

Course Outline (F2019)

BME700: Biomedical Engineering Capstone Design

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Calendar Description	<p>This single term course has two objectives. (1) The lectures provide students with advice on design, project management, reliability, practical advice on software, circuits and components and the documentation of their work. The lectures are organized as a seminar series presented by the faculty lab coordinators and practicing engineering professionals. The seminar series' goal is to provide students with knowledge that will assist them with project design and implementation. (2) The laboratory component of the course provides students with an opportunity to select a project to be completed in the Winter semester course BME 800 Design Project. Students search information, design and source components in consultation with the faculty lab coordinators who will supervise their projects in the Winter term. Project topics are provided from which students select a topic. Seminars on bioethics will also be arranged.</p>
Prerequisites	<p>BLG 601, BME 501, BME 516, BME 632, BME 639, BME 674, EES 612, BLG 701, BME 506, BME 423, BME 406 and MTH 410</p>
Antirequisites	<p>None</p>
Corerequisites	<p>None</p>
Compulsory Text(s):	<p>1. Teamwork and Project Management, Karl A. Smith, 3rd edition, McGraw Hill, 2004</p>
Reference Text(s):	<p>1. Design of Biomedical Devices and Systems, Paul H. King and Richard C. Fries, 2nd edition, CRC press, 2008.</p>

<p style="text-align: center;">Learning Objectives (Indicators)</p>	<p>At the end of this course, the successful student will be able to:</p> <ol style="list-style-type: none"> 1. Develop ability and technical skills to make decisions in engineering designs using judgment in solving problems with uncertainty and imprecise information. (2a) 2. Predict user needs, define design parameters, and identify constraints in the process of defining Engineering Design Project (EDP). (4a) 3. Select optimal choice among alternatives applying known constraints identified in the project definition. (4c) 4. Demonstrates skills to work as a team player and participates towards team effectiveness. (6b) 5. Demonstrates skills to work as a team player and participates towards positive team dynamics. (6a) 6. Demonstrates written communication skill through the ability of constructing effective arguments and drawing conclusions using evidence in discussing design choices, using technical vocabulary, and presenting information clearly and concisely. (7a) 7. Demonstrates oral communication skill through the ability of constructing effective arguments and drawing conclusions using evidence in discussing design choices, using technical vocabulary, and presenting information clearly and concisely. (7b) 8. Demonstrates the ability to understand the impact of his/her decision and activities on the environment. (9a) 9. Demonstrates awareness in considering and applying ethical guidelines in decision making. (10a) 10. Understand systematic decomposition of project into key tasks, determine tasks inter-relationship, and manage project to meet budget and time line. (11b) 11. Demonstrate ability to assimilate existing knowledge of the field, understand how literature is produced and maintain currency. (12b) <p>NOTE: Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).</p>																
<p style="text-align: center;">Course Organization</p>	<p>1.0 hours of lecture per week for 13 weeks 1.0 hours of lab/tutorial per week for 12 weeks</p>																
<p style="text-align: center;">Teaching Assistants</p>	<p>NA</p>																
<p style="text-align: center;">Course Evaluation</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left; background-color: #f2f2f2;">Theory</th> </tr> </thead> <tbody> <tr> <td style="width: 80%;">Design Process and Project Management Exam</td> <td style="text-align: right;">25 %</td> </tr> <tr> <td>Seminars Attendance and Quizzes</td> <td style="text-align: right;">10 %</td> </tr> <tr> <td>Final written report summarizing design activities</td> <td style="text-align: right;">30 %</td> </tr> <tr> <th colspan="2" style="text-align: left; background-color: #f2f2f2;">Laboratory</th> </tr> <tr> <td>Milestones and Milestone Compliance Reports</td> <td style="text-align: right;">15 %</td> </tr> <tr> <td>Project Oral Exam</td> <td style="text-align: right;">20 %</td> </tr> <tr> <td>TOTAL:</td> <td style="text-align: right;">100 %</td> </tr> </tbody> </table> <p>Note: In order for a student to pass a course with "Theory and Laboratory" components, in addition to earning a minimum overall course mark of 50%, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the "Course Evaluation" section for details on the Theory and Laboratory components.</p>	Theory		Design Process and Project Management Exam	25 %	Seminars Attendance and Quizzes	10 %	Final written report summarizing design activities	30 %	Laboratory		Milestones and Milestone Compliance Reports	15 %	Project Oral Exam	20 %	TOTAL:	100 %
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<p>Examinations</p>	<p>Course evaluation will be based on students' performance and design reports. Each project group consists of 4 students. Each student will be evaluated both individually and as a group.</p> <p>Examination on "Design Process and Project Management" is carried out in Week 6 (tentative)</p> <p>Students must attend specified seminars (& quizzes) in weeks 7-11 and submit project milestones (Week 3) and milestones compliance reports (weeks 5, 7, 9, and 11) to their FLC for evaluation prior to meeting with their FLCs.</p> <p>The final written reports will be assessed not only on their technical merit, but also on the communication skills of their author as exhibited through the reports. The written report will be evaluated as follows:</p> <p>i) Introduction and Objective</p> <ul style="list-style-type: none"> -Statement of the problem, clarification of need and requirements <p>ii) Approach and Methods</p> <ul style="list-style-type: none"> -Relevant literature review, use of suitable engineering concepts and methods -Alternative design approaches examined and analyzed <p>iii) Design Analysis and Synthesis</p> <ul style="list-style-type: none"> -Design specifications, challenges and methodology -Use of modern concepts and methods for data gathering, analysis, and synthesis -Charts on the design process <p>iv) Technical Writing and General Organization</p> <ul style="list-style-type: none"> -English, spelling, conciseness, clarity, cover page, index, sequence of chapters, references, appendices, overall adequacy, and integration of the report <p>Project Design Oral Exam – Weeks 12/13 Final Report Submission – Week 13</p>
<p>Other Evaluation Information</p>	<p>NA</p>
	<p>Course Organization Details =====</p> <p>The engineering design projects are selected from a published list of project topics on the course D2L web site. The description of each topic contain a preamble that gives an overview of the project and explains why it is of interest. Partial specifications, objectives, and suggested approach are included. All topics are 4-student projects.</p> <p>Note: BME students can only choose project topics from BME 700 approved list of projects.</p> <p>Once the EDP topics are posted in the D2L, students can contact the professors teaching this course termed the Faculty Lab Coordinators (FLCs) to discuss their project topics available for student selection and the design challenges for those projects. If a student(s) wishes to propose (or) modify a topic, the student should first choose the topic(s) closest to their likes from the approved list of BME EDP topics and go through the BME EDP topic selection process. Once they are assigned a topic by the computer selection process, they can then discuss with their assigned FLC to modify their topics subjected to the approval of their respective FLCs.</p> <p>In Week 3 (tentative) lecture hour, a seminar on "Design Process and Project Management" is scheduled.</p> <p>During Week 2, students must select their project topics online using our Department's computers. The actual dates of the computer topic selection and the procedure will be announced. If more than one group of students selects a particular project topic, the approval of the selection is based on a random process; those who do not get the approval will re-select another topic.</p> <p>Once topics are assigned to the groups, the students will start the design activities and meet with their FLCs regularly the following weeks of the course. During the weeks when in-class seminars/quizzes/exams are scheduled, it is students responsibility to discuss with their FLCs ahead of time and identify alternate meeting times.</p> <p>In Week 6 (tentative) lecture hours, students must do an examination (25% of total course grade) on the subject of Design Process and Project Management.</p> <p>During Weeks 7 to 11, students attend seminars* (that will be announced on the course D2L web site) and/or carry out design work in a specific location or laboratory and report to their designated FLC. Seminars may be team-</p>

**Other
Information**

taught by the guest speakers or FLCs. These seminars will be scheduled and announced on the course D2L website.

*Note: Weeks 7-11 are tentatively planned for seminars/quizzes, the actual weeks will be announced subjected to the availability of the guest speakers.

During Weeks 12/13, students must do their Oral Exam with their designated FLCs and submit their Final Report in Week 13.

Project Cost,Equipment, and Laboratories
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Project costs for components and other supplies will be borne by the students. Some specialized components may be provided by the Department. This will be noted in the project description. Students should carefully assess the cost implications of a particular project before making a commitment. Requests for equipment or laboratory usage outside of your scheduled lab hours should be directed to your FLC.

Roles of a FLC and FA
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This course presents administrators with a major challenge in coordination. Laboratory resources must be managed to ensure their adequacy, longevity, student safety, and security. Students are to be placed with a FLC who can advise them.

Role of Faculty Laboratory Coordinator (FLC)

1. Ensure that adequate design components meeting the expectation of BME EDP is in each project under their supervision.
2. Provide, where feasible, technical and project management advice without unduly removing the challenge from the student.
3. Advise the student, where necessary and possible, in the acquisition of parts, test equipment, and specialized laboratory facilities, as required.
4. Monitor the student's weekly progress.
5. Evaluate the performance of the students (individually and as a group) as per the course evaluation.

Role of Faculty Advisor (FA)

The FA is a faculty member who has voluntarily suggested a project or is formally or informally advising the student. When a FA generates a project, the FA is acknowledged in the Engineering Design description. FA generated projects should be approved by the course coordinator and the FLC team and is subjected to agreement of one of the designated FLCs to serve as the supervisor. A FA may or may not be interested in assisting the student beyond the project generation phase. As a courtesy, the student should always discuss the project with the FA when one exists and establish the nature and extent of any advice the FA wishes to provide. Upon project completion, in the Winter Term, it is suggested that the student provide an Engineering Design report copy to the FA if the advisor so wishes. This copy does not have to be bound.

Scope of EDP
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The project component BME 700 will make significant demands on the student's time. The key to completing all aspects of this course is to carefully define reasonable limits to what is being undertaken and to budget time on a regular basis to minimize last minute rushes. During the weekly meetings with FLCs, the student has the chance to discuss challenges that arise and log their progress in their project. As stated earlier, the intended value of the engineering design project is to provide a major experience in engineering design. Therefore, it is important that the project is thoroughly researched and well under way in BME 700 during the Fall Term and a plan of actions for the Winter Term course BME 800 is carefully drawn up. Your FLC may refuse to assist the student who has not made a reasonable effort to solve their problem.

Ultimately, the successful completion of the project is the sole responsibility of the student.

Week	Hours	Chapters / Section	Topic, description
1-13			Biomedical Engineering Capstone Design

Laboratory/Tutorials/Activity Schedule

Week	Lab	Description
1	-	Presenters/Evaluators: EDP Coordinator, FLCs, Staff Activities: Course Management, EDP Topics
2	-	Presenters/Evaluators: EDP Coordinator, FLCs, Staff Activities: Computer Selection of EDP Topics, Lab Safety, Begin Meetings with FLCs
3	-	Presenters/Evaluators: EDP Coordinator, FLCs, PM Faculty Activities: Design Process and Project Management Seminar/ FLCs Meetings and Design Activities/ Project Milestone Submission
4	-	Presenters/Evaluators: FLCs Activities: FLCs Meetings and Design Activities
5	-	Presenters/Evaluators: FLCs Activities: FLCs Meetings and Design Activities/ Milestone Compliance Report (St1)
6	-	Presenters/Evaluators: EDP Coordinator, FLCs Activities: Design Process and Project Management Exam/ FLCs Meetings and Design Activities
7	-	Presenters/Evaluators: Guest Speakers, EDP Coordinator, FLCs Activities: Seminar*/ FLCs Meetings and Design Activities/ Milestone Compliance Report (St2). *Note: Weeks 7-11 are tentatively planned for seminars/quizzes, the actual weeks will be announced subjected to the availability of the guest speakers.
8	-	Presenters/Evaluators: Guest Speakers, EDP Coordinator, FLCs Activities: Seminar/ FLCs Meetings and Design Activities
9	-	Presenters/Evaluators: Guest Speakers, EDP Coordinator, FLCs Activities: Seminar/ FLCs Meetings and Design Activities/ Milestone Compliance Report (St3)
10	-	Presenters/Evaluators: Guest Speakers, EDP Coordinator, FLCs Activities: Seminar/ FLCs Meetings and Design Activities
11	-	Presenters/Evaluators: Guest Speakers, EDP Coordinator, FLCs Activities: Seminar/ FLCs Meetings and Design Activities/ Milestone Compliance Report (St4)
12	-	Presenters/Evaluators: FLCs Activities: Project Design Oral Exam
13	-	Presenters/Evaluators: FLCs Activities: Project Design Oral Exam/ Final Report Submission/ Submission of BME 800 plan for all 4 phases
-	-	Additional information: - The above activity schedule is tentative and if there are any changes, announcements will be made on D2L.

Policies & Important Information:

1. Students are required to obtain and maintain a Ryerson e-mail account for timely communications between the instructor and the students;
2. Any changes in the course outline, test dates, marking or evaluation will be discussed in class prior to being implemented;
3. Assignments, projects, reports and other deadline-bound course assessment components handed in past the due date will receive a mark of ZERO, unless otherwise stated. Marking information will be made available at the time when such course assessment components are announced.

4. Refer to our **Departmental FAQ** page for information on common questions and issues at the following link: <https://www.ee.ryerson.ca/guides/Student.Academic.FAQ.html>.

Missed Classes and/or Evaluations

When possible, students are required to inform their instructors of any situation which arises during the semester which may have an adverse effect upon their academic performance, and must request any consideration and accommodation according to the relevant policies as far in advance as possible. Failure to do so may jeopardize any academic appeals.

1. **Health certificates** - If a student misses the deadline for submitting an assignment, or the date of an exam or other evaluation component for health reasons, they should notify their instructor as soon as possible, and submit a Ryerson Student Health Certificate AND an Academic Consideration Request form within 3 working days of the missed date. Both documents are available at <https://www.ryerson.ca/senate/forms/medical.pdf>. **If you are a full-time or part-time degree student, then you submit your forms to your own program department or school;**
2. **Religious, Aboriginal and Spiritual observance** - If a student needs accommodation because of religious, Aboriginal or spiritual observance, they must submit a Request for Accommodation of Student Religious, Aboriginal and Spiritual Observance AND an Academic Consideration Request form within the first 2 weeks of the class or, for a final examination, within 2 weeks of the posting of the examination schedule. If the requested absence occurs within the first 2 weeks of classes, or the dates are not known well in advance as they are linked to other conditions, these forms should be submitted with as much lead time as possible in advance of the absence. Both documents are available at www.ryerson.ca/senate/forms/relobservforminstr.pdf. **If you are a full-time or part-time degree student, then you submit the forms to your own program department or school;**
3. **Academic Accommodation Support** - Before the first graded work is due, students registered with the [Academic Accommodation Support office](http://www.ryerson.ca/studentlearningsupport/academic-accommodation-support) (AAS - www.ryerson.ca/studentlearningsupport/academic-accommodation-support) should provide their instructors with an Academic Accommodation letter that describes their academic accommodation plan.

Academic Integrity

Ryerson's [Policy 60 \(the Academic Integrity policy\)](#) applies to all students at the University. Forms of academic misconduct include plagiarism, cheating, supplying false information to the University, and other acts. The most common form of academic misconduct is plagiarism - a serious academic offence, with potentially severe penalties and other consequences. It is expected, therefore, that all examinations and work submitted for evaluation and course credit will be the product of each student's individual effort (or an authorized group of students). Submitting the same work for credit to more than one course, without instructor approval, can also be considered a form of plagiarism.

Suspensions of academic misconduct may be referred to the Academic Integrity Office (AIO). Students who are found to have committed academic misconduct will have a Disciplinary Notation (DN) placed on their academic record (not on their transcript) and will normally be assigned one or more of the following penalties:

1. A grade reduction for the work, ranging up to and including a zero on the work (minimum penalty for graduate work is a zero on the work);
2. A grade reduction in the course greater than a zero on the work. (Note that this penalty can only be applied to course components worth 10% or less, and any additional penalty cannot exceed 10% of the final course grade. Students must be given prior notice that such a penalty will be assigned (e.g. in the course outline or on the assignment handout);
3. An F in the course;
4. More serious penalties up to and including expulsion from the University.

The unauthorized use of intellectual property of others, including your professor, for distribution, sale, or profit is expressly prohibited, in accordance with Policy 60 (Sections 2.8 and 2.10). Intellectual property includes, but is not limited to:

1. Slides
2. Lecture notes
3. Presentation materials used in and outside of class
4. Lab manuals
5. Course packs
6. Exams

For more detailed information on these issues, please refer to the [Academic Integrity policy](https://www.ryerson.ca/senate/policies/pol60.pdf) (<https://www.ryerson.ca/senate/policies/pol60.pdf>) and to the Academic Integrity Office website (<https://www.ryerson.ca/academicintegrity/>).

Important Resources Available at Ryerson

1. [The Library](https://library.ryerson.ca/) (<https://library.ryerson.ca/>) provides research workshops and individual assistance. Inquire at the Reference Desk on the second floor of the library, or go to library.ryerson.ca/guides/workshops
2. [Student Learning Support](https://www.ryerson.ca/studentlearningsupport) (<https://www.ryerson.ca/studentlearningsupport>) offers group-based and individual help with writing, math, study skills and transition support, and other issues.