Course Outline

Instructor

- Blair Yoshida, P.Eng.
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Office Hours

- By appointment

Teaching Assistant

- TBD

Contact Hours

- 4 credit hours
- Lectures
  3 hours × 13 weeks = 39 hours
- Laboratories
  3 hours × 5 weeks = 15 hours

Prerequisites:

- ECE 4150 Control Systems
- ECE 4830 Signal Processing 2

Course Website:

http://ece.eng.umanitoba.ca/undergraduate/ECE4420/

Important Dates

- **Term Test**
  March 3rd, 2015
- **Voluntary Withdrawal Deadline**
  March 19th, 2015
- **Mid-term Break**
  February 16–20, 2015
  No classes or examinations
- **Good Friday**
  April 3rd, 2015
  No classes or examinations

ECE 4420 – Digital Control

Winter 2015

Course Objectives

This course provides an introduction to analysis and design of computer-controlled systems. This course not only focuses on mathematical concepts in digital control, including Z-transform, transfer functions, state space models and digital controllers design, but also provides students with hands-on experience in analysis and design of digital control systems using simulation software. After this course, students are expected to know how to analyze the performance of digital control systems and design feedback controllers to meet the required performance system specifications.

Course Content

The following topics will be covered:

- Introduction to digital control systems.
- Feedback control systems characteristics and performance.
- Sampled data systems.
- Transfer functions and state-space models
- Discrete system analysis using z-transform and inverse z-transform.
- Discrete equivalents to continuous systems.
- Design using transform techniques.
- Effects of sampling and quantization.

Laboratories

Complete experimental data for all 5 laboratories must be recorded in a lab notebook. At the end of each experiment, the notebook must be signed by the Teaching Assistant.

Textbook

Digital Control of Dynamic Systems, G.F. Franklin, J. D. Powell, and M. Workman, Ellis-Kagle Press, 3rd edition, 1997.

Requirements/Regulations

- Attendance at lectures and laboratories is essential for successful completion of this course. Students must satisfy each evaluation component in the course to receive a final grade.
- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should also familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations* dealing with incomplete term work, deferred examinations, attendance and withdrawal.
- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, wireless communication or data storage devices) are allowed in examinations unless approved by the course instructor.

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 70%
- Engineering Design: 30%

Attributes

A1: A knowledge base for engineering
A2: Problem analysis
A3: Investigation
A4: Design
A5: Use of engineering tools
A6: Individual and team work
A7: Communication skills
A8: Professionalism
A9: Impact of engineering on society/environment
A10: Ethics and equity
A11: Economics and project management
A12: Life-long learning

Competency Levels

1 - Knowledge (Able to recall information)
2 - Comprehension (Ability rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships.)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

Updated: 03 January 2015

Learning Outcomes

1. Ability to convert a feedback control system a mathematically description which can be manipulated.
2. Ability to analyze a feedback control system to predict its behaviour.
3. Ability to design components of a feedback control system.

Expected Competency Levels

Outcome	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12
1	4	4	4				3					3
2	6	4	4	2	3							3
3	4	4	4	2	3							

Evaluation

The final course grade will be determined from a student's performance in laboratories and on examinations. Programmable calculators are not allowed in the mid-term and final examinations. Students must receive a minimum of 50% on the final examination and must complete all the laboratories in order to be eligible to receive a passing grade.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Quizzes / Class participation	15	F, S	1, 2, 3
Laboratories	10	F, S	1, 2, 3
Mid-Term Test	25	F, S	1, 2, 3
Final Examination	50	S	1, 2, 3

* Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations* on *Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.