TRAILBLAZER ADVENTURER
INNOVATOR DEFENDER CHALLENGER
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Syllabus

BIOE 4412: **Design of Light-Frame Building Systems**

Winter 2022

University of Manitoba | Price Faculty of Engineering

COURSE DETAILS

Course Title & Number:	BIOE 4412, **Design of Light-Frame Building Systems**
Number of Credit Hours:	3
Class Times & Days of Week:	Tuesday and Thursdays 8:30 am - 9:45 am in person or video lectures posted weekly, tutorials as detailed in 'course schedule'(uploaded on UMLearn)
Location for Classes:	TBA or if online only, course will utilize a combination of asynchronous delivery for lecture materials (i.e. materials will be posted to review over a given schedule), and some synchronous elements such as live tutorials and term tests during scheduled time slots, timed assessments in line with class time.
Lab Time and Location:	Mondays 2:30 pm - 5:20 pm (Location: TBA) *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 possibly transition to in-person learning during the week of February 28 after the Winter Term Break.*

Instructor Contact Information

Instructor(s) Name:	**Farhoud Delijani**, Ph.D, P.Eng
Office Location:	E3-374, EITC/Or virtual
Office Hours or Availability:	By appointment
Email:	Farhoud.Delijani@umanitoba.ca
Contact:	I will be happy to help you with any questions you might have in person (if allowed), via email, phone, or on WebEx (video)

TA's Contact Information

Name and Email Addresses:	**Kenton McCorquodale-Bauer** - mccorquk@myumanitoba.ca
Office Hours or Availability:	By appointment (via WebEx)

Course Description

To provide students with an understanding of building system design from foundations to roofs. Students will gain experience in designing structures and built-environment of light-frame buildings.

Course Goals

By the end of the term BIOE 4412 students should be able to:

- Demonstrate an understanding of various light-frame structural systems and their application.
- Complete a set of calculations to evaluate building envelope performance related to heat and moisture management.
- Complete a set of calculations to determine environmental and structural loading on a building.
- Prepare a report that summarizes design concept to construction of a hands-on project. Report shall include a cost analysis.

Why is this course useful?

This course provides students with an understanding of structural design concepts as related to light-frame buildings combined with heating and ventilation fundamentals. An understanding of how structures manage loads is important to overall design. This course provides students with strategies to determine structural and environmental loads used in the design of light frame building systems.

How this course fits into the curriculum?

This course is intended for students in their latter years in Biosystems Engineering. This course will provide the student with the opportunity to gain an understanding of structural behaviour, and heating, ventilation, and energy efficient strategies for light-frame buildings. The relationship between various components within a building envelope is fundamental to how we as design engineers can integrate this knowledge into the design of light frame buildings.

Course Content and Scope

The following is a basic list of topics/lectures to be covered during this course. The order in which they have been presented does not, however, necessarily imply the order in which they will be encountered.

1. Introduction and course outline
2. Wood Species and Grading
3. Introduction to Building Systems
4. Load Flow in Structures

5. Flexural Design in Light Frame Buildings
6. Built Up Beam Design Light Frame Buildings
7. Design of Compressive Members in Light Frame Buildings
8. Insulation Strategies in Light Frame Buildings
9. Environmental Quality and Control in Buildings (By Dr. Qiang Zhang)
10. Energy Consumption and Sustainability
11. Alternative Building Materials
12. Earth Structures
13. Structural Insulated Panels
14. Green Building Overview

Where applicable computer design software may be used in conjunction with topics above. For example: HOT2000 for thermal performance, modeling tools for ventilation design.

Laboratory: two hours per week for one term

1. Hands-on lab: construction of small-scale structures (building)
2. Facility tours
3. Guest speakers

Textbook, Readings, and Course Materials

- Environment Control for Animals and Plants, with Computer Applications
- ASHRAE Handbook of Fundamentals
- ASABE Standards
- National Building Code of Canada
- Wood Design Manual – 2020, Canadian Wood Council

Course Technology (Remote version)

When taught remotely, this course relies on an online learning environment, so the expectation is that each student is able to access the internet in a reliable manner, be able to download and view video lectures and also be able to participate as needed in video conferences. Trials of all of these components will be provided for students to see if their connection is capable of handling these tasks.

Students are also expected, for the term project, assignments and term tests, to have access to either a good quality phone camera, or a computer drawing software, and a word processing software to prepare their reports and relevant diagrams.

Course Expectations and Policies

Attendance and Time Input:

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 the instructor beforehand through email. Also, while the importance of technology is recognized in our daily lives (laptops, tablets, cell phones, etc.) please exercise discretion. When we are engaged in class discussion and interaction, your full attention is requested. There is no technological substitute for the development of communication skills. In accordance with university policy all email communication for this course shall be conducted using your University of Manitoba email address only. Please ensure that you are monitoring your university account for this course.

In the asynchronous portions of this course (video lectures), students are strongly recommended to keep pace and watch the lectures at the prescribed schedule. The instructor for the course has put in significant effort to ensure that the pace is not more than a student would be used to in a regular term. Approximately 5 hours of lecture content and about an equivalent amount of time spent on homework per week is expected for the course. 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.

Class Communication:

You are required to obtain and use your University of Manitoba email account for all communication between yourself and the University. Please note that all communication must comply with 'the electronic communication with student' policy.

Expectations for Synchronous (Live) Remote Learning Activities:

- Please mute your microphone
- Please do not conduct side conversations, direct messaging, texting, or email with other students during the lecture
- Use the chat window to ask short questions or use the "raise your hand" icon for longer questions that are best asked out loud
- Tutorial may be recorded and posted on UM Learn after the class at the discretion of the instructor.

Academic Integrity:

Each student in this course is expected to abide by the University of Manitoba Academic Integrity principles. Always remember to reference the work of others that you have used. Also be advised that you are required to complete your assignments independently unless otherwise specified. If you are encouraged to work in a team, ensure that your project complies with the academic integrity regulations. You must complete the term tests and the final exam solely on your own. Inappropriate collaborative behavior and violation of other Academic Integrity principles will lead to serious disciplinary action. Visit the Academic Calendar, Student Advocacy, and Academic Integrity web pages for more information and support.

I. Group projects are subject to the rules of academic dishonesty;
II. Group members must ensure that a group project adheres to the principles of academic integrity;
III. All work should be completed independently unless otherwise specified.

Distributing Teaching Content:

No audio or video recording of lectures or presentations is allowed in any format, openly or surreptitiously, in whole or in part without permission. Course materials (in any format) are for the participant's private study and research. This also means that any provided pre-recorded content/notes/assignments are not to be distributed or shared as the instructors hold copyright over these materials.

Posting term test, exam, or assignment problems online for the purpose of seeking solutions from the so-called tutoring websites, is not allowed and is considered a serious form of plagiarism. Please note that your activities on such websites can be tracked and you may be disciplined accordingly.

Student Accessibility Services:

The University of Manitoba is committed to providing an accessible academic community. Students Accessibility Services (SAS) offers 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
Phone: (204) 474-7423
Email: Student_accessibility@umanitoba.ca

Using Copyrighted Material:

All students are required to respect copyright as per Canada's *Copyright Act*. We will use copyrighted content in this course. I have ensured that the content I use is appropriately acknowledged and is copied in accordance with copyright laws and University guidelines. Copyrighted works, including those created by me, are made available for private study and research and must not be distributed in any format without permission. Do not upload copyrighted works to a learning management system (such as UM Learn), or any website, unless an exception to the Copyright Act applies or written permission has been confirmed. For more information, see the University's Copyright Office website at http://umanitoba.ca/copyright/ or contact um_copyright@umanitoba.ca.

Course Evaluation Methods

Due to the nature of the course and its focus on developing skills, there will be a variety of evaluation methods to ensure that your progress throughout the course is noted and reflected in evaluations.

- **Design Assignments (10%)** Students will be expected to complete two design assignment that will provide experience with determining environmental loads, load flow through structures, building envelope design and basic member sizing.

- **Lab reports (10%)** Students will be expected to write lab reports that will show their understanding of the concepts discussed and studied during the lab periods (either in person or virtually).

- **Mid-Term Exam (15%)** Students will be evaluated on the concepts presented in class and will be based on assignments and in-class discussions.

- **Term Project (15%)** Students will work in design teams on a project related to light-frame building construction. The details of the project will be presented in class. Students will identify design solutions, complete a hands-on project and present their results to the class.

- **Final Exam (50%)** Students will be evaluated on the entire term, including labs and guest presentations. There will be an emphasis on material presented after the mid-term.

TITLE	VALUE
Assignments	10%
Lab Reports	10%
Mid Term Exam	15%
Term Project	15%
Final Examination	50%
Total	**100%**

- **Assignments**

A variety of assessments will be used, focusing on aspects covered in live or video lectures. See the course schedule posted on UM Learn for the assignment dates. The assignments will be posted on UMLearn on the specified date (7:00AM) and will be due one week later at 11:59PM of the 7th day. Students are expected to solve the problems, scan the hardcopy and submit a single pdf file of their work on the designated dropbox on UMLearn. Please keep the hard copy of all of your assignments till the end of the semester. Summative feedback (with some formative comments depending on the assessment) will be provided to you once the TA finishes marking your submissions.

Late assignments will be accepted up to 3 days following their due date. Late assignments will receive a mark deduction of 30, 40 and 50% **no exceptions**. The assignments must be completed individually: you are required to only consult with the TAs or course instructor if you need help. All sources of information (paper and/or electronic documents) used in the assignments must be properly referenced.

- **Midterm exam**

Midterm exam is a 120-minute exam and will take place on Monday March 21st during the lab period (2:30-5:30 PM). Midterm exam will cover material taught in lectures and included in lecture notes since the start of the term. Midterm exam cannot be made up, no exceptions. Missing the exam for excused documented medical, compassionate or travel reasons will entail

adding the weight of the exam to the weight of the final exam. Travel request should be pre-approved by the Dean's office or the instructor prior to any test. Only pens, pencils, rulers, erasers, and calculators are allowed in the exam. Personal devices such as IPods, IPads, cell phones and laptops are not allowed.

- **Term Project**

A single project covering a variety of topics discussed and covered throughout the term. Term project is mostly based on understanding and analyzing a relevant light frame design problem and justifying your analysis and decisions. Term project is a group activity which starts March 28th and ends on April 20th at midnight.

- **Final Examination**

If taught remotely, the final is an open book test (3 hours in length) that pulls from a broad base of knowledge. Students will be tested in a situation that does not place emphasis on memorization of content, but tests ability to apply knowledge taught in the course to solve problems.

If taught in person, the final exam will be a **2:00 hours-long** closed book exam. Only allowed documents, pens, pencils, rulers, erasers, and calculators are allowed in the exam. Personal devices such as IPods, IPads, cell phones and laptops are not allowed. **Please note: You must pass the final exam in order to pass the course.**

General requirements for assignments, term tests, term project and the final exam:

When taught remotely, all students must upload a copy of their handwritten/typed work on the designated dropbox on UMLearn. Please note that ***the only acceptable format is pdf***. Other file formats (such as Word files), low quality and hard-to-read submissions won't be marked and a zero will be recorded for the associated homework. The TAs have been advised not to ask for resubmission of the improper submissions. Make sure you have a pdf maker app installed on your phone. Contact us at the beginning of the term, if you do not own a smart phone or don't know how to use a pdf maker app (the one I personally use is called Genius Scan – PDF scanner and it works really well).

Timed Assessment Policy

During any timed assessments (term tests, exams), the course instructor will be available live via WebEx and email. If a submission (due to a technical issue) cannot be made, a student will be asked to either provide an oral or email submission of their work. All students are expected to keep a hard copy of their work during and after an assessment until the marks are released. A student can be assigned a grade of zero if the assessment submission is illegible.

Any timed assessments (term tests, exams) submitted late is subject to a late submission penalty of 1% per minute over the due date plus the grace period. As an example, on a 120-minute test, if a submission is submitted at 136 minutes (120+15+1), after the start time there will be a 1% reduction

applied to the overall grade due to the one minute delay. No timed assignment will be accepted after 10 minute late mark.

Grade Breakdowns

The typical grade breakdown for this course is shown below, although this is subject to modification at the discretion of the instructor or the board of examiners.

LETTER GRADE	PERCENTAGE BRACKET
A+	95-100
A	86-94.99
B+	80-85.99
B	73-79.99
C+	65-72.99
C	60-64.99
D	50-59.99
F	Less than 49.99

Voluntary Withdrawal

Students who did not drop the course by the deadline set by the registrar's office will still be assigned a final grade. Withdrawal courses will be recorded on your official transcript, please refer to the Registrar's Office web page for more information.

Assignment Extension and Late Submission Policy

All items submitted for evaluation are due at times specified on the items themselves, unless otherwise explicitly told. It is understandable that sometimes situations arise that cause you to be unable to hand in an assignment on time. Late submissions will be accepted but unless an affordance is made (on a case by case basis), any late design project or assignment will be evaluated at a full letter grade lower per day per assignment. Extensions may be granted only if arranged in advance, and it is advisable to submit 'quality' work even if late. It is not the intention of the course to evaluate students on unfinished work.

Supplemental Course Information

All engineering courses 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.

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 Teamwork:** 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.

Expected Competency Level

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

Graduate Attribute Allocation for BIOE4412

Assessment Element	Value	Attributes Covered	Indicators Assessed	Level Note 1
Mid Term Exam	15%	Problem Analysis Knowledge Base	PA.3 Analyzes and solves complex engineering problems KB.4 Specialized Engineering science	D
Assignments and lab reports	10% (x2)	Design Communication Skills Engineering Tools Knowledge Base	DE.2 Uses an appropriate design process DE.3 Develops possible solutions CS.2 Produces appropriate engineering documents ET.1 Uses tools to complete engineering activities KB.3 Fundamental Engineering science KB.4 Specialized Engineering science	D
Project	15%	Design Communication Skills Individual & Team	DE.1 Understands open-ended engineering design DE.2 Uses an appropriate design process DE.3 Develops possible solutions CS.1 Applies principles for effective engineering communication CS.3 Delivers effective technical presentations IT.1 Participates in group activities IT.2 Contributes equitably to group work IT.3 Exhibits appropriate interpersonal skills	D
Final Exam	50%	Knowledge Base Design	KB.3 Fundamental Engineering science KB.4 Specialized Engineering science DE.2 Use appropriate design process	D

Students - UM COVID-19

The University of Manitoba (the "UM") is committed to maintaining a safe learning environment for all students, faculty, and staff. Should campus operations change because of health concerns related to the COVID-19 pandemic or other campus-wide emergency, it is possible that this course will move to a fully remote delivery format. Should the instructor be required to stay at home for an extended period and an alternate instructor not be available, the course may move temporarily to a remote delivery format. In that instance, you may be provided with an asynchronous option to minimize the impact the change may have on your schedule.

PPE and Mask Wearing

In a face-to-face environment, our commitment to safety requires students to observe all physical distancing (2m) and personal protective equipment (PPE) guidelines set by the University (https://umanitoba.ca/coronavirus)

While on campus and in class, you must wear PPE (Personal Protective Equipment) as stipulated in current University policies, procedures, and guidelines. Students who fail to comply are subject to disciplinary action in accordance with the Student Discipline Bylaw and the Non-Academic Misconduct and Concerning Behaviour Procedure.
Medical-grade 3-ply masks are available at many locations on campus, including specific classroom locations, designated by your unit, the Elizabeth Dafoe Library (Fort Garry Campus) and the Brodie Centre main doors (Bannatyne Campus). Additional PPE, if necessary for a specific learning environment, will be provided to you by the teaching unit.
If you do not follow masking and other requirements you will be asked to leave the learning space and may only return to the class already in progress when you have complied with these requirements. Repeated issues will result in disciplinary action as previously noted.

Students should not eat or drink during class time.

Illness

Remember: **STAY HOME IF YOU HAVE SYMPTOMS OR ARE ILL.** If you become sick or are required to self-isolate you should notify your instructor by email so you can develop a plan to complete the course learning outcomes while you are absent.
If you have symptoms, do not come to campus or any UM facilities. Complete the self assessment on the Manitoba Public Health site and follow the guidelines, which may include booking a COVID-19 test.

What to do if you become ill while at UM:

1. Leave the classroom, lab or workspace immediately. Continue to wear your mask while leaving the premises and/or while waiting for transportation.
2. Perform hand hygiene (soap and water or hand sanitizer) and avoid contact with others, and

minimize contact with the physical environment.

3. Once at home, complete the MB self-assessment and follow the directions that are provided.
4. Inform your supervisor(s), instructor(s) or, if in residence, the appropriate individual.
5. You must remain off campus and all UM facilities until cleared to return in accordance with self-assessment, testing results, or MB Health requirements.

Recommended transportation options (in order):

1. Drive yourself home.
2. Pick-up by family or friend – remember to keep your mask on and to distance as much as possible, and where possible, open a window to improve ventilation.
3. Pickup by taxi/Uber:
    - Remain masked and perform hand hygiene before entering the vehicle.
        - Avoid touching the inside of the vehicle
        - Keep your mask on for the duration of the ride
        - Where possible, open a window to improve ventilation.
4. Winnipeg Transit buses - Winnipeg Transit has indicated that individuals that are ill **must not use Transit.**