University of Manitoba

Department of Biosystems Engineering

Course Details

Course Title & Number: BIOE 4240 Graduation Project, Fall 2022
Number of Credit Hours: 3
Class Times & Days of Week: Lectures: M/W/F
Location for classes: Online (Note: The course will be offered by remote learning until public health conditions allow for in-person activities to resume on campus. As of the start of the term, the plan is for the course to transition to in-person learning during the week of February 28 after the Winter Term Break).

Pre-Requisites: BIOE 3270 (034.327) - Instrumentation and Measurement for Biosystems/or approval of department.

Course Description:
Either an independent or a directed study including at least one of: a comprehensive literature review, an experimental research project, or an engineering design problem. The project is to be concluded by a formal thesis.

Instructor Information

Instructor(s) Name: Derek Inglis/Mashiur Rahman
Office Location (Mr. Inglis/M. Rahman): A206 Agricultural Engineering Building/583 Duff Roblin
Office Hours or Availability: Please make an appointment if you wish to meet with us outside of class hours.
Office Phone No. 204-474-7964/204-47408509
Cell Phone No. 204-470-5290/431-374-0549
Email: Derek.Inglis@umanitoba.ca; mashiur.rahman@umanitoba.ca;
Contact: You may contact us by phone (text or call – use cell number), by email, or in person. Emails sent after business hours will not likely be answered until the next day.

General Course Information

The course is project based. Students will be given general guidance related to conducting an independent project. Your findings will be communicated through written reports and formal presentations. Students are expected to have regular contact with their project advisor (a schedule that is mutually agreeable to the student and project advisor).

Why is this course useful?
There are many instances when an engineer will be faced with a situation when an informed decision cannot be made until sufficient information is provided. In such situations, there is a need to obtain information through means such as experimental study or a comprehensive review of the published literature. A practicing engineer will use these skills to maintain professional competence and to contribute to the advancement of the engineering knowledge. During this course, students will gain the experience of managing and completing an independent project. Communication skills will be developed through a preparation of a written project report and a formal presentation of project findings.

**How does this course fit into the curriculum?**
This is a required course in the Biosystems Engineering program. Students are expected to register for BIOE 4240 in their graduating year.

### Course Goals

The intent of this course is:

- To give students an opportunity to be solely responsible for completion of a term-long engineering project.
- To provide students with the confidence to undertake lifelong learning activities intended to generate the information needed to make informed decisions.
- To introduce students to the types of research relevant to the discipline of Biosystems Engineering.

### Intended Learning Outcomes

At the conclusion of the course, the student should be able to:

1. Critically evaluate scientific publications using a format of an annotated bibliography.
2. Propose and execute a plan to investigate an engineering problem.
3. Compile a written report and compose (and deliver) an oral presentation.

### Expected Level of Development in Course

<table>
<thead>
<tr>
<th>Learning Outcome</th>
<th>KB</th>
<th>PA</th>
<th>IN</th>
<th>DE</th>
<th>ET</th>
<th>IT</th>
<th>CS</th>
<th>PR</th>
<th>IE</th>
<th>EE</th>
<th>EP</th>
<th>LL</th>
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<td>A</td>
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</tbody>
</table>

*Attributes:
- KB  A knowledge base for engineering
- PA  Problem analysis
- IN  Investigation
- DE  Design
- ET  Use of engineering tools
- IT  Individual and teamwork
- CS  Communication skills
- PR  Professionalism
- IE  Impact of engineering on society/environment
Textbook, Readings, Materials

1. The course coordinators will provide written instructions for the required format of the written report.

One hard copy is available in the Donald W. Craik Engineering Library Design TC, T 11 D33 2011; Similar online materials in the library are also available.

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. The content used is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by us, are made available for private study and research and must not be distributed in any format without permission.

Recording Class Lectures

Mr. D. Inglis/M. Rahman and the University of Manitoba hold copyright over the course materials, presentations and lectures that form part of this course. No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission from D. Inglis/M. Rahman. Course materials (both paper and digital) are for the participant’s private study and research.

Course Technology

As a courtesy to the instructor and your classmates, use of cell phones is not permitted during class time. Please remember to switch off your cell phone to avoid interruptions. Laptops may be used during lectures only for the purpose of taking notes. Some course materials will be available through UM Learn.

Class Communication

The University requires all students to activate an official University email account. For full details of the Electronic Communication with Students please visit: University of Manitoba Electronic Communication with Students Policy. Please note that all communication between you as a student and your instructor must comply with the electronic communication with student policy. You are required to obtain and use your U of M email account for all communication between yourself and the university.

Expectations and Course Policies

Student and Department Responsibilities: In general, the graduation project is the responsibility of the student. All aspects of the research such as fabrication of equipment, computer programming, and design...
of data acquisition systems are the responsibility of the student. Support staff are available to provide assistance, not to work for the student. If the work is being carried out in another Department or off campus, the research is still to be the product of the student and not a technician. Although the Department is able to provide some assistance with the purchase of equipment and materials necessary for the thesis, all equipment purchases and requests for use of existing Departmental equipment require prior authorization in writing. The student is responsible for the costs associated with the preparation of the written report and the final oral presentation. Any item requiring fabrication by technicians must receive approval in advance in writing by the project advisor. Furthermore, before carrying out any fabrication or construction work that requires the use of Department power tools or space, the student must receive prior approval of the appropriate technician.

**Academic Integrity:** Plagiarism or any other form of cheating in examinations, term tests or academic work is subject to serious academic penalty. Cheating in examinations or tests may take the form of copying from another student or bringing unauthorized materials into the exam room. Exam cheating can also include exam impersonation. A student found guilty of contributing to cheating in examinations or term assignments is also subject to serious academic penalty. Students should acquaint themselves with the University’s policy on plagiarism, cheating, exam impersonation and duplicate submission. Electronic detection tools may be used to screen assignments in cases of suspected plagiarism.

**Late Assignments:** Each deliverable is due before 4:00 pm or the appropriate late penalty will apply. Assignments submitted after the due date will be docked 25% per school day.

**Referencing Style**

Students are expected to follow the Canadian Biosystems Engineering journal referencing style when citing references in course assignments. The *Instructions for preparing a paper for Canadian Biosystems Engineering* is available through UM Learn. Please refer to this guide to ensure that you follow the correct referencing style.

**Students Accessibility Services (SAS)**

**Student Accessibility Services**

If you are a student with a disability, please contact SAS for academic accommodation supports and services such as note-taking, interpreting, assistive technology and exam accommodations. Students who have, or think they may have, a disability (e.g. mental illness, learning, medical, hearing, injury-related, visual) are invited to contact SAS to arrange a confidential consultation. *Student Accessibility Services*

520 University Centre; 204 474 7423; Student_accessibility@umanitoba.ca

**Class Schedule**

A preliminary schedule is provided below. The schedule is subject to change at the discretion of the instructors and/or based on the learning needs of the students but such changes are subject to Section 2.8 of the ROASS Procedure.

1. Course Introduction
2. Forms of scientific misconduct, plagiarism
3. Scientific writing – organization, abstracting, referencing style, introduction, objectives
BIOE 4240 Graduation Project

4. Literature review, Materials & Methods, and How to make sense of your results
5. How to effectively display your results, graphs and tables.
6. How to write effective conclusions
7. Updates on progress of the projects. Input from the students.
8. Making an effective oral presentation
9. Individual updates on progress of the projects
10. Updates on individual projects. Input from the students.

Important Dates:

<table>
<thead>
<tr>
<th>Task</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research Proposal due</td>
<td>February 9 (Wednesday), 2022</td>
</tr>
<tr>
<td>Annotated Bibliography due</td>
<td>March 16 (Wednesday), 2022</td>
</tr>
<tr>
<td>Sentence Outline due</td>
<td>April 04 (Monday), 2022</td>
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<tr>
<td>Exit Survey due</td>
<td>April 18th (Monday), 2022</td>
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<tr>
<td>Written Report due</td>
<td>April 27th (Wednesday), 2022</td>
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<tr>
<td>Oral Presentations</td>
<td>April 25th (Monday), 2022</td>
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<tr>
<td>Voluntary Withdrawal Date</td>
<td>April 25th (Monday), 2022</td>
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Course Evaluation Methods

Final letter grades will be assigned on the basis of the overall performance of the class, and the spread of the numerical marks.

Term Assignments 10% (Research Proposal; Annotated Bibliography; Sentence Outline; Exit survey)
Oral Presentation 20%
Written Report 60%
Advisor Review 10%

All courses in the Biosystems Engineering program are expected to contribute, in some way, to the development of one or more of the 12 graduate attributes that have been identified by the Canadian Engineering Accreditation Board. The table below shows the graduate attributes covered in BIOE 4240 in relation to the 6 assessment element that contributes to your overall grade in the course. The final column indicates the approximate level of development in graduate attributes that is anticipated in this course.
<table>
<thead>
<tr>
<th>Grade Component</th>
<th>Specific Evaluation Point</th>
<th>Graduate Attribute</th>
<th>Indicators Being Assessed</th>
<th>Level*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments (10%)</td>
<td>Research Proposal</td>
<td>Individual &amp; Teamwork</td>
<td>IT.2 Carries out individual responsibility</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Annotated Bibliography</td>
<td>Lifelong Learning</td>
<td>LL.4 – Demonstrates research and information literacy skills</td>
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<tr>
<td></td>
<td>Sentence Outline</td>
<td>Communication Skills</td>
<td>CS.2 – Designs and produces appropriate engineering documents (i.e., research reports, engineering reports, design documents)</td>
<td></td>
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<tr>
<td>Exit survey</td>
<td>/</td>
<td>/</td>
<td>/</td>
<td>A</td>
</tr>
<tr>
<td>Oral Presentation (20%)</td>
<td>Research Presentation</td>
<td>Communication Skills</td>
<td>CS.3 – Delivers effective technical presentations</td>
<td>A</td>
</tr>
<tr>
<td>Written Report (60%)</td>
<td>Investigation, Methods, Analysis (42%)</td>
<td>Investigation</td>
<td>IN.1 – Gathers information (literature review, measurements, experiments, laboratory exercises) and analyzes data</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Format and Style (18%)</td>
<td>Communication Skills</td>
<td>CS.2 – Designs and produces appropriate engineering documents (i.e., research reports, engineering reports, design documents)</td>
<td>A</td>
</tr>
<tr>
<td>Advisor Review (10%)</td>
<td>Survey by Student Advisor</td>
<td>Use of Engineering Tools Ethics and Equity Individual and Teamwork Lifelong Learning</td>
<td>ET.1 Uses tools to complete engineering activities ET. 2 Evaluates and selects appropriate tools for a given scenario EE.3 Demonstrates individual accountability IT.2 – Carries out individual responsibility</td>
<td>A</td>
</tr>
</tbody>
</table>

*Level of Development of Graduate Attributes (I = Introductory; D = Intermediate; A = Advanced)
Grading

The grading scale used for this course is shown below.

<table>
<thead>
<tr>
<th>Letter Grade</th>
<th>Percentage out of 100</th>
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</thead>
<tbody>
<tr>
<td>A+</td>
<td>92-100</td>
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<tr>
<td>A</td>
<td>85-91</td>
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<tr>
<td>B+</td>
<td>78-84</td>
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<tr>
<td>B</td>
<td>72-77</td>
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<tr>
<td>C+</td>
<td>66-71</td>
</tr>
<tr>
<td>C</td>
<td>60-65</td>
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<tr>
<td>D</td>
<td>50-59</td>
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<tr>
<td>F</td>
<td>Less than 50</td>
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Assignment Descriptions

Research Proposal (2.5%):
Prepare a research proposal (1-2 pages) that includes:
- the proposed title of your report
- the name of your advisor
- the nature of the research project (i.e., experimental research, engineering design, or comprehensive literature review). Under this section, include background information and the reason(s) for conducting this research. Add 2-3 references to support your statements.
- a statement of the project objective
- a description of the proposed methodology (including analysis of data if applicable)
- a project timeline (use a separate page to show week by week expectations), and
- a Gantt chart of the project timeline (use a separate page for the chart).

The research proposal must be signed by your advisor.

Annotated Bibliography (2.5%):
An Annotated Bibliography is a list of sources, usually on one topic that includes brief summaries and/or evaluations of the sources. The annotated bibliography:
- forces you to keep a record of sources
- develops the habit of critically examining sources, and
- develops a specific writing skill that is common in academia.

Please note: providing the google address in references is not sufficient, unless it is a government document.
Select at least five publications relevant to your area of research. Generate an annotation for each publication. Do not exceed 1 typed page per source. Your annotation should be concise and include the following information:

- complete bibliographic citation (using Canadian Biosystems Engineering journal style)
- review the main content of the source; be sure to state any limitations of the work
- make an assessment of the usefulness of the source to your proposed (or on-going) research

Sentence Outline (2.5%):
A sentence outline is a tool that can help you predict the structure of your written thesis before you actually write it. Unlike a topic outline, which uses only key words or short phrases to depict the structure of a written document, the sentence outline uses complete sentences to depict the written document’s structure. You may be questioning the value of the effort associated with preparing an outline when the written report is to contain standard sections such as introduction, literature review, materials and methods, results and discussion, and conclusions. (Note: If you are doing a graduation project that falls into the category of an engineering design or a comprehensive literature review, then not all of these standard sections would apply.) Although these main sections are obvious, your organization of material within each section is often not so obvious. It is important that you carefully consider organization of material within each section to most clearly convey your message. The sentences that you prepare for the sentence outline may be used as the opening sentences in each of the sections of your written report.

Exit Survey (2.5%):
The new Canadian Engineering Accreditation Board (CEAB) requires that institutions demonstrate that their students possess 12 specific attributes upon graduation. Attributes are measured by indicators, which are the knowledge, skills and behaviors associated with each attribute. This survey will be used to provide information for the cycle of continual improvement of our Biosystems Engineering program; it will not be used to assess you individually although this exit survey is a required assignment of this course.

Oral Presentation (20%):
Students are required to defend their work to a panel of professors. This defense will take the form of a formal oral presentation (using a tool such as PowerPoint) and a subsequent question period.

Written Report (60%):
A written report is required. The report must describe the project that has been completed by the student. A grading rubric will be provided. The reports will be evaluated by one of the course coordinators, your advisor, and one additional member of the department.

Advisor Review (10%):
Your academic advisor will be asked to complete a survey to assess your performance on the project. The survey will specifically assess the ability that you displayed with respect to the use of tools to complete the project, your ability to manage the project, and your ability to undertake lifelong learning. From the student perspective, there is no assignment associated with this component of the grade – the mark for this component of the grade will be assigned based on your advisor’s perception of your work throughout the semester.
Supplemental Course Information for BIOE 4240

All courses in the Biosystems Engineering program are expected to contribute, in some way, to the development of one or more of the 12 graduate attributes that have been identified by the Canadian Engineering Accreditation Board. The 12 graduate attributes have been defined below for your information. While there are likely some aspects of many of these attributes that can be found in this course, the attributes being emphasized in this course are: 3) Investigation, 5) Use of Engineering Tools, 6) Individual and Team Work, 7) Communication Skills, 10) Ethics and Equity, and 12) Lifelong Learning.

Graduate Attributes

1. **A Knowledge Base for Engineering**
   Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.

2. **Problem Analysis**
   An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions.

3. **Investigation**
   An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data, and synthesis of information in order to reach valid conclusions.

4. **Design**
   An ability to design solutions for complex, open-ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.

5. **Use of Engineering Tools**
   An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations.

6. **Individual and Team Work**
   An ability to work effectively as a member and leader in teams, preferably in a multi-disciplinary setting.

7. **Communication Skills**
   An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.

8. **Professionalism**
   An understanding of the roles and responsibilities of the professional engineer in society, especially the primary role of protection of the public and the public interest.
9. **Impact of Engineering on Society and the Environment**
An ability to analyze social and environmental aspects of engineering activities. Such ability includes an understanding of the interactions that engineering has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions, and the concepts of sustainable design and development and environmental stewardship.

10. **Ethics and Equity**
An ability to apply professional ethics, accountability, and equity.

11. **Economics and Project Management**
An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.

12. **Life-long Learning**
An ability to identify and address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge.