Name of Institute: Institute of Technology and Engineering
Name of Faculty: Dr. Vrushank Shah

Course code: EC0421
Course name: Signals and Systems
Pre-requisites: Mathematics
Credit points: 03
Offered Semester: IV

Course coordinator (weeks 1 - 14)
Full name: Dr. Vrushank Shah
Department with siting location: 3rd floor, Faculty Room, Bhanwar Building
Telephone: 9898331721, Intercom:3325
Email:ec.hod@indusuni.ac.in
Consultation times: 4:00 PM to 5:00 PM

Course lecturer (weeks 1 - 14)
Full name: Dr. Vrushank Shah
Department with siting location: 3rd floor, Faculty Room, Bhanwar Building
Telephone: 9898331721, Intercom:3325
Email:ec.hod@indusuni.ac.in
Consultation times: 4:00 PM to 5:00 PM

Students will be contacted throughout the session via mail with important information relating to this course.

Course Objectives

By participating in and understanding all facets of this course a student will:

1. Coverage of continuous and discrete-time signals and systems, their properties and representations and methods those are necessary for the analysis of continuous and discrete-time signals and systems.
2. Knowledge of time-domain representation and analysis concepts as they relate to difference equations, impulse response and convolution, etc
3. Concepts of the sampling process
4. Knowledge of frequency-domain representation and analysis concepts using Fourier analysis tools, Z-transform, Laplace Transform.

Course Outcomes (CO)

1. Students will be able to represent & classify signals, Systems & identify LTI systems
2. Students will be able to derive Fourier series for continuous & Discrete time signals
3. Students will be able to find Fourier transform for different signals
4. Students will be able to analyze systems by performing Convolution
5. Students will be able to analyze DT systems using Z-transforms & Laplace Transform.

Course Outline

UNIT-I

[12 hours]

INTRODUCTION

- Definitions and concepts of different types of signals;
- Continuous-time and discrete-time signals;
- Mathematical operation on Discrete time signals
- Systems: Continuous-time and Discrete-time systems and basic system properties.
- Sampling of Continuous time signals
- Response of LTI Discrete time system in time domain.
- Linear convolution
- Impulse response
- Circular Convolution
- Correlation
- Relation between convolution and correlation

UNIT-II

FOURIER SERIES **[15 hours]**

- Representation of Fourier series,
- Continuous time periodic signals,
- Fourier series for discrete time signals
- Properties of Fourier series,
- Gibbs phenomenon
- Dirichlet's conditions

FOURIER TRANSFORMS

- Deriving Fourier transform from Fourier series,
- Properties of Fourier transforms,
- Introduction to Hilbert Transform
- Analysis of LTI discrete time system using discrete time Fourier transform
- Aliasing in frequency spectrum due to sampling

UNIT-III

LAPLACE TRANSFORMS **[15 hours]**

- Review of Laplace transforms, Partial fraction expansion,
- Inverse Laplace transform,
- Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals,
- Properties of L.T's relation between L.T's, and F.T. of a signal.
- Laplace transform of certain signals using waveform synthesis
- Analysis of LTI continuous time system using Laplace Transform

UNIT-IV

Z–TRANSFORMS **[12 hours]**

- 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.
- Analysis of LTI continuous time system using Z-transform Transform

Method of delivery

Face to face lectures, self-study material, Active Learning Techniques, PowerPoint Presentations, Assignments

Study time

Lecture hours: 3 hours

CO-PO Mapping (PO: Program Outcomes)

CO \ PO	PO 1	2	3	4	5	6	7	8	9	10	11	12
1	√				√	√	√	√				
2	√				√	√	√	√				
3		√			√					√		
4		√								√		
5	√		√									

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

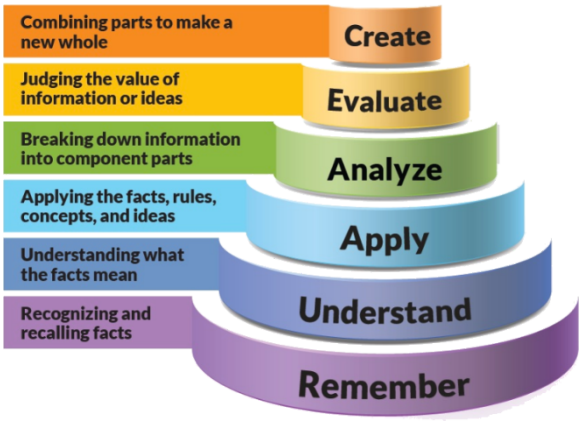


Figure 1: Blooms Taxonomy

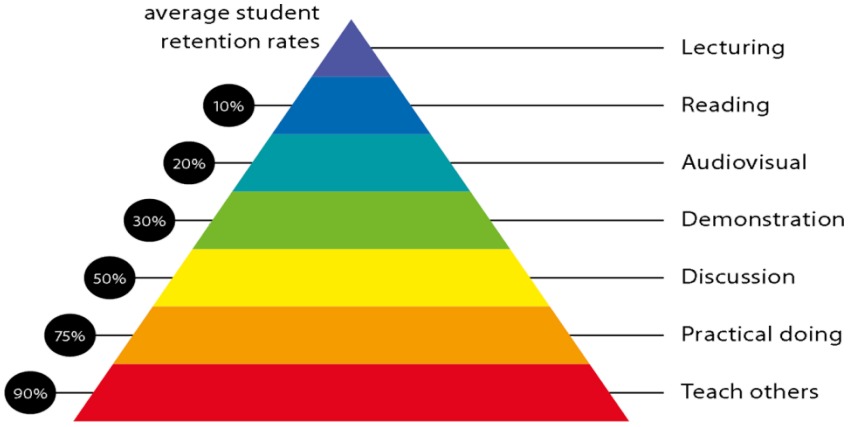


Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of Electronics and Communication Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**

Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

(Mention what practical work this Course involves)

Not Applicable

Lecture/tutorial times

(Give lecture times in the format below)

Under Preparation

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Details of referencing system to be used in written work

Text books

1. Alan V. Oppenheim, A. S. Willsky "Signals and Systems", PHI
2. A Nagoor Kani ,"Signals & Systems ",Mc Graw Hill..

Additional Materials

1. Ramakrishna Rao, P, "Signals and Systems" Tata McGraw Hill, 2008.
2. Simon Haykin and Barry Van Veen, "Signals & Systems", John Wiley and Sons Inc., New Delhi, 2008.

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

EC

Example:		
Quiz 1	10% (week 4)	Objective (1-3)
Quiz II	10% (week 8)	Objective (1-4)
Simulation Exercises	**20% (week 1-14)**	**Objective(1-4)**
Class Test	20% (week 7)	Objectives (2-4)
Final exam (*closed book*)	40%	Objectives (1-4)

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

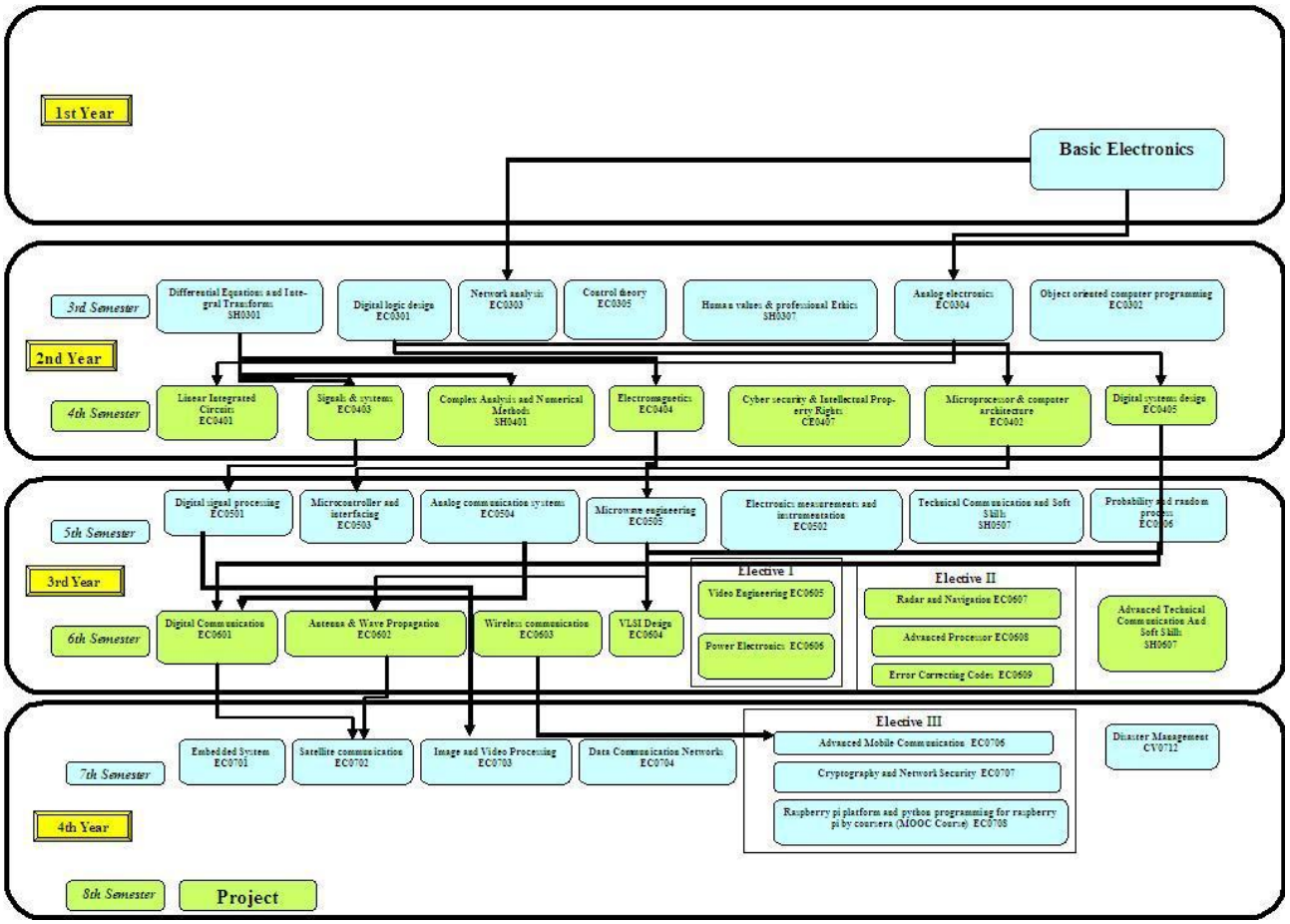
Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment).

Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	Definitions and concepts of different types of signals; Continuous-time and discrete-time signals; Mathematical operation on Discrete time signals, Systems: Continuous-time and Discrete-time systems and basic system properties., Sampling of Continuous time signals , Response of LTI Discrete time system in time domain.	1-2	BB,Chalk,PPT
	Weeks 2	Linear convolution, Impulse response, Circular Convolution , Correlation, Relation between convolution and correlation	1-2	BB,Chalk,PPT
	Week 3	Representation of Fourier series, Continuous time periodic signals, Fourier series for discrete time signals	*1-2*	BB,Chalk,PPT
	Week 4	Properties of Fourier series, Gibbs phenomenon, Dirichlet's conditions,	1-2-3	BB,Chalk,PPT
	Week 5	Deriving Fourier transform from Fourier series, ,	2-3	BB,Chalk,PPT
	Week 6	Properties of L.T's relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis. Analysis of LTI continuous time system using Laplace Transform	*2-3*	BB,Chalk,PPT
	Week 7	Properties of Fourier transforms, Introduction to Hilbert Transform	2-3	BB,Chalk,PPT
	Week 8	Analysis of LTI discrete time system using discrete time Fourier transform. Aliasing in frequency spectrum due to sampling	2-3	BB,Chalk,PPT
	Week 9	Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform,	*4*	BB,Chalk,PPT

	Week 10	Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's relation between L.T's, and F.T. of a signal.	4	BB,Chalk,PPT
	Week 11	Laplace transform of certain signals using waveform synthesis. Analysis of LTI continuous time system using Laplace Transform	4	BB,Chalk,PPT
	Week 12	Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms	4-5	BB,Chalk,PPT
	Week 13	Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms	4-5	BB,Chalk,PPT
	Week 14	Analysis of LTI continuous time system using Z-transform Transform	4-5	BB,Chalk,PPT


1st Year
Basic Electronics
3rd Semester
Differential Equations and Integral Transforms SH0301
Digital logic design EC0301
Network analysis EC0303
Control theory EC0305
Human values & professional Ethics SH0307
Analog electronics EC0304
Object oriented computer programming EC0302
2nd Year
4th Semester
Linear Integrated Circuits EC0401
Signals & systems EC0403
Complex Analysis and Numerical Methods SH0401
Electromagnetics EC0404
Cyber security & Intellectual Property Rights CE0407
Microprocessor & computer architecture EC0402
Digital systems design EC0405
5th Semester
Digital signal processing EC0501
Microcontroller and interfacing EC0503
Analog communication systems EC0504
Microwave engineering EC0505
Electronics measurements and instrumentation EC0502
Technical Communication and Soft Skills SH0507
Probability and random process EC0506
3rd Year
Elective I
Video Engineering EC0605
Power Electronics EC0606
Elective II
Radar and Navigation EC0607
Advanced Processor EC0608
Error Correcting Codes EC0609
6th Semester
Digital Communication EC0601
Antenna & Wave Propagation EC0602
Wireless communication EC0603
VLSI Design EC0604
Advanced Technical Communication And Soft Skills SH0507
Elective III
Advanced Mobile Communication EC0706
Cryptography and Network Security EC0707
Raspberry pi platform and python programming for raspberry pi by coursera (MOOC Course) EC0708
Disaster Management CV0712
7th Semester
Embedded System EC0701
Satellite communication EC0702
Image and Video Processing EC0703
Data Communication Network EC0704
4th Year
8th Semester
Project