Introduction to Communication Networks: ELEC 437/539

Instructor

- [Professor Edward Knightly](#)
- Office: OES 436
- Office hours: scheduled to assignments and by request

Background

Topics covered are self-contained so that a background in networking is not required. An introductory probability class such as ELEC 303 (Random Signals in Electrical Engineering Systems) or STAT 310 (Probability and Statistics) is a required prerequisite.

Course Objectives

Develop knowledge and skills to design and analyze communication networks with a focus on wireless networks and performance evaluation.

Course Outcomes

Students completing the course will understand the following networking concepts:

1. Wireless networking, including medium access and cross-layer design in ALOHA, CSMA, IEEE 802.11 (Wi-Fi), and cellular networks (5G/6G)
2. Congestion control: fluid models, network utility maximization, TCP
3. Routing: shortest path trees, Dijkstra's algorithm, Bellman-Ford algorithm, RIP, OSPF, and BGP
4. Security: public key cryptography, authentication, and secure wireless
5. Traffic management: statistical multiplexing, delay bounds, quality of service

Students will be able to apply analytical models and simulation tools to networking problems and understand performance evaluation techniques:

1. Stochastic models
2. Renewal theory
3. Embedded Markov chains
4. Distributed convex optimization
5. Graph theory

Case studies include Wi-Fi, 5G/6G, Internet of Things (IoT), and the Internet

Grading

30% Problem sets
25% Simulation assignments
20% Midterm
25% Final exam

You may discuss homework assignments with classmates, but all solutions must be original and individually prepared. Late work will be penalized at 15% of its full credit per day up to a maximum of 4 days, after which no late work will be accepted.

ELEC 539 additionally requires an ns-3 research project. The project results and write-up count for 15% of the final grade, with the above categories correspondingly reduced.

Required Textbook

J. Walrand and S. Parekh, *Communication Networks: A Concise Introduction, Second Edition.* Morgan & Claypool, 2018.

Rice Honor Code

In this course, all students will be held to the standards of the Rice Honor Code, a code that you pledged to honor when you matriculated at this institution. If you are unfamiliar with the details of this code and how it is administered, you should consult the Honor System Handbook. This handbook outlines the University's expectations for the integrity of your academic work, the procedures for resolving alleged violations of those expectations, and the rights and responsibilities of students and faculty members throughout the process.

Disability Support Services

If you have a documented disability or other condition that may affect academic performance you should: 1) make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 / adarice@rice.edu / x5841) to determine the accommodations you need; and 2) talk with me to discuss your accommodation needs.

Syllabus Change Policy

This syllabus is only a guide for the course and is subject to change with advanced notice.