The University of Jordan
School of Engineering
Electrical Engineering Department
2nd Semester – A.Y. 2020/2021

Course: **Signal Analysis & Systems – 0953221 (3 Cr. – Core Course)**

Instructor: Prof. Mohammed Hawa
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Office Hours: Wed and Thu (to be announced on elearning)

Course website: **Start here: https://elearning.ju.edu.jo;** Video meetings and Oral quiz: Zoom; Written quiz: https://juexams.com; Video Lectures: YouTube (Mohammed Hawa); Backup: https://www.hawa.work/221;

Catalog description: Signal classification and system models. Continuous time signals. Signals and vectors. Generalized Fourier series representation. Amplitude and phase spectra of signals. Energy and power content of signals. Bandwidth of signals. The Fourier transform and its applications. Sampling of signals. Convolution of signals. Power and energy spectral densities. Correlation functions. Time-domain analysis of continuous time systems. The system impulse response. Communication channels. Filters: low-pass filter, high-pass filter, band-pass filter and band-stop filter. Discrete time signals. The discrete Fourier transform (DFT) and the Fast Fourier transform (FFT). Spectral analysis of DFT systems. Unit sample response to arbitrary input sequences. Introduction to the Z-transform. Project.

Prerequisites by course: **EE 0903211 – Electrical Circuits (I)** (pre-requisite or co-requisite), and
Mt 0301101 – Calculus I (pre-requisite), and
Mt 0301102 – Calculus II (pre-requisite)

Prerequisites by topic: Students are assumed to have a background in the following topics:

- Calculus (integration and differentiation) and complex number arithmetic.
- Electric circuit analysis techniques, phasors, transfer functions and filters.
- Using MATLAB and other circuit simulation software.

Textbook: ***Linear Systems and Signals* by B.P. Lathi and Roger Green, Oxford University Press, 3rd Edition, 2017.**

References:

- *Signals and Systems: A MATLAB Integrated Approach* by Oktay Alkin, CRC Press, 1st Edition, 2014.
- *Schaum's Outline of Signals and Systems* by Hwei P Hsu, McGraw-Hill Education, 3rd Edition, 2013.
- *Signals, Systems & Transforms* by Charles L. Phillips, John Parr and Eve Riskin, Pearson, 5th Edition, 2013.
- *Signals and Systems For Dummies* by Mark Wickert, For Dummies, 1st edition, 2013.
- *Signals and Systems: A Primer with MATLAB* by Matthew N. O. Sadiku and Warsame Hassan Ali, CRC Press, 1st Edition, 2015.
- *Signals and Systems* by Alan V. Oppenheim, Alan S. Willsky and S. Hamid, Pearson. 2nd Edition, 1996.
- *Continuous and Discrete Signals and Systems* by Samir S. Soliman and Mandyam D. Srinath, Pearson, 2nd Edition, 1998.

Schedule: 16 Weeks, 42 lectures (50 minutes each) plus exams.

Course goals: The overall objective is to introduce the student to the basics of signal analysis in time and frequency domains. The concepts of Fourier series and transform and power and energy spectra are emphasized. In addition, linear time-invariant systems are analyzed using the impulse response and transfer functions.

Course learning outcomes (CLO) and relation to ABET student outcomes (SO):

Upon successful completion of this course, a student will: **[SO]**

1. Be able to classify signals and systems into continuous and discrete types. [1]
2. Use Fourier series and transform to evaluate and sketch the line, density, power and energy spectra of signals. [1]
3. Know how to convert analog signals into discrete/digital signals and vice versa. [1]
4. Know the appropriate filters and communication channels suitable for signal processing and transmission. [1]
5. Be able to use the DFT and FFT for the analysis of signals and systems. [1]

Course topics:

	Topic	Hrs
1.	Signals and system classification into continuous-time and discrete-time. Continuous-time signal characteristics (even, odd, periodic, aperiodic, etc). Properties of continuous-time systems (stability, linearity, etc).	**6**
2.	Impulse representation of continuous-time systems. Convolution and its properties. Properties of Linear Time-Invariant (LTI) systems. Impulse response.	**6**
3.	Generalized, complex exponential, and trigonometric Fourier series representation of periodic signals. Frequency spectra. Properties of Fourier series.	**6**
4.	The Fourier transform and its properties (linearity, time scaling, time shifting, time transformation, duality, convolution, frequency shifting, differentiation, integration, etc).	**6**
5.	The Fourier transform of some typical time domain signals.	**3**
6.	Sampling and digitizing of continuous time signals and their spectra.	**3**
7.	Line, power and energy spectra of signals. Bandwidth of signals.	**6**
8.	Applications of the Fourier transform. Filters (ideal and practical).	**4**
9.	Discrete-time signals. Discrete-time Fourier transform. Fast Fourier transform. Introduction to the z-transform.	**2**

Ground rules:

Attendance is required and highly encouraged. To that end, attendance will be taken every lecture. Eating and drinking are **not** allowed during class, and cell phones must be set to silent mode. All exams (including the final exam) should be considered **cumulative**. Exams are closed book. No scratch paper is allowed. You will be held responsible for all reading material assigned, even if it is not explicitly covered in lecture notes.

Assessments:

Exams, Quizzes, Projects, and Assignments.

Assessment & grading policy:

Assignments	**0 %**	Quizzes	**20 %**
First Exam	**0 %**	Projects	**0 %**
Midterm Exam	**30 %**	Lab Reports	**0 %**
Final Exam	**50 %**	Presentation	**0 %**
		Total	**100 %**

Last Updated:

February 2021