ECE 452 Communication Systems

Catalog Data:
EE 452 Communication Systems (3 cr.). Introduction to modern communication systems; baseband pulse and data communication systems; communication channels and signal impairments; filtering and waveform shaping in the time and frequency domain; carrier-modulation for AM and FM transmission; bandpass digital and analog communication systems; comparison of system performance. Prereq: EE 350. (Alt/yrs) Meets for 50 min. 3 times/week.

Textbook:
Modern Communication Systems by Couch, Prentice-Hall, 1995.

References:
1. Wireless Channels by Wells, EE 452 Course Packet, 1995.

Coordinator:
Richard B. Wells, Associate Professor of Electrical and Computer Engineering

Objectives:
1. Learn to analyze and design basic signal processing and modulation methods.
2. Learn to analyze signals and systems in the time and frequency domains.
3. Learn how to use mathematical methods such as the equivalent baseband signal model in the design of signals and signal conditioning subsystems.
4. Learn how to design systems for best performance in the presence of noise and establish link budgets for the system.
5. Learn how to apply Nyquist signaling theory in the design of baseband and passband communication systems.
6. Apply mathematical and design methods to case studies in radio, wireless, modem, and satellite communication systems.

Relationship to Program Objectives:
The support of program objectives (lettered) by course objectives (numbered) is identified by the bulleted entries in the following table.

	A	B	C	D	E
1	•	•	•	•	
2	•	•	•		
3	•	•	•		
4	•	•	•		
5		•	•		
6	•	•	•		

Prerequisites by Topic:
1. Laplace transforms
2. Fourier transforms
3. Linear algebra

Topics:
1. Introduction to communication systems
2. Mathematical modeling of signals and systems
3. Characterization of random signals and noise
4. Power spectral density and autocorrelation functions
5. Baseband signal processing and transmission using PAM and PCM
6. Nyquist signaling theory

7. Carrier-modulated systems for AM, FM, PM transmission
8. System performance evaluation and link budgeting
9. Multiplexing methods in time, frequency, and coding domains
10. Elements of wireless channels and radiowave propagation

Computer Usage:
Matlab and Mathcad

Laboratory Projects:
None

ABET engineering topics content:

Engineering Science:	2 credits
Engineering Design:	1 credit

Assessment Tools:
1. Homework problems
2. Two one-hour exams
3. One two-hour final exam

Desired Course Outcomes:
1. Students will demonstrate ability to develop a mathematical model of time-varying and of nonlinear signal processing systems.
2. Students will demonstrate ability to design system-level specifications for bandwidth, transmit power, receiver sensitivity, modulation, and demodulation.
3. Students will demonstrate ability to design signal processing subsystems at the block diagram level such as filters, amplifiers, mixers, detectors, and phaselocked loops.
4. Students will demonstrate an understanding of Fourier analysis techniques.
5. Students will demonstrate an understanding of Nyquist design techniques.
6. Students will demonstrate an understanding of system noise analysis and link budgeting.
7. Students will demonstrate an ability to make well-reasoned selection of effective modulation methods for particular applications.
8. Students will demonstrate ability to communicate problem solutions effectively.

Relationship of Desired Course Outcomes to Desired Program Outcomes:
The relationship between desired course outcomes (numbered) and desired electrical engineering program outcomes (lettered) is illustrated by the bulleted entries in the following table.

	a	b	c	d	e	f	g	h	i	j	k	l	m
1	●				●						●	●	
2	●		●		●						●	●	
3	●		●		●						●	●	
4	●										●	●	●
5	●		●								●	●	
6	●										●	●	●
7			●		●						●	●	●
8							●					●	