SYSC3501 Course Outline-- Summer 2018

Calendar Description

SYSC 3501 [0.5 credit]

Communication Theory

Review of signals, linear systems and Fourier theory; signal bandwidth and spectra; digital waveform coding. Introduction to analog and digital modulation systems; synchronization; characterization and effects of noise; link budgets; communications media and circuits; applications to current communications systems.

Precludes additional credit for SYSC 3503.

Prerequisites: MATH 3705 and ( SYSC 3600 or SYSC3610).

Lectures three hours per week and laboratory three hours during alternate weeks.

Students who have not satisfied the prerequisites for this course must either:

a) Withdraw from the course immediately; or

b) Submit a prerequisite waiver request and have it approved (Please visit www.sce.carleton.ca/ughelp for more information); otherwise they will be de-registered from the course after the last day to register for courses in the Summer 2018 term.

Course Website

http://www.sce.carleton.ca/courses/sysc-3501/s18

Course website is password-protected: Login:sysc3501, Password: sysc3501_2018

Learning Outcomes

Students will learn important and fundamental concepts and theory about communication systems including power, bandwidth, spectrum, LTI systems, analog modulation and demodulation (e.g. AM-DSBSC, AM-DSB-C, SSB), digitalization, pulse shaping, digital modulation and demodulation (e.g., ASK, PSK and FSK), baseband and passband signaling, multiplexing, matched filter receiver, link budget, effects of noise, etc. Through a series of five laboratories students will be able to implement and perform measurements on practical communication systems and circuits.
Instructors

<table>
<thead>
<tr>
<th>Name</th>
<th>E-Mail</th>
<th>Telephone</th>
<th>Office</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prof. Ioannis Lambadaris</td>
<td><a href="mailto:ioannis@sce.carleton.ca">ioannis@sce.carleton.ca</a></td>
<td>(613) 520-2600 ext. 1974</td>
<td>4448 ME</td>
<td>Tu,Wed 2:30am-3:30pm or by appointment</td>
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Lecture Schedule

<table>
<thead>
<tr>
<th>Section</th>
<th>Room</th>
<th>Lecture Time</th>
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<tbody>
<tr>
<td>A</td>
<td>TBA</td>
<td>Tu,Wed 11:30am-2:30pm</td>
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Laboratory Schedule

<table>
<thead>
<tr>
<th>Room</th>
<th>Lecture Time</th>
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<tbody>
<tr>
<td>MC6070</td>
<td>Tue 2:30pm-5:30pm (SECTION A1)</td>
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<tr>
<td></td>
<td>Thu 11:30am – 2:30pm (SECTION A2)</td>
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It is your responsibility not to miss a laboratory! We have a very tight schedule and lab make up planning is virtually impossible!

Textbook


Other References


Assignments

Assignments and solutions will be posted on the course website on a regular basis. Do the assignments as soon as you can to avoid many assignments piling up. Note that assignments will not be marked and therefore do not have to be handed in.

Laboratories

There will be in total five scheduled labs plus a lab preamble, which you need to read ahead of time in order to familiarize yourself with the lab equipment. Each student will be required to perform all the labs. All the scheduled labs will be conducted in **MC6070**. Detailed lab material, instructions and schedule can be found in the course web site.
Note that students who missed attendance for two labs or more without a valid excuse will automatically receive an F (or FND) in the course. A valid excuse is required for missing a final examination. Students who miss a lab must contact their professor and the head TA in a timely fashion and provide a valid medical report within a week after their scheduled lab date; otherwise a mark of zero will be assigned for that lab. Please note that the class is relatively big and it is virtually impossible to reschedule missed labs.

Students are required to do their labs in their assigned group and during their scheduled lab sessions.

**Lab Groups**

The laboratories will be performed in groups and lab groups will be formed by yourselves during the first week of the term, or otherwise you will be randomly assigned on-site during the first lab. A lab group normally consists of two students and, once formed, it should remain the same throughout the term.

More information on lab groups will be posted on the Laboratory Section of the course website.

**Lab Manuals**

Laboratory manuals will be posted on the course web site in the Laboratory Section of the course web site.

**Lab Reports**

Each group must complete one joint report for each lab, which must include answers to all the questions (theoretical and experimental) in the lab manual. Students must demonstrate their experiment to the TAs during their lab session. Notes, data, sketches etc. must be initialed by one of the TAs responsible for the lab and included in the report. The ones not initialed may be given a zero mark.

Lab reports are due at 4:00 pm one week after the completion of your lab session. For example, if you performed your lab on a Tuesday, it would be due the following Tuesday at 4:00 pm. **Any lab report submitted after the deadline will be given a mark of zero. No exceptions.** Do not leave things to the last minute to avoid unforeseen circumstances (e.g. printer problems and transportation problems). A good way to avoid these problems is to finish the lab at least a day earlier.

Lab reports shall be dropped off by the due date in the designated drop box, which is located near the men's washroom, down the hall from the SYC office on the 4th floor of Mackenzie building.
Quizzes and Tests

There will be one in-class test and two in-class mini tests/quizzes

Students who claim illness, injury or other extraordinary circumstances beyond their control as a reason for missed term work (quiz or in-class test) must inform their professor and submit a valid excuse no later than three (3.0) days from the examination date; otherwise, a zero mark will be assigned for that quiz or test.

No transfer of grades from one exam/quiz to another must be assumed!

Students must arrive for their tests on time and may not leave the test early. A student arriving late for a test may not be allowed to write the test and receive a grade of zero.

Evaluation and Marking Scheme

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<tr>
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<th>Percentage</th>
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<tbody>
<tr>
<td>Laboratories</td>
<td>20%</td>
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<tr>
<td>Test</td>
<td>40%</td>
</tr>
<tr>
<td>Mini Test/Quiz #1</td>
<td>25%</td>
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<tr>
<td>Mini Test/Quiz#2</td>
<td>15%</td>
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Whichever marking scheme is used, a student will receive an F (or FND) if she/he:
1. Failed to achieve a passing grade (50%) in the laboratories OR
2. Missed more than one lab OR
3. Failed to achieve a passing grade (50%) in the in class test and each of the mini tests.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term because of disability, pregnancy or religious obligations. Please review the course outline promptly and email your instructor with any requests for academic accommodation during the first two weeks of class or as soon as possible after the need for accommodation is known to exist.

It takes time to review and consider each request individually and to arrange for accommodations where appropriate. Please make sure you respect these timelines particularly for in-class tests, as well as any change in due dates for papers and reports.

You can visit the Equity Services website to view the policies and to obtain more detailed information on academic accommodation at http://carleton.ca/equity/accommodation.
Students with disabilities requiring academic accommodations in this course are encouraged to contact a coordinator at the Paul Menton Centre (PMC) for Students with Disabilities to complete the necessary letters of accommodation. After registering with the PMC, make an appointment to meet and discuss your needs with me at least two weeks prior to each in-class test. This is necessary in order to ensure sufficient time to make the necessary arrangements.

**Academic Integrity**

Plagiarism (copying and handing in someone else's work for credit) is a serious instructional offence that will not be tolerated. Note that the person providing solutions to be copied is also committing an offence as they are an active participant in the plagiarism. The person copying and the person copied from will be reprimanded according to the regulations set by Carleton University. Please refer to the section on instructional offences in the Undergraduate Calendar for additional information.

**Laboratory Health and Safety**

Every student should have a copy of the Laboratory Health and Safety Manual. An electronic version of the manual can be found at [www.sce.carleton.ca/courses/health-and-safety.pdf](http://www.sce.carleton.ca/courses/health-and-safety.pdf).

**Sharing of Course Materials**

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 to Week Outline

Week 1 (May 8-9)
Introduction and overview of communication theory and systems (Chapter 1)
Review of complex arithmetic (notes)
Properties of signals and noise (Section 2.1)
Fourier Transform and Spectra (Section 2.2)
Power Spectrum (Section 2.3)

Week 2 (May 15-16)
Review of linear systems (Section 2.6)
Fourier Series and periodic signals (Section 2.5)
Bandwidth (Section 2.9)
Limiter, mixers, up- and down-converters (notes, Sections 4-10-12)

Week 3 (May 22-23)
AM-DSB-C and noncoherent detection (Sections 5.1, 4-13)
AM-DSB-SC and coherent detection (Sections 5.3, 4-13)
SSB and VSB (brief, Section 5.5)
Phase and frequency modulation and demodulation (Sections 5.6, 4-13)
Superheterodyne receiver and image frequencies (4-16)

FIRST IN CLASS MINI EXAM/QUIZ (Wednesday May 23, approx. 45min.)

Week 4 (May 29-30)
Sampling, quantization, and PCM systems (Sections 3.1 - 3.3)
Digital baseband modulation, binary and multilevel signaling (Section 3-4)
Digital bandpass modulation: BASK, BPSK, BFSK, QPSK, M-ary PSK, QAM (Sections 5.9 and 10)

Week 5 (June 5-6-8)
Random processes (Sections 6.1-6.5, brief)
Thermal noise (Section 6.6)

IN CLASS TEST (Friday June 8, approx. 2hours)

Week 6 (June 12-13)
Error probabilities for binary signals (Sections 7.1-7.2)
Matched filter (Section 6.8)
Coherent demodulation of digital bandpass modulation (Section 7.3)
Noncoherent demodulation of digital bandpass modulation (brief Section 7.4)
Comparison of digital signaling systems (Section 7.6)

**Week 7 (June 20)**

Free space radio propagation, antennas, and link budgets (Section 8.6)
SECOND MINI IN CLASS TEST/QUIZ (Wednesday June 20, approx. 45min)

Last updated: April 17, 2018