

RYERSON UNIVERSITY
Department of Electrical and Computer Engineering
ELE 635 - Communication Systems - Winter 2009
Course Information
www.ee.ryerson.ca/~courses/ele635/

Instructor:

Name	Office	Ext.	Email	Counselling Hours
<u>Raymond Phan</u>	EPH 408	2746	rphan@ee.ryerson.ca	Wednesdays: 11 a.m. - 12 p.m. Thursdays: 10 a.m. - 11 a.m.

Teaching Assistants:

Name	Email
Hamed Rasouli	hrasouli@ryerson.ca
Khalid Abdel Hafeez	kabelha@ryerson.ca

Lecture/Lab Hours:

Wednesdays: 9:00 a.m. – 11:00 a.m. **ENG 105**

Thursdays: 9:00 a.m. – 10:00 a.m. **ENG 105**

Labs: Labs alternate every **other** week. They start the week of January 12, 2009, or January 19, 2009, depending on your section. Please refer to the Lab schedule on BlackBoard, or your schedules on RAMSS.

Course Structure and Topics Covered:

This course offers a comprehensive introduction to the basic principles of communication theory with emphasis on analog modulation systems. The topics include: Fourier methods of signal and system representation, amplitude modulation, angle and frequency modulation, frequency division multiplexing, super-heterodyning, waveform generation and detection techniques, effects of noise in analog communication systems; analog-to-digital signal conversion, sampling theorem, quantization and pulse code modulation.

Prerequisites:

Completion of all second year courses, with the addition of **ELE 532: Signals and Systems**, and **MTH 514: Probability and Stochastic Processes**

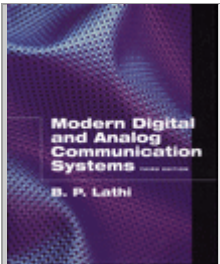
Textbook Sections Covered:


Introduction to Communication Systems	Chapter 1, Chapter 2 (2.1, 2.2, 2.3, 2.4), Chapter 3
Analog to Digital Signal Conversion	Chapter 6 (6.1, 6.2)
Amplitude Modulation	Chapter 4
Angle Modulation	Chapter 5
Random Processes and Power Spectrum	Chapter 11 (11.1, 11.2, 11.4)
Effects of Noise in Analog Communication Systems	Chapter 12 (12.1, 12.2, 12.3)

Topics Covered:

1. **Introduction to Communication Systems:** Elements of communication systems, Review of signal representations in time and frequency domain, bandwidth, filters, distortionless transmission.
2. **Analog to Digital Signal Conversion:** Sampling theorem, quantization and pulse code modulation.
3. **Amplitude Modulation (AM):** Suppressed carrier modulation, large carrier modulation, vestigial sideband modulation, single-sideband modulation, superheterodyne receiver structure, comparison of AM systems, frequency division multiplexing, carrier acquisition.
4. **Angle Modulation:** Frequency modulation (FM) and phase modulation (PM), narrowband FM, wideband FM, average power in angle modulated waveforms, generation of wideband FM, demodulation of FM signals.
5. **Random Processes and Power Spectrum:** Random processes, transmission of a random process through a linear system, energy and power spectral density functions, Gaussian process, correlation functions, narrow-band noise.
6. **Effects of Noise in Analog Communication Systems:** Receiver model, noise in DSB-SC receivers, noise in SSB receivers, noise in FM receivers, pre-emphasis and de-emphasis in FM, propagation effects, threshold effect in FM, SNR in AM and FM reception.

Note: You are expected to be very familiar with the concepts learned in **ELE 532: Signals and Systems**. In ELE 635, Chapters 1, 2 and 3 will be covered on a review basis only. There are assigned problems (that are not marked) from these chapters, and are for you to practice applying the fundamental concepts of communication systems theory. Please check the BlackBoard course for more details. The assigned problems in Chapters 1, 2 and 3 are for you to practice the important concepts of signals and systems, which is a requirement for this course.

REQUIRED TEXTBOOK	<p><u>Modern Digital and Analog Communication Systems, by B.P. Lathi, 3rd Edition, 1998.</u> <u>ISBN: 0195110099</u></p>	
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OPTIONAL TEXTBOOK	<p><u>Communication Systems, by S. Haykin, 4th Edition, 2001.</u> <u>ISBN: 0471178691</u></p>	
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Course Evaluation:

Theoretical Components: (80%)

Midterm Exam	25%	Wednesday, February 11, 2009. 9 - 11 a.m. ENG 105. Closed-book Exam. Non-programmable calculators are permitted.
Quiz	10%	Wednesday, March 18, 2009. 10 - 11 a.m. ENG 105. Closed-book Quiz. Non-programmable calculators are permitted.
Final Exam	45%	T.B.D. <i>Closed-book Exam. Non-programmable calculators are permitted. Date and Room are to be announced.</i>

Laboratory Components: (20%)

Lab Performance	15%	There are 5 labs in total. Marks are based on attendance, prelabs, participation and completion
Formal Lab Report	5%	A formally typed lab report should be submitted for one randomly selected lab which will be selected by the TA. Each group will submit only one formal report. The lab report is due within two weeks from the completion of the lab.

Labs:

There will be **5 lab assignments** in this course that will require the purchasing of an electronics lab kit. The kit will cost approximately between \$10 and \$15. More information will be given in class. Lab assignments are to be done **ON A PARTNER BASIS IN GROUPS OF TWO (2)**. The lab handouts will be made available on the BlackBoard course page. It is your responsibility to print off the lab documents for each lab, and to bring them to your scheduled lab time slot. Your scheduled lab hours and rooms are for you to go to the lab room and have dedicated time where you can work on the lab and have help from the TA.

The labs are **alternating** every other week. Please consult the ELE 635 BlackBoard course to determine when your ELE 635 lab will be, given the current week. You **CANNOT** work on these labs outside of your own time slot. The experiment must be completed on the same day as the lab is scheduled. All labs require a **prelab** to be completed. This prelab is to be handed in at the beginning of the lab session. Failure to do so will result in a mark of 0 for the **ENTIRE** lab. All labs consist of gathering experimental data using the communication systems equipment in ENG 402. Once you have finished gathering the data, and filling this out on the lab document, please complete the conclusions, which are part of every lab. Once this is performed, hand in the completed lab document, along with your conclusions to the TA. The TA will mark the lab, and return it to you the following lab session.

IMPORTANT NOTES:

- **It is the student's responsibility to inform the instructor, within the first TWO weeks of class, of any religious observances that conflict with important course dates. No accommodation will be made if these conflicts are not brought to our attention within the first TWO weeks.**
- **It is the students' responsibility to regularly check the course web page for updates and announcements**
- **If you miss any significant dates for valid medical reasons, then you must fill out a medical form at the front office of the Department of Electrical & Computer Engineering ENG 478.**
- **Lab assignments handed in past the due date and time will not be accepted for marking and will receive a mark of ZERO. The ONLY time where a lab report can be submitted is directly to the hands of the TA in the lab session that it is due. E-mailing the report to the instructor, or the TAs, or sliding the report under the instructor's door, or the TA's door is NOT acceptable, and will count as a non-submission.**

NOTE: Ryerson University Policy

- "All of the required course specific written reports will be assessed not only on their technical or academic merit, but also on the communication skills of the author as exhibited through these reports."
- "All students are required to activate and maintain a Ryerson University central Matrix e-mail account which shall be an official means by which they will receive University communications." It is also recommended that, where possible, students utilize these accounts for communicating with their instructors.