University of Manitoba | Price Faculty of Engineering
Department of Electrical and Computer Engineering

Course Outline

ECE 3740 – Systems Engineering Principles 1

Fall 2021

IMPORTANT NOTICE – Mandatory Requirement to Report

This course will be conducted using remote instruction. Students who are accessing the course from outside of Canada or the USA ***must notify the instructor*** and indicate in which country they are located. Access to software may be restricted from some countries and failure to comply with these restrictions may result in criminal prosecution.

Instructor

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Office Hours

- By appointment

Teaching Assistant

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Contact Hours

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

Prerequisites:

- COMP 2140 Data Structures and Algorithms

Course Website:

https://umanitoba.ca/umlearn

Course Objectives

This course teaches systematic approaches to the design and development of large and complex computer based systems. The systematic approaches include hardware and software architecture and architectural elements; design patterns; object oriented design, analysis, and synthesis; and hardware and software engineering. This course uses the project based learning and hands-on experiential learning method to develop design thinking, critical problem solving, communication, and teamwork skills. Students will work throughout the course individually and in coordinated teams on designing hardware and software for solving an authentic real world computer engineering problem. Students are evaluated by their demonstration of the specified CEAB attributes and performance in the hands-on sub-projects, midterm test, and final exam.

Course Content

The following topics will be covered:

- Principles of object orientation: class/object, information hiding, polymorphism, inheritance/interface
- Principles of object oriented analysis: modeling, domain analysis, requirements engineering, problem breakdown and analysis
- Principles of object oriented synthesis: divide and conquer, minimizing complexity, maximizing cohesion, architectural patterns, design patterns, designing for reuse, and reusing designs
- Java and C programming languages for software descriptions
- Modeling: Unified Modeling Language (UML) and XML
- Debugging, verification, and validation
- Use of TCP/IP Stack software and associated tools
- Test Plan and Procedures (unit and system tests) and design documentation.

Projects

- Client-Server architecture and socket design
- Developing TCP/UDP client-servers across different platforms
- Console and Graphical User Interface (GUI) design
- Interfacing with sensors for environmental monitoring and control using PMODs
- Service oriented architecture application, design and integration

Textbook

Course notes available online.

Other Resources

Object-oriented Software Engineering: Practical Software Development Using UML and Java
T. C. Lethbridge and R. Laganiere, 2nd edition, McGraw Hill, 2001. ISBN 0-07-710908-2

The Java Tutorials, http://java.sun.com/docs/books/tutorial/index.html.

Unified Modeling Language User Guide, G. Booch, J. Rumbaugh and I. Jacobson

Traditional Territories Acknowledgement

The University of Manitoba campuses and the Department of Electrical and Computer Engineering are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we

Important Dates

- **Term Test**
  November 1st, 2021
  6:00PM – 8:00PM
- **Voluntary Withdrawal Deadline**
  November 23rd, 2021
- **National Day for Truth and Reconciliation**
  September 30th, 2021
  No classes or examinations
- **Thanksgiving Day**
  October 11th, 2021
  No classes or examinations
- **Remembrance Day**
  November 11th, 2021
  No classes or examinations
- **Fall Term Break**
  November 8th –12th, 2021
  No classes or examinations

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 50%
- Engineering Design: 50%

Graduate Attributes

KB: A knowledge base for engineering
PA: Problem analysis
IN: Investigation
DE: Design
ET: Use of engineering tools
IT: Individual and team work
CS: Communication skills
PR: Professionalism
IE: Impact of engineering on society/ environment
EE: Ethics and equity
EP: Economics and project management
LL: Life-long learning

Competency Levels

1 - Knowledge (Able to recall information)
2 - Comprehension (Ability to 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)

Learning Outcomes

1. Identify the importance of applying systems engineering principles to design of large and complex systems.
2. Perform requirements engineering for large and complex software design.
3. Model the designs of large and complex systems using UML.
4. Apply the main object oriented principles to the design of large and complex embedded systems.
5. Demonstrate the ability to use an integrated development environment to develop embedded applications on host computers, servers, and microcontrollers.
6. Construct formal test cases and test plans.
7. Write design documentation.

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1	2	2	2	3								2
2	4	4	4				3					2
3	4	4	4	5	5							2
4	4	4	4	5	5							
5	3				3							
6	3	3	3	3								2
7					3		3					2

Evaluation

The final course grade will be determined from a student's performance in the projects and on examinations. In order to receive a passing grade in this course:

- All projects must be completed and a passing grade must be achieved.
- A passing grade in the final exam must be achieved.

Component	Value (%)	Method of Feedback	Learning Outcomes Evaluated
Projects, Assignments, Laboratories	25	F, S	1, 2, 3, 4, 5, 6, 7
Term Test	25	F, S	2, 3, 4, 5, 6
Final Examination	50	S	1, 2, 3, 4, 5, 6, 7

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

CEAB Graduate Attributes Assessed

DE.1 – Understands the complexities of an open-ended engineering design problem and defines appropriate objectives and constraints.

ET.1 – Uses tools to complete engineering activities.

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.

Grading Scale

Letter	Mark
A+	95–100
A	85–94
B+	80–84
B	70–79
C+	65–69
C	55–64
D	45–54
F	< 45

Note: These boundaries represent a guide for the instructor and class alike. Provided that no individual student is disadvantaged, the instructor may vary any of these boundaries to ensure consistency of grading from year-to-year.

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

Copyright Notice

Requirements and 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.
- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Supplemental Resources