

ELEN E4703: Wireless Communications

COURSE BENEFITS:

Learn about wireless communication systems. System design fundamentals. Trunking theory. Mobile radio propagation. Reflection of radio waves. Fading and multipath. Modulation techniques; signal space; probability of error, spread spectrum. Diversity. Multiple access.

PROFESSOR DIAMENT

Professor Diament joined the E.E. faculty in 1963. His teaching and research areas are in all phases of electromagnetics and wave propagation, including microwaves, antennas, optics, radiation statistics, plasmas, wave interactions, relativistic electron beams, and transient electromagnetic phenomena. He is the author of **Wave Transmission and Fiber Optics**, published in 1990 by Macmillan, and of **Dynamic Electromagnetics**, published in 2000 by Prentice Hall.

Professor Diament's current interests include: Biological applications of electromagnetics; antennas for satellite communications, mutual coupling in antenna arrays, waveguiding.

APPLICABLE DEGREE PROGRAMS

Most courses 4000-level and above can be credited to all degree programs. **All** courses are subject to advisor approval.

ADDITIONAL COURSE FEES: None

Lecturer: Paul Diament

Office Hours: Mon, Wed 11:00-11:50am or by appointment

Office Phone: (212) 854-3111 (email strongly preferred)

Email Address: diament@ee.columbia.edu

Teaching Assistant: TBA

Teaching Assistant's Office: TBA

Teaching Assistant's Office Hours: TBA

Teaching Assistant's E-mail Address: TBA

Day & Time of Class: Monday/Wednesday: 2:40 – 3:55 pm

Viewing Schedule: N/A

Class Location:

Class Homepage: TBA

Credits for Course: 3

Class Type: Lecture

Prerequisites: EE E3701 or the equivalent (Intro to Communications Systems and Networks).

Description: Wireless communication systems. System design fundamentals. Trunking theory. Mobile radio propagation. Reflection of radio waves. Fading and multipath. Modulation techniques; signal space; probability of error, spread spectrum. Diversity. Multiple access.

Required Text(s): Rappaport, Theodore S. *Wireless Communications - Principles & Practice, 2nd Edition*. Prentice Hall, 2002 ISBN: 0-13-042232-0

Reference Text(s): None

Homework(s): TBA

Project(s): None

Paper(s): None

Midterm Exam(s): TBA

Final Exam: TBA

Grading: Homework assignments, Midterm, and Final.

Help with Homework Assignments: [Erlang and Q functions](#)
[Review of Decibel Scale](#)

Software Requirements: Web Browser

Homework Submission: Upload or Via fax to CVN at (212) 854-0466

COURSE OUTLINE FOR CURRENT SEMESTER

Date	Topic	Topics/Chapters Covered	Assigned	Due
	1	Introduction to Wireless Communication Systems mobile radio, cellular telephony		
	2	Systems Design Fundamentals cellular concept, hexagonal cell model, channel assignment, handoff strategies, channel reuse		
	3	Trunking Theory grade of service, traffic intensity, blocking, queuing, Erlang B&C formulas		
	4	Mobile Radio Propagation large-scale path loss, antenna fundamentals, radiation intensity, system parameters, gain, effective area, power transmission, reciprocity, Friis formulas		
	5	Reflection of Radio Waves Snell's laws, Fresnel reflection coefficients, ground reflection model, diffraction, Fresnel zones, scattering, path loss models		
	6	Fading and Multipath factors that affect fading, Doppler shifts, multipath channel, flat vs. frequency selective and fast vs. slow fading		
	7	Modulation techniques amplitude modulation, single sideband, frequency and phase modulation, digital modulation, pulse shaping, signal space and probability of error, spread spectrum		
	8	Equalization, Diversity, Channel Coding adaptive equalization; microscopic and macroscopic diversity; polarization, frequency, and time diversity; coding, block codes, convolutional codes		
	9	Multiple Access Techniques frequency-, time-, code-, and space-division multiple access; packet radio		