

ENTS 759C: Optimization, Drivetesting, and Analysis of Modern Cellular Networks Syllabus

Course Description

This course will focus on optimizing an operational 2G/3G network by collecting drivetest data and analyzing the results in detail. Students will learn to use drivetest equipment in a real-world environment and will study the behavior of both 2G and 3G networks in varying conditions. Students will also learn details of the GSM and UMTS physical and network layers as they relate to optimization.

Instructor Contact Information

Dr. Michael Dellomo
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Office hours:
1363 AV Williams Building
Days and times will be announced

Prerequisites

Either ENTS656, ENTS653, or permission of the instructor. Students must have a **graduate level** understanding of cellular networks before taking this course.

Books

An Introduction to GSM by Siegmund Redl, Matthias K. Weber, and Malcolm Oliphant
WDCMA text to be decided.

Course Format

The course will be scheduled to meet for a 3 hour lecture and 3 hour lab session each week. For the first few weeks, lectures will be given in both lecture and lab sessions. Once students start collecting data, lab sessions will be used for review of the drivetest data. Toward the end of the semester, both lecture and lab session may be used to review data, as time permits.

Course Policies

Attendance & participation

Attendance and participation in lecture sessions are not required and students will not be graded on it. However, it is highly recommended that students attend lectures and lab sessions to ask questions about the course. Attendance and participation in lab sessions where student's data is being reviewed IS required.

Assignments

All assignments must be completed by the end of the semester. Students will be divided into drivetesting teams and it is each team member's responsibility to see that the assignments are completed in a timely manner. It is recommended that students review collected data before presenting it for review by the instructor. ALL GROUP MEMBERS MUST BE PRESENT!

Academic Integrity

The University of Maryland has a nationally recognized Honor Code, administered by the Student Honor Council. This code sets standards for academic integrity for all undergraduate and graduate students, and you are responsible for upholding these standards in this course. It is very important for you to be aware of the consequences for cheating, fabrication, facilitation and plagiarism. For more information please visit: <http://www.shc.umd.edu>. Students who engage in academic dishonesty in this course will receive no points for the assignments and will

be reported to the Honor Council and the Office of Judicial Programs for further action. There will be no warnings! Remember, it is not worth it!

Professional Behavior

Students must understand that the drivetesting equipment is a professional tool to be used by professionals. Unprofessional behavior will not be tolerated. When students check out the equipment, they are accepting responsibility for it. Students will be held accountable for the safe return of the equipment in working order. If you break it or lose it, you will have to pay for it!

Persons with disabilities

Students with a documented disability should inform the instructor as soon as possible if academic accommodations are needed. Accommodations for individuals with disabilities can be arranged through the Disability Support Service (DSS), a division of the University Counseling Center. Please call 301.314.7682, email dissup@umd.edu, or visit Shoemaker Building for more information.

Cell phones

Any use of cell phones is not permitted during class time. Please turn off all cell phones prior to the start of class.

Grading

The course will consist of 4 drivetesting assignments, one midterm and one final exam. The point breakdown is given below.

Homework	200 points	distributed amongst the assignments
Midterm	100 points	Date TBD
Final	<u>200 points</u>	Date TBD
Total	500 points	

Class assignments

Once students have been trained in the setup and use of the drivetest equipment, they will be sent to collect drivetest data. Students will perform two 2G drives, one 3G drive and one 3G walk test. It is required that either the instructor or TA be present the first time students set up the equipment to drivetest. Students are responsible for acquiring a vehicle for use during drivetests. Once data is collected, students will arrange with the instructor to review the data during a lab session. Details will be given once the course is in progress.

Drivers licenses

To fully participate in the course all students must have learned to drive by the midterm (i.e. by week 8). An international license is sufficient; however, it is highly recommended that all students acquire a US drivers license. All students must share the driving responsibility.

Tentative Course Schedule

1. Introduction (~1 week [Lecture + Lab sessions])
 - General Overview
 - History of GSM/UMTS and service provider (T-Mobile)
 - Review of PCS/AWS Frequency bands/Land division and license issues
2. GSM/UMTS and Propagation (~1 week [Lecture + Lab sessions])

- GSM/UMTS technology review
 - Review of propagation equation with GSM specifics
 - Review of COST 231 model and coverage
 - Review of elementary frequency planning
 - Review of CDMA technology
3. Capacity and Drivetesting (~1 week)
 - Review of Erlang computations
 - Capacity calculations for GSM
 - Overview of GSM concepts
 - BCCH, SDCCH, TCH, BSIC, CID
 - [Lab] Demonstration of drivetesting equipment and post analysis software
 4. Drivetesting Methodology and Assignments (~1 week)
 - CW drivetests
 - Site overviews
 - Problem identification
 - Optimization
 - Group assignments and details for first drive
 - [Lab] Demonstration drive
 5. GSM/UMTS Overview(~1 week)
 - Concepts and terminology
 - Equipment details
 - Movement, Call setup, Handover, Paging
 - [Lab] Data review
 6. Frequency Planning (~1 week)
 - More on frequency planning and interference
 - Frequency Hopping
 - Capacity issues in a hopping system
 - [Lab] Data review
 7. GSM Physical Layer (~2 weeks)
 - Parameter Overview
 - TDMA Frames
 - Logical vs Physical Channels
 - Channel Assignments
 - Speech Coding
 - Ciphering, Modulation, etc.
 - [Lab] Data Review
 8. UMTS Physical Layer(~2 Weeks)
 - Parameter Overview
 - Logical, Physical, and Transport Channels
 - Channel assignments and interactions
 - CDMA capacity calculations
 - CDMA planning
 - [Lab] Data Review

9. Data and Network Layers (~2 weeks)

- Data Layer
- Network Layer
- Layer 3 Messages
- [Lab] Data Review

10. GPRS and EDGE and 3G/4G (time permitting)

- Data Network Issues
- Network Overlay (GSM/UMTS and UMTS/LTE) and intersystem handovers
- Protocols
- [Lab] Data Review

11. Extra Lab Sessions (~ remaining weeks)