ME491
Manufacturing Processes and Systems

The Schaefer School of Engineering and Science
Spring 2025

Instructor:	Chan Yu
Canvas Course Address:	Section A https://sit.instructure.com/courses/77680
	Section B https://sit.instructure.com/courses/77681
Course Schedule:	Section A Tuesday/Thursday 12:30 pm – 1:45 pm
	Section B Tuesday/Thursday 11:00 am – 12:15 pm
Contact Info:	cyu@stevens.edu
Office Hours:	Tuesday/Thursday 3 – 5 pm

COURSE DESCRIPTION

This course introduces manufacturing processes including traditional manufacturing processes, latest additive manufacturing technologies, and more. For each manufacturing process, machines and process parameters will be identified for quality improvement and cost reduction. Material behavior and process physics will be discussed to further understand the principles of the process. This course also covers the systems of manufacturing including automation technologies, integrated manufacturing systems, and manufacturing support systems.

STUDENT LEARNING OUTCOMES

After successful completion of this course, students will be able to

- understand the fundamentals of the manufacturing processes
- mathematically model key manufacturing process parameters and capabilities
- identify and select alternative processes and materials for better quality and less cost
- understand the basic concepts of modern manufacturing systems
- understand the key elements of the automation systems
- understand quality control concepts related to manufacturing processes

COURSE FORMAT AND STRUCTURE

This course is on-campus. To access the course materials, please visit stevens.edu/canvas. For more information about course access or support, contact the Technology Resource and Assistance Center (TRAC) by calling 201-216-5500.

Course Logistics

- When assignments are due, they are **due by class start time on the due date** listed in the course schedule.
- **Late assignments will not be accepted**, except for medical reasons or prior approval by instructor.

Instructor's Online Hours

I will be available via email and respond as soon as I am available (generally within 24-48 hours). For the online discussions, I will check in at least three times per week. Keep in mind that it is not possible for me to respond to every single posting every week (nor is it pedagogically appropriate), but I will be sure to respond to various postings and students each week and attempt to assure equality in terms of responses to students. When emailing me, please place in the subject line the course number/section and the topic of the email (i.e., ME491A – Homework 2 Question).

TENTATIVE COURSE SCHEDULE

Week	Date	Subject	Project
1	1/21	Manufacturing Introduction	
	1/23	Engineering Materials and Process Selection	
2	1/28	Solidification Processes (Metal Casting)	
	1/30		
3	2/4	Metal Forming (Rolling, Forging, Metal Extrusion)	
	2/6		Project idea due
4	2/11	Sheet Metalworking (Shearing, Drawing, Bending)	
	2/13	Material Removal Process	
5	**2/18**	**No class - Monday class schedule**	
	2/20	Material Removal Process	Project proposal due
6	2/25	Polymer Processes	
	2/27	Additive Manufacturing	
7	3/4	Other Manufacturing Processes (Joining Methods)	
	3/6	Other Manufacturing Processes (Surface & Heat Treatment)	
8	3/11	Manufacturing Systems Introduction	
	3/13	**Midterm Exam**	
9	**3/18**	**No class - Spring Break**	
	3/20		
10	3/25	Manufacturing Systems - Production lines	
	3/27	Group Technology and Cellular Manufacturing	
11	4/1	Flexible Manufacturing Systems	
	4/3	Introduction to Automation	
12	4/8	Industrial Control Systems	

	4/10	Hardware Components for Automation and Process Control	
13	4/15	Computer Numerical Control	
	4/17	Industrial Robots	
14	4/22	Discrete Process Control	
	4/24	Material Handling and Identification	
15	4/29	Manufacturing Support Systems	
	5/1	Quality Control System	
16	5/6	Final Review	Project final presentation

COURSE MATERIALS

Textbook(s)

- "Automation, Production Systems, and Computer-Integrated Manufacturing" Mikell P. Groover, 5th Edition, Pearson

- "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems" Mikell P. Groover, 6th Edition, Wiley

COURSE REQUIREMENTS

Homework & Attendance

- Homework will be assigned after each topic to aid students to understand the subject. Late homework will not be accepted, except for medical reasons or prior approval by instructor.
- Attendance will be checked and graded.

Project

This project provides students with an opportunity to apply the knowledge and techniques discussed in this course by re-designing/optimizing a production system for a product. Each group (**up to 3**) will select a manufactured product or an existing manufacturing production system. Each group will then identify the problems with the current production system and optimize the production system.

- **Project idea**
  - Find an existing product or a production system (for ex. bicycle, toothbrush, disposable cups)
  - Submit a brief description of the product (or production process)

- **Project Proposal Presentation**
  - Submit a presentation including;
    - Background about the product (or process) and the motivation for your project
    - Description of the selected product manufacturing processes currently used including process diagram (flow chart), production economics, and manufacturing systems
    - Problems identified to optimize the existing production system (cost reduction, sustainability, process efficiency, etc.).
    - Approaches/plan to solve the problems identified.

- **Final Project Presentation**

Submit and present a final presentation including;

- Introduction
  - Background
  - Problem statement (purpose, objective)
- Final manufacturing process (or system) model
  - Production process steps (with a flow diagram)
  - Process step details
  - Automation implementation
  - Alternate material selection (if applicable)
  - Quality control methods
  - Environment and waste minimization
- Complete manufacturing system model
  - Production system implemented
  - Factory layout including production equipment, automation, material handling equipment, quality control, etc.
- Performance expectation
  - Economics, production rate, etc.
- Comparisons of existing process (or product) vs. your process (or product)
  - Quantitative (time, cost, efficiency, production rate etc.) or qualitative
  - Pros vs Cons
- Conclusions

- **Milestones and submissions**
  - Project idea (10%) February 6, 2025
  - Project proposal presentation (20%) February 20, 2025
  - Final presentation (60%) May 6, 2025
  - Review and peer evaluation (10%) May 6, 2025

Midterm Exam

Open book and usage of laptop is allowed. **No make-ups.**

Final Exam

Comprehensive final exam will be given during the final exam period. Open book and usage of laptop is allowed. **No make-ups**.

GRADING PROCEDURES

Grades will be based on:

Homework & Attendance	25%
Project	25%
Midterm Exam	20%
Final Exam	30%

Late Policy
Late homework will not be accepted, except for medical reasons or prior approval by instructor.

ACADEMIC INTEGRITY

Generative AI Technologies
You may use AI programs e.g. ChatGPT to help generate ideas and brainstorm. However, you should note that the material generated by these programs may be inaccurate, incomplete, or otherwise problematic. Beware that use may also stifle your own independent thinking and creativity.

You may not submit any work generated by an AI program as your own. If you include material generated by an AI program, it should be cited like any other reference material (with due consideration for the quality of the reference, which may be poor).

Any plagiarism or other form of cheating will be dealt with under relevant Stevens policies.

Undergraduate Honor System
Enrollment into the undergraduate class of Stevens Institute of Technology signifies a student's commitment to the Honor System. Accordingly, the provisions of the Stevens Honor System apply to all undergraduate students in coursework and Honor Board proceedings. It is the responsibility of each student to become acquainted with and to uphold the ideals set forth in the Honor System Constitution. More information about the Honor System including the constitution, bylaws, investigative procedures, and the penalty matrix can be found online at http://web.stevens.edu/honor/.

The following pledge shall be written in full and signed by every student on all submitted work (including, but not limited to, homework, projects, lab reports, code, quizzes and exams) that is assigned by the course instructor. No work shall be graded unless the pledge is written in full and signed.

"I pledge my honor that I have abided by the Stevens Honor System."

Students who believe a violation of the Honor System has been committed should report it within ten business days of the suspected violation. Students have the option to remain anonymous and can report violations online at www.stevens.edu/honor.

ACCOMMODATIONS

Stevens Institute of Technology is dedicated to providing appropriate accommodations to students with documented disabilities. The Office of Disability Services (ODS) works with undergraduate and graduate students with learning disabilities, attention deficit-hyperactivity disorders, physical disabilities, sensory impairments, psychiatric disorders, and other disabilities to help students achieve their academic and personal potential. They facilitate equitable access to the educational programs and opportunities offered at Stevens and coordinate reasonable accommodations for eligible students. These services are designed to encourage independence and self-advocacy with support from the ODS staff. The ODS staff will facilitate the provision of accommodations on a case-by-case basis.

For more information about Disability Services and the process to receive accommodations, visit https://www.stevens.edu/student-diversity-and-inclusion/disability-services. If you have any questions please contact the Office of Disability Services at disabilityservices@stevens.edu or by phone: 201.216.3748.

Disability Services Confidentiality Policy
Student Disability Files are kept separate from academic files and are stored in a secure location within the Office of Disability Services. The Family Educational Rights Privacy Act (FERPA, 20 U.S.C. 1232g; 34CFR, Part 99) regulates disclosure of disability documentation and records maintained by Stevens Disability Services. According to this act, prior written consent by the student is required before our Disability Services office may release disability documentation or records to anyone. An exception is made in unusual circumstances, such as the case of health and safety emergencies.

INCLUSIVITY

Stevens Institute of Technology believes that diversity and inclusiveness are essential to excellence in academic discourse and innovation. In this class, the perspective of people of all races, ethnicities, gender expressions and gender identities, religions, sexual orientations, disabilities, socioeconomic backgrounds, and nationalities will be respected and viewed as a resource and benefit throughout the semester. Suggestions to further diversify class materials and assignments are encouraged. If any course meetings conflict with your religious events, please do not hesitate to reach out to your instructor to make alternative arrangements.

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Disrespectful conduct and harassing statements will not be tolerated and may result in disciplinary actions.

Name and Pronoun Usage
As this course includes group work and class discussion, it is vitally important for us to create an educational environment of inclusion and mutual respect. This includes the ability for all students to have their chosen gender pronoun(s) and chosen name affirmed. If the class roster does not align with your pronouns and/or name, please inform the instructor of the necessary changes.

Religious Holidays
Stevens is a diverse community that is committed to providing equitable educational opportunities and supporting students of all ethnicities and belief systems. Religious observance is an essential reflection of that rich diversity. Students will not be subject to any grade penalties for missing a class, examination, or any other course requirement due to religious observance. In addition, students will not be asked to choose between religious observance and academic work. Therefore, students should inform the instructor at the beginning of the semester if a requirement for this course conflicts with religious observance so that accommodations can be made for students to observe religious practices and complete the requirements for the course.

MENTAL HEALTH RESOURCES

Part of being successful in the classroom involves a focus on your whole self, including your mental health. While you are at Stevens, there are many resources to promote and support

mental health. The Office of Counseling and Psychological Services (CAPS) offers free and confidential services to all enrolled students who are struggling to cope with personal issues (e.g., difficulty adjusting to college or trouble managing stress) or psychological difficulties (e.g., anxiety and depression). Appointments can be made by phone (201-216-5177), online at https://stevensportal.pointnclick.com/confirm.aspx, or in person on the 2nd Floor of the Student Wellness Center.

EMERGENCY INFORMATION

In the event of an urgent or emergent concern about your own safety or the safety of someone else in the Stevens community, please immediately call the Stevens Campus Police at 201-216-5105 or on their emergency line at 201-216-3911. These phone lines are staffed 24/7, year-round. For students who do not reside near the campus and require emergency support, please contact your local emergency response providers at 911 or via your local police precinct. Other 24/7 national resources for students dealing with mental health crises include the National Suicide Prevention Lifeline (1-800-273-8255) and the Crisis Text Line (text "Home" to 741-741). If you are concerned about the wellbeing of another Stevens student, and the matter is *not* urgent or time sensitive, please email the CARE Team at care@stevens.edu. A member of the CARE Team will respond to your concern as soon as possible.