

**Course Description:**

This is an introductory course in mobile and wireless networks. The course covers fundamental techniques in design and operation of the second, third, and fourth generations of wireless cellular networks and wireless LANs. The emphasis is on the traditional design of cellular mobile systems, including both voice and data services. We will start by covering topics related to the wireless channel; i.e., the radio propagation models and the multiple access techniques. Then, we will proceed with studying the engineering of a cellular system, including detailed explanation of some standards of the existing common air interfaces for voice and data (e.g., GSM, GPRS, IS-95, WCDMA, LTE, WiFi, WiMAX). We will learn how signaling is performed in cellular networks, how a mobile session and a mobile call are controlled, and how security features are designed in those networks. Introduction to third generation wideband systems and novel technologies, such as Bluetooth and ad hoc networks, will be covered as well.

The course is a mixture of theoretical, engineering, and practical topics in contemporary wireless systems.

**Prerequisites:** A course in Computer Networks (e.g., CS 5390) and a course in Probability.

**Course Instructor:** Prof. Zygmunt J. Haas, [haas@utdallas.edu](mailto:haas@utdallas.edu)

**Office Hours:** TBD

**Course URL:** TBA

**Course Schedule:** Mondays/Wednesdays, 10:00am – 11:15pm; Room: ECSN 2.126

**Course Text:**

- \* TBD
- \* References to technical articles will be provided during the course

**Grading Policy:**

Homework sets: 30%  
Exams (35% each): 70%



**Homework Assignments:**

There will be 8-10 homework sets, which will be typically posted on Tuesdays. Each assignment will be due typically two weeks after its distribution (before class), with some exceptions. Some assignments may require limited computer use.

**Exams (2 exams):**

- \* Exam #1: TBD
- \* Exam #2: TBD

### Grading Rules:

- \* Both components are essential for the final grade.
- \* No one is exempt from the exams. If you have missed an exam due to a legitimate reason, you need to reschedule a makeup exam as soon as possible.
- \* If you did not turn in up to 2 homework sets due to a legitimate reason, the turned-in assignments will carry the total of the 30% of the final score.
- \* Any final score component missed not due to a legitimate reason will count as no credits in the final score calculation.
- \* See the course web site for what constitute a legitimate reason.
- \* Individual work is assumed on homework sets and exams.

### Reading Assignments:

Reading assignments will be posted weekly, typically on Tuesdays after class. It is very important to go over the reading material before the next class. If not specified otherwise, the source of the reading assignment is the course textbook

### Tentative Syllabus:

- \* Introduction to the world of Mobile Radio
- \* Fundamentals of wireless systems design:
  - \* The Cellular Principle - frequency reuse
  - \* The Interference vs. Capacity tradeoff
  - \* Channel Assignment techniques
  - \* Capacity Planning, Traffic Engineering, and Trunking Efficiency
    - \* Brief Introduction to Queuing Theory
  - \* Handoff Algorithms
  - \* Power Control Schemes
- \* Signaling and Call Control
- \* Radio Propagation Models
  - \* Fundamentals (Path Loss, Doppler)
  - \* Large-scale fading (shadowing)
  - \* Small-scale fading (multipath)
- \* Modulation, Equalization, Diversity techniques, Channel Coding, Speech Coding
- \* Wireless Local Area Networks (802.11, 802.15, Bluetooth, etc)
  - \* Multiple Access, Medium Access, and Physical Layer Considerations
- \* Mobility Management, Mobility in the Internet (RFC 2002)
- \* Introduction to Wireless Network Security
- \* Details of Air Interface designs (e.g., IS-95, GSM, GPRS, WCDMA(3GPP))
- \* Ad Hoc Networks
- \* Fourth Generation Broadband Systems



Prepared by: Z.J. Haas, October 25, 2013