Southern Methodist University

SMU EETS 8306 and NTU TC 751-N, Fall 2001
Wireless, Cellular, & Personal Telecommunications
http://www. engr. smu. edu/~ triggs/

Lecture 1: Course Overview
(Syllabus)

Instructor: Alan Triggs, Ericsson Inc.
alan. triggs@ericsson.com
(972) 583-3107

Instructor Profile

• Director, Service Solutions with Ericsson Inc.
  – Telecom Management & Professional Services Group
• M.S.E.E., UTD, specialization in wireless
• 6 years of experience. Technical experience includes:
  – 3G solutions
  – CDMA system performance
  – GSM RF features analysis
  – GSM BSS new product introduction
  – Test environment development (wireline networks)
• SMU adjunct faculty member since 1998
Overview

- Introduction to Wireless, Cellular, and Personal Telecommunications (PCS)
  - Primarily mobile wireless
  - Focus on the major technologies; CDMA, GSM, & 3G
  - Limited coverage of fixed wireless

- Semi-technical treatment
  - About 30% of students typically lack an engineering or science undergraduate degree

- One objective: to give you sufficient understanding of the technology to make intelligent decisions
  - Adequate understanding of technology, regulations, politics, and business are very important in the telecommunications industry. One alone is insufficient. - R. Levine

What is “Wireless Communication”?
Business & Technology Relationship

• PCS technology selection spurred huge debate
  – A “holy war” between CDMA, TDMA, and GSM

• Sprint paid $2 billion for nationwide PCS spectrum
  – Just for the permission to use the spectrum….and it’s getting much more expensive

• Major business reasons for choosing a technology:
  – Equipment costs
  – Vendor financing
  – Politics, partnerships, and footprint strategy
  – Availability of attractive terminals
  – Delivery times, services, support, etc.

Business & Technology Relationship (cont.)

• Major technical reasons for choosing a technology:
  – Capacity (no. of users per Hertz)
  – Coverage (larger cell radius means fewer base stations)
  – Speech quality
  – Data throughput and advanced features
  – Ease of design and operation
  – Evolution roadmap

• Churn is caused by business & technical issues
  – Approximately 30% of subscribers who switch to another wireless operator do so due to poor coverage or quality

• Which is more important? - financing, capacity…..
  – Only a solid understanding of both the business and technology will allow you to decide
Course Outline

Four Major Categories:

1. Introduction and Overview of Technology and Business
   - Lecture 1: Course overview, schedule, grading, book reviews
   - Lecture 2: Technology overview
   - Lecture 3: Business and regulatory issues

2. Digital Communication Basics
   - Lecture 4: Speech and channel coding and digital modulation

Course Outline (Cont.)

3. Cellular and RF Concepts
   - Lecture 5: Cellular/PCS network architecture
   - Lecture 6: Cellular design and planning
   - Lecture 7: Propagation, Link Budgets, Fading and Coverage
   - Lecture 8: Equalization and diversity
   - Lecture 9: Antenna systems

   - Midterm Exam
Course Outline (Cont.)

4. Wireless Systems and Standards
   - Lecture 10: Generations of mobile communications, analog, and TIA/EIA-136 (TDMA)
   - Lecture 11: Global System for Mobile Communications (GSM)
   - Lecture 12: TIA/EIA-95 (CDMA)
   - Lecture 13: Wireless mobile data
   - Lecture 14: Third generation systems
   - Lecture 15: Brief overview of other wireless technologies

   - Project Presentations
   - Final Exam

Grading

3 Homeworks 30%
   - 10 questions each, relatively short

Midterm Exam 20%
   - 1 hour, in-class/proctored
   - Open books, open notes, closed neighbor
   - 25 questions, mostly multiple choice

Final Exam 50%
   - Take home exam, unlimited time

Optional Team Project for in-class student 60%
   - See next slide for details
   - Replaces the final exam and last homework
Team Project

- **Wireless Operator Performance Evaluation**
  - Measure performance of GSM operator (Voicestream) in Dallas
  - Collect over-the-air data through drive-testing
  - Evaluate coverage, quality, parameter settings, antenna configurations, frequency plan, etc.
  - Write report and provide brief presentation

- **60% of grade**
- **3-4 students per team**
- **Project is far more educational than a Final Exam**

Team Project (Cont.)

- **Project team members will require:**
  - *Considerably* more time than a final exam and one homework would require
  - Ability to meet peers frequently
  - Each team must have access to a color printer, PowerPoint, PC laptop, and a vehicle capable of carrying 3-4 people with some small equipment. A good image processing tool (such as PaintShop Pro) would be very helpful.

- **Grading based on:**
  - Overall report and presentation quality, accuracy, and scope
  - Instructor’s subjective opinion of your individual contribution
  - Confidential peer evaluations
Course Textbook

- No single text can cover this course
  - The chosen GSM book will be useful for the Final Exam (or Project), and will provide a good understanding of the world’s most popular cellular technology.
- Handouts, and web links from various texts, journals, and magazines will also be provided
  - Handouts are being mailed this first week to distance-learning students. You should have a total of 83 pages.

Previous Course Books

- **Wireless PCS**
  - Rajan Kuruppillai, et al
  - 1997, McGraw-Hill, Softback
  - (easy reading)

- **Handbook of Mobile Radio Networks**
  - by Sami Tabbane
  - 2000, Artech House, Hardback

- **The Mobile Communications Handbook**
  - by Jerry D. Gibson
  - 1999, CRC Press, Hardback
Some Other Good Books

**Cellular Mobile Systems Engineering**
*Saleh Faruque, Nortel.* Good for TDMA, CDMA, Cell & Frequency Planning, & Site Engineering. Easy to read.

**Wireless Personal Communications Systems**
*David Goodman, WINLAB, Rutgers.* Good for the Protocol & Messaging for all Cellular/PCS Standards, including Low-Tier PCS. Easy to read.

**Wireless Communications**
*Theodore Rappaport, Virginia Tech.* Good for Propagation, Modulation, Coding, & Equalization. Graduate EE text.

Good CDMA Specific Books

**CDMA RF System Engineering**
*Samuel C. Yang, AirTouch.* Good for the basics of CDMA, CDMA Call Processing, CDMA Design Engineering, and CDMA Performance. Easy to read.

**CDMA Systems Engineering Handbook**
*Jhong Sam Lee & Leonard Miller, JSLAI.* Good for everything related to CDMA, particularly Modulation, Coding, Rake, and System Design. Very heavy reading. 1228 pages of packed information.
Good GSM Specific Books

The GSM System for Mobile Communications
Michel Mouly & Marie-Bernadette Pautet. Good for a general introduction to GSM. Considered the “bible” of GSM, but getting old now (1992). Easy to read.

An Introduction to GSM
Siegmund Redl, Matthias Weber, Malcolm Oliphant. Good for a general introduction to GSM, the GSM air-interface, and GSM testing. Similar to the course textbook but getting a little old (1995).

Good TDMA Specific Book

Understanding Digital PCS - The TDMA Standard
Cameron Kelly Coursey. Good for a general introduction to TDMA. Detailed coverage of the protocol and physical layer. 1998. Easy to read.
Good 3G Specific Books

**WCDMA for UMTS**
Harri Holma (Editor), Antti Toskala (Editor)
John Wiley & Sons, 2001

**IS-95 CDMA and CDMA2000**
Vijay Kumar Garg
Prentice Hall, 1999

Good Wireless Magazines

**IEEE Personal Communications**
(soon to be named “IEEE Wireless Communications”)  
IEEE’s primary wireless magazine. Easy to read articles. Good quality, refereed articles. $25.00 per year for 6 issues (in addition to regular IEEE dues).  
www.comsoc.org

**IEEE Communications**  
IEEE’s primary communications magazine. Approximately 50% is wireless related. Easy to read articles. Good quality, refereed articles. Free with $25.00 membership of IEEE Communications Society (in addition to regular IEEE dues). 12 issues per year.  
www.comsoc.org
Good Magazines/Newspapers

**RCR**
Weekly publication. Most articles/stories on-line. Registration on-line also at: http://www.rcrnews.com

**Wireless Week**
Weekly publication. Most articles/stories on-line. Registration on-line also at: http://www.wirelessweek.com

Miscellaneous Comments About the Course

- **Attendance is Not Mandatory**
  - But exams, homeworks, and project are primarily based on class material. You should find it interesting to come to class. If not, it’s your instructor’s fault.

- **Office Hours**
  - As long as necessary after class, as needed.
  - Anytime over email (responses sent within 24 hours usually).

- **Slide Materials**
  - Font sizes, packing of information on a slide, and colors are optimized for content delivery, and note taking. Feedback is welcome, but with all things considered, these settings are probably best.
  - Feedback on slide content and errors is most welcome.
Miscellaneous Comments About the Course

• Contact List
  – SMU EE Department Administrator:  
    Susan Bailey (214) 768-3109
  – SMU Distance Learning Coordinator:  
    Gary McCleskey (214) 768-3108
  – Videotape Problems: vthelp@seas.smu.edu

• Class Times & Dates
  – Thursday evenings, 6:30-9:20pm CST
  – First day of class: Thursday, August 23th
  – No class on Thanksgiving
  – Last day of class: Thursday, November 29th

Important Comments for Distance Students

• WWW will be used for distribution of most material
  – http://www.engr.smu.edu/~triggs (Select Fall 2001 link)
  – All lectures and homeworks will be posted before being needed, but sometimes just the day before.
  – PDF format.

• The final exam will involve using TEMS software. This is available for download on the web. Please download ASAP.

• I do attempt to repeat all questions and valid comments, for the benefit of distance students.
  – If I don’t repeat a comment/remark, it’s usually because it has no value for the entire class
Important Comments for Distance Students

• Email me as soon as possible with the following information completed:
  – Name
  – SSN, Last 4 Digits
  – Phone number (daytime number)
  – Email (very important)
  – Employer and job title (with 2-3 line description of job and any relevant wireless experience)
  – Section type (SMU videotape, Green Network, or NTU)
  – If you watch live, or on tape delay.
  – Confirmation of ability to download and run the TEMS software

Important Comments for Distance Students

• ALL assignments should be returned to Gary McCleskey at SMU by either fax, email, or mail;
  Fax: (214) 768-8621   Email: garym@seas.smu.edu
  Mail: Gary McCleskey
        Dept. of Electrical Engineering
        Southern Methodist University
        PO Box 750338
        Dallas, TX 75275-0338

• DON'T email/call to confirm receipt of assignments and DON'T submit assignments twice (eg: by fax AND mail)
  – That adds a tremendous amount of unnecessary work for both Gary and myself….see next slide….
Important Comments for Distance Students

- **Golden Rule for Submission of Material:**
  - I know there are delays and technical difficulties with live transmission and videotapes. I will NOT penalize any student for getting their material in late, unless I contact you to discuss it first. Therefore, do not seek confirmation of receipt of material. I will let you know if I don’t have it or if only part of the assignment came through. Please just be honorable and do your best to meet the deadlines.

- **Gary can return assignments much faster if you write legibly and include the following on them:**
  - Student Number.
  - Address you want the assignment returned to.

Reading Assignment

- Reading assignments will always be listed on the last slide of a lecture (if there are any)

- No assignment for this lecture 😊