Course Description
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.

Prerequisites
- COMP 2140 Data Structures and Algorithms

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

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

Web Page
- http://ece.eng.umanitoba.ca/undergraduate/ECE3740/

Textbook
- Course notes available online.
Other References

Evaluation Details
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:
1. All projects must be completed and a passing grade must be achieved.
2. A passing grade in the final exam must be achieved.

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
<th>Details</th>
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<tbody>
<tr>
<td>Projects, Assignments, Labs</td>
<td>25%</td>
<td>All must be submitted and a passing grade achieved.</td>
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<td>Term Test</td>
<td>25%</td>
<td>Wed., Nov. 5, 2014, 6:00-8:00 P.M., Room E3-516.</td>
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<tr>
<td>Final Examination</td>
<td>50%</td>
<td>Scheduled by Registrar’s Office, performed in E3-516.</td>
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Instructor
- Prof. K. Ferens. Ph.D., P.Eng.
- Room: E1-544 EITC
- Telephone: (204) 474-8517
- Email: Ken.Ferens@umanitoba.ca

Office Hours
- TBA.

Teaching Assistant
- TBA

Voluntary Withdrawal Date
- Wednesday, November 12th, 2014.

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 Sections 4 and 6 of the 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.

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 and Requirements of the University of Manitoba, Section 7.1, students are reminded that plagiarism or any other form of cheating in examinations, assignments, laboratory reports or term tests is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating in examinations or term assignments is also subject
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 Level **

<table>
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<tr>
<th>Learning Outcome</th>
<th>A1</th>
<th>A2</th>
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*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 (Able to rephrase information)
3 - Application (Able 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 whole)
6 - Evaluation (Able to judge of the worth of something)

Student Contact Time (Hrs)

Lectures: 3 hrs lecture/week × 13 weeks/term = 39 hrs
Laboratories: 3 hrs laboratory × 5 weeks = 15 hrs
Tutorials: 0 hr tutorial × 0 weeks = 0 hrs

Evaluation

<table>
<thead>
<tr>
<th>Component</th>
<th>Value (%)</th>
<th>Methods of Feedback *</th>
<th>Learning Outcomes Evaluated</th>
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<td>Mid-Term Test</td>
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<td>1-7</td>
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<tr>
<td>Final Examination</td>
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<td>S</td>
<td>1-7</td>
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* Methods of Feedback: F - formative (written comments and/or oral discussion), S - summative (number grades)