Price Faculty of Engineering
Department of Biosystems Engineering

BIOE 4412: Design of Light-Frame Building Systems
Winter 2024

Course Outline

Instructor
Dr. Farhoud Delijani, P.Eng.
(he/him/his)
E3–374 EITC
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Student Hours
- Open door policy
- Individual assistance is always available by appointment – stop by!

Teaching Assistant
- Patrick Seale
  sealep@myumanitoba.ca

Lecture Location
- EITC E2-351
  Tues 8:30 - 9:45 AM
  Thurs 8:30 - 9:45 AM

Lab Location
- 102 Dafoe Rd., Agriculture/Civil building, Grain Storage Lab
  Mondays 2:30-5:25 PM

Contact Hours
- 4 credit hours
- Lectures:
  37 hours
- Laboratories:
  24 hours

Prerequisites:

BIOE 2110 and BIOE 3590

Course Website:
http://umanitoba.ca/umlearn

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.

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.

Topics covered
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

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

Reference materials
- National Building Code of Canada (latest edition), National Research Council of Canada, Ottawa
- Engineering Design in Wood (Limit States Design), CAN-CSA O86-09 Canadian Standards Association
- Wood Reference Handbook, Canadian Wood Council
- Environment Control for Animals and Plants, with Computer Applications
- ASHRAE Handbook of Fundamentals
- ASABE Standards

Accreditation Details

Accreditation Units

- Mathematics: 0%
- Natural Science: 0%
- Complementary Studies: 0%
- Engineering Science: 75%
- Engineering Design: 25%

Graduate 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
EE: Ethics and equity
EP: Economics and project management
LL: Life-long learning

Competency Levels

1 - Knowledge (Able to recall information)
2 - Comprehension (Ability to rephrase information)
3 - Application (Ability to apply knowledge in a new situation)
4 - Analysis (Able to break problem into its components and establish relationships.)
5 - Synthesis (Able to combine separate elements into a whole)
6 - Evaluation (Able to judge the worth of something)

Grading Scale

Letter	Mark
Letter	Mark
A+	92-100
A	85-91.99
B+	78-84.99
B	72-77.99
C+	66-71.99
C	60-65.99
D	50-59.99

Learning Outcomes

By the end of this course, you will be able to:

No.	Learning Outcome	Transferable Skill
1	Demonstrate partial understanding of the Canadian standard for wood design CSA O86 for the design of wood structures.	Design
2	Demonstrate an understanding of various light-frame structural systems and their application.	Design
3	Complete a set of calculations to determine environmental and structural loading on a building.	Design
4	Complete a set of calculations to evaluate building envelope performance related to heat and moisture management.	Design
5	Prepare a report that summarizes design concept to construction of a hands-on project. Report shall include a cost analysis as well.	Teamwork, Professionalism, design, written communication

Expected Competency Levels

Outcome	KB	PA	IN	DE	ET	IT	CS	PR	IE	EE	EP	LL
1				3								
2				3								
3	4	3		4								
4	4	3		4								
5			3	4		5	5					

CEAB Graduate Attributes Assessed

KB.4 - Recalls and defines, and/or comprehends and applies, first principles and concepts in specialized engineering science.
PA.3 - Analyzes and solves complex engineering problems.
IN.1 - Gathers information (literature review, measurements, experiments, laboratory exercises) and analyzes data.
DE.2 - Uses an appropriate design process.
IT.1 - Participates in group activities and decision-making.
IT.2 - Contributes equitably to completion of group work.
IT.4 - Develops or demonstrates leadership skills.
CS.1 - Understands, interprets and/or applies principles for effective engineering communication (oral, written and graphical).
CS.2 - Designs and produces appropriate engineering documents (i.e., research reports, engineering reports, design documents, graphics).
CS.3 - Delivers effective technical presentations.

Important Dates

- **Winter term break**
  Feb. 19 - 23, 2024
- **Last Day of Classes**
  Apr. 10, 2024
- **Examination and test dates**
  Apr. 12, 2024 - Apr. 26, 2024

Traditional Territories Acknowledgement

The University of Manitoba campuses are located on the original lands of the Anishinaabeg, Cree, Oji-Cree, Dakota, and Dene peoples, and on the homeland of the Métis Nation.

We respect the Treaties that were made on these territories, we acknowledge the harms and mistakes of the past, and we dedicate ourselves to move forward in partnership with Indigenous communities in a spirit of reconciliation and collaboration.

Evaluation

Component	Value (%)	Assessor	Method of Feedback*	Learning Outcomes Evaluated	I/T**
Assignments (x2)	10	TA	S	1, 2, 4, 5	I
Lab Reports	10	TA	S	1-4	I/T
Mid-term exam	20	Instructor	F, S	1-4	I
Term Project	15	TA/Instructor	S	5	T
Final Examination	45	Instructor	F, S	1-5	I

* Method of Feedback: **F** - Formative (written comments and/or oral discussion), **S** - summative (numerical grade)
** I/T: **I** – Individual effort, **T** – Team effort

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the *General Academic Regulations* on *Academic Integrity*, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty.

Requirements/Regulations

- No programmable devices or systems (such as calculators, PDAs, iPods, iPads, cell phones, smart watches, wireless communication, or data storage devices) are allowed in examinations unless approved by the course instructor.
- All email communication must conform to the Communicating with Students university policy.

Communicating with Students

- Attending lectures and laboratories is essential for the successful completion of this course.
- Self-declaration forms may be completed for missed tests, exams, or assignments during short-term absences (≤72 hours) for extenuating circumstances. Students don't need to share personal information about their situation beyond declaring the nature of the extenuating circumstance on the self-declaration form.

Self-Declaration Form for Brief or Temporary Absence

- This form cannot be used for planned absences like vacations. It is also not to be used for longer-term absences, or ongoing circumstances (e.g., Authorized Withdrawals, Leaves of Absence, or other accommodations), which will still require additional documentation.

Self-Declaration Policy for Brief or Temporary Absences

- It is the responsibility of each student to contact the instructor in a timely manner if he or she is uncertain about his or her standing in the course and about his or her potential for receiving a failing grade. Students should familiarize themselves with the University's *General Academic Regulations*, as well as Section 3 of the Faculty of Engineering *Academic Regulations* dealing with incomplete term work, deferred examinations, attendance, and withdrawal.

General Academic Regulations
Engineering Academic Regulations

- Students should be aware that they have access to an extensive range of resources and support organizations. These include Academic Resources, Counselling, Advocacy and Accessibility Offices as well as documentation of key University policies e.g. Academic Integrity, Respectful Behaviour, Examinations and related matters.

Supplemental Resources

Retention of Student Work

Students are advised that copies of their work submitted in completing course requirements (i.e. assignments, laboratory reports, project reports, test papers, examination papers, etc.) may be retained by the instructor and/or the department for the purpose of student

assessment and grading, and to support the ongoing accreditation of each Engineering program. This material shall be handled in accordance with the University's *Intellectual Property Policy* and the protection of privacy provisions of *The Freedom of Information and Protection of Privacy Act (Manitoba)*. Students who do not wish to have their work retained must inform the Head of Department, in writing, at their earliest opportunity.

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