Electrical, Computer And Systems Engineering Department
ESCE-6961 Fundamentals of Wireless Broadband Networks

Spring 2007 Syllabus

Course Description

This course will cover the fundamental concepts in wireless broadband communications and networks from a systems perspective.

The course begins with an in-depth introduction to wireless systems and wireless channels (path loss, shadowing, fading, statistical/empirical models). Topics subsequently covered include an information-theoretic capacity of wireless channels, digital modulation and detection, diversity techniques (adaptive modulation and coding, multiple-antennas: (MIMO and space-time communications), multi-carrier modulation/OFDM and spread spectrum/CDMA). The course then covers multi-user wireless systems, modern MAC layer design (FDMA/TDMA/CDMA/OFDMA/SDMA/CSMA), and mobility/handoff issues. The course will also overview how these concepts are realized in real-world wireless standards such as IEEE 802.11a/b/g/n (WiFi), 802.16e (WiMax), 2G/2.5G/3G cellular wireless networks. The course ends with an introduction to cutting edge research topics in cross-layer design of multi-hop wireless systems.

Prerequisites:
 Required
  ESCE-4670 Computer Communication Networks or equivalent
Desirable:
  ECSE-4520 Communication Systems
  ECSE-6510 Introduction to Stochastic Signals and Systems

Instructor
Prof. Shivkumar Kalyanaraman. (Call me "**Shiv**").
Office: **JEC 6042**
Phone: 276-8979
Email: shivkuma@ecse.rpi.edu
  {Note: use course bulletin board (see below) for any query that may be of interest to others}
Office Hours: **Wed: 4:00 pm - 6:00 pm or by email appointment**

Course Secretary [for *all* administrative requests]
Audrey Hayner
Office JEC 6003
Phone: 276-6019

Teaching Assistants:
TBA. [Neeraj Jaggi, jaggin@rpi.edu, x8289]

Required Text
David Tse, Pramod Viswanath, *Fundamentals of Wireless Communications*, Cambridge Univ. Press, 2005, ISBN # 0-521-84527-0

Recommended Book: (we will also closely follow content from parts of this text)
Andrea Goldsmith, *Wireless Communications*, Cambridge Univ. Press, 2005, ISBN #: 0-521-83716-2

Recommended Resources:

1. Jeffrey G. Andrews, Arunabha Ghosh, Rias Muhamed, **Fundamentals of WiMAX: Understanding Broadband Wireless Networking, Prentice Hall Communications Engineering and Emerging Technologies Series,** February 2007; ISBN: 0132225522

Tentative Grading Percentages
Exams (Quizzes)		**50%**
(Test 1:	15 points;	
Test 2:	15 points;	
Test 3 (COMPREHENSIVE):	20 points;	
Homeworks		**30%**

- One homework per major lecture slide set
- Submission, self-grading with TA oversight (submit graded version);
[Solution/grading policy will be provided after submission deadline]
- Each submission has equal weight.
- One late submission allowed up to 1 week after deadline, 10% penalty (please notify TA).
- Beyond that late submissions will not be accepted (no credit).

Research Case Study/Term Paper   **20%**

Exam (Quiz) Schedule and Conflicts
Since the **exams will be held during class hours**, you should not have any conflicts. However, if you do have a scheduled conflict for the exam period with a lower-numbered course, see the instructor. There will be **NO make-up exams.** All exams will be **open book/notes**. Exams will typically consist of quantitative problems, design questions, multiple choice (true-false) questions and short answer questions and will focus on concepts. Exams will be extremely time-limited and will cover both text and additional reading material. Exams 1 and 2 will test you on the incremental material covered since the previous exam. Exam 3 will be comprehensive, but it will place extra emphasis on incremental material.

Exam dates:
EXAM 1: February 23rd, 2007   (15%)
EXAM 2: March 30th, 2007   (15%)
EXAM 3: May 1st, 2007   (20%, comprehensive)

Course Delivery Format:

This course will consist of lectures, in-class exercises, informal quizzes, problem sets, a case study and examinations (quizzes).

- **Lectures** will consist of upto 75% of class time. Lectures and other course material will be available online ***on the instructor's web page.*** WebCT details (for homework submission) will be announced in the first day of class.
- **Homeworks** will be handed for every major slide set, with the due date being the Sunday midnight of the week the slide set is completed. Please do your homework problems as the material is being covered (especially for longer slide sets).
- **Exams** will contain numerical design problems, true/false questions, concept questions, short-answer or quantitative type questions. Exams will be open-book, but will be extremely time-constrained. Material from slides, text, papers/handout reading and homeworks will be included in the scope of exams.
- **Research Case study** is intended to give you a first hand, in-depth experience in researching a new area in networking. Groups of up to two students are allowed per case study, but a more in depth study and report is expected from groups of two. You will choose from a menu of suggested research topics, or based upon your own research topic in the area of wireless broadband networks. Each proposed topic should include mandatory paper/chapter readings, followed by a set of other minor references. Your task is to critique the material, organize it in a framework of your own, and make sound judgments about the past and future directions of work in the topic area. You could choose to do a performance evaluation/simulation (ns-2 or Matlab etc) as part of your case study. The case study report should be a document no longer than 10 pages. I will expect the case study to be of high quality, reflecting deep understanding, original thinking and be written like a professional technical paper, and will grade it strictly.
- **Bulletin Board:** The WebCT site for the course has a bulletin board that we will use for all course related technical and administrative discussion. The TA will be monitoring the bulletin board and respond promptly to your queries. Please use this facility in preference to sending us emails directly because the entire class can benefit from the discussion.
- **Online Videos of Prerequisite & Other Networking Courses:** available for reference at the instructor's web page (Google: "shiv rpi")