

**MECHENG 4Z03**  
**Computer Aided Design, Manufacturing, and Engineering (CAD/CAM/CAE)**  
Undergraduate Studies  
Winter 2024  
Course Outline

**CALENDAR/COURSE DESCRIPTION**

Solid modelling theory, part creation, assemblies and rigid bodies, mechanism simulation, B-Splines, data exchange, CNC machining and inspection, additive manufacturing, topology optimization. Major project using computer laboratory facilities.

This course will primarily be delivered using practical exercises to bolster experience using CAD software that may be applied in an industrial setting.

**PRE-REQUISITES AND ANTI-REQUISITES**

Prerequisite(s): Registration in level IV or above of any Mechanical Engineering or Mechatronics Engineering program.

Antirequisite(s): MECHENG 4ZR3

**TIMETABLE**

Lectures

Class Number	Day	Start Time		End Time	Room Number
C01 (2753)	Thursday	7:00 PM	to	10:00 PM	MDCL 1309

Labs

Section Number	Day	Start Time		End Time	Room Number
L01 (2782)	Wednesday	2:30 PM	to	3:20 PM	ABB C208
L02 (2783)	Wednesday	1:30 PM	to	2:20 PM	ABB C208
L03 (2784)	Tuesday	1:30 PM	to	2:20 PM	ABB C208
L04 (2785)	Monday	12:30 PM	to	1:20 PM	ABB C208
L05 (2842)	Tuesday	9:30 AM	to	10:20 AM	ABB C208
L06 (2898)	Monday	11:30 AM	to	12:20 PM	ABB C208
L07 (2953)	Tuesday	8:30 AM	to	9:20 AM	ABB C208

**INSTRUCTOR OFFICE HOURS AND CONTACT INFORMATION**

**Nathan Smith**  
smithna2@mcmaster.ca

**Office Hours:**  
Thursday – 4:00pm to 6:30pm  
Or by appointment (via MS Teams)

#### TEACHING ASSISTANT OFFICE HOURS AND CONTACT INFORMATION

**Hao Wang**  
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**Daniel Edward**  
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**Office Hours:** TBD

#### COURSE WEBSITE/ALTERNATE METHODS OF COMMUNICATION

Avenue to Learn (hereafter: Avenue) is used to administer the course. These tools are used to increase efficiency. Students should be aware that, when they access the electronic components of this course, 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 this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure, please discuss this with the course instructor. Avenue can be accessed via the following link:

<http://avenue.mcmaster.ca/>

The course will be delivered in-person. In the event that the course is required to be delivered online, the instructor may modify the course structure and assessment details to more appropriately support an online format. There will be plenty of notice given before any modifications are made. All course information will be communicated through Avenue - it is your responsibility to regularly check the course webpage to stay apprised of course news and any changes in our delivery format.

#### MATERIALS AND FEES

##### Optional Reference Texts:

Zeid, I., *Mastering CAD/CAM*, 2004, McGraw-Hill, ISBN 0072868457

Tickoo, S., *SolidWorks 2020 for Designers*, 2020, Cadcam Technologies, ISBN 1640570047

##### CAD Software:

This course is about learning CAD, generally. With our current licensing, the principal software is Autodesk Inventor and Autodesk Fusion 360. If McMaster University suggests course delivery will move to an online format, Fusion 360 may be used more often since it is less computationally demanding for personal computers.

#### COURSE FORMAT AND EXPECTATIONS

The Winter 2024 semester was originally planned for in-person delivery – this is subject to change based on McMaster University and the Province of Ontario's guidance. The course delivery may be modified to support an online format. It is your responsibility to regularly check the *Avenue* webpage to stay apprised of course news and any changes in our delivery format. In any case, the course will mainly be delivered in a synchronous format, and some asynchronous material will be provided to support your learning. The course is organized as follows:

- One (1) three-hour classroom-based lecture per week
- One (1) one-hour tutorial/lab per week

The following deliverables will be used to evaluate your performance (further details are provided in the “Assessment” section later in this document):

- Weekly class exercises
- Lab exercises
- Four (4) assignments
- One (1) midterm exam
- One (1) final project

<b>LECTURE SCHEDULE</b>
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This course is majority delivered using practical exercises during the lecture and lab times. As such, the lecture and lab are continuum and very integrated. In addition, lectures will incorporate a theory/discussion component. The exercises will cover the following topics (not strictly in order of delivery):

Topic No.	Topic
1	Drawing, editing, and modifying sketches
2	Using relations and fully defining sketches
3	Creating reference geometries
4	Creating, editing, and modifying features
5	Advanced part modelling
6	2D drawings: basics, views, dimensions
7	2D drawings: GD&T and Bubble Prints
8	Mold Design
9	Basic geometric & surface modelling
10	Coordinate transforms
11	Basic simulation using Finite Element Analysis (stress and deformation analysis)
12	Motion and mechanism simulation
13	Introduction to part programming & toolpath generation
14	Topology optimization in CAE
15	CAM for additively manufactured components
16	G-Code generation & interpretation
17	Additional CAD/CAM/CAE applications will be covered as time permits

<b>ASSESSMENT</b>
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Component	Due Date	Weight
Class and Lab Exercises		25%
Assignments		30%
Midterm Exam		20%
Design Project		25%
Total		100%

<b>ASSESSMENT DETAILS</b>
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**Marked in-Class and Lab Exercises (25%)**

**Learning Outcome(s):** 1,2,3,4,5,7,8,9

All Class and Lab Exercises (what is presented by the Instructor/TAs in lecture/lab) will be marked. The Instructor/TAs will present each exercise – students are expected to perform the exercise as well and submit their own original work.

**Submission:** To be announced on Avenue.

**Assignment (30%)**

**Learning Outcome(s):** 1,2,3,4,5,6,7,8,9

This includes four (4) assignments based on material presented throughout the course.

**Submission:** To be announced on Avenue.

**Practical Exam (20%)**

**Learning Outcome(s):** 1,2,3,4,5,7,8,9

Midterm Exam to be scheduled for the week of February 26, 2024 (details to be announced on Avenue).

**Project (25%)**

**Learning Outcome(s):** 1,2,3,4,5,7,8,9

Final project that incorporates all aspects taught in the course (details to be announced on Avenue).

**Submission:** To be announced on Avenue.

<b>COURSE INTENDED LEARNING OUTCOMES</b>
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By the end of this course, students should be able to:

#	Outcome
1.	Model the 3D geometric information of machine components including assemblies, and automatically generate 2D production drawings.
2.	Understand the basic analytical fundamentals that are used to create and manipulate geometric models in a computer program.
3.	Visualize machine components and assemblies before their actual fabrication through modeling, animation, shading, rendering, lighting, and colouring.
4.	Model complex shapes including freeform curves and surfaces.
5.	Understand the possible applications of the CAD/CAM/CAE systems in motion analysis, structure analysis, optimization, rapid prototyping, reverse engineering and virtual engineering.

6. Implement CNC programs for milling and turning machining operations.
7. Create a computer aided manufacturing (CAM) model and generate the machining codes automatically using the CAM system.
8. Integrate CAD and CAM/CAE systems by using the CAD system for modeling design information and converting the CAD model into a CAM/CAE model for modeling/manufacturing/simulation information.
9. Use full-scale CAD/CAM/CAE software systems designed for geometric modeling of machine components and automatic generation of manufacturing information.

#### ENGINEERS CANADA – GRADUATE ATTRIBUTES

Successfully completing this course will contribute to the following graduate attributes as defined by Engineers Canada. The Learning Outcomes defined above supports this section. The Graduate Attributes defined in this section are measured for Accreditation purposes only and will not be directly taken into consideration in determining a student's grade in the course.

#	Attribute	Learning Outcome(s)
A04	Design, 4.01: Recognize/Follow Engineering Design Process	1, 2, 4, 5, 6, 7, 9
A04	Design, 4.06: Determine/Employ Standards and Codes of Practice	2, 5, 6, 7, 8
A05	Use of Engineering Tools, 5.01: Evaluate/Select Appropriate Tool	3, 5, 8, 9
A05	Use of Engineering Tools, 5.02: Use Modern/State of the Art Tools	9
A05	Use of Engineering Tools, 5.03: Create/Adapt/Modify Tools/Techniques	1, 4, 9

For more information on Accreditation, please visit: <https://www.engineerscanada.ca>

#### EQUITY, DIVERSITY, AND INCLUSION

Every registered student belongs in this course. Diversity of backgrounds and experiences is expected and welcome. You can expect your Instructor to be respectful of this diversity in all aspects of the course, and the same is expected of you.

The Department of Engineering Physics is committed to creating an environment in which students of all genders, cultures, ethnicities, races, sexual orientations, abilities, and socioeconomic backgrounds have equal access to education and are welcomed and treated fairly. If you have any concerns regarding inclusion in our Department, in particular if you or one of your peers is experiencing harassment or discrimination, you are encouraged to contact the Chair, Associate Undergraduate Chair, Academic Advisor or to contact the [Equity and Inclusion Office](#).

### MENTAL HEALTH & WELLNESS

For a list of McMaster University's resources, please refer to the [Student Wellness Centre](#). [Talkspot](#) is a non-crisis mental health resource specifically for students in the Faculty of Engineering.

### 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](#), located at <https://secretariat.mcmaster.ca/university-policies-procedures-guidelines/>

The following illustrates only three forms of academic dishonesty:

1. plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. improper collaboration in group work.
3. copying or using unauthorized aids in tests and examinations.

### AUTHENTICITY / PLAGIARISM DETECTION

This course 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](http://www.mcmaster.ca/academicintegrity).

### COURSES WITH AN ON-LINE ELEMENT

McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms.

This course uses on-line elements (e.g., e-mail, Avenue to Learn (A2L), 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, user names 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.

### 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](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

### COURSE POLICY ON MISSED WORK, EXTENSIONS, AND LATE PENALTIES

1. It is the students’ responsibility to regularly check the course webpage (e.g., Avenue to Learn) for updates and announcements related to this course.
2. All submissions are due at midnight (specifically, 11:59 PM on the due date).
3. Arrangements must be made with the Instructor prior to any missed work/extensions/late submissions. Exceptions may be made regarding unforeseeable situations.
4. Late penalties will be applied at the Instructor’s discretion.

### SUBMISSION OF REQUEST FOR RELIEF FOR MISSED ACADEMIC WORK

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”.

1. **Relief for missed academic work worth less than 25% of the final grade resulting from medical or personal situations lasting up to three calendar days:**
  - Use the [McMaster Student Absence Form](#) (MSAF) on-line self-reporting tool. No further documentation is required.
  - Students may submit requests for relief using the MSAF once per term.
  - An automated email will be sent to the course instructor, who will determine the appropriate relief. Students must immediately follow up with their instructors. Failure to do so may negate the opportunity for relief.
  - The MSAF cannot be used to meet a religious obligation or to celebrate an important religious holiday.
  - The MSAF cannot be used for academic work that has already been completed attempted.
  - An MSAF applies only to work that is due within the period for which the MSAF applies, i.e. the 3-day period that is specified in the MSAF; however, all work due in that period can be covered by one MSAF.
  - The MSAF cannot be used to apply for relief for any final examination or its equivalent. See *Petitions for Special Consideration* above.

2. **For medical or personal situations lasting more than three calendar days, and/or for missed academic work worth 25% or more of the final grade, and/or for any request for relief in a term where the MSAF has been used previously in that term:**
  - Students must report to their Faculty Office to discuss their situation and will be required to provide appropriate **supporting documentation**.
  - If warranted, the Faculty Office will approve the absence, and the instructor will determine appropriate relief.

#### 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.

#### 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.