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; and
- 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)

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.

Contact Hours:
2 lecture hours/week:
Lectures will be delivered asynchronously through pre-recorded videos posted to course OWL site. Lecture videos will be organized in 20-30 min chunks which students should review on a weekly basis. The scheduled lecture time will be used as a “help session” where students are strongly encouraged to attend to ask questions or for clarification on posted lecture material. Attending lectures is not mandatory but students seeking assistance are encouraged to join their lecture section (Section 001, 002 or 003).

2 tutorial hours every other week for 10 weeks each term;
A 2-hour tutorial session (Part (A) of assignments) scheduled every other week as per the course timetable will be delivered synchronously through the MasteringEngineering online platform. A zoom meeting
session will be held during each tutorial time for students seeking assistance while working on the assignments. The link to the zoom meeting will be posted on a weekly basis to the course OWL. Attending the zoom meeting during the 2-hour tutorial session is not mandatory.

A take-home assignment (Part (B) of assignments) will be delivered asynchronously every other week through the MasteringEngineering online platform. Course Teaching Assistants (TAs) will hold weekly zoom meetings for students seeking help with Part (B) of the assignment. The link to the zoom meeting and date/time of these help sessions will be posted weekly on course OWL.

**Note:** Review of lecture material and self-study should take approximately 6 hours per week.

**Instructors:**

**Fall Term**

Dr. Aham Adawi, P.Eng. : (section 001), office: SEB 20, email: aadawi2@uwo.ca

Dr. Ayman El Ansary, P.Eng. : (section 002), office: SEB 3090, email: aelansa@uwo.ca

Dr. Ayan Sadhu, P.Eng. : (section 003), office: SEB 3020, email: asadhu@uwo.ca

**Administrative Support:** Sandra McKay, SEB 3005

**Winter Term**

Dr. Aham Adawi, P.Eng. : (section 001), office: SEB 20, email: aadawi2@uwo.ca

Dr. Ayman El Ansary, P.Eng. : (section 002), office: SEB 3090, email: aelansa@uwo.ca

Dr. Ayan Sadhu, P.Eng. : (section 003), office: SEB 3020, email: asadhu@uwo.ca

**Administrative Support:** Sandra McKay, SEB 3005

**Textbook:**


Students will be advised on class notes by individual instructors.

**Computing:**

The course website can be found on OWL at http://owl.uwo.ca/ and should be checked on a regular basis for class notes, pre-recorded lecture videos, participation activities, notices about assignments, quizzes, midterms, and grades. Tutorial assignments, participation activities, quizzes, midterm, and final exams will require the use of the MasteringEngineering online platform that can be accessed at http://www.masteringengineering.com/. Registration on this website requires the use of an access code that can be purchased either packaged with the textbook or separately. An info session will be held during the first week of the Fall 2020 term to provide students with purchase options and instructions on how to use the MasteringEngineering platform.

Students are required to use computing devices (desktops, laptops, or tablets) capable of accessing the MasteringEngineering website during tutorials, quizzes, midterm, and Final Exam.
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) Analyze 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]

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

General Learning Objectives

<table>
<thead>
<tr>
<th>E = Evaluate, T = Teach, I = Introduce</th>
<th>Knowledge Base</th>
<th>Engineering Tools</th>
<th>Impact on Society</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Analysis</td>
<td>E</td>
<td>E</td>
<td>Ethics and Equity</td>
</tr>
<tr>
<td>Investigation</td>
<td>I</td>
<td>I</td>
<td>Economics and Project Management</td>
</tr>
<tr>
<td>Design</td>
<td></td>
<td>Professionalism</td>
<td>Life-Long Learning</td>
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</tbody>
</table>
Evaluation:
The final course mark will be determined as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Participation</td>
<td>10%</td>
</tr>
<tr>
<td>MasteringEngineering assignments</td>
<td>10%</td>
</tr>
<tr>
<td>Quizzes</td>
<td>20%</td>
</tr>
<tr>
<td>Midterm exam</td>
<td>25%</td>
</tr>
<tr>
<td>Final exam</td>
<td>35%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Note:  
(a) Students must pass the final examination to pass this course. Students who fail the final examination will be assigned the aggregate mark, as determined above, or 48%, whichever is less.
(b) 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.
(c) 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

1. Quizzes and Examinations:
Four quizzes will be given during tutorials throughout the year (two per term). The dates and times for these quizzes will be dependent on which tutorial section a student is enrolled in. Quizzes dates/times will be posted to the calendar on the course OWL site at the beginning of each term. A two-hour midterm examination will take place during the December 2020 final examination period, while a three-hour final examination will take place during the April 2021 final examination period. All quizzes, and the midterm and final examinations will be conducted synchronously through the MasteringEngineering online platform. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service.

2. MasteringEngineering Assignments
Six coursework related assignments will be given throughout the year using the MasteringEngineering online tutorial and homework system (three per term). Late assignments will receive a grade based on the questions completely answered by the student at the time that the assignment is due. Extensions are to be negotiated with the course instructor, not the teaching assistants.

3. Participation
Participation marks will be assigned based on students’ activities in completing both OWL Forums and LearningCatalytics, which is a classroom learning tool packaged with the MasteringEngineering online platform. Students will be informed on a weekly basis when such participation activities will be made available.
4. 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:
http://www.uwo.ca/univsec/handbook/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.

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:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf

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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.

**Notice:**

All quizzes, and the midterm and final examinations will be conducted synchronously through the MasteringEngineering online platform. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service.

Students are responsible for regularly checking their email, course website (https://owl.uwo.ca).

**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.

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