Carleton University  
Department of Systems and Computer Engineering  
SYSC4600 Digital Communication  
Course Outline  
Term: F2017

Instructor: Professor Mohamed El-Tanany  
Office: MC 7082  
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Email: tanany@sce.carleton.ca  
Lectures: Wednesdays and Fridays 11:35-12:55pm, 2202 CB (Canal Building)  
Office Hours: Wednesdays and Fridays, after the lecture  
TA: Vilas Joshi, Room: MC6010, Email: vilasjoshi@carleton.ca  

Course Description and Objectives: The objective of this course is to introduce the student to advanced topics in modulation and coding. Topics covered includes signal space representation, probability of error and bounds for AWGN channel, applications to PSK, QPSK, FSK, QAM, multi-carrier modulation and OFDM, spread-spectrum communication and CDMA, information theory, source coding theorem, channel capacity, linear block codes and convolutional codes.

Prerequisites: SYSC 3501 Communication Theory  
STAT 3502 Probability and Statistics  
Students who have not satisfied the prerequisites for this course must either a) withdraw from the course, or b) obtain a prerequisite waiver from the Registrar's office, or c) will be de-registered from the course after the last day to register for courses in the Fall term.


References  
• Proakis and Salehi, digital communications, fifth edition.  
And the course Notes which will be made available on culearn

Laboratory Sessions: Even Tuesdays 14:35 am – 17:25 pm, 6045 MC (Minto)  
Labs start the second week of classes (week of the 18th of September 2017)

Grading:  
Assignments: 20%, four assignments  
Mid-Term Exam: 15% (Wednesday, November 1, in-class, 70minutes)  
Labs: 15% (4 or 5 in total)  
Final Exam: 50% (will be scheduled by exam services, 3 hours). To pass the course, a student must obtain at least 50% in the final exam.

REMARKS
The final exam is for the evaluation purposes only and will not be returned to the student. A student who misses the mid-term exam must submit formal documentation (such as a physician’s report) if they wish to seek an alternate arrangement to write the mid-term exam.

- The students must be present in the lab during the lab period.
- Students are expected to attend all lectures and lab periods as required. The Faculty of Engineering and Design requires students to have a conflict-free timetable, so requests to accommodate missed exams, assignment due dates, project milestones, etc., because of conflicts with other courses, jobs or vacation plans will not be considered.

**Academic Accommodations for Students with Disabilities:**
“The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at 613-520-6608 or pmc@carleton.ca for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me your **Letter of Accommodation** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation *(if applicable)*. **Requests made within two weeks will be reviewed on a case-by-case basis.** After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website (www.carleton.ca/pmc) for the deadline to request accommodations for the formally-scheduled exam *(if applicable)*.”

**Plagiarism:** Plagiarism (copying and handing in for credit someone else's work) is a serious instructional offense that will not be tolerated. Please refer to the section on instructional offenses in the Undergraduate Calendar for additional information.

**Course Sharing Websites:** Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s). Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

**Week-By-Week Outline** *(maybe modified)*

- **Weeks 1-2** Overview of digital communications systems.
  - Review of probability concepts and stochastic processes.
  - Review of linear system concepts including frequency analysis.

- **Weeks 3-6** Baseband transmission and matched filter.
  - Signal space analysis and geometric representation of signals.
  - Maximum likelihood detection.
  - Probability of error.
**Week 7** Bandpass transmission and relevant developments in hardware devices.

**Weeks 8-9** Linear clock codes, syndrome decoding, Hamming distance. Error detecting and correcting capabilities of block codes. Examples of linear block codes.

**Weeks 10-11** Convolutional codes, distance properties, systematic and non-systematic codes. Decoding of convolutional codes and Viterbi algorithm.

**Week 12** Introduction to information theory. Shannon’s channel capacity theorem. Shannon limits. Introduction to source coding.