Western University - Faculty of Engineering  
Department of Civil and Environmental Engineering

**ES1022B – Engineering Statics – Course Outline – Intersession 2021**

This course introduces the principles of static equilibrium. The general objectives are for the student to become able to:

- identify, formulate, analyse and solve engineering problems using the principles of static equilibrium.
- apply this knowledge to the analysis of two dimensional trusses, frames and machines, internal forces within a beam and impending motion of rigid bodies due to the effects of friction;
- apply calculus principles to determine the centroid of lines, areas and volumes, and the moment of inertia of an area;
- improve communication skills by documenting problem solutions in coherent and legible engineering calculations;

**Calendar Copy:**
Analysis of forces on structures and machines, including addition and resolution of forces and moments in two and three-dimensions. The application of the principles of equilibrium. Topics: trusses; frames; friction; and centroids. (0.5 course)

**Contact Hours:**
Daily, excluding Wednesdays, from 1:30-5:30 pm each week, for three weeks from May 31-June 18, 2021; (recommended additional personal study - three hours/day).

**Prerequisites:** None

**Corequisites:** None

**Antirequisite:** None

**Note:** It is the student's responsibility to ensure that all Prerequisite and Corequisite conditions are met or that special permission to waive these requirements has been granted by the Faculty. It is also the student's responsibility to ensure that they have not taken a course listed as an Antirequisite. The student may be dropped from the course or not given credit for the course towards their degree if they violate the Prerequisite, Corequisite or Antirequisite conditions.

**Instructor:**
Dr Craig Miller, ACEB 4480, email: cmiller@eng.uwo.ca. **Administrative Support:** SEB 3005
Textbook:


Prepared class notes should be brought to each class, and may be downloaded from the course OWL site at [https://owl.uwo.ca/portal](https://owl.uwo.ca/portal).

Computing:

The course website can be found on OWL at [https://owl.uwo.ca/portal](https://owl.uwo.ca/portal), and should be checked on a regular basis for class notes, notices about assignments, quizzes, exams, and grades. Tutorial assignments will require the use of the *MasteringEngineering* online tutorial and homework system that can be accessed at [http://www.pearson.com/mastering](http://www.pearson.com/mastering). Registration on this website requires the use of an access code that can be purchased either packaged with the text book or separately. Students who have previously purchased a *MasteringEngineering* access code for the 2020-21 undergraduate academic year will not be required to purchase a new access code, as their existing access code will still be valid for 12 months from the date of their first registration on *MasteringEngineering*.

Students are required to use portable computing devices (laptops or tablets) capable of accessing the *MasteringEngineering* website during tutorials.

Units:

Both SI and US Customary units will be used in lectures and examinations.

Specific Learning Objectives: [GA Indicator]

1. Statics of Particles
   a) Apply parallelogram law of vector addition to forces [KB1, KB2]
   b) Resolve forces in rectangular, cylindrical and spherical coordinates [KB1, KB2]
   c) Apply scalar and vector methods to calculate resultant of concurrent forces [KB1, KB2]
   d) Analyse frictionless system of pulleys [KB1, PA2]
   e) Calculate forces in elastic springs [KB1]
   f) Solve equilibrium problems involving concurrent forces in 2D and 3D [KB3, PA2]
2. Statics of Rigid Bodies
   a) Calculate the moment of a force about a point and about an axis [KB2, PA2]
   b) Determine the resultant force/couple system at a given point in 2D and 3D [KB2, PA2]
   c) Determine the resultant of a coplanar system of forces and couples [KB3, PA2]
   d) Master procedure for drawing free-body diagrams [PA2]
   e) Solve equilibrium problems in 2D with concentrated and distributed loading [KB3, PA2]
3. Trusses
   a) Calculate tension and compression forces in members using the method of joints [KB3, PA2]
   b) Calculate tension and compression forces in members using the method of sections [KB3, PA2]
   c) Identify the zero-force members [KB3, PA2]
4. Frames and Machines
   a) Recognize internal and external forces on pin-connected members [KB3, PA2]
   b) Recognize two and three-force members [KB3]
   c) Draw free-body diagrams of various components of frames and machines [KB3, PA2]
   d) Solve equilibrium problems involving multi-component frames and machines [KB3, PA2]
5. **Internal Forces**
   a) Calculate internal forces in members using the method of sections [KB3, PA2]
   b) Draw shear force and bending moment diagrams [KB3, PA2]

6. **Friction**
   a) Implement the theory of dry friction and concept of impending motion in rigid body analysis [KB2]
   b) Solve equilibrium problems involving wedges [KB3, PA2]

7. **Centroid and Centre of Gravity**
   a) Apply calculus principles to determine the centroid of lines, areas and volumes [KB1]
   b) Locate centroid and centre of gravity of composite bodies [KB3, PA2]

8. **Moment of Inertia**
   a) Apply calculus principles to determine the moment of inertia of an area [KB1]
   b) Calculate the moment of inertia of composite bodies using the parallel axis theorem [KB3, PA2]

Instructors may expand on material presented in the course as appropriate.

**General Learning Objectives:**

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**Evaluation:**

The final course mark will be determined as follows:

Online *MasteringEngineering* pre-class quizzes: 10%

Online *MasteringEngineering* homework assignments: 30%

End of module quizzes: 30%

Final assessment: 30%

Total: 100%

**Note:** (a) Students who have failed this course previously must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted.

(b) Should any of the quizzes conflict with a religious holiday that a student wishes to observe, the student must inform the instructor of the conflict no later than two weeks before the scheduled test. For further information on accommodations for religious holidays see [http://www.uwo.ca/univsec/handbook/appeals/accommodation_religious.pdf](http://www.uwo.ca/univsec/handbook/appeals/accommodation_religious.pdf)
1. Quizzes and Final Assessment:
A total of six 60-minute end of module quizzes will be given using MasteringEngineering over the three weeks of the course, during the last hour of the scheduled class time (4:30 – 5:30 pm), on the dates shown below:

- End of module quiz #1 Friday, June 4, 2021
- End of module quiz #2 Tuesday, June 8, 2021
- End of module quiz #3 Thursday, June 10, 2021
- End of module quiz #4 Monday, June 14, 2021
- End of module quiz #5 Thursday, June 17, 2021
- End of module quiz #6 Friday, June 18, 2021

The final assessment will be scheduled by the Office of the Registrar, and will take place during the Intersession final exam period on either Monday, June 21, 2021 or Tuesday, June 22, 2021. The format of the final assessment will be communicated to students before the start of the third week of the course on Monday, June 14, 2021.

2. Online Pre-class Quizzes and Homework Assignments
Daily pre-class quizzes and homework assignments will be given using the MasteringEngineering online tutorial and homework system. Late pre-class quizzes and homework assignments will receive a grade based on the questions completely answered by the student at the time that the quiz or assignment is due. Extensions are to be negotiated with the course instructor, not the teaching assistants.

3. Use of English
In accordance with Senate and Faculty Policy, students may be penalised up to 10% of the marks on all assignments, tests, and examinations for the improper use of English. Additionally, poorly written work with the exception of the final examination may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**Cheating:**
University policy states that cheating is a scholastic offence. The commission of a scholastic offence is attended by academic penalties that might include expulsion from the program. If you are caught cheating, there will be no second warning. For more information on scholastic offenses, please see:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf

**Attendance:**
Any student who, in the opinion of the instructor, has not engaged sufficiently in class, laboratory, or tutorial periods will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular final examination in the course.
**Accommodation:**

Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: [Academic Accommodation for Students with Disabilities](#).

**Academic Consideration for Student Absence:**

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student’s final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation. Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see [Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs](#) and for the Student Medical Certificate (SMC), see: [https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

**Religious Accommodation:**

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the [Western Multicultural Calendar](#).

**Use of Recordings:**

All of the remote learning sessions for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings. Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor.
Conduct:
Some components of this course will involve online interactions. To ensure the best experience for both you and your classmates, please honour the following rules of etiquette:

- please “arrive” to class on time
- please use your computer and/or laptop if possible (as opposed to a cell phone or tablet)
- ensure that you are in a private location to protect the confidentiality of discussions in the event that a class discussion deals with sensitive or personal material
- to minimize background noise, kindly mute your microphone for the entire class until you are invited to speak, unless directed otherwise
- [suggested for classes larger than 30 students] In order to give us optimum bandwidth and web quality, please turn off your video camera for the entire class unless you are invited to speak
- [suggested for cases where video is used] please be prepared to turn your video camera off at the instructor’s request if the internet connection becomes unstable
- unless invited by your instructor, do not share your screen in the meeting

The course instructor will act as moderator for the class and will deal with any questions from participants. To participate please consider the following:

- if you wish to speak, use the “raise hand” function and wait for the instructor to acknowledge you before beginning your comment or question
- remember to unmute your microphone and turn on your video camera before speaking
- self-identify when speaking.
- remember to mute your mic and turn off your video camera after speaking (unless directed otherwise)

General considerations of “netiquette”:

- Keep in mind the different cultural and linguistic backgrounds of the students in the course.
- Be courteous toward the instructor, your colleagues, and authors whose work you are discussing.
- Be respectful of the diversity of viewpoints that you will encounter in the class and in your readings. The exchange of diverse ideas and opinions is part of the scholarly environment. “Flaming” is never appropriate.
- Be professional and scholarly in all online postings. Cite the ideas of others appropriately.

Note that disruptive behaviour of any type during online classes, including inappropriate use of the chat function, is unacceptable. Students found guilty of Zoom-bombing a class or of other serious online offenses may be subject to disciplinary measures under the Code of Student Conduct: https://www.uwo.ca/univsec/pdf/board/code.pdf

Notice:
Students are responsible for regularly checking their email, course website (https://owl.uwo.ca/portal) and notices posted outside the Civil and Environmental Engineering Department Office

Consultation:
Students are encouraged to discuss problems with their teaching assistant and/or the Instructor in tutorial sessions. Office hours will be arranged for the students to meet with the Instructor and teaching assistants. Other individual consultation can be arranged by appointment with the instructor.
Course Breakdown:
50% Natural Science; 50% Engineering Science.
AUs: Total 48; Natural Science 24; Engineering Science 24.

The document “INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED” is part of this course outline.