



Manufacturing Processes ME481 – Fall 2021

***A Comment on the Covid-19 Pandemic:** As they have throughout the past year and a half, policies around academic and public health are subject to change as this COVID-19 pandemic evolves. This course will follow all policies issued by the University, which are documented on the [Campus Blueprint's FAQ](#). These policies may change over the course of the term, so please review the [Campus Blueprint's FAQ](#) for the most up to date information.*

Course description

This course examines how components are made, highlighting the choice of processing options, process settings, and process performance using metrics of cost, quality, time, flexibility, environmental impacts, and the influence of processes on the final mechanical properties of the product. The course includes mathematical modeling of manufacturing processes used in industry to manufacture mechanical systems: machining, deformation, 3d printing and powder processing, joining, surface treatment, and solidification and heat treatment processes. The material systems discussed in the course include metals, polymers, ceramics, and composites.

Course goals (Intended Learning Objectives)

By the finish of this course students should be able to:

1. **Understand** how the key manufacturing processes function and **compare** their function and capabilities.
2. **Identify** the key components and functions of machine tool elements.
3. **Model and analyze** key manufacturing processes having gained experience using analytical and numerical (e.g., Finite Element Analysis) techniques.
4. Make manufacturing process and part design **decisions** based on business and part requirements (e.g., **low volume vs. high volume, high cost vs. low cost, material and dimensional requirements**), manufacturing performance capabilities (**cost, speed, quality, flexibility, and environmental impacts**), and how the process changes the **material properties**.
5. Have gained **hands-on experience** with CNC machines, metal forming, and finishing.

Course schedule

The definitive course schedule can be found [here](#). Please note that it is likely to be updated during the semester so keep checking it.

Grading

Homework assignments	20 %
Labs (completion, reports, & peer eval.)	35 %
Lab 1a	2.5 %
Lab 1b	10 %
Lab 2	5 %
Lab 3	5 %
Lab 4	5 %
Lab 5	2.5 %
Peer Evaluation	5 %
Exam 1	20 %
Exam 2	20 %
Lecture Quizzes	2.5 %
Class participation	2.5 % (attendance and active participation)

Lab 4 (3d printing lab) will require all students to attain Duderstadt's Ultimaker 3d printer certification. Get a head start: shorturl.at/djnAK

If you are not satisfied with a grade, you can request that we take another look at it. Such requests must be accompanied by a memorandum from you explaining why you think your work merits a different grade and this must be submitted within a week after you get your assignment back. After a week, no re-grade requests will be accepted. Late homework and lab reports will be accepted up to 24 hours after the due date with a 25% penalty.

Lecture format

Lectures will be on Tuesday and Thursday 9:00-10:20 am in 1014 Dow / [<https://umich.zoom.us/j/94751553875>]. The intention in F21 is that all lectures will have a live hybrid format: live both in-person and online on zoom. All lectures will be recorded and posted to Canvas shortly after the lecture.

Lecture quizzes

A short quiz will accompany every lecture and must be completed by each individual student within 7 days of the lecture.

Laboratory sessions

During the course, student teams (4-5 people) will perform laboratory exercises corresponding to the lectures. All students should follow the latest university advice on COVID-19 health & safety when performing the labs. The GSI will help ensure the students receive the latest safety information.

Absence policy

Please contact the instructor/GSI as early as possible if you need to miss a class. No more than two absences are deemed acceptable without prior agreement with the instructor.

Course Topics

- Overview of manufacturing processes and the foundation for innovations and global competitiveness
- Work & tool materials
- Machine tools
- Casting & Heat Treatments
- Machining
- Metal forming
- Polymer and composite manufacturing
- Additive manufacturing
- Joining
- Finishing
- Integrated Computational Materials Engineering (ICME)
- Concurrent Engineering / Integrated Product & Process Engineering
- Integrated circuit (IC) manufacturing
- Programming of ABB Robot
- Term project on the manufacturing processes for key components of a DJI Spark drone (Lab 1b)

Course books

The books below provide additional information and context to the course material. They are recommended as you move forward with your (design &) manufacturing career. However, ownership of these books is not needed to do well in ME481.

- Kalpakjian and Schmid, *Manufacturing Processes for Engineering Materials*, 6th Ed, Pearson, 2016.
- Steven Liang and Albert Shih, *Analysis of Machining and Machine Tools*, Springer, 2016. Free download: <https://link.springer.com/book/10.1007/978-1-4899-7645-1>

Homeworks & Labs

Submitted via Canvas. All deadlines are 11:59 pm Eastern time on deadline day.

Honor Code

Homework assignments and the exams must be completed on your own. You must independently formulate your solution, though discussing the subject matter with your classmates is encouraged in the case of the homeworks only. You may not compare your solution with your classmates. You must submit the solution individually.

The violation of this policy also a violation of the honor code (<http://www.engin.umich.edu/students/honorcode/>) and may be grounds for initiating action before the College of Engineering's Honor Council.

Diversity, Equity, and Inclusion

I consider this classroom to be a place where you will be treated with respect, and I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All members of this class are expected to contribute to a respectful, welcoming, and inclusive environment for every other member of the class. I am dedicated to helping each of you achieve all your academic goals concerning this class. I may either, in the lecture or smaller interactions, accidentally use a language that creates offense or discomfort. Should I do this, please contact me and help me understand and avoid making the same mistake again.

Student Mental Health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. The University of Michigan is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. You can learn more about the broad range of confidential mental health services available on campus via <https://caps.umich.edu/mitalk>.

SSD students

Please send your VISA form to Professor Cooper as soon as possible. SSD students will receive the SSD recommendation for time extensions on the exams. Regarding the homeworks, which are individual assignments, please let Professor Cooper know as soon as possible if a time extension is needed due to an SSD related reason. Usually, up to a 48 hour time extension may be granted so that we can still promptly post solutions for the class and so that the student in question does not fall behind. The labs are team assignments and the deadlines are expected to stay unchanged. The deadlines on the individual lecture quizzes (one week after the relevant lecture) are also expected to remain unchanged.

Instructional team

Dr. Dan Cooper, Instructor (he/him/his) drcooper@umich.edu	Office: 2458 GGB Office hours: 4:00-5:00 pm on Tuesdays and 3:00-4:00 pm on Thursdays. Office hours will be hybrid (available in person in my office and on zoom)
Jingxuan (Jessie) Lyu jxlyu@umich.edu	Office: 1210 H.H. Dow Office hours: 2:00-3:00 pm on Mondays and Wednesdays. Office hours will be ZOOM ONLY (link)
Ketut Bagus (Gus) Putra bagus@umich.edu	Office: 1210 H.H. Dow Office hours: TBD

Miguel Funes miguelaf@umich.edu	Office: 1100F H.H. Dow Office hours: TBD
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