

MIE519H1S Advanced Manufacturing Technologies Syllabus

Course Outline

Instructor

Prof. Patrick C. Lee
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Office Hours

Tuesday 14:00-15:00

Teaching Assistants

Anthony Tuccitto
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Course Schedule

Lectures

Tuesday
Hours: 12:00-15:00

Room: GB 120

Contact Hours

- 0.5 credits
- Lectures:
3 hrs x 13 wks/term = 39 hrs

Prerequisites

N/A

Course Website

Quercus Portal

Important Dates

Project Due Dates:

Interim Report

Feb. 25th, 2025

Final Report & Presentation

Apr. 1st, 2025

Midterm Exam

Mar. 4th, 2025

Course Description

This course is designed to provide an integrated multidisciplinary approach to Advanced Manufacturing Engineering, and provide a strong foundation including fundamentals and applications of advanced manufacturing (AM). Topics include: additive manufacturing, 3D printing, micro- and nano-manufacturing, continuous & precision manufacturing, thin-film and electronics materials manufacturing, green and biological manufacturing. New applications of AM in sectors such as automotive, aerospace, biomedical, and electronics.

Textbook

Textbooks are for references only.

- Manufacturing Processes for Advanced Composites, by Campbell Jr, Flake C, Elsevier, 2004
- Advanced Manufacturing Technology for Medical Applications, by Ian Gibson, Wiley 2005
- Manufacturing Engineering & Technology (7th Edition), by Serope Kalpakjian and Steven Schmid, Prentice Hall, 2013
- Manufacturing Engineering Handbook, by Hwaiyu Geng, McGraw Hill, 2004
- Product Design for Manufacture and Assembly, Third Edition (Manufacturing Engineering and Materials Processing) by Geoffrey Boothroyd and Peter Dewhurst, CRC press, 2010

Requirements/Regulations

<https://engineering.calendar.utoronto.ca/academic-regulations>

List of Tentative Topics

- **Introduction**
 - Course outline & Introduction;
 - Current and future trends of advanced manufacturing technologies;
- **Micro- and Nano-Manufacturing**
 - Micro-/nano-layered manufacturing;
 - Carbon-based nanoparticle manufacturing;
 - Nano-engineered fiber composites;
 - Nano-etching of surfaces (lithography);

- **Additive Manufacturing**
 - Stereolithography (SLA);
 - Fused Deposition Modeling (FDM);
 - Selected Laser Sintering (SLS);
 - Electron Beam Melting (EBM);
 - Materials Jetting;
 - Binder Jetting;
- **Electronic Materials Manufacturing**
 - Micro-electro-mechanical systems (MEMS);
 - Wearable electronics;
- **Green & Biological Manufacturing**
 - Biomaterials;
 - Tissue manufacturing;
 - Bio-3D printing;
 - Bio and sustainable foams;
 - Biomimetic designs;
- **Optional Topics**
 - Digital Twin;

Learning Objectives

At the end of the course, students should be able to:

- Develop potential application-driven solutions to real-life advanced manufacturing problems with targeted quantitative estimation
- Recommend potential improvements over currently available manufacturing technologies and platforms
- Understand the key practical theory with the operation principles of advanced manufacturing technologies and their potential limitations
- Address the key challenges and obstacles with manufacturing at the micro- and nano-scale
- Develop and quantify the environmental impact and implications from the utilization of advanced manufacturing strategies
- Select and justify appropriate technologies for specific application when considering parameters such as build quality, throughput, resolution, and other physical properties required

Evaluation

- Midterm Exam (25%)

- Term Project Reports and Presentation (35%)
- Final Exam (40%)
- Total: 100 %

Academic Integrity

Students are expected to conduct themselves in accordance with the highest ethical standards of the Profession of Engineering and evince academic integrity in all their pursuits and activities at the university. As such, in accordance with the General Academic Regulations on Academic Integrity, students are reminded that plagiarism or any other form of cheating in examinations, term tests, assignments, projects, or laboratory reports is subject to serious academic penalty (e.g. suspension or expulsion from the faculty or university). A student found guilty of contributing to cheating by another student is also subject to serious academic penalty. Normally, students will be required to submit their course essays to Turnitin.com and/or Ouriginal for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the Turnitin.com and/or Ouriginal reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of the Turnitin.com and/or Ouriginal service are described on the Turnitin.com and/or Ouriginal web site.

Generative Artificial Intelligence (AI) Usage

- Students are encouraged to make use of technology, including generative artificial intelligence (AI) tools, to contribute to their understanding of course materials.
- Students may use artificial intelligence tools, including generative AI, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit.
- **Students must submit, as an appendix with their assignments, any content produced by an artificial intelligence tool, and the prompt used to generate the content.**
- Any content produced by an artificial intelligence tool must be cited appropriately. Many organizations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: <https://style.mla.org/citing-generative-ai/>).
- Students may choose to use generative artificial intelligence tools as they work through the assignments in this course; this use must be documented in an appendix for each assignment. The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work.
- Course instructors reserve the right to ask students to explain their process for creating their assignment
- **Students may use artificial intelligence tools for creating an outline for an assignment, but the final submitted assignment must be original work produced by the individual student alone.**
- Students may not use artificial intelligence tools for taking tests in this course, but students may use generative AI tools for other assignments.

- If you have any question about the use of AI applications for course work, please speak with the instructor.

Inclusivity Statement

You belong here. The University of Toronto commits to all students, faculty and staff that you can learn, work and create in a welcoming, respectful and inclusive environment. In this class, we embrace the broadest range of people and encourage their diverse perspectives. This team environment is how we will innovate and improve our collective academic success. You can read the evidence for this approach here.

We expect each of us to take responsibility for the impact that our language, actions and interactions have on others. Engineering denounces discrimination, harassment and unwelcoming behaviour in all its forms. You have rights under the Ontario Human Rights Code. If you experience or witness any form of harassment or discrimination, including but not limited to, acts of racism, sexism, Islamophobia, anti-Semitism, homophobia, transphobia, ableism and ageism, please tell someone so we can intervene. Engineering takes these reports extremely seriously. You can talk to anyone you feel comfortable approaching, including your professor or TA, an academic advisor, our Assistant Dean, Diversity, Inclusion and Professionalism, the Engineering Equity Diversity & Inclusion Action Group, any staff member or a U of T Equity Office.

You are not alone. Here you can find a list of clubs and groups that support people who identify in many diverse ways. Working together, we can all achieve our full potential.

Statement on Accommodations

The University of Toronto supports accommodations for students with diverse learning needs, which may be associated with mental health conditions, learning disabilities, autism spectrum, ADHD, mobility impairments, functional/fine motor impairments, concussion or head injury, blindness and low vision, chronic health conditions, addictions, deafness and hearing loss, communication disorders and/or temporary disabilities, such as fractures and severe sprains, or recovery from an operation.

If you have a learning need requiring an accommodation the University of Toronto recommends that students register as soon as possible with Accessibility Services.

Phone: **416-978-8060**

Email: **accessibility.services@utoronto.ca**

Statement on Mental Health

As a university student, you may experience a range of health and/or mental health challenges that could result in significant barriers to achieving your personal and academic goals. Please note, the University of Toronto and the Faculty of Applied Science & Engineering offer a wide range of free and confidential services that could assist you during these times.

As a U of T Engineering student, you have an [Academic Advisor](#) (undergraduate students) or a [Graduate Administrator](#) (graduate students) who can support you by advising on personal matters that impact your academics. Other resources that you may find helpful are listed on the [U of T Engineering Mental Health & Wellness webpage](#), and a small selection are also included here:

- [Accessibility Services & the On-Location Advisor](#)
- [Graduate Engineering Council of Students' Mental Wellness Commission](#)
- [Health & Wellness](#) and the [On-Location Health & Wellness Engineering Counsellor](#)
- [Inclusion & Transition Advisor](#)
- [U of T Engineering Learning Strategist](#) and [Academic Success](#)
- [My Student Support Program \(MySSP\)](#)
- [Registrar's Office](#)
- [SKULE Mental Wellness](#)
- [Scholarships & Financial Aid Office & Advisor](#)

If you find yourself feeling distressed and in need of more immediate support resources, consider reaching out to the counsellors at [My Student Support Program \(MySSP\)](#) or visiting the [Feeling Distressed webpage](#).

Land Acknowledgement

The University of Toronto operates on land that for thousands of years has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississauga of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.