

COURSE INFORMATION

Course Name: Statics & Mechanics of Materials

Course Code: CIV ENG 2P04

Session Offered: Fall 2023

Calendar Description: Principles of statics as applied to rigid bodies. Internal forces, shear and bending moment diagrams, Stress and strain, elastic behaviour of simple members under axial force, torsion, bending and traverse shear, Principal stresses.

Pre-Requisites: Physics 1D03 and registration in Level II or above of Civil Engineering program

Instructor: Hisseine Ousmane
Email: hisseino@mcmaster.ca

Phone: (905) 525-9140 x 20189
Office Hours: Mon. 10:00 – 11:00 AM

Teaching Assistants:

Yara Soliman (solimy1@mcmaster.ca); Ahmed Fageeri (fageeria@mcmaster.ca);
 Mohamad Tarabin (tarabinm@mcmaster.ca); Zayaan Khan (khantz51@mcmaster.ca)

Class Schedule Days: Lectures: Mon., Wed., Thur. Time: 1:30 PM – 2:20 PM
Tutorial:

T01: Fr. Time: 2:30 AM – 4:20 PM
 T02: Fr. Time: 2:30 AM – 4:20 AM
 T03: Fr. Time: 2:30 AM – 4:20 AM
 T04: Fr. Time: 2:30 AM – 4:20 AM

Accommodation: In keeping with university policy (see Section 7), if you have unique circumstances, please feel free to reach out so that accommodation may be arranged to help you achieve your learning goals for this course.

Textbook: [R.C. Hibbeler, Statics and Mechanics of Materials in SI Units, 5th edition, Pearson](#)

1. COURSE OBJECTIVES

This is the first course in structural mechanics and is aimed at developing your understanding of basic skills in statics and mechanics of materials, also referred to as strength of materials. The course comprises two parts:

- The first part focuses on fundamentals of statics, including equivalent force systems, equilibrium in two- and three- dimensions, internal forces, truss solution techniques, and shear and bending moment diagrams.
- The second part focuses on mechanics of materials, including fundamentals of stress and strain, response of members to axial, torsion, bending, transverse shear, and stress transformations.

A pictorial representation of the course content is presented below. The specific skills you will develop upon completing this course are presented in section 2.

Statics [Weeks 1 to 5]

Mechanics of Materials [Weeks 6 to 13]

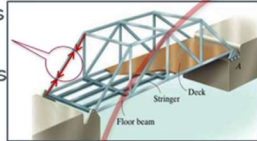
CH: 6

Centre of Gravity;
Centroids &
Moment of inertia



CH: 5

Structural Analysis
Internal Forces
Analysis of trusses



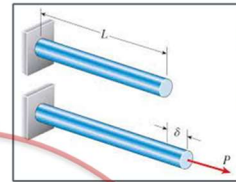
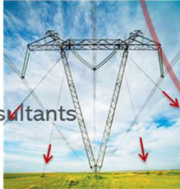
CH: 4

Equilibrium of rigid bodies
Static (in) determinacy
Stability
Free body diagrams
Particle equilibrium



CH: 1,2,3

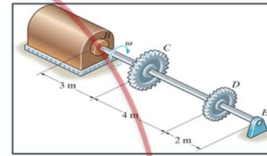
Force Vectors
Position Vectors
Force System Resultants
3D Force vectors



CH: 7 Stress & Strain

CH: 8 Mechanical properties of
Materials

CH: 9 Axial Load

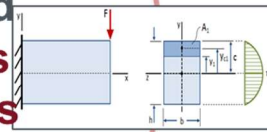


CH: 10

Torsion

- Shear stress & strain;
- Torsion of solid and hollow circular sections

Statics and Mechanics of Materials



CH: 11 Bending

CH: 12 Transverse shear



CH: 13 Combined loading

CH: 14

- Stress transformation
- Principal stresses
 - Mohr's circle representation

Pictorial course outline

2. COURSE LEARNING OUTCOMES (CLOs)

Successfully completing this course increases your knowledge base for engineering so that you will be able to:

- 1) Recall Newton's Laws of Motion and the principle and use of SI system of units in engineering problems [CEAB Indicator 1.2]
- 2) Draw and label free body diagrams of physical problems [1.2]
- 3) Apply the equations of static equilibrium to calculate resultant and reaction force vectors [1.1, 1.2]
- 4) Distinguish statical determinacy and indeterminacy [3.1]
- 5) Calculate and express the forces within members of a statically determinate truss under load [1.2]
- 6) Calculate and express the forces within a bending member under load [1.1, 1.2]
- 7) Determine the moment of inertia of simple and composite areas [1.2]
- 8) Calculate the stresses, strains, and deformations within members under axial load, shear, flexure, and torsion [1.1, 1.2]
- 9) Calculate the deformations and forces within simple statically indeterminate structures [1.2, 3.1]
- 10) Transform stresses on elements of plane stress and define principal stresses and orientation at a point [1.2, 3.1]

Graduate Attributes and CEAB Indicators

Through this course, you will develop in the following graduate attributes and indicators:

1. A knowledge base for engineering (Demonstrated competence in university level mathematics, natural sciences, engineering fundamentals, and specialized engineering knowledge appropriate to the program.)
 - 1.1. Competence in Mathematics
 - 1.2. Competence in Natural Sciences
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.)
 - 3.1 Able to recognize and discuss applicable theory knowledge base.

3. COURSE SPECIFIC POLICIES

For an enriching learning experience, students are expected to comply with the following guidelines:

- **Punctuality:** Students are expected to be on time. If occasionally delays occurred, please join the class while minimizing the class.
- **In-class follow-up:** You may notice that some course notes pertaining to important concepts (e.g., diagrams, tables, figures, etc.) are **incomplete**. This is intentional so that students can complete their own notes in-class. Course notes will be available online ahead of class. Therefore, students are expected to have the notes (printed or soft) for personalized note taking. Students are expected to actively participate in every class.
- **Courtesy:** Each student is responsible of maintaining an enriching learning ecosystem. Cellphone should be on either airplane mode or on silence. You are also expected to communicate (orally and in written) politely. **Offensive language or gestures are unacceptable.**
- All lectures and tutorials are mandatory.
- CIVENG 2P04 students must attend Registrar's Office assigned tutorial sessions.
- All email exchanges must be via McMaster University email accounts. Emails from non-McMaster accounts will not receive a reply. Students shouldn't send emails via Avenue to Learn (A2L).
- Lecture notes, additional notes and assignments will be posted on A2L. Students are expected to check and read all the materials posted on A2L.

4. TENTATIVE SCHEDULE

Week#: Date	Lecture Topics (can be slightly altered, depending on the progress)	Evaluation
WEEK 1: Sep 4	Introduction: Force vectors; Vector Operations	
WEEK 2: Sep 11	Statics	Force system: Force & Position vectors; Force system resultants; Moments
WEEK 3: Sep 18		Equilibrium of Rigid Bodies; Free Body Diagrams; 2D&3D systems
WEEK 4: Sep 25		Structural Analysis: Analysis of trusses; Determinacy and indeterminacy; Two force members; Zero force members; Analysis of frames and machines
WEEK 5: Oct 2		Sectional Properties: Center of Gravity; Centroids; Moment of inertia; Radius of Gyration; Parallel-Axis Theorem; Moments of Inertia of Composite Areas
READING WEEK: Oct 9 — Midterm Recess: No Lectures or Tutorial		
WEEK 7: Oct 16	Mechanics of Materials	Stress and Strain: Normal stress; Shearing stress and bearing stress in connections; Strain; Mechanical Properties of Materials
WEEK 8: Oct 23		Axial loading: Analysis of axially loaded member, Deformation of axially loaded member
WEEK 9: Oct 30		Torsion: Analysis of members subjected to torsion: Shear stress and strain; Torsion of solid and hollow circular sections
WEEK 10: Nov 6		Bending: Bending normal stress distribution; Eccentric axial loading; Deformation of a symmetric beam in pure bending; Shear and moment diagrams
WEEK 11: Nov 13		Transverse shear: Stress due to transverse loads; Shear stresses in common beams; Longitudinal shear on beams
WEEK 12: Nov 20		Combined loading: Shear stress distribution in thin-walled sections; Critical shear stress; State of stress caused by combined loading
WEEK 13: Nov 27		Transformation of stress and strain cont'd: Introduction to transformation of stresses, principal stresses and Mohr's circle representation
WEEK 14: Dec 4: — Course Wrap-Up		
FINAL EXAMS: Scheduled during the regular University Final Examination period established by the Registrar's Office		
NOTE: Additional topics may be addressed, or some topics may be skipped, depending on learning progress.		

5. ASSESSMENT OF LEARNING		WEIGHT %								
Individual components will be weighted as follows:										
8 Quizzes		15%								
3 Term Tests		60% (20% for each term test)								
Final Exam		25%								
Bonus		5% (Class attendance*)								
Students achieving a mark of at least 60% on each of the three term tests, and whose cumulative average is equal to or greater than 75% have the option to be exempted from writing the final exam. Students meeting the above requirements and choosing not to take the final exam, should inform the instructor by email no later than December 6, 2023 . For those who receive an exemption, the individual component for the final grade will be weighted as follows:										
Assignments		15%								
Term Tests		85% (28.3% for each term test)								
Bonus		5% (Class attendance*)								
Targeted Course Learning Outcomes (CLO)										
Evaluation	CLO 1	CLO 2	CLO 3	CLO 4	CLO 5	CLO 6	CLO 7	CLO 8	CLO 9	CLO 10
Quiz 1										
Quiz 2										
Quiz 3										
Quiz 4										
Quiz 5										
Quiz 6										
Quiz 7										
Quiz 8										
Term Test 1										
Term Test 2										
Term Test 3										
Final exam										

6. LABORATORY SAFETY

The Faculty of Engineering is committed to McMaster University's Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs and policies". It is your responsibility to understand McMaster University's Risk Management system, which is supported by a collection of Risk Management Manuals (RMMs) that contain programs and policies in support of the Risk Management System. The RMMs are available from https://hr.mcmaster.ca/employees/health_safety_well-being/our-safety/risk-management-manuals-rmms/.

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for specific experiments (see course lab manuals) and the laboratory equipment https://www.eng.mcmaster.ca/sites/default/files/civil_lab_health_and_safety_manual.pdf

Additionally, McMaster University's workplace health and safety guidance related to COVID-19 must always be followed (available from <https://hr.mcmaster.ca/resources/covid19/workplace-health-and-safety-guidance-during-covid-19/>).

7. COMMUNICATIONS

It is the student's responsibility to:

- Maintain current contact information with the University, including address, phone numbers, and emergency contact information.
- Use the University provided e-mail address or maintain a valid forwarding e-mail address.
- Regularly check the official University communications channels. Official University communications are considered received if sent by postal mail, by fax, or by e-mail to the student's designated primary e-mail account via their "@mcmaster.ca" alias.
- Accept that forwarded e-mails may be lost and that e-mail is considered received if sent via the student's @mcmaster.ca alias.
- Check the McMaster/Avenue email and course websites on a regular basis during the term.

8. POLICIES

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>.

The following illustrates only three forms of academic dishonesty:

- plagiarism, e.g., the submission of work that is not one's own or for which other credit has been obtained.

- improper collaboration in group work.
- copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to www.mcmaster.ca/academicintegrity.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, usernames for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g., use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Students with disabilities who require academic accommodation must contact [Student Accessibility Services \(SAS\)](#) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator. For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORK

[McMaster Student Absence Form \(MSAF\)](#): In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work".

The McMaster Student Absence Form is a self-reporting tool for **Undergraduate Students** to report absences that last up to 5 days and provides the ability to request accommodation for any missed academic work. Please note, this tool **cannot** be used during any final examination period. You may submit a maximum of 1 Academic Work Missed request per term. It is **your** responsibility to follow up with your instructor immediately regarding the nature of the accommodation. If you are absent more than 5 days or exceed 1 request per term you **must** visit your Associate Dean's Office (Faculty Office). You may be required to provide supporting documentation. This form should be filled out immediately when you are about to return to class after your absence.

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

PROTECTION OF PRIVACY ACT (FIPPA)

The Freedom of Information and Protection of Privacy Act (FIPPA) applies to universities. Instructors should take care to protect student names, student numbers, grades, and all other personal information at all times. For example, the submission and return of assignments and the posting of grades must be done in a manner that ensures confidentiality – see <http://www.mcmaster.ca/univsec/fippa/fippa.cfm>.

ANTI-DISCRIMINATION

The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer, or the Human Rights Consultant, as soon as possible.

https://www.mcmaster.ca/policy/General/HR/Discrimination_and_Harassment.pdf

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

9. MCMASTER GRADING SCALE

Grade	Equivalent Grade Point	Equivalent Percentages
A+	12	90-100
A	11	85-89
A-	10	80-84
B+	9	77-79
B	8	73-76
B-	7	70-72
C+	6	67-69
C	5	63-66
C-	4	60-62
D+	3	57-59
D	2	53-56
D-	1	50-52
F	0	0-49