



ENGG*3120 Computer Aided Design and Manufacturing

01

Winter 2024

Section(s): 01

School of Engineering

Credit Weight: 0.75

Version 1.00 - January 24, 2024

1 Course Details

1.1 Calendar Description

The course presents the elements of solid modelling, creation of parts of increasing complexity and the assembly of parts to form a final design, along with mechanism simulation. The operation and programming of CNC machines is covered.

Pre-Requisites:

ENGG*2100, ENGG*3280

Restrictions:

Non-BENG students may take a maximum of 4.00 ENGG credits.

1.2 Course Description

Computer-aided design (CAD) and computer-aided manufacturing (CAM) are the foundation of digital design and fabrication. In this course, you will learn the theory and tools for various CAD/CAM functions including solid geometry modeling, complex shape modeling, assembly design, stress/thermal analysis, motion analysis, and CAM simulation.

1.3 Timetable

Lectures (in person)

Tuesday & Thursday 4:00 PM– 5:20 PM THRN 1319

Labs (in person)

Session A: 0102 Monday, 11:30 AM - 01:20 PM, THRN 1313

Session B: 0101 Wednesday, 11:30 PM - 01:20 PM, THRN 1313

1.4 Final Exam

No Final Exam.

2 Instructional Support**2.1 Instructional Support Team**

Instructor:	Scott Simmons PhD, EIT
Email:	ssimmons@uoguelph.ca
Telephone:	5198244120
Office:	THRN 2106
Office Hours:	By appointment through email

2.2 Teaching Assistants

Leonardo Gadelha Tumajan Costa de Melo: lgadelha@uoguelph.ca

Mohammad Vahid Ehteshamfar: mehtesha@uoguelph.ca

3 Learning Resources**3.1 Required Resources****Course Website (Website)**

<https://courselink.uoguelph.ca/>

Courselink 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 UofG 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.

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 *Courselink* - it is your responsibility to regularly check the course webpage to stay apprised of course news and any changes in our delivery format.

Software SolidWorks 2020 and MasterCAM X8 (Software)

SolidWorks is available on school computers. You can install a student copy on your PC using this instruction set from the

SOE: <https://www.soe.uoguelph.ca/webfiles/SoftwareInstall/Win10/Solidworks%20Installation%20Instruc09-01.pdf>

MasterCAM is available on school computers

Autodesk Fusion 360 is available for free for students and educators

Additional Resources (Other)

Additional resource will be posted on CourseLink under "Content" tab.

3.2 Recommended Resources

SolidWorks 2020 for Designers (Textbook)

Prof. Sham Tickoo, CAD/CIM Technologies, USA. This book is primarily used as a command reference throughout the semester. Moreover, some class exercises and assignments will be based on the problems in this book. However, a large portion of the materials covered in this course is from other sources. Nevertheless, it is a required textbook, and students are highly recommended to have a copy of this book.

You can purchase (or rent) the online Edition from <https://www.vitalsource.com>.

<https://www.vitalsource.com/products/solidworks-2020-for-designers-18th-edition-prof-sham-tickoo-v9781640570849>

3.3 Additional Resources

Communication and email policy (Other)

Please use lectures as your main opportunity to ask questions about the course. Major announcements will be posted to the course website. **It is your responsibility to check the course website regularly.** As per university regulations, **all students are required to check their <uoguelph.ca> email account regularly:** Email is the official route of communication between the University and its students.

It is your responsibility to abide by the following guidelines for all email correspondence:

- Send all emails from your uoguelph.ca e-mail account.
- Include the course code “ENGG*3120” in the subject line of all emails.

- Use a professional tone and appropriate etiquette in all your correspondence.
- Before emailing a GTA or the instructor with a question, check the course outline and Courselink announcements/newsfeed to see if your question has already been answered there.

Important: Unprofessional emails will not be responded to.

For all correspondence satisfying the above guidelines, the instructor and TAs will abide by the following guidelines:

- Respond to questions within 24 hours on weekdays. Do not expect replies on evenings, holidays, or weekends.
- Use a professional tone and appropriate etiquette in all correspondence

Occasionally, an email may get missed, especially during busy times in the term. If you have not received a timely reply and you are confident that you have abided by all of the guidelines above, please resend your email and we will try to respond to it immediately.

4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Model the 3 D geometric information of machine components including assemblies, and automatically generate 2 D 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, and coloring.
4. Model complex shapes including freeform curves and surfaces.
5. Understand the possible applications of the CAD/CAM systems in motion analysis, structure analysis, optimization, reverse engineering and virtual engineering.
6. Create a computer aided manufacturing (CAM) model and generate the machining codes automatically using the CAM system.
7. Integrate CAD and CAM systems by using the CAD system for modeling design information and converting the CAD model into a CAM model for modeling the manufacturing information.
8. Be able to generate process plans for a given design model and apply CAM software to generate toolpaths for machining operations.

4.2 Engineers Canada - Graduate Attributes (2018)

Successfully completing this course will contribute to the following:

#	Outcome	Learning Outcome
1	Knowledge Base	2, 4
1.1	Recall, describe and apply fundamental mathematical principles and concepts	4
1.3	Recall, describe and apply fundamental engineering principles and concepts	2
4	Design	1, 3, 4
4.3	Create a variety of engineering design solutions	1, 4
4.4	Evaluate alternative design solutions based on problem definition	1, 3, 4
4.5	Develop and refine an engineering design solution, through techniques such as iteration, simulation and/or prototyping	3
5	Use of Engineering Tools	1, 3, 4, 5, 6, 7, 8

#	Outcome	Learning Outcome
5.2	Demonstrate proficiency in the application of selected engineering tools	1, 3, 4, 5, 6, 7, 8
5.3	Recognize limitations of selected engineering tools	5

5 Teaching and Learning Activities

5.1 Lab

Week 2

Topics: Lab 1: Part modeling 1

Learning Outcome: 1, 2

Week 3

Topics: Lab 2: Part modeling 2

Learning Outcome: 2

Week 5

Topics: Lab 3: Sheet metal

Learning Outcome: 2

Week 6

Topics: Lab 4: Surface modeling

Learning Outcome: 4

Week 7

Topics: Lab 5: Assembly design

Learning Outcome: 3

Week 9

Topics: Lab 6: motion animation

Learning Outcome: 5

5.2 Lecture Schedule

This course is mainly delivered using practical exercises during the lecture and the lab in a computer room. As such the lecture and the lab are continuum and very integrated. The exercises will cover:

- Lecture 1-5: part modeling including part modeling and drawing, patterning, 3D sketching, equation-driven shapes
- Lecture 6-10: process-related part design: sheet metal, custom-form tools, weldment design, surface modeling, mold design
- Lecture 11: assembly design
- Lecture 12: top-down design approach
- Lecture 13-15: motion analysis including exploded animation, motion simulation, result plot, part function, mate functions
- Lecture 16-18: static analysis: discretization error, stress singularity, symmetric boundary conditions, static analysis for assembly
- Lecture 19-20: Dynamic analysis: buckling analysis, drop test
- Lecture 21-22: Thermal analysis
- Lecture 23-24: CAM: G code, MasterCAM

5.3 Important Dates

Please refer to the undergraduate calendar 2021-2022 for scheduled dates at:

<https://calendar.uoguelph.ca/undergraduate-calendar/schedule-dates/winter-semester/>

6 Assessments

6.1 Assessment Details

Marked In-Class and Lab Exercises (25%)

Date: Week 1 to Week 12

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

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 – you are expected to perform the exercise as well and submit your own original work.

Submission: Each student will be given a personal and private folder on the Soe-Public (P:) drive for file submissions.

Assignment (30%)

Date: Week 3, 6, 8, 10, 11

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

This includes 5 individual assignments based on material presented throughout the course.

Submission: Each student will be given a personal and private folder on the Soe-Public (P:) drive for file submissions.

Practical Exam (20%)

Date: Week 7

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

Practical Exam (25%) Tuesday, February 27, 2024, (Theoretical & Practical Exam, Time: TBA, Location: TBA)

Design Project (25%)

Date: Week 12

Learning Outcome: 1, 2, 3, 4, 5, 6, 7, 8

Final project that incorporates all aspects taught in the course. Details to be announced on CourseLink.

Submission: Use the Soe-Public (P:) drive for file submissions.

7 Course Statements

7.1 Course Grading Policies

Missed Assessments: If you are unable to meet an in-course requirement due to medical, psychological, or compassionate reasons, please email the course instructor before the due date. See the undergraduate calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Accommodation of Religious Obligations: If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements. See the undergraduate calendar for information on regulations and procedures for Academic Accommodation of Religious Obligations:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Passing grade: Students must obtain a grade of 50% in order to pass this course.

Missed quiz and midterm tests: If you miss a test due to grounds for granting academic consideration or religious accommodation, the weight of the missed test will be transferred to the attempted ones. There will be no makeup quiz or midterm tests.

Lab Work: You must attend and complete all laboratories. If you miss a laboratory due to grounds for granting academic consideration or religious accommodation, arrangements must be made with the teaching assistant to complete a makeup lab.

Late Lab Reports: Late submissions of lab reports will not be accepted.

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.

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.**

7.2 Relationships with other Courses & Labs

Previous Courses:

ENGG*2100, ENGG*3280. The fundamental introduction of CAD in ENGG*2100 and the knowledge about the design of machine elements are assets in this course

Follow-on Courses:

This course is not a direct pre-requisite for any other course.

8 School of Engineering Statements

8.1 Instructor's Role and Responsibility to Students

The instructor's role is to develop and deliver course material in ways that facilitate learning for a variety of students. Selected lecture notes will be made available to students on Courselink but these are not intended to be stand-alone course notes. Some written lecture notes will be presented only in class. During lectures, the instructor will expand and explain the content of notes and provide example problems that supplement posted notes. Scheduled classes will be the principal venue to provide information and feedback for tests and labs.

8.2 Students' Learning Responsibilities

Students are expected to take advantage of the learning opportunities provided during lectures and lab sessions. Students, especially those having difficulty with the course content, should also make use of other resources recommended by the instructor. Students who do (or may) fall behind due to illness, work, or extra-curricular activities are advised to keep the instructor informed. This will allow the instructor to recommend extra resources in a timely manner and/or provide consideration if appropriate.

8.3 Lab Safety

Safety is critically important to the School and is the responsibility of all members of the School: faculty, staff and students. As a student in a lab course you are responsible for taking all reasonable safety precautions and following the lab safety rules specific to the lab you are working in. In addition, you are responsible for reporting all safety issues to the laboratory supervisor, GTA or faculty responsible.

9 University Statements

9.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

9.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Graduate Calendar - Grounds for Academic Consideration

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

<https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml>

9.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Graduate Calendar - Registration Changes

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml>

Associate Diploma Calendar - Dropping Courses

<https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml>

9.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

9.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
<https://www.uoguelph.ca/sas>

For Ridgetown students, information can be found on the Ridgetown SAS website
<https://www.ridgetownc.com/services/accessibilityservices.cfm>

9.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community—faculty, staff, and students—to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Graduate Calendar - Academic Misconduct

<https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml>

9.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

9.8 Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars

<https://www.uoguelph.ca/academics/calendars>

9.9 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).
