

ECE 342 SIGNALS and SYSTEMS

COURSE INFORMATION

Winter Term 2011

Instructor:

Andrew HEUNIS, office CEIT-3115, extn. 32083, email: heunis@kingcong.uwaterloo.ca

Teaching Assistant:

Alan KUURSTRA, office DC-3720, extn. 37459, email: akuurstr@engmail.uwaterloo.ca

Scheduling Information:

Schedule: Regular Classes:

RCH-307 Monday 8.30 a.m. - 9.20 a.m.
RCH-307 Wednesday 8.30 a.m. - 9.20 a.m.
RCH-307 Friday 8.30 a.m. - 9.20 a.m.

Additionally:

RCH-307 Thursday January 13, 8.30 a.m. - 9.20 a.m. (compulsory)
RCH-307 Thursday January 27, 8.30 a.m. - 9.20 a.m. (compulsory)
RCH-307 Thursday February 10, 8.30 a.m. - 9.20 a.m. (compulsory)

RCH-307 Thursday March 3, 8.30 a.m. - 9.20 a.m. (optional)
RCH-307 Thursday March 17, 8.30 a.m. - 9.20 a.m. (optional)
RCH-307 Thursday March 31, 8.30 a.m. - 9.20 a.m. (optional)

Note: All scheduling information for the course can be found at the website

<http://www.adm.uwaterloo.ca/infocour/CIR/SA/under.html>

(the Winter 2011 term has the code 1111).

Class Notes and Text: Course notes will be made available on the web, at the address

<http://www.ece.uwaterloo.ca/~ece342>

These notes will be the main source material. A reference for the course is the book "Continuous and Discrete Signals and Systems" (Second Edn.), by Samir S. Soliman and Mandyam D. Srinath, Prentice Hall. This is an *optional reference only!* The purchase of this book is not necessary, since *absolutely all course material* will be in the class notes and problem sets.

Course Labs: none!! :=)

Grade Allocations for Course: midterm 35%; final 65%.

Assignments: These will be assigned approximately every two weeks. Solutions will be available on the course website ten days later. Assignments will not be handed in or graded.

Formal Prerequisites for the course:

ECE-100, ECE-241, MATH-115, MATH-117, MATH-211

Course Details: (Chapter/Section references in the following are to the optional book of Soliman and Srinath in "Class Notes and Text")

1. Introduction to signals and systems (Sections 1.1 to 1.6; 2.1; 2.2; 6.1)

Discrete and continuous signals, systems, linearity, time invariance, causality, electrical networks.

2. Time domain analysis of continuous time linear systems (Sections 1.6; 2.3 to 2.5)

Impulse response and convolution integral, linear differential equations, zero-input and zero-state response, stability.

3. Frequency domain analysis of continuous time linear systems (Sections 5.3; 5.5; 5.6; 5.8)

Laplace transforms, transfer functions, block diagrams, partial fraction expansions, system realization, frequency response.

4. Time & frequency domain analysis of discrete time linear systems (Sections 6.2; 6.3; 6.5; 8.1 to 8.6)

Impulse response and convolution sum, linear difference equations, zero-input and zero-state response, stability, z- transforms, transfer functions, block diagrams, system realization, frequency response.

5. Periodic signals and Fourier series (Chapter 3)

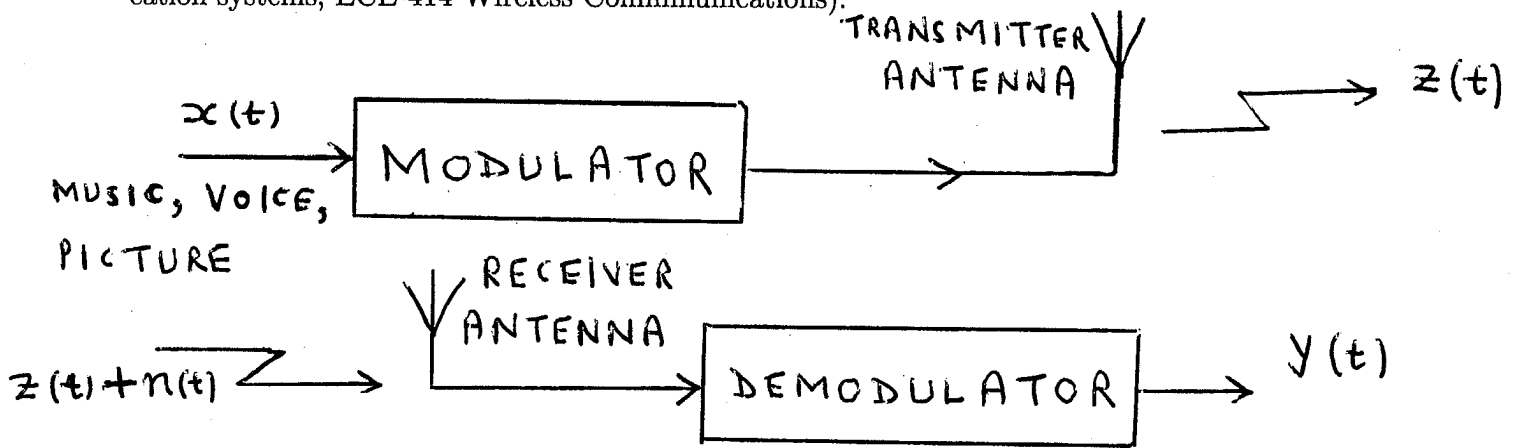
Fourier series and their properties, calculation of Fourier coefficients, system analysis with Fourier series.

6. Nonperiodic signals and the Fourier transform (Sections 4.1 to 4.4)

Fourier transforms and their properties, system analysis with Fourier transforms, filters, sampling, signal reconstruction.

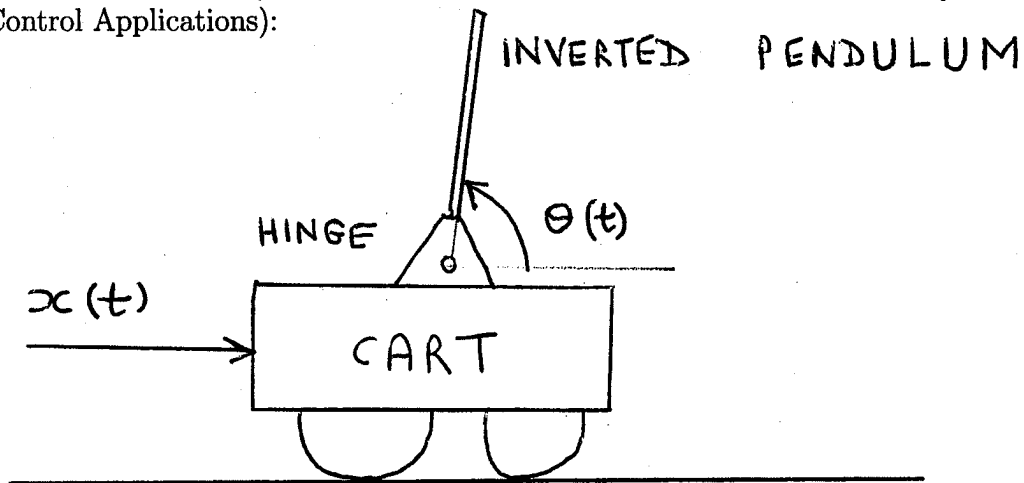
Prolog - Goals of the course: To study *signals* and *systems* from a *time-domain* and *frequency domain* point of view. The time/frequency domain viewpoint studied in ECE-342 is indispensable for signal processing, communication systems and control systems. Typical problems are:

1. Reconstruct a signal from given "samples" of the signal. e.g. reconstruct music from its "samples" on a compact disc (ECE-342 is a prerequisite for ECE-413 Digital Signal Processing).
2. Radio, TV and wireless communication (ECE-342 is a prerequisite for ECE-318 Communication systems, ECE-414 Wireless Communications):



How to "modulate" the signal $x(t)$ to get a transmittable signal $z(t)$?
 How to "filter out" the effect of the noise signal $n(t)$ added by transmission?
 How to reconstruct a signal $y(t)$ which is "close" to the original signal $x(t)$?

3. Feedback Control Systems (ECE-342 is a prerequisite for ECE-380 Control Systems, ECE-484 Digital Control Applications):



How to design a "controller" which adjusts position $x(t)$ of the cart based on measured tilt angle $\theta(t)$ to keep inverted pendulum close to vertical?

Appendix

Midterm Examination A student who misses the midterm examination for an illness or other serious and valid reason (as decided by the instructor) and provides the appropriate documentation (e.g., a Verification of Illness Form) will have the weight of the mid-term examination moved to the final examination (that is, the final examination counts for 100 % of the course grade). A student who misses the midterm examination without a serious and valid reason will be awarded a grade of zero on the mid-term examination.

Academic Integrity In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check www.uwaterloo.ca/academicintegrity/ for more information.]

Grievance A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70, Student Petitions and Grievances, Section 4, <http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm>. When in doubt please be certain to contact the department's administrative assistant who will provide further assistance.

Discipline A student is expected to know what constitutes academic integrity to avoid committing academic offenses and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the undergraduate associate dean. For information on categories of offenses and types of penalties, students should refer to Policy 71, Student Discipline, <http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm>. For typical penalties check Guidelines for the Assessment of Penalties at <http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.

Appeals A decision made or penalty imposed under Policy 70, Student Petitions and Grievances (other than a petition) or Policy 71, Student Discipline may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72, Student Appeals, <http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm>.

Note for students with disabilities The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.