September 9, 2020

University of Manitoba
Faculty of Agricultural & Food Sciences
Department of Biosystems Engineering

COURSE DETAILS

Course Title & Number:	BIOE 4900 Biosystems Engineering Design 3
Number of Credit Hours:	4
Lecture/Lab Times:	T/TH 8:30-11:20 am
Classroom Location:	Remote
Lab Location:	Remote
Pre-Requisites:	BIOE 3900 Biosystems Design 2

Undergraduate Calendar Description
An opportunity for the Biosystems Engineering student to practice fundamental engineering competencies (project management, technical communication) in the preparation of preliminary design for the client. Students will be expected to demonstrate professionalism as a part of a design team. May not be held with BIOE 3580. Prerequisite: BIOE 3900.

How does this course fit into the curriculum?
This is a required course in the Biosystems Engineering program; the prerequisite for BIOE 4900 is BIOE 3900. The Biosystems Engineering program has four design courses that build upon basics that were introduced in ENG 1430 (i.e., introduction to the engineering design process and the dynamics of working as a team to solve an engineering problem). BIOE 4900 is the third of these four courses and is to be taken during the 4th year of the program. This course will provide the student with the opportunity to use skills from other courses, build on fundamental engineering competencies, and develop engineering communication skills that are most important in industry. BIOE 4900 builds on the principles of engineering design with a specific project that will be taken from concept to a set of design documents in BIOE 4900, and then on to prototyping or proof of concept in BIOE 4950 the following term.

Why is this course useful?
Design is one of the core graduate attributes identified by the Canadian Engineering Accreditation Board. Although engineers must have sufficient skills to analyze complex problems, they must also be able to communicate effectively and work in teams or individually to solve challenging, open-ended problems within real time constraints. In this course, engineering communication topics are integrated alongside design concepts with an overall emphasis on project management. Design teams prepare a preliminary design in response to a design assignment submitted by industry. Instructors of this course will facilitate the engineering student to continue their development of the CEAB graduate attributes needed for a career as a professional engineer, including design, problem analysis, engineering communication skills, working in a team to manage a project, professionalism, impact of engineering on society and the environment, economics and project management, and lifelong learning.

Instructor Contact Information

Instructor(s) Name:	Dr. Don Petkau, P.Eng., Senior Instructor
Office Location:	E2-358 EITC (at home)
Office Hours or Availability:	By appointment outside of class or laboratory hours.
Office Phone No.	204-479-4084
Email:	Don.Petkau@umanitoba.ca
Contact:	You may contact me with questions related to the course by phone, or by email.

Instructor(s) Name:	Dr. Jillian Seniuk Cicek, Ph.D.
Office Location:	333 Stanley Pauley Engineering Building (at home)
Office Hours or Availability:	Virtually, by appointment.
Office Phone No.	204-474-9698
Email:	Jillian.SeniukCicek@umanitoba.ca
Contact:	You may contact me with questions related to the course by email.

Instructor(s) Name:	Mr. James White, P.Eng. (Engineer-in-Residence)
Office Location:	E1-268 EITC (at home)
Office Hours or Availability:	By appointment
Office Phone No.	
Email:	James.White@umanitoba.ca

All email communication must conform to the Communicating with Students university policy. We will do our best to respond to your questions within 24 h.

Textbook, Readings, Materials

Instructors will refer to this text, but students are not required to purchase this for the course:

Dunwoody, A.B., T.N. Teslenko, J. Reilly, S.E. Nesbit, P.J. Cramond and C.S. Paterson. 2018. Fundamental Competencies for the 21st-Century Engineer, Second Edition. Don Mills, ON: Oxford University Press.

Students are required to use steel-toe shoes and safety glasses when working in the fabrication shop or wood shop.

Course Goals

The objectives of this course are as follows:

Engineering Objectives:
Provide students with the opportunity to gain knowledge and skills in several engineering fundamentals. Through a problem-solving approach with an emphasis on clear communication, design teams will produce a set of deliverables for a prototype or proof of concept that will be manufactured in BIOE 4950 during the following winter term. These deliverables will include:

- Design calculations
- Drawings
- Specifications
- Material costs/budget

Communication Objectives:
Provide students with the opportunity to converse in various engineering communication scenarios and demonstrate competence in:

- Resume preparation and interview skills
- Keeping an engineering journal
- Revising and editing their own and their peers' documents
- Negotiating a variety of interpersonal styles and learning to work effectively, ethically, equitably and professionally in a team environment
- Demonstrating effective and engaging presentation skills

Intended Learning Outcomes

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

1. Use appropriate communication strategies to manage and document an engineering design project
2. Critique in written form a design proposal prepared by another student team
3. Write an engineering proposal for an external client
4. Use project management tools and fundamentals to manage an engineering design project
5. Use appropriate information (i.e., research literature, engineering codes, standards, etc.) to generate and/or support design information
6. Present and accept critique from a wider audience on how design components fit within the overall team design project

Expected Competency Level **

Learning Outcome	Attributes*											
	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1							A	A				
2						A	A					
3						A	A					
4											D	
5			A	A	A		A	A				
6				A	A		A					A

***CEAB 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 Lifelong learning

*****Expected Level of Development*:**

I - Introductory

D – Developing

A- Advanced

Using Copyrighted Material

Please respect copyright. We will use copyrighted content in this course. We have ensured that 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

The course instructors 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 the course instructors. Course materials are for the participant's private study and research.

Course Technology

It is the general University of Manitoba policy that all technology resources are to be used in a responsible, efficient, ethical and legal manner. The student can use all technology in classroom setting only for educational purposes approved by instructor and/or the University of Manitoba Student Accessibility Services. While we recognize the importance of technology in our daily lives (laptops, cell phones, blackberries) we ask that you use them with discretion. For example, this includes turning off cell phones during class time and if working on a laptop, ensuring that the work is related exclusively to the lecture/course. Some course materials will be available through UM Learn.

Class Communication

In accordance with university policy all email communication for this course shall be conducted using your University of Manitoba email address only.
For full details of the Electronic Communication with Students please visit: http://umanitoba.ca/admin/governance/media/Electronic_Communication_with_Students_Policy_-_2014_06_05.pdf

Please note that all communication between you as a student and your instructors must comply with the electronic communication with student policy:
(http://umanitoba.ca/admin/governance/governing_documents/community/electronic_communication_with_students_policy.html).

Please ensure that you are also monitoring your UM Learn account for this course.

Expectations: You Can Expect Us To

Learning is most effective when both the instructors and the students are engaged in the subject material. The role of the instructors, therefore, is to create an environment that facilitates student engagement and learning. In this course, you can expect an active learning environment. Some dissemination of information will occur using the traditional lecture format. However, a substantial portion of the course will be used to facilitate teamwork and the development of teams' design projects. The nature of design tends to be open-ended, iterative and relies on the self-discipline of the engineer to see a project through to completion. The schedule for this course provides for two blocks of time each week, in which a portion of the time will be used to present more traditional lecture material for certain aspects of the course. This will be done to provide direction for assignments and other activities required for the course. The remainder of class time will be reserved to work on design projects. This time will be used for a variety of activities, including: consulting with the instructors, working on design drawings, meeting with industry members, and sourcing product information.

Expectations: We Expect You To

Attendance and punctuality are expected, primarily as this is a team-based course, requiring students to maximize opportunities to work effectively with their teammates in class. If you must be absent, please notify your team members and us beforehand via email. When we are engaged in class discussion and interaction, your full attention is requested. While instruction time for this course is less structured than in a traditional analysis course, successful completion of the course requirements demands that this time be used wisely.

Academic Integrity:
All applicable rules and regulations in the University of Manitoba General Calendar, including those on plagiarism, cheating (Section 7.1) and examination impersonation (Section 4.2.8) are to be read and followed. Continued registration in this course implies that you accept, and will comply, with these conditions. Reproduction of another student's work is not acceptable. Please refer to the "Academic Integrity" section of the University of Manitoba Undergraduate Academic Calendar. (http://crscalprod.ad.umanitoba.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=341&chapterid=4295&loaduseredits=False).

Referencing Style

Students are expected to follow the CSBE reference style when citing references in course assignments. The ***Biosystems Engineering Citation Guide – CSBE Style*** is available through UM Learn. Please refer to this guide to ensure that you follow the correct referencing style.

Students Accessibility Services

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 http://umanitoba.ca/student/saa/accessibility/
520 University Centre 204-474-7423 Student_accessibility@umanitoba.ca

Class & Lab Schedule

The following schedule provides an overview of course content.

Week 1

September 10 **Introductions & course outline: Team Deliverables** (JW): Team Charter; R1 Project Plan; R2 Project Plan; Design Review; Design Package; Memos; **Individual Deliverable** (DP): Self & Peer Evaluations; Logbooks (60 mins);

Student introductions (45 mins)(JSC);

Introduction to projects (30 mins)(DP);

Project RFP (30 mins)(JW) (**Upload by end of day**);

Homework: Dr. Phil Ferguson: "Notebook Etiquette (and Law)"

Week 2

September 15 **Lecture:** Collaborative Projects & Team Charters (30 mins)(JSC & JW). Design teams will be assigned. First team meeting: Teams will discuss their approaches to collaborative projects and writing their team charter. **Team Charters should be posted on UM Learn Discussion Forum** by end of day. (45 mins).

Lecture: Design Process and Project Definition (DP) (60 mins). Structured Design Time (60 mins): Rest of class time is devoted to "problem definition". Students expected to work independently to produce a written document i) outlining the current understanding of the design problem and ii) listing questions that need to be answered during the initial meeting with client.

Project Update Memo #1 due: Students expected to submit a memo to the course instructors indicating the team's understanding of the design problem.

September 17 ***Design time***. It is anticipated that design teams will use this time to meet with project sponsors to clarify understanding of the design problem.

Week 3

September 22 Mini Lecture: "Technical Memorandums" & Assigned Memos (JSC) (15 mins). Lecture: "Running Effective Meetings" (JSC) (45 mins) followed by ***structured design time*** (teams will reflect on their team processes, team charter, and meetings thus far, and make plans for running effective meetings going forward).

Project Update Memo #2 due: Students expected to submit a memo to the course instructors indicating how their understanding of the design problem changed as a result of meeting with the industry sponsor and their plans for running effective meetings. Due by end of day.

September 24 **Class brainstorming activity.** Design teams will use brainstorming or other idea generation techniques to generate potential design solutions for each Design Team (15 mins/team – 120 minutes). Structured Design Time (60 mins): Team discussion to assess potential solutions and select one(s) that warrant further investigation. Teams to decide

what additional information is required in order to select a single conceptual solution.)

Project Update Memo #3 due: Students expected to submit a memo to the course instructors indicating i) potential design solutions generated through brainstorming that warrant further investigation and ii) the information that the student has agreed to research. Due by end of day.

Week 4

September 29 **Lecture:** "Phase – Gate Process" (JW)(1.5 h). Followed by *Design time*.

October 1 ***Design time.***

Week 5

October 6 Guest Lecture: Kathryn Atamanchuk – Project Management (1 h) followed by ***structured design time*** (Teams will develop a WBS & Gantt Chart for their design projects. Upload by end of week).

October 8 ***Design time***.

Week 6

October 13 ***Design time.***

October 15 Lecture: Design Review (JW & DP). Followed by ***Design time***.

R1 Project Plan Due. It is to be submitted to the course instructors and the client.
The R1 Project Plan is intended to be a concise report prepared for the industry client. The written document is to include:

i) Engineering problem to be solved
ii) Stakeholders
iii) Background information consulted and ideas considered
iv) Conceptual solution being proposed

Week 7

October 20 Guest Lecture

October 22 ***Design time.***

Week 8

October 27* Guest Lecture

October 29 ***Design time***.

Week 9

November 3 **Lecture:** "FMEA's" (JW) (2.0 h). Followed by ***Design time***.

November 5 ***Design time***.

Week 10

November 10 **Fall term break – no class**

November 12 **Fall term break – no class**

Week 11

November 17 Guest Lecture

November 19 ***Design time***.

Week 12

November 24 **Discussion: Design Review & Design Package (DP & JW)**. **Mini-lecture:** "Graphics in Communication" (JSC). Followed by *Design time.*

November 26 ***Design time***.

Week 13

December 1 Design Review: Course instructors, technicians, and project sponsor will be present for a formal design review. Each design review will be allocated 30 min. Teams will be expected to orally present the conceptual solution being proposed, the rationale for choosing this solution, and the method by which proof of concept will be evaluated. Members of the panel will be given opportunity to ask questions and/or make suggestions for the design team to consider going forward. Design teams are expected to take notes during the design review so that useful information arising from the review is not lost.

December 3 Design Review: Course instructors, technicians, and project sponsor will be present for a formal design review. Each design review will be allocated 30 min. Teams will be expected to orally present the conceptual solution being proposed, the rationale for choosing this solution, and the method by which proof of concept will be evaluated. Members of the panel will be given opportunity to ask questions and/or make suggestions for the design team to consider going forward. Design teams are expected to take notes during the design review so that useful information arising from the review is not lost.

Week 14

December 8 **Logbook Review:** Students expected to make their engineering logbooks/journals available during class on December 8th. Each student is expected to meet individually with the course instructors to explain their logbooks/journals methodology and reflect on the effectiveness of their methodology in creating their logbooks/journals as a record of the details and decisions associated with the design project.

Design time when not participating in Logbook review.

December 10 Peer Evaluations due; Course evaluations to be completed (online). **Team Meetings: Adjourning (Re-evaluate Team Charter; Reflect on Team Process (prompts provided).**

R2 Project Plan due: The Project Plan is intended to be a concise report prepared for the industry client. Written document to include:

i) Engineering problem to be solved
ii) Stakeholders
iii) Background information consulted and ideas considered
iv) Conceptual solution being proposed
v) Risk analysis
vi) Method by which proof of concept will be evaluated

vii) Projected timeline for the project (including proof of concept evaluation)
viii) Anticipated project expenses

Design Package due: The design package represents that bulk of the design work that students will do this term, and should include the following elements:
i) design calculations,
ii) specifications,
iii) construction drawings

Important Dates:

October 22	R1 Project Plan Due
November 9-13	No classes – Fall Break
November 23:	Last date for Voluntary Withdrawal for fall term courses.
December 1 & 3:	Design Reviews
December 10:	R2 Project Plan and Design Package due

Course Evaluation Methods

The final grade for this course will be based on the assessments of engineering communication assignments, written reports, drawing package and the oral design review. The grade distribution will be as follows:

Engineering Design Project (55% of course grade)
- Project Plans (R1 and R2) (20%)
- Design Package (20%)
- Design Review (10%)
- Client Evaluation (5%)

Term Assignments (20% of course grade)
- Shop Safety Training & Orientation (Planned for week of January 5 to January 15) (**Required to move to BIOE 4950**)
- Engineering Logbook/Journal (5%)
- Project Update Memos (3) (10%)
- Team Charter (5%)

Mid-Term Exam (Take home) (10% of course grade)

Professionalism (15% of course grade)
- Attendance
- Self & Peer Evaluations (Instructors have the discretion to use the peer evaluations to inform the professionalism grade. Students with poor peer evaluations could lose their Professionalism mark (up to 15% of course grade, and could be assessed up to a 10% deduction to the Team deliverables (Engineering Design Project (55% of course grade)).

Grading

The grading scale used for this course is shown below.

Letter Grade	Percentage out of 100
A+	92-100
A	85-91
B+	78-84
B	72-77
C+	66-71
C	60-65
D	50-59
F	Less than 50

Assignment Descriptions

Engineering Design Project (55% of course grade)

Project Plan (20%): Design teams are required to submit a written document that includes: i) a description of the engineering problem to be solved, ii) Stakeholders, iii)background information that has been consulted and ideas considered, iv) the conceptual solution being proposed, v) Risk Analysis, vi) the method by which proof of concept will be evaluated, vii) the projected timeline for completion of the project (including proof of concept evaluation), and viii) anticipated project expenses. Proposals will be due at the end of the term. An assessment rubric will be provided to students when the design proposal is introduced in class.

Design Package (20%): The design package represents the bulk of the design work that students will do this term, and includes the following elements: Design calculations, Specifications, Construction drawings, Students will be guided through these processes throughout the term. Specifications and/or rubrics will be provided in class.

Design Review (10%): At the end of the term, each student is expected to participate in a Design Review. Design teams are expected to describe the conceptual solution being proposed, the rationale for choosing this solution, and the method by which proof of concept will be evaluated. A panel consisting of the course instructors, department technicians, and the industry client will ask questions as a means of critiquing the proposed design. The grade will be based on the team's presentation and responses to questions during the design review.

Client Evaluation (5%): The design team's industry client will be asked to assess the design proposal and the design review.

Term Assignments (20% of course grade)

Shop Safety Training & Orientation: (due to current circumstances this exercise is scheduled for the first two weeks in January) In preparation for prototype fabrication in BIOE 4950, students are required to complete shop safety training and orientation during BIOE 4900. Students are expected to review safe work procedures that have been developed for the major tools present in the department's fabrication shop and wood shop, to attend an orientation session hosted by one of the department's shop technicians, and complete a quiz to demonstrate understanding of the safety protocols in place for the department's shop facilities.

Engineering Logbook/Journal: Students are expected to keep an engineering logbook/journal for their design project. At the end of the semester, students will meet with the course instructors in person to defend the adequacy of their journal as a permanent record of the details and decisions associated with the design project.

Project Update Memos: Students are expected to provide regular progress updates to the course instructors using the format of written memos. The memos will be evaluated and feedback provided to enable students to develop this important communication skill.

Cover letter / Resume Assignment: The ability to effectively market yourself is important. Students will get practice preparing a resume and cover letter for a relevant engineering position. Students will peer review each other's resumes and cover letters.

Mid-Term Exam (Take home) (10% of course grade)

There will be a take-home midterm examination.

Professionalism (15% of course grade)

Attendance: Attendance will be taken for each class. Students who have more than 3 unexcused absences will forfeit the 5% Attendance grade.

Confidential Peer Evaluations: The ability to provide an appropriate performance evaluation is an important skill associated with leading a team in a work environment. Students will be expected to complete written performance evaluations for their team members using a format provided by the course instructors. For the purposes of this course, the written performance evaluations will be submitted to the course instructors and will NOT be shared with your peers. These evaluations will be used to assess individual students' contributions to their team project. If there are concerns with a student's contributions, the instructors will meet with individuals to determine if this will ultimately affect a student's final grade (see comment under Professionalism above).

EVALUATION CRITERIA – All marking rubrics and assessment criteria will be provided to students in class and on UM Learn when the assignments are introduced in class.

Assignment Grading Times

The last date for Voluntary Withdrawal (VW) from the course is November 18, 2019. Students can expect to receive marks for several items prior to the VW date. Marks for the Design Proposals and the Design Package will not be available to students until the end of the term.

Assignment Extension and Late Submission Policy

Deadlines are a reality in the world of engineering. We expect assignments to be completed on time. Assignments submitted after the due date will be deducted 10% per day. Missed assignments will receive a grade of zero. All assignments must be submitted and workshops, seminars, and speed interviews must be attended to pass the course.