

Instructor: Dr. Ibrahim Elshafiey
Office 2C115 - Phone 467-6751

Lectures Schedule and Location: Sat., Mon. and Wed. at 1C19
Section I: 9-9:50 am
Section II: 11-11:50 am

Text Book:

Simon Haykin, *Communication Systems*, John Wiley & Sons, Inc., New York,
4th Edition, 2001.

References:

1. Bruce Carlson, Paul B. Crilly, and Janet C. Rutledge, *Communication Systems*, McGraw Hill, Boston, 4th Edition, 2002.
2. B. P. Lathi, *Modern Digital and Analog Communication Systems*, Oxford University Press, New York, 3rd Edition, 1998.

Measurable Objectives:

- Define components of communication systems
- Mention limitations of communication systems.
- Conduct Fourier transform of continuous signal.
- Analyze response due to filter or channel.
- Analyze random processes
- Describe amplitude modulation techniques
- Design AM demodulation system
- Analyze linear modulation systems
- Analyze angle modulation systems
- Design angle modulation scheme
- Recognize principles of digital communication

Relationship to Program Objectives: This course contributes to the general objectives listed for an Electrical Engineering Department.

a. Apply math, science and engineering

This course focuses on mathematical formulation of communication systems.

c. An ability to design a system, component, or process to meet desired needs.

The homework assignments explain how to design simple communication systems. An optional project is given to students to design and test an AM or FM transmitter.

e. Identify, formulate and solve engineering problems

The class includes various examples of analysis of engineering problems related to analog and digital communication systems.

g. An ability to communicate effectively.

Focus is given in grading homework, quizzes and term exams on the ability of student to formulate his thinking in a correct way in terms of logic and mathematical formulation. Class discussions also focus on these aspects.

h. Broad education necessary to understand the impact of engineering solutions in a global and societal context

The impact of applying communication theories on modern technologies is discussed throughout the course.

i. Recognition of the need for and an ability to engage in life-long learning.

The course explains how advanced modeling tools are required to analyze complex engineering system related to electromagnetic phenomenon. Students are directed to the need of continuous investigation of new tools.

j. Knowledge of contemporary issues.

Students are engaged during the lecture time in discussing contemporary issues related to modern communication systems.

k. Use of modern engineering tools

The students are urged to read communication magazines.

Course Content

Topic 1: INTRODUCTION

Elements and Limitation of Communication System; Modulation and Coding; Historical Perspective and Societal Impact.

Topic 2: Signals and Spectral (Review)

Line Spectra and Fourier Series; Fourier Transform and Continuous Spectra.

Topic 3: Signal Transmission and Filtering

Response of LTI Systems; Signal Distortion in Transmission; Equalization.

Topic 4: Random Processes

Stationary Processes; Mean, Correlation and Covariance Functions; Ergodic Processes; Transmission of a Random Process through a Linear Time-Invariant Filter; Power Spectral Density.

Topic 5: Amplitude (Linear) Modulation

Amplitude Modulation; Linear Modulation Schemes: Double Sideband Suppressed Carrier Modulation, Single Sideband Modulation, Vestigial Sideband Modulation;

Quadrature-Carrier Multiplexing; Coherent Detection; Envelope Detection; Frequency Division Multiplexing; Superheterodyne Receiver.

Topic 6: Angle (Exponential) Modulation

Narrowband Frequency Modulation; Wideband Frequency Modulation; Transmission bandwidth of FM signals; Generation and Demodulation of FM Signals; FM Stereo Multiplexing.

Topic 7: Sampling and Pulse Modulation

Sampling Theory and Practice; Pulse-Amplitude Modulation; Pulse-Time Modulation; Quantization Process; Pulse-Code Modulation; Time-Division Multiplexing; Delta Modulation; Differential Pulse-Code Modulation.

Topic 8: Principles of Digital Data Transmission

Baseband Pulse Transmission, Intersymbol Interference, Distortionless Baseband Binary Transmission, Passband data transmission, Binary Phase Shift Keying (BPSK), Quadrature-Phase-Shift Keying (QPSK), Hybrid Amplitude/Phase Modulation Schemes, Binary Frequency Shift Keying (BFSK), Minimum Shift Keying (MSK).

Grading:	15 %	Homework and Quizzes	
	20 %	First Mid-Term Exam	(Monday 18/2/1426 6:00 PM)
	25 %	Second Mid-Term Exam	(Monday 1/4/1426 6:00 PM)
	40 %	Final Exam	

Attendance: Attendance is mandatory in lectures and tutorials. A student who misses more than 25% of classes will not be allowed to take the final exam.