Western Engineering

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEEING

ECE4437a – Communication Theory

Course Outline Fall/Winter 2025

COURSE DESCRIPTION: The objective of the course is to provide the students an in-depth understanding of the fundamental principles and theories related to communication systems. The course aims to develop students' analytical and design skills through the study of communication processes/ theories and the completion of design-oriented assignments. At the end of the course, the students will be able to use appropriate methods and tools in analyzing communication signal, channel and system in achieving specific design goals including system capacity and bit error rate performance.

ACADEMIC CALENDAR:

Academic Calendar Link

Introduction to communication systems and information theory. Classification of signals and systems. Communication channel modeling. Fourier series and transform applications.
Modulation techniques. Sampling theory and digital transmission. Digital modulation, optimum receiver design, performance analysis. Error control. Selected topics.

PRE OR COREQUISITES: ECE 3330A/B, ECE 3331A/B (or AISE 3351A/B or the former ECE 3351A/B),
ECE 3375A/B, Statistical Sciences 2141A/B or Statistical Sciences 2143A/B, NMM 2276A/B or the former Applied Mathematics 2276A/B

CEAB ACADEMIC UNITS: Engineering Science 100%

CONTACT HOURS:

Lecture 3 hours/week

Tutorial 1 hour/week

RECOMMENDED/REQUIRED TEXT:

- G. Proakis & Masoud Salehi, Fundamentals of Communication Systems (2edition), Prentice Hall, 2014, ISBN-13: 978-0-13-335485-0. 1edition available at Taylor Library: TK5101.P755 2005
- Lecture slides.

RECOMMENDED/ REQUIRED SOFTWARE:

- MATLAB, SIMULINK software and online tutorials

RECOMMENDED RESOURCES/REFERENCES:

- S. Haykin, Communication Systems, 4th Edition, John Wiley and Sons, 2001, ISBN: 0-471- 1786-4. Available at Taylor Library: TK5101.H37 2001
- Related published journal and conference papers.

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES)

Knowledge Base	A	Engineering Tools	A	Impact on Society	
Problem Analysis	A	Individual & Teamwork	A	Ethics and Equity	
Investigation	A	Communication		Economics and Project Mgmt.	
Design	D	Professionalism		Life-Long Learning	

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

COURSE MATERIALS: The material for this course will be taught in lectures. It is imperative that you attend each lecture.

- Overview of communication system
- Classification and representation of communications signals
- Analysis of communication signals in time and frequency domain
- Fourier series and Fourier transformation
- Amplitude modulation and angle modulation
- Sampling theory; A/D, D/A conversion
- Digital amplitude, phase, frequency modulations
- Random signals in communication process
- Optimum receiver design and communication system performance analysis
- Communication channel
- Channel impairment and impact
- Information theory
- Selected topics.

UNITS: SI

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES:

This course will cover a variety of fundamental principles and theories related to communication systems. The following table summarizes the course topics, learning outcomes along with CEAB GAIs where the GAIs in bold indicate ones to be measured and reported annually.

COURSE TOPICS AND SPECIFIC LEARNING OUTCOMES	(CAEB) Graduate Attribute
Understand the basic architecture and components of a communication system	KB3, **PA1**, PA2
Use different ways of representing communication signals	KB3, ET2
Analyze communication signals in time/frequency domain	KB1, **PA1**, PA2, PA3, ET2
Understand and analyze signals with probabilistic theory	**PA1**, PA2, PA3, ET2
Understand and use concept of information, information rate, coding	KB1, KB3
Understand the process of sampling of signals and analog to digital/digital to analog conversions	KB1, KB3, ET2, I1, I2, **I3**
Design digital modulation techniques and corresponding optimum receivers	KB1, D1, PA3, ET2
Analyze the performance of a communication system through its bit error rate and capacity	**PA1**, PA2, PA3, ET2, D3
Investigate and Understand organization, principles of operation and performance metrics of existing communications systems in the real world applications (case study)	ITW1, **ITW2**, I1, I2, **I3**, PA3, D1
Investigate characteristics of different sources of information and be able to map these characteristics to parameters of communications system to transmit this source	I1, I2, **I3**

EVALUATION:

Name	% Worth	Assigned (Tentative)	Due Date (Tentative)	CEAB GAs ASSESSED
Assignment	12% (4 assignments)	Sent, 15, 29 Oct 13, 27	Sept, 22, Oct, 6, 20, Nov , 10	KB1 KB3 PA1 PA2 PA3 I1 I2 I3 D1 D3 ET2 ITW1 ITW2

Midterm	20%	TBD	TBD	KB1 KB3 PA1 PA2 PA3 I1 I2 I3 D1 D3
Project	10%	Sept, 25	October, 25	KB1, KB2, PA1, PA2, PA3, I1, I2, I3
Participation/ Quiz	8%	Every Friday lecture, first 10 minutes	In class	KB1 KB3 PA1 PA2 PA3 I1 I2 I3 D1 D3 ET2 ITW1 ITW2
Final Examination	50%	TBD	Mid-December	KB1 KB3 PA1 PA2 PA3 I1 I2 I3 D1 D3

Note that the dates listed above are **tentative** and may be adjusted if needed. Marks will be assigned on the basis of method of analysis and presentation, correctness of solution, clarity and neatness.

COURSE POLICIES:

All work submitted must be of professional quality in the requested format. Material that is handed in dirty, illegible, disorganized, or in an unapproved format will be returned to the student for resubmission and the late submission penalty will take effect. An additional penalty of 10% may be deducted for poor grammar, incoherence, or lack of flow in the written reports.

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

FINAL EXAMINATION: The final exam will take place during the regular examination period. The final exam will be three 3 hours long, closed book. Only simple, nonprogrammable calculators are allowed.
To obtain a passing grade in the course, a mark of 60% or more must be achieved on the final examination. A final examination mark < 60% will result in a final course grade of 48% or less.
If the above conditions are not met, your final grade cannot be greater than 48%. Students who have failed this course (i.e., final average < 50%) must repeat all components of the course.

LATE SUBMISSION POLICY:

Advise the instructor if you are having problems completing the assignment on time prior to the due date of the assignment and be prepared to submit an Academic Consideration Request and provide documentation if requested by the instructor at:
https://www.eng.uwo.ca/undergraduate/academic-consideration-for-absences.html
If you are granted an extension, establish a due date with the instructor. The approval of the Chair of your Department is not required if assignments are completed prior to the last day of classes. Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.

This course employs flexible deadlines for assignments. The assignment deadlines can be found above in the course outline. For each assignment, students are expected to submit the assignment by the deadline listed. Should illness or extenuating circumstances arise, students are permitted to submit their assignment up to 72 hours past the deadline without academic penalty. Should students submit their assessment beyond 72 hours past the deadline, a late penalty of 20% per day will be subtracted from the assessed grade. **As flexible deadlines are used in this course, requests for academic consideration will not be granted.** If you have a long-term academic consideration or an accommodation for disability that allows greater flexibility than provided here, please reach out to your instructor at least one week prior to the posted deadline.

All deliverables will be penalized by 20% of the available marks per day for late submission. Deliverables submitted more than 5 days late will not be accepted.

ATTENDANCE: Attendance is mandatory for all lectures.

FACULTY OF ENGINEERING POLICIES:
Students must familiarize themselves with the policies of the Faculty of Engineering

https://www.eng.uwo.ca/electrical//pdf/2025-UG-Policy-and-Procedures.pdf