## The University of Jordan School of Engineering Electrical Engineering Department

1<sup>st</sup> Semester – A.Y. 2025/2026



Course: Communications I – 0953421 (3 Cr. – Core Course)

**Instructor:** Prof. Mohammed Hawa

Office: E306, Telephone: 06/5355000 ext 22857, Email: hawa@ju.edu.jo

Office Hours: will be posted soon

Platform: https://www.hawa.work/421

Catalog description:

Classification of communication systems. Channel impairments: attenuation, distortion, noise, etc. Continuous-wave (CW) modulation. Double Sideband Suppressed Carrier (DSB-SC), Amplitude Modulation (AM) and Quadrature Amplitude Modulation (QAM). Bandwidth. Mixers. Coherent detection and effects of frequency/phase errors. Frequency Modulation (FM) and Phase Modulation (PM). AM and FM transmitters, receivers and radio broadcasting. Noise sources and noise representation in CW modulation. Signal-to-Noise Ratio (SNR) calculations. Frequency Division Multiplexing (FDM) and Time Division Multiplexing (TDM). Introduction to baseband transmission: sampling, quantization, line coding, and pulse shaping. Introduction to digital modulation techniques: ASK, FSK, PSK and QPSK. Introduction to performance of digital modulation schemes in the presence of noise.

Prerequisites by course:

EE 0963321 - Probability and Statistics (pre-requisite or co-requisite), and

EE 0953221 - Signal Analysis & Systems (pre-requisite)

Prerequisites by topic:

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

- Continuous-time signal analysis, Fourier series and Fourier transform.
- Filters and the difference between the LPF, HPF and BPF.
- Using MATLAB and other circuit simulation software.

Textbook:

Modern Digital and Analog Communications Systems by B. P. Lathi and Zhi Ding, Oxford University Press, 5th Edition, 2022.

**References:** 

- Fundamentals of Communication Systems by John G. Proakis and Masoud Salehi, Prentice Hall, 2<sup>nd</sup> Edition, 2013.
- Analog and Digital Communications (Schaum's Outlines) by Hwei P. Hsu, McGraw-Hill, 2<sup>nd</sup> Edition, 2002.
- Digital and Analog Communication Systems by Leon W. Couch, Prentice Hall, 8th Edition, 2012.
- An Introduction to Digital and Analog Communications by Simon Haykin and Michael Moher, Wiley, 2<sup>nd</sup> Edition, 2006.
- Analog and Digital Communication Systems by Martin S. Roden, Discovery Press, 5<sup>th</sup> Edition, 2003.
- Digital Communication Systems by Simon Haykin, Wiley, 1st Edition, 2013.
- Contemporary Communication Systems using MATLAB by John G. Proakis, Masoud Salehi and Gerhard Bauch, Thomson-Engineering, 3<sup>nd</sup> Edition, 2012.

Schedule:

On Campus [16 Weeks, 42 lectures (50 minutes each) including exams]

Course goals:

The overall objective is to introduce the student to the basics of communications theory. This course emphasizes:

- Analog modulation and demodulation techniques.
- Performance evaluation of communication systems in the presence of noise.
- Modern trends in communication systems.

	rse learning outcomes (CLO) and relation to ABET student outcomes (SO): a successful completion of this course, a student will: Understand the theory behind amplitude, frequency and phase modulation techniques. Become familiar with the performance measures used in conjunction with communication systems including required channel bandwidth and signal-to-noise ratio (SNR). Be able to identify the different parts of AM and FM transmitters and receivers. Learn how FDM and TDM multiplexing systems work. Become familiar with digital modulation techniques: ASK, FSK, PSK and QPSK. Be able to identify design choices in contemporary communication systems, such as: satellite systems, landline and cellular telephony, wireless networks, television and radio broadcasting systems.	[SO] [1] [1] [1] [1] [1] [1]
Cou	rse topics:	Hrs
1.	Channel impairments: attenuation, distortion and noise. Noise sources/characteristics.	4
2.	Classification of communication systems (analog and digital, baseband and carrier).  Communication system block diagram.	2
3.	(Handout) Signal Analysis Review: <i>time</i> and <i>frequency</i> domains, Fourier series and transform, spectral densities, RMS, average power, dBm levels, filters.	3
4.	Double Sideband Suppressed Carrier (DSB-SC) modulation/demodulation. Mixers, coherent detection and frequency/phase errors. Gilbert Cell. Switching modulator/demodulator.	5
5.	(Handout) Introduction to baseband digital transmission: sampling of signals, quantization, line coding and pulse shaping.	3
6.	First Exam.	1
7.	Quadrature Amplitude Modulation (QAM) and Vestigial Sideband (VSB). Analog TV broadcasting standards.	3
8.	Frequency conversion (heterodyning).	1
9.	AM modulation/demodulation. AM modulation index and power efficiency. Modulators, demodulators, envelope detector, synchronous detector.	4
10.	Frequency division multiplexing (FDM) and FDMA. AM radio broadcasting.	2
11.	Noise representation (AWGN noise). Performance of <i>analog</i> communication systems in the presence of noise, Signal-to-Noise Ratio (SNR) for DSB-SC and AM.	4
12.	Midterm Exam.	1
13.	Frequency Modulation (FM) and Phase Modulation (PM): time-domain representation, bandwidth estimation (Carson's rule), Narrowband and Wideband FM, FM and PM	5
14. 15.	advantages/disadvantages and applications. SNR of FM signals. FM radio broadcasting. Time division multiplexing (TDM) and TDMA. Telephony and Pulse Cod Modulation (PCM). (Handout) Introduction to Digital Modulation techniques: Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK), Quadrature Phase Shift Keying (QPSK) and Quadrature Amplitude Modulation (QAM). Performance Analysis.	2 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. Academic integrity must be maintained.

Assessr	ment &
grading	policy:

First Exam	20 %	Assignments	0 %	
Midterm Exam	30 %	Projects	0 %	
Final Exam	<b>50</b> %	Lab Reports	0 %	
Quizzes	0 %	Presentation	0 %	
		Total	100 %	

Last Updated: October 2025