SYSC3501 Course Outline-- Summer 2017

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 2017 term.

Course Website

http://www.sce.carleton.ca/courses/sysc-3501/s17

Course website is password-protected: Login:sysc3501, Password: sysc3501_S2017

Instructor

<table>
<thead>
<tr>
<th>Section</th>
<th>Name</th>
<th>E-Mail</th>
<th>Telephone</th>
<th>Office</th>
<th>Office Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Prof. Xiaoping</td>
<td><a href="mailto:xpliu@sce.carleton.ca">xpliu@sce.carleton.ca</a></td>
<td>(613) 520-2600 ext. 1774</td>
<td>7040 MC</td>
<td>MW 14:00-15:00</td>
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Lecture Schedule

<table>
<thead>
<tr>
<th>Section</th>
<th>Room</th>
<th>Lecture Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Mackenzie Building 4499</td>
<td>MW 8:35 - 11:25</td>
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**Laboratory Schedule**

<table>
<thead>
<tr>
<th>Section</th>
<th>A1</th>
<th>A2</th>
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<tbody>
<tr>
<td>Time</td>
<td>Tue 11:35 - 14:25</td>
<td>Thu 11:35 - 14:25</td>
</tr>
<tr>
<td>Location</td>
<td>MC6070</td>
<td>MC6070</td>
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**Textbook**


**Other References**


**Assignments**

Assignments and solutions will be posted on the course website in 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.

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 equivalent to reasons for missing a final examination. Students who miss a lab must contact the 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.

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

Due to the large number of students enrolled in the course, scheduling make-up labs are not possible.
Lab Groups

The laboratories will be performed in groups and lab groups in general will be formed during the first week of the term. A lab group normally consists of two students and, once formed, it will remain the same through 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 Laboratories page.

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 the coming Monday for Lab Section A1 and 4:00pm the coming Wednesday for Lab Section A2 after the completion of your lab session. 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.

Examinations

There will be two in-class tests and one formally scheduled final exam.

Students who miss an in-class test must contact the professor within a week after the test date and provide the original copy of a valid medical report in a timely fashion; otherwise, a mark zero will be assigned for that test. Students who miss an in-class test with an excuse that is deemed valid may have the portion of the mark allocated to the test, reallocated towards the final exam.

The final exam is for the evaluation purposes only and will not be returned to the student. Students who miss the final exam may be granted permission to write a deferred examination (see the Undergraduate Calendar for regulations on deferred exams). These students have additional time to study and a relatively less crowded examination schedule compared to their
colleagues who write the final exam. As such, it is only fair to expect substantially better performance from these students on the deferred examination than on the final exam.

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 mark of zero.

**There will be no make-up in-class tests.**

**Marking Scheme**

Maximum of {Scheme #1, Scheme #2, Scheme #3}

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<thead>
<tr>
<th></th>
<th>Scheme #1</th>
<th>Scheme #2</th>
<th>Scheme #3</th>
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<tbody>
<tr>
<td>Laboratories</td>
<td>20%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>In-class Test #1</td>
<td>15%</td>
<td>10%</td>
<td>15%</td>
</tr>
<tr>
<td>In-class Test #2</td>
<td>15%</td>
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<td>10%</td>
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<tr>
<td>Final Exam</td>
<td>50%</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 final exam.

**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](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.**
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.

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).

Others

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.
Course Outline

Week 0 (Jul 3-7)
Introduction and overview of communication theory and systems (Chapter 1)
Review of complex arithmetic (notes)
Properties of signals and noise (Section 2.1)

Week 1 (Jul 10-14)
Fourier Transform and Spectra (Section 2.2)
Power Spectrum (Section 2.3)
Fourier Series and periodic signals (Section 2.5)
Review of linear systems (Section 2.6)

Week 2 (Jul 17–21)
Bandwidth (Section 2.9)
Limiter, mixers, up- and down-converters (notes, Sections 4-10-12)
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)

Week 3 (Jul 24-28)
Superheterodyne receiver and image frequencies (4-16)
Sampling, quantization, and PCM systems (Sections 3.1 - 3.3)
Digital baseband modulation, binary and multilevel signaling (Section 3-4)

In-Class Test #1: Monday July 24
Week 4 (Jul 31-Aug 4)

Digital bandpass modulation: BASK, BPSK, BFSK, QPSK, M-ary PSK, QAM (Sections 5.9 and 10)

Random processes (Sections 6.1-6.5, brief)

Thermal noise (Section 6.6)

Error probabilities for binary signals (Sections 7.1-7.2)

Matched filter (Section 6.8)

Week 5 (Aug 7 – 11)

Coherent demodulation of digital bandpass modulation (Section 7.3)

Noncoherent demodulation of digital bandpass modulation (brief Section 7.4)

In-Class Test #2 : Wednesday August 9

Week 6 (Aug 14 –18)

Comparison of digital signaling systems (Section 7.6)

Free space radio propagation, antennas, and link budgets (Section 8.6)

TDM, FDM, CDM and Spread Spectrum (Sections 3.9, 5.7 and notes) if time permits

Last updated  June 25, 2017