CSC/ECE 575 Spring 2024 - Introduction to Wireless Networking

Instructor
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Course website: Moodle - 'my courses page and then go to CSC/ECE 575
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Class Meeting Time: Mon/Wed. 11:45am - 1:00pm, FWH 2341 .

Overview
In this re-designed introductory class to wireless networking technology, we will cover the most widely deployed wireless systems (e.g., 5G/LTE, WiFi 5/6, IoT and NB-IoT), and the latest developments from physical layer solutions to applications like vehicular communication standards and autonomous driving . Specifically, the contents include:

1. Overview of wireless networking: terminologies, classifications, and architecture

2. Radio transmissions and antenna techniques: channel models and MIMO principles

3. Multiplexing, modulation, and coding schemes (MCS)

4. Spectrum access, sharing, and resource management for WiFi, 5G/LTE, and Internet of Things (IoT)

5. Mobility and roaming support

6. Service-based architecture and SDN in 5G&Beyond

7. Vehicular communications (Optional)

Learning objectives
At the end of the course, students will be able to 1) understand and master the basic techniques, principles, and solutions of wireless technologies, 2) apply different techniques for the entire protocol stack of wireless applications toward selected key performance, 3) develop wireless application use cases with radio and mobility models, and at least 2 different network architectures, and 4) gain experience with one or more packages in matlab toolbox.

Reference Books

- "Wireless Communication Networks and Systems," by Cory Beard and William Stallings, 2016.

- "5G Wireless: A Comprehensive Introduction," 1st edition, by William Stallings.

- "Introduction to Wireless Communications and Networks," by Krishnamurchy Raghunandan, in the series of Textbooks in Telecommunication Engineering, Springer, 2021 (available on the web).

Other references:
There is a large number of books, papers, reports, white papers available through the NCSU library on wireless networking. Also, there are a lot of documents and on-line lectures available through various sites in the Internet. Students are encouraged to consult and share other sources in addition to lecture notes. However, it is worthnoting that *google search and browsing* will consume **a significant amount of time**, while spending more time may provide a different point of view and may help you understand the material better. The contents discussed in the classroom, along with the posted readings on the Moodle page provide **sufficient** knowledge for all course assignments.

Assignment, Submission, and Grading
This course will have comprehensive assignments and tests as follows:

- **homework assignments (15%):** there will be 6-8 homework assignments that are distributed every 2-3 weeks on the Moodle page. All homework assignments will be submitted via Moodle link with **filename as 575-HW2-unityID.pdf** for all students with the same deadline (DE and on-campus students). Each homework assignment will be graded on a 50-point scale.

- **Quizzes (10%):** there will be 10 quizzes (15-25 minutes) with multiple choice questions that are distributed in the class every 2-3 lectures. On-campus students will turn in during the class, and DE students will turn in prior to 12:59pm the next day. All students who turn-in the quizzes on time will receive full credits with a 'Pass' mark, with 70% and above. All students will have a **second chance** to re-take the quizzes, before the midterm, and the final exam, respectively.

- **labs (15%):** each student is expected to conduct 5-6 matlab-based labs and submit lab reports individually. For students who are interested in hands-on labs, contact the instructor for accommodation. All students who turn-in the labs on time will receive full credits, with scores of 70% and more. All students are allowed to re-take the labs and submit the day before the last class, that is, April 21, 2024.

- **Midterm (25%):** The midterm exam will be a combination of 20% MCQs and 80% problem-solving questions similar to the homework assignments prior to the midterm date for 75 minutes. .

- **Final Exam (30%):** The final exam will be a combination of 20% MCQs and 80% problem-solving questions similar to the homework assignments for the materials from (inclusive) the midterm for 120 minutes.

- **Attendance (5%):** This is required for all on-campus students and video watches will be examined for DE students.

- **Project (5 points):** Extra credits can be awarded for a project, which can be a survey on a new topic, a simulation study, or an exploratory hands-on experiment. The details will be discussed and distributed 4 weeks before the last class, upon requests from students with one-to-one meetings .

- **Letter grades (105 points)** : A (97, 93, 90), B (87, 83, 80), C (77, 73, 70). Any students who receive lower than C-range will be encouraged to quit the course so as not to affect GPA significantly.

No extension will be granted, unless there is a serious medical reason for which you will have to provide a doctor's letter. Start working on your assignment as early as possible. Do not procrastinate!! Learn to plan you work ahead of deadlines and use your time efficiently.

Prerequisites Basic understanding of 570 equivalent computer networking, matlab experience, and 582-equivalent of wireless communications will be helpful.

University Policy
We follow the general university policy and resources on academic integrity (https://studentconduct.dasa.ncsu.edu/academic-integrity-overview/), health and wellbeing guidelines (https://counseling.dasa.ncsu.edu/ and https://healthypack.dasa.ncsu.edu/) , and NC State Protect the Pack (https://healthypack.dasa.ncsu.edu/services-provided/covid-19/).
Students with disabilities All effort will be made to ensure that no students with disabilities are denied any opportunity to successfully complete this course. If you have specific requirements that need to be addressed, please contact me immediately. Possible changes can include (but are not necessarily limited to) rescheduling classes from inaccessible to accessible buildings, providing access to auxiliary aids such as, tape recorders, special lab equipment, readers, note takers, and interpreters. This may also include oral or taped tests, readers, scribes, separate testing rooms, or extension of time limits.