

ECE 4433a/b – Digital Communication Systems

Course Outline for 2012 - 2013

Objectives:

The objective of the course is to provide the students an in-depth understanding of the principles and limitations involved in the design and implementation of digital communication systems. The course aims to develop students' analytical and simulation skills through the study of communication techniques; and the completion of design-oriented assignments and laboratory exercises. At the end of the course, the students will be able to design and analyze communication systems with certain design goals, including bandwidth, channel conditions and bit error rate performance. Modern wireless communication systems with high industry relevance will also be discussed in this course.

CEAB Units: ES 70%, ED 30%

Contact Hours: 3 lecture hours/week (SEB-2094, TU 8:30-10:30am, F 1:30-2:30pm), 1.5 laboratory hours/week, 0.5 week (W 2:30-5:30pm)

Restrictions: Limited to students in their 4th year of the Electrical or Computer Engineering program.

Prerequisites: ECE 3331a/b, ECE 3370a/b, Stats 2141a/b, AM 3415a/b

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from the course for failing to have the necessary prerequisites.

Topics:

- Evolution of communication technologies.
- Communication system design goals and tradeoffs.
- Review of Fourier transforms, random signal and analog modulation.
- Digital amplitude, phase, frequency modulations.
- Optimum receiver design and communication system performance analysis.
- Baseband data transmission systems and analysis.
- Digital communications through passband channel.
- Channel impairment and intersymbol interference.
- Adaptive equalization and compensation for wireless communication channel.
- Synchronization techniques.
- Forward error correction coding techniques.
- Multiple access techniques: FDMA, TDMA, and CDMA.
- Principle and application of OFDM system.
- Modern communication systems, WiFi, WiMAX, LTE.

Specific Learning Objectives:

- Understand the limitation of communication system design, including bandwidth, power, error rate performance and implementation cost.
- Use time/frequency signal analysis tools for communications system design.
- Design digital modulation techniques and corresponding optimum receivers.
- Analyze the performance of a communication system through its bit error rate.
- Compensate channel distortion with equalization techniques.
- Use channel coding including linear block and convolutional codes for error control.
- Design pseudo-noise sequences, spread spectrum systems.
- Design TDMA, FDMA, and multi-carrier systems.

General Learning Objectives

Knowledge Base	3/3	Engineering Tools	3/2	Impact on Society	
Problem Analysis	3/3	Individual & Team Work	3/2	Ethics and Equity	
Investigation	2/2	Communication		Economics and Project Mgmt	
Design	3/2	Professionalism		Life-Long Learning	

Rating: x/y , where x is the cognitive level (1: Remember, 2: Understand, 3: Apply) at which the attribute is assessed and y is the academic level (1: Beginner, 2: Intermediate, 3: Advanced) at which the attribute is assessed.

Course Materials:

- J.G.Proakis & Masoud Salehi, Fundamentals of Communication Systems, Prentice Hall, 2005, ISBN:0-13-147135-X. Available at Taylor Library: [TK5101.P755 2005](#)
- Class notes.

Reference Materials:

- S. Haykin, Communication Systems, 4th Edition, John Wiley and Sons, 2001, ISBN: 0-471-1786-4. Available at Taylor Library: [TK5101.H37 2001](#)
- T.S. Rappaport, Wireless Communications: Principles and Practice, Second Edition, PHI, 2002, ISBN 0-13-042232-0. Available at Taylor Library: [TK5103.2.R366 2002](#)
- Related published journal and conference papers.
- MATLAB, student version with Simulink, Release 12 or later, www.mathworks.com/store

Evaluation:

Course Component	Weight	Maximum Penalties (*)	
		English	Presentation
Assignment	15%	10%	10%
Laboratory	15%	10%	10%
Midterm	20%	10%	10%
Final Examination (3 hours)	50%	10%	10%

To obtain a passing grade in the course a mark of 50% or more must be achieved on the midterm as well as on the final examination. A final examination mark <50% will result in a final course grade of 48% or less.

Assignments: A total of FOUR assignments would be given from time to time during the course. These assignments must be submitted on the dues dates mentioned on them. Failure to submit on due dates will attract a penalty at the rate of 20% per day.

Laboratories: The laboratory portion of this course will consist of simulations and experiments using MATLAB. Students are required to successfully complete the experiments and submit laboratory reports by the due date. Late submissions will penalized at a rate of 20% per day overdue.

Midterm: A total worth of 20% of the final mark will be given to midterm.

Final Examination: The final examination will be closed book (3 hours) and carries weight of 50%.

*Use of English Policy:

In accordance with the policy of the University, the grade assigned to all written and oral work presented in English shall take into account syntax, diction, grammar and spelling. In the professional life of an engineer, the manner in which oral and written communications are presented is extremely important. An engineering student must develop these skills as an integral part of the undergraduate program. To encourage the student

to do so, the grades assigned to all written and oral work will take into account all aspects of presentation including conciseness, organization, neatness, use of headings and the preparation and use of tables and figures.

All work will be marked first for content after which a penalty not to exceed the maximum shown may be applied for lack of proficiency in English and/or presentation.

Attendance Policy:

All classes, laboratories, and tutorials are mandatory, unless otherwise stated. Any student who, in the opinion of the instructor is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

Cheating and Plagiarism Policy:

Students must write their essays and assignments in their own words. Whenever students take an idea, or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing such as footnotes or citations. University policy states that cheating, including plagiarism, is a scholastic offence. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning.

All required papers may be subject to submission for textual similarity review to commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted will be included as source documents on the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between the University of Western Ontario and Turnitin.com (<http://www.turnitin.com>)

Use of Electronic Devices Policy:

Cellular phones, mp3 players, PDAs, handhelds, tablets, laptops, and similar devices: please turn these off during class and keep them hidden from sight. These devices are expressly forbidden during an exam except when otherwise directed by the instructor.

Faculty of Engineering Policy on Repeating All Components of the Course:

Students who are required to repeat an Engineering course must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment, or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.

Internet/Bulletin Board Policy:

It is the student's responsibility to read the course website and/or bulletin board and be aware of any information that is posted about the course. If the student fails to act on information that has been posted on these sites and does so without a legitimate explanation (i.e., those covered under the illness/compassionate form), then there are NO grounds for an appeal.

Submission Policy: Assignments/Laboratory Reports: all submissions are due by 5:00PM on the due dates.

Course Accessibility:

Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

Students that are in emotional/mental distress should refer to Mental Health @ Western, <http://www.uwo.ca/uwocom/mentalhealth/>, for a complete list of options about how to obtain help.

Course Instructor:

Dr. Xianbin Wang
Office: TEB-355
Email: wang@eng.uwo.ca

Consultation Hours: Wednesdays 1:30PM - 3:30PM

Course Website: OWL <https://owl.uwo.ca>

A course website will be maintained. Assignments, laboratory exercises, lab timetable, submission deadlines, announcements, office hours for the course etc. will be posted on the website for electronic viewing and download in Portable Document Format (PDF) format.

Submission Locker: #209 (2nd Floor, TEB).