

Stevens Institute of Technology
School of Business

Syllabus

TM615 Sections A and W0: Wireless Communications and Mobile Computing

Semester: Fall Semester	Day of Week/Time: Wednesdays/6:15 PM until 8:45 PM
Instructor name and contact information Dr. Kevin Ryan kryan@stevens.edu (office) 1-201-216-5565 Babbio Center Room 415	<u>Office Hours:</u> Thursdays; 4:00 PM to 5:30 PM. You are also welcome to contact me to schedule an appointment. (Note; We can use the Canvas classroom “anytime”) <u>Class Website:</u> Access through Canvas.

Overview

This course provides a broad and comprehensive perspective of mobile wireless networks. Topics covered include fundamentals of mobile wireless networking, radio architecture, the multiple access techniques of TDMA, CDMA (with examples provided from UMTS and cdma2000), and OFDMA. The principle 4G standard, LTE, is also studied. The LTE access and core networks are examined and the important functional network elements are identified and distinguished. Key enabling technologies for 5G wireless networks are also identified and discussed. Emphasis is given to the role of Software Defined Networks and Network Function Virtualization in 5G (and 4G) networks. To assist in this discussion, an introduction to both SDN and NFV is provided. 5G mobile wireless networks are introduced and the architecture and challenges of emerging 5G networks are examined. The impact of the Cloud (or Centralized) RAN (C-RAN) in 4G and 5G networks is also studied.

Prerequisites: TM601, TM605, and TM610

Introduction to Course

- ❑ Challenging and comprehensive course.
- ❑ Two quizzes, a comprehensive final, and weekly homework assignments.
- ❑ All quizzes and the final exam are closed notes and closed books.
- ❑ For Section A (on-campus colleagues); the two quizzes and final exam will be given in-class and not online. (Please refer to the course schedule located at the end of this syllabus for the test dates).
- ❑ For Section WO (on-line colleagues); I request that you take the two quizzes and final exam online at the beginning of the scheduled class for each exam. (Please refer to the course schedule located at the end of this syllabus for the test dates). If you are unable to take the quiz or final exam due to a work commitment, please contact me directly to re-schedule the test.
- ❑ All lecture notes, homework assignments and solutions, and this course syllabus are/will be available on the Canvas course web site. It is your responsibility to download the required material from the course website for each class.
- ❑ Our weekly lectures are broadcasted (in real-time) to online students using Zoom. Each lecture is recorded and stored; you may access these Zoom lectures anytime during the semester.
- ❑ You are responsible for all course announcements and information for a class you do not attend. The course calendar, located at the end of this syllabus, is subject to change.
- ❑ Homeworks are assigned weekly and are due **at the start of each class**. Please submit your homeworks by email (kryan@stevens.edu). Please do not use Canvas email to contact me. No assignments will be accepted after the first class past the original due date
- ❑ Guidelines for an INC: Student has completed a significant portion of the course, is in good standing, and has an emergency (e.g. work or family). Student must request a grade of INC in writing before the academic deadline for an INC petition. (Please refer to the academic calendar on the Registrar's web site for the date of the academic deadline to submit an INC petition).
- ❑ You must read, sign, and submit the ethical statement found in this course syllabus.

Relationship of Course to Rest of Curriculum

This is the fundamental wireless course and is the foundation for other courses in the management of wireless networks curriculum.

Learning Goals

Upon successful completion of this course the student will:

1. Understand the trade-off between capacity and coverage in a mobile wireless system and the role of frequency reuse, cell sectorization, and cell splitting in the planning and design of a cellular-based wireless system.
2. Describe and draw a block-diagram of a generic digital radio. Discuss the trade-offs in the design of the various functional blocks.
3. Understand and describe the fundamental operation of CDMA in a mobile wireless system and be able to provide examples of CDMA operation in UMTS and cdma2000.
4. Describe the network and protocol operation of the principle 4G mobile wireless networking standard: LTE.
5. Clearly articulate how Software-Defined Networks and Network Function Virtualization provide the advanced architecture to meet the changing network requirements.
6. Identify and discuss 5G network architecture and the associated key enabling technologies for emerging 5G networks
6. Describe the role of Software Defined Networks and Network Function Virtualization in 4G and 5G networks.
7. Describe the architecture of the Cloud (or Centralized) RAN (C-RAN)

Pedagogy

The course will employ lectures and individual weekly homework assignments. Our weekly on-campus lectures are broadcasted (in real-time) to online students using Zoom. Each lecture is recorded and stored; you may access these Zoom lectures anytime during the semester from the course web site. In addition, all the course lecture notes will be/are available on the course web site. There will also be two quizzes and a comprehensive final exam.

Required Text(s)

No text is required for this course.

Optional text;

From GSM to LTE-Advanced Pro and 5G: An Introduction to Mobile Networks and Mobile Broadband. Third Edition Author: Martin Sauter. John Wiley & Sons, Ltd. Hardcover; ISBN 978-1-119-34686-9. October 2017 2014; E-Book; ISBN 978-1-119-34693-7.

Required Readings

IEEE scholarly articles will be provided as needed.

Additional Readings

None.

Assignments

Weekly comprehensive homework assignments.

Grading	Grade Percent
Weekly Homework Assignments	10
Two Quizzes	25 each
Final Exam	40
Total Grade	100%

Grading

Letter Grade	Numerical Grade
A	90 and above
B+	87 to 89.9
B	83 to 86.9
B-	80 to 82.9
C+	75 to 79.9
C	70 to 74.9
C-	65 to 69.9
F	Below 65

Ethical Conduct

The following statement is printed in the Stevens Graduate Catalog and applies to all students taking Stevens courses, on and off campus.

“Cheating during in-class tests or take-home examinations or homework is, of course, illegal and immoral. A Graduate Academic Evaluation Board exists to investigate academic improprieties, conduct hearings, and determine any necessary actions. The term ‘academic impropriety’ is meant to include, but is not limited to, cheating on homework, during in-class or take home examinations and plagiarism.”

Consequences of academic impropriety are severe, ranging from receiving an “F” in a course, to a warning from the Dean of the Graduate School, which becomes a part of the permanent student record, to expulsion.

Reference: The Graduate Student Handbook, Academic Year 2003-2004 Stevens Institute of Technology, page 10.

Consistent with the above statements, all homework exercises, tests and exams that are designated as individual assignments MUST contain the following signed statement before they can be accepted for grading.

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination. I further pledge that I have not copied any material from a book, article, the Internet or any other source except where I have expressly cited the source.

Signature _____ Date: _____

Please note that assignments in this class may be submitted to www.turnitin.com, a web-based anti-plagiarism system, for an evaluation of their originality.

Course/Teacher Evaluation

Continuous improvement can only occur with feedback based on comprehensive and appropriate surveys. Your feedback is an important contributor to decisions to modify course content/pedagogy which is why we strive for 100% class participation in the survey.

All course teacher evaluations are conducted on-line. You will receive an e-mail one week prior to the end of the course informing you that the survey site (<https://www.stevens.edu/assess>) is open along with instructions for accessing the site. Login using the same username and password you use for Moodle. Simply click on the course that you wish to evaluate and enter the information. All responses are strictly anonymous. We especially encourage you to clarify your position on any of the questions and give explicit feedbacks on your overall evaluations in the section at the end of the formal survey which allows for written comments. We ask that you submit your survey prior to the last class.

TM 615 Sections A and W0 Course Schedule Fall Semester

Week	Topic Covered
1	Overview of RF Engineering Fundamentals
2	Generic Digital Radio
3	CDMA Fundamentals
4	CDMA Fundamentals (cont.)
5	Examples of CDMA Networks; UMTS and cdma2000 Quiz One; will be given at the start of the class for one hour
6	OFDM and OFDMA Fundamentals
7	Fourth Generation Wireless; LTE
8	Fourth Generation Wireless; LTE (cont.)
9	Introduction to SDN and NFV
10	5G Mobile Wireless Networks Quiz Two; will be given at the start of the class for one hour
11	5G Mobile Wireless Networks (cont.)
12	SDN, NFV, and 5G
13	C-RAN
14	This lecture is reserved in case we have not covered all the required material listed above If we have covered all the required material, we will have an extra lecture on a new topic

15	Comprehensive Final Exam; will be given for the duration of this class (two and one-half hours)
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