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

ES1022y – Engineering Statics - Course Outline 2021/22

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; 2 tutorial hours every other week for 10 weeks each term - this is equivalent to 2 lecture hours/week and 1 tutorial hour/week over one term.
Attendance at the tutorial session is mandatory

A 2-hour tutorial session (Part (A) of assignments) scheduled every other week as per the course timetable will be delivered in-person (synchronously) through the MasteringEngineering platform.
A take-home assignment (Part (B) of assignments) will be delivered asynchronously every other week through the MasteringEngineering 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.

“In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor”

Instructors:

Fall Term
Dr. Ayman El Ansary, P.Eng.       : (section 001), office: SEB 3090, email: aelansa@uwo.ca
Dr. Aiham Adawi, P.Eng.            : (section 002), office: SEB 20, email: aadawi2@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. Ayman El Ansary, P.Eng.       : (section 001), office: SEB 3090, email: aelansa@uwo.ca
Dr. Aiham Adawi, P.Eng.            : (section 002), office: SEB 20, email: aadawi2@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/](http://owl.uwo.ca/), and should be checked on a regular basis for class notes, participation activities, notices about assignments, quizzes, midterms, and grades. Tutorial assignments, participation activities, quizzes, midterm, and final exam will require the use of the *MasteringEngineering* platform that can be accessed at [http://www.masteringengineering.com/](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 2021 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) 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 [PA1]
   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 [PA1]
   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
E = Evaluate, T = Teach, I = Introduce

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Evaluation:
The final course mark will be determined as follows:

- Participation (Learning Catalytics and OWL Forums): 10%
- MasteringEngineering assignments: 10%
- Quizzes: 20%
- Midterm exam: 25%
- Final exam: 35%
- Total: 100%

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](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 2021 final examination period, while a three-hour final examination will take place during the April 2022 final examination period. **All quizzes, and the midterm and final examinations will be conducted through the MasteringEngineering platform.** Completion of this course will require you to have 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 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
In-class participation marks will be assigned based on students’ activities in completing 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.

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:
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.

Conduct:
Students are expected to arrive at lectures on time, and to conduct themselves during class in a professional and respectful manner that is not disruptive to others. Late comers may be asked to wait outside the classroom until being invited in by the instructor. Please turn off your cell phone before coming to a class, tutorial, quiz or exam.

On the premises of the University or at a University-sponsored program, students must abide by the Student Code of Conduct: http://www.uwo.ca/univsec/board/code.pdf

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

Students are responsible for regularly checking their email, and 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.