way of performing sampling?

(C214.5) (Knowledge)

5. Determine inverse Z-transform of following

a)  $X(Z) = 1/(1-az^{-1})$ , ROC =  $|z| > |a|$

b)  $X(Z) = 1/(1-az^{-1})$ , ROC =  $|z| < |a|$  (C214.4) (Analysis)

6. Define Aliasing and explain different ways to avoid Aliasing? (C214.5) (Knowledge)

7. Write the Properties of Cross Correlation for energy signals. (C214.6) (Knowledge)



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## TUTORIAL TOPICS

## SUBJECT: SIGNALS AND SYSTEMS

S.NO	Unit	TOPIC	Number of Sessions Planned	Teaching method/Aids
1.	1	Find the even and odd components of the following signals i) $x(t) = e^{j2t}$ ii) $x(t) = \sin 2t + \sin 2t \cos 2t + \cos 2t$	1	BB
2.		Write a short notes on Elementary signals.	1	BB
3.	2	State Dirchlet's conditions.	1	BB
4.		Fourier Transform of standard signals.	1	BB
5	3	Determine the convolution sum of the two sequences $x(n) = \{ 1, 4, 3, 2 \}$ and $h(n) = \{ 1, 3, 2, 1 \}$ ↑	1	BB
6		Determine whether the following systems are linear or non-linear i) $y(t) = e^{x(t)}$ ii) $y(n) = n^2 x(n)$	1	BB
7	4	Find the Laplace transform of the signal $x(t) = e^{-at}u(t) - e^{-bt}u(-t)$ .	1	BB
8		Write any four properties of Z-transform.	1	BB
9	5	State and explain Natural sampling.	1	BB
10		Write any two properties of Auto correlation.	1	BB





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

Course Title	SIGNALS AND SYSTEMS
Course Code	EC304PC
Programme	B.Tech
Year & Semester	II year I-semester, A sec
Regulation	R18
Course Faculty	P.Rajendra, Assistant Professor, ECE

## Slow learners:

S No	Roll no	No of backlogs	Internal-I Status	Internal-II Status
1	21X31A0402	3	20	16
2	21X31A0403	3	21	15
3	21X31A0408	3	20	19
4	21X31A0409	4	15	14
5	21X31A0412	3	22	16
6	21X31A0414	3	23	14
7	21X31A0417	3	21	18
8	21X31A0422	3	21	17
9	21X31A0433	3	21	16
10	21X31A0435	3	23	16
11	21X31A0436	3	15	17

**Advanced learners:**

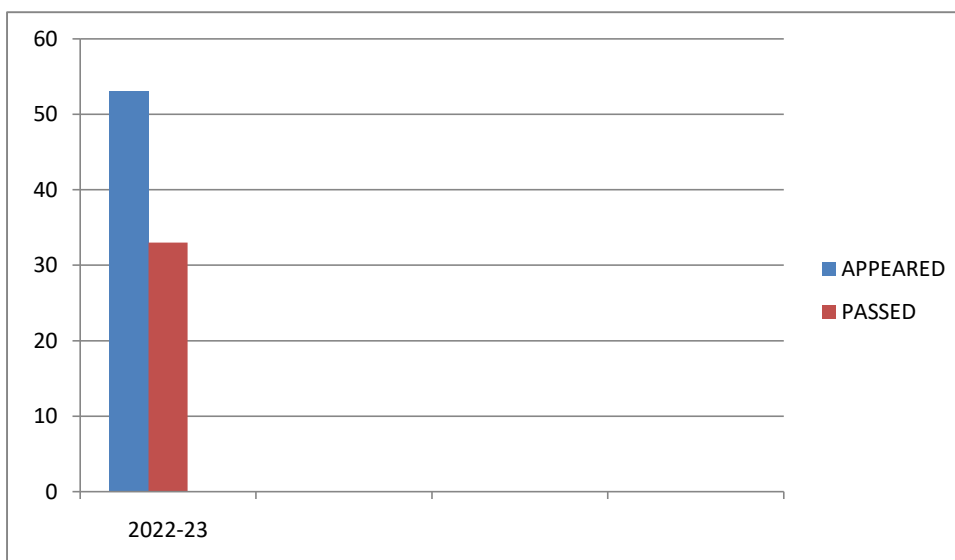
S.NO	ROLL.NO.	Assigned work
1	21X31A0401	<p>Advanced Concepts material is provided for advanced learners, Subject seminars are presented by advanced learners in the class., and Advanced learners are encouraged to support slow learners.</p>
2	21X31A0405	
3	21X31A0410	
4	21X31A0413	
5	21X31A0415	
6	21X31A0418	
7	21X31A0420	
8	21X31A0421	
9	21X31A0423	
10	21X31A0424	
11	21X31A0426	
12	21X31A0427	
13	21X31A0429	
14	21X31A0430	
15	21X31A0431	
16	21X31A0432	
17	21X31A0434	
18	21X31A0437	



## BATCH ECE-II BTECH I SEM ECE-A RESULT ANALYSIS

ACADAMIC YEAR	COURSE NAME	NUMBER OF STUDENTS		QUESTION PAPER SETTING		PASS%
		APPEARED	PASSED	INTERNAL	EXTERNAL	
2022-23	SIGNALS AND SYSTEMS	53	33	COURSE FACULTY	JNTUH	62.26

### SIGNALS AND SYSTEMS (C214) RESULT ANALYSIS





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Khalsa Ibrahimpatnam, Sheriguda (V), Ibrahimpatnam (M), Ranga Reddy Dist., Telangana – 501 510

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

## DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING

### REMEDIAL CLASSES TIME TABLE

A.Y 2022-23

SEMESTER-I

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	EDC	NATL	DSD	PTSP	SS
II ECE-B	NATL	DSD	PTSP	SS	EDC
III ECE-A	MPMC	DCCN	CS	BEFA	EMI
III ECE-B	DCCN	CS	BEFA	EMI	MPMC
III ECE-C	CS	BEFA	EMI	MPMC	DCCN
IV ECE-A	MW&OC	DIP	PPL	NS&C	JAVA
IV ECE-B	DIP	PPL	NS&C	JAVA	MW&OC
IV ECE-C	PPL	NS&C	JAVA	MW&OC	DIP

  
**HOD 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(V), Ibrahimpatnam,  
R R Dist Telangana -501 510



41	22X35A0407	5				4				10	5
42	22X35A0408	4				2				10	5
43	22X35A0409	4				3				10	5
44	22X35A0410	4		5						10	5
45	22X35A0411	4				4				10	5
46	22X35A0412	4				4				10	5
47	22X35A0413	5				5				9	5
48	22X35A0414	5		4						10	5
49	22X35A0415	5				4				8	5
50	22X35A0416	4				5				10	5
51	22X35A0417	4				2				10	5
52	22X35A0418	4		5						9	5
53	22X35A0419	4		4						10	5
54	22X35A0420	5				5				10	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		50	0	28	0	12	0	0	0	52	54
Number of students attempted		50	0	38	0	15	0	0	0	54	54
Percentage of students scored more than target		100%		74%		80%				96%	100%

**CO Mapping with Exam Questions:**

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

% Students Scored >Target %	100%		74%		80%					96%	100%
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**CO Attainment based on Exam Questions:**

CO - 1	100%									96%	100%
CO - 2			74%		80%					96%	100%
CO - 3										96%	100%
CO - 4											
CO - 5											
CO - 6											

CO	Subj	obj	Asgn	Overall	Level
CO-1	100%	96%	100%	99%	3.00

Attainment Level	
1	40%

CO-2	77%	96%	100%	91%	3.00
CO-3		96%	100%	98%	3.00
CO-4					
CO-5					
CO-6					

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 : P.RAJENDRA

Academic Year: 2022-23

Branch & Section: ECE - A

Examination: II Internal

Course Name: SIGNALS AND SYSTEMS

Year: II

Semester: I

S.No	HT No.	Q1a	Q1b	Q2a	Q2b	Q3a	Q3b	Q4a	Q4b	Obj2	A2
Max. Marks ==>		5	2	5		5		5		10	5
1	21X31A0401	4		4						9	5
2	21X31A0402	5								6	5
3	21X31A0403	2								8	5
4	21X31A0404			2						8	5
5	21X31A0405	4								7	5
6	21X31A0406	5		4						9	5
7	21X31A0407			5						4	5
8	21X31A0408	5								9	5
9	21X31A0409	2								7	5
10	21X31A0410	4								8	5
11	21X31A0412			4						7	5
12	21X31A0413	4		3						8	5
13	21X31A0414	1								8	5
14	21X31A0415	4		2						7	5
15	21X31A0416	4								7	5
16	21X31A0417	4				2				7	5
17	21X31A0418	5								6	5
18	21X31A0420	4				3				8	5
19	21X31A0421	4				3				7	5
20	21X31A0422	4		2						6	5
21	21X31A0423	4								9	5
22	21X31A0424	3								8	5
23	21X31A0425	4		3						9	5
24	21X31A0426	4				2				9	5
25	21X31A0427	5				5				9	5
26	21X31A0428	4		2						9	5
27	21X31A0429	4				2				8	5
28	21X31A0431	4		2						6	5
29	21X31A0432			5						6	5
30	21X31A0433			4						7	5
31	21X31A0434	4		3						6	5
32	21X31A0435	4								7	5
33	21X31A0436	4		2						6	5
34	21X31A0437			4						7	5
35	22X35A0401	4		5						7	5
36	22X35A0402	4		3						7	5
37	22X35A0403	5								7	5
38	22X35A0404	3								6	5
39	22X35A0405			3						6	5
40	22X35A0406	5								7	5
41	22X35A0407	4				2				7	5
42	22X35A0408			2						7	5
43	22X35A0409	2								7	5
44	22X35A0410	5		5						7	5



45	22X35A0411	4				4				8	5
46	22X35A0412	4		5						7	5
47	22X35A0413	5				5				8	5
48	22X35A0414	5		4						8	5
49	22X35A0415	5								8	5
50	22X35A0416	5		4						8	5
51	22X35A0417	4				3				7	5
52	22X35A0418	4				5				8	5
53	22X35A0419	4		4						8	5
54	22X35A0420	4		5						8	5
Target set by the faculty / HoD		3.00	1.20	3.00	0.00	3.00	0.00	3.00	0.00	6.00	3.00
Number of students performed above the target		42	0	19	0	7	0	0	0	53	54
Number of students attempted		46	0	26	0	11	0	0	0	54	54
Percentage of students scored more than target		91%		73%		64%				98%	100%

**CO Mapping with Exam Questions:**

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

% Students Scored >Target %	91%		73%		64%					98%	100%
-----------------------------	-----	--	-----	--	-----	--	--	--	--	-----	------

**CO Attainment based on Exam Questions:**

CO - 1											
CO - 2											
CO - 3									98%	100%	
CO - 4	91%		73%						98%	100%	
CO - 5									98%	100%	
CO - 6					64%				98%	100%	

CO	Subj	obj	Asgn	Overall	Level
CO-1					
CO-2					
CO-3		98%	100%	99%	3.00
CO-4	82%	98%	100%	93%	3.00
CO-5		98%	100%	99%	3.00
CO-6	64%	98%	100%	87%	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 : P.RAJENDRA

Academic Year:

2022-23

Branch & Section: ECE - A

Year / Semester:

II / I

Course Name: SIGNALS AND SYSTEMS

S.No	Roll Number	Marks Secured
1	21X31A0401	33
2	21X31A0402	
3	21X31A0403	11
4	21X31A0404	16
5	21X31A0405	26
6	21X31A0406	29
7	21X31A0407	5
8	21X31A0408	4
9	21X31A0409	4
10	21X31A0410	45
11	21X31A0412	4
12	21X31A0413	29
13	21X31A0414	5
14	21X31A0415	32
15	21X31A0416	26
16	21X31A0417	7
17	21X31A0418	29
18	21X31A0420	29
19	21X31A0421	35
20	21X31A0422	10
21	21X31A0423	36
22	21X31A0424	4
23	21X31A0425	16
24	21X31A0426	28
25	21X31A0427	39
26	21X31A0428	10
27	21X31A0429	29
28	21X31A0431	29
29	21X31A0432	11
30	21X31A0433	6
31	21X31A0434	32
32	21X31A0435	26
33	21X31A0436	13
34	21X31A0437	29
35	22X35A0401	34

Max Marks	75
Class Average mark	24
Number of students performed above the target	33
Number of successful students	53

S.No	Roll Number	Marks Secured
36	22X35A0402	29
37	22X35A0403	15
38	22X35A0404	20
39	22X35A0405	26
40	22X35A0406	29
41	22X35A0407	45
42	22X35A0408	13
43	22X35A0409	17
44	22X35A0410	39
45	22X35A0411	33
46	22X35A0412	30
47	22X35A0413	30
48	22X35A0414	15
49	22X35A0415	36
50	22X35A0416	49
51	22X35A0417	26
52	22X35A0418	26
53	22X35A0419	26
54	22X35A0420	44

Attainment Level	% students
1	40%
2	50%

Percentage of students scored more than target	62%
<b>Attainment level</b>	<b>3</b>

3	60%
---	-----



# SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY

Department of Electronics and Communication Engineering

## Course Outcome Attainment

Name of the faculty P.RAJENDRA

Academic Year: 2022-23

Branch & Section: ECE - A

Course Name: SIGNALS AND SYSTEMS

Year: II

Semester: I

Course Outcomes	1st Internal Exam	2nd Internal Exam	Internal Exam	University Exam	Attainment Level
CO1	3.00		3.00	3.00	3.00
CO2	3.00		3.00	3.00	3.00
CO3	3.00	3.00	3.00	3.00	3.00
CO4		3.00	3.00	3.00	3.00
CO5		3.00	3.00	3.00	3.00
CO6		3.00	3.00	3.00	3.00
<b>Internal &amp; University Attainment:</b>			3.00	3.00	
<b>Weightage</b>			25%	75%	
<b>D Attainment for the course (Internal, University)</b>			0.75	2.25	
<b>CO Attainment for the course (Direct Method)</b>			3.00		

Overall course attainment level

**3.00**



# SRI INDU INSTITUTE OF ENGINEERING & TECHNOLOGY

Department of Electronics and Communication Engineering

## Program Outcome Attainment (from Course)

Name of Faculty: P.RAJENDRA                      Academic Year: 2022-23  
 Branch & Section: ECE - A                              Year: II  
 Course Name: SIGNALS AND SYSTEMS           Semester: I

### CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	1	2
CO2	3	1	-	-	2	-	-	-	-	-	-	-	1	3
CO3	3	-	2	-	-	-	-	-	-	-	-	-	1	2
CO4	2	3	-	-	1	-	-	-	-	-	-	-	1	3
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	2
CO6	3	1	-	-	2	-	-	-	-	-	-	-	1	3
<b>Course</b>	<b>2.8</b>	<b>1.8</b>	<b>2</b>	<b>-</b>	<b>1.6</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1</b>	<b>2.5</b>

CO	Course Outcome Attainment
CO1	3.00
CO2	3.00
CO3	3.00
CO4	3.00
CO5	3.00
CO6	3.00
<b>Overall course attainment level</b>	<b>3.00</b>

### PO-ATTAINMENT

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>CO Attainment</b>	<b>2.80</b>	<b>1.80</b>	<b>2.00</b>	<b>-</b>	<b>1.60</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>1.00</b>	<b>2.50</b>

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



# **SRI INDU INSTITUTE OF ENGINEERING AND TECHNOLOGY**

Accredited by NAAC with A+ Grade, Recognized under 2(f) of UGC Act 1956

(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/>

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## **ASSIGNMENTS AND REGISTERS**

### **Assignment 1 script link:**

<https://drive.google.com/file/d/1ZtqBuplNL5ZqQSZZDNzmEMWRVwM6ynxL/view?usp=sharing>

### **Assignment 2 script link:**

<https://drive.google.com/file/d/1X2AoiMhZZLa1gv2kTFjsnBGbv7B5w0Xm/view?usp=sharing>

### **Attendance register link:**

<https://drive.google.com/file/d/1PLHG5PJ2-j5QZvYS9B3R8FmmTu8GT1aw/view?usp=sharing>