[ELEC2100] [Signals and Systems] [Spring 2023-2024] [Credits:4]

Course Description

This is a foundation course introducing signals and systems for modelling and analysis of a variety of engineering systems. The course covers continuous- and discrete-time Fourier analysis, Laplace Transform, interactions between signals and linear time invariant (LTI) systems, sampling theorem, differential and difference equations as LTI systems, and application examples in communications, control, and multimedia. MATLAB introduced as an integral part of this course.

Exclusion(s) : ELEC2100H
Prerequisite(s) : MATH2011 or MATH2023 or MATH2111 or MATH2350 or MATH2351 or MAT2352

List of Topics

Lecture Outline

Week 1	Introduction and Complex Number
Week 2	Basic Characterization and Manipulation of Signals
Week 3	The Impulse and the Complex Exponential
Week 4	Linear Time-Invariant Systems
Week 5	System Function and Frequency Response
Week 6	CTFS and DTFS
Week 7	CTFT and DTFT
Week 8	Wireless Communication
Week 9	Sampling and Digital Processing of Signals
Week 10	Modern Application Examples – Spectrum Analyzer, FFT and OFDM
Week 11	Differential Equations as LTI Systems
Week 12	Laplace Transform and System Characterization
Week 13	Laplace Transform Applications – Feedback Control, Filter Design and Implementation

Laboratory Outline

Lab 1	Plot signals and process data files
Lab 2	Impulse response and convolution
Lab 3	FS and filters
Lab 4	Modulation, demodulation and sampling

Intended Learning Outcomes

On successful completion of this course, students will be able to :

CO1 - Describe Basic Continuous Time and Discrete Time signals and different ways to make use of and manipulate them.

CO2 - List the Properties of LTI systems and to determine the output of an LTI system using the impulse response and the convolution sum/integral, and the frequency response and transform.

CO3 - Correctly apply the appropriate transform (FS, DTFS, FT, DTFT) to produce a Frequency domain representation for continuous-time/discrete-time and periodic/aperiodic signals, and relate basic operations in the time and frequency domains.

CO4 - State and prove the sampling theorem.

CO5 - Analyze differential and difference equations as causal LTI systems and to realize them in different block diagram forms.

CO6 - Apply theories learnt to the analysis of communication systems including Amplitude Modulation and Frequency Division Multiplexing, the communication channel, mechanical systems, and new problems.

CO7 - Use the Software Tools Matlab to manipulate, process, analyze and plot signals.

Textbook(s)

Nil

Reference Books/Materials

Alan V. Oppenheim, Alan S. Wilsky and S.H. Nawab, Signals and Systems, Prentice-Hall Internal Editions, 2nd Edition

Relationship of Course to Program Outcomes

Please refer to the Report Section 4.3.2 (iii).

Grading Scheme

Homework	18%
Laboratory exercises	12%
Mid-term Examination	25%
Final Examination	45%