Ahmedabad University

Course	ECE210 Signals and Systems	Semester	Monsoon Semester 2024
Faculty Name(s)	Mehul Raval	Contact	mehul.raval@ahduni.edu.in
School	SEAS	Credits	3
GER Category:	Not Applicable	Teaching Pedagogy Enable:NO	P/NP Course: Can not be taken as P/NP

Schedule

Section 1	08:00 am to 09:30 am	Tue	01-08-24 to 26-11-24
	08:00 am to 09:30 am	Thu	01-08-24 to 26-11-24
Section 2	11:00 am to 12:30 pm	Tue	01-08-24 to 26-11-24
	11:00 am to 12:30 pm	Thu	01-08-24 to 26-11-24

Prerequisite	Not Applicable
Antirequisite	Not Applicable
Corequisite	Not Applicable

Course Description	It is a classical course covering the following broad topics • Introduction to signals and systems • Convolution and Correlation • Continuous time Fourier Series • Discrete time Fourier series • Continuous time Fourier Transform • Discrete time Fourier Transform • Discrete Fourier Transform • Filters
Course Objectives	The objectives are to make student ● Understand mathematical description and representation of continuous and discrete time signals and systems. ● Help them develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system. ● Understand and resolve the signals in frequency domain using Fourier series and Fourier transform.

Learning Outcomes	At the end of the course students will be able to (1) apply the concepts of signal operations (2) appreciate various types of signals and their classifications (3) appreciate and apply various properties of systems (4) calculate convolution between two or more signals (5) calculate Correlation between two or more signals (6) appreciate and apply the concept of Fourier series (7) appreciate and apply the concept of continuous time Fourier Transform (8) appreciate and apply the concept of Discrete time Fourier Transform (9) design and build filters (10) appreciate and apply the concept of Discrete time Fourier series (11) to work in a team and learn about implementing a project

Pedagogy	In class: • Running the class in studio mode with group of students working together. • The course will flow with a suitable balance between in class and outclass activities. • Use of in-class time for project. • Set of reading material, papers, books, online resources, or list of topics, related project. • Use of audio visual aids like simulations, graphics, sound bites. • Use debrief session at the beginning of class to collect questions and discuss most common ones. Out of class • Setup of course management system and discussion forums. • Office hour with Instructor • Use of peer learning in class • Signal capturing and processing through their own devices.
Expectation From Students	• 100 % Attendance. • Attentive in the class • Regular in solving assignments • Working in a cooperative fashion while working in groups

Assessment/Evaluation	• Mid-Semester Examination:
	  ◦ Written examination - 30%
	• End Semester Examination:
	  ◦ Written exam - 40%
	• Other Components:
	  ◦ Class participation (Including attendance) - 10%
	  ◦ Assignments - 10%
	  ◦ Quiz - 10%

Attendance Policy	As per Ahmedabad University Policy.

Project / Assignment Details	It will be based on the topic covered during the corresponding week.
Course Material	Reference Book • Fundamentals of signals and systems, Govind Sharma, Michael Roberts, Second Edition, Tata Mcgraw Hill, ISBN: 9780070702219, Year: 2010, • Fundamentals of signals and systems, Govind Sharma, Michael Roberts, Second Edition, Tata Mcgraw Hill, ISBN: 9780070702219, Year: 2010,
Additional Information	Professor Ashok Ranade will conduct one hands on session per week.

Session Plan

NO.	TOPIC TITLE	TOPIC & SUBTOPIC DETAILS	READINGS,CASES,ETC.	ACTIVITIES	IMPORTANT DATES
1	Introduction	Definitions and Examples		Discussions	
2	Analog and Digital Signals	Sampling and Quantization, Analog to Digital conversion, Sampling theorem		Simulations	
3	Signal Classification	Periodic – No periodic, Even – Odd, Energy – Power,		Simulations	
4	Elementary Signals	Unit step, Unit ramp, Unit impulse, complex exponentials		Discussions	
5	Mathematical operations on signals	Transformation of independent variable – Time Delay and Advance		Problems and Simulations	
6	Mathematical operations on signals	Transformation of independent variable – Time folding and time scaling		Problems and Simulations	
7	Mathematical operations on signals	Transforming amplitude – Amplitude scaling, Addition and Subtraction		Simulations	
8	Mathematical operations on signals	Multiplication and Division, Differentiation and Integration		Problems and Simulations	
9	Systems	Introduction, Memory and Memoryless systems, Time Invariant and Time Variant		Problems	
10	Systems	Linear – Non Linear Systems, Causal – Non Causal systems		Problems	
11	Systems	Stable – Unstable and Inverse Systems		Problems	

12	Time domain representation of LTI systems	Introduction, Convolution integral		Problems	
13	Convolution	Discrete time convolution, and Properties		Problems and Simulations	
14	System Properties	System properties in terms of causality, stability		Discussions	
15	System Properties	De-convolution and step responses		Discussions and Problems	
16	Frequency domain – CT Fourier Series	Response of LTI systems to exponential and periodic signals, Need for Fourier representation		Problems and Simulations	
17	CT Fourier Series	Orthogonality and Fourier series representation of CT signals		Problems	
18	CT Fourier Series	Properties – Linearity, Time shift, Modulation theorem, Convolution theorem, Parseval's theorem		Problems	
19	CT Fourier Transform	Forward and inverse transform		Problems and Simulations	
20	CT Fourier Transform	Properties – Time shifting, Frequency shifting, Duality		Problems	
21	DTFT	Discrete time Fourier Transform. Similarity to CTFT		Problems	
22	Filters	Digital Filters. FIR and IIR . Design of FIR filters		Computer simulations	
23	Discrete Fourier Transform	Discrete Fourier Transform, Discrete Fourier series		Computer simulations	
24	Applications to music	Musical scale. Generating frequency notes		Computer simulations	

25	Music rhythms and automatic compositions	Introduction to meters. Tchniques for automatic compositions		Discussions	
26	Control system basics	Open loop and closed loop controls		Computer simulations	
27	Project	Project discussions		Project discussions	
28	Project	Project discussions		Project discussions	
29	Project	Project discussions		Project discussions	
30	Project	Project discussions		Project discussions	