

"ENMA 201: Bigger, Faster, Better: The Quest for Absolute Technology"

Department of Materials Science and Engineering
Spring 2025, Tue, Thur 12:30 to 1:45 pm;
Discussion: Fri 10:00 - 10:50am, 11:00 - 11:50am

Instructor:

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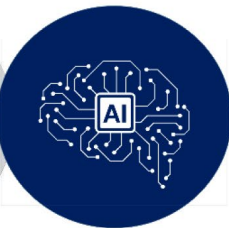
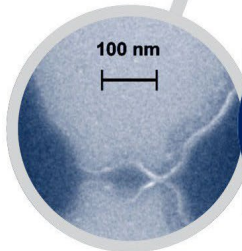
To be announced

Synopsis

Technology has become one of the dominant forces of our lives. Rapid, pervasive technological change characterizes our current lives and future, but ambivalence marks our relationships with technology. Our world faces enormous technological opportunities and challenges, including climate change, alternative energy sources, the sustainability of agriculture, urbanization and material use, a rapidly growing population faced with increasing productivity and decreasing demand for labor, advanced manufacturing, the "greening" of the economy versus economic growth, multifaceted issues of artificial intelligence, data explosion and protection of personal information issues, and others. A big question that characterizes humanity's relationship with advanced technology is: How do we prevent the accelerating transformation of technology turn it from friend to foe, i.e. help us realize our Utopian dreams rather than our Dystopian visions?

This course introduces concepts necessary to understand scientific, engineering and societal driving forces of selected technological transformations, and the conflicts inherent in introduction of new technologies. The goal of this class is to introduce students to technology choices, developments and driving forces that are shaping our lives, and by using team approaches, to research and discuss the necessary choices and decisions by considering the potential benefits and consequences ahead of time so that powerful technology benefits humanity rather than harm it.

The opportunity for students from different disciplines to work jointly on inevitable questions concerning our current/future lives with advanced technology, and developing approaches to judicious implementation of technology to prevent it changing from friend to foe, provides unique opportunities for novel insights, learning from others and growth.



Top: China's high-speed trains and world record; **Center:** Race to build the world's tallest building; **Bottom:** small semiconductor transistor and artificial intelligence (AI) enabled by this.

Lectures and Topics

- Technology and Our World. Human-developed technology has changed the world.
- Technology and the Idea of Progress.
- Feeding the World. The challenges for modern agriculture to feed the world's population approaching 9 Billion.
- Advances in Materials for Clothing, Housing, and Advanced Cities
- Energy Uses, Impacts and Challenges
- Industrial Revolutions and Societal Impacts
- Technology for Information and Communication
- The Impacts of Transportation Technology: Globalization and Others
- The Nanoscience and Technology Revolution
- Information Revolution and the Challenges of Artificial Intelligence
- The Future of Electrical Power and Technology; Challenges of AI Data Centers and Emissions
- Climate Change and Technologies of the Needed Energy Transition
- Research, Development and Advanced Manufacturing: How is technological change produced?
- Military Competition, Role of Technology, Cooperation and Peace
- Sustainable vs. Unsustainable Technologies
- Population Trends, Affluence and Planetary Boundaries
- Current Industrial Revolutions and important current issues with Technological Evolution of our World
- Circular Economies, and Required Technologies
- The Changing Nature of Work, Occupation and Leisure
- Future Technological Societies, and Economic Systems Enabled by Advanced Technology
- Guest lecture - to be announced

Lectures will focus on topics covered in lecture notes (distributed after class) and other resources.

Team discussions of important topics will take place throughout the course. Most of this will take place in the second part of each regular class and on Fridays. Each team must work out and submit sets of slides for questions posed each week. **The slides are due each Mon following the discussions.** The format is that you work with a partner on two key questions to explore possible solutions, and come up with a path forward. Each of you is responsible for one presentation on one of the questions to be submitted each week, but this needs to reflect a team effort. From the submitted sets of slides each week, several will be selected for presentation in class and you will be notified.

A Research Project of a team. To complement the other parts, students will work within a team to explore selected technological issues.

Exams will be based on materials covered in lectures, discussion sessions and reading assignments.

Class attendance is mandatory. In case your team is selected for presentation, you will need to present along with your team member.

See below for a description of further details on **expectations with regard to this class.**

Textbook: None, required reading materials will be distributed.

Grading: There will be two exams and an independent research project. The latter will be presented to the class and described in a research report. The research paper will take the place of an in-class final exam.

Your grade will be determined approximately by the following:

Hour Exams: 20% each

Team discussion slides and presentations: 30%

Team final project: Presentation + report: 30%

Class Participation, Outstanding Team Performance, Stimulating Questions: up to 10% Bonus

General Expectations: This is a highly interactive class and your attendance of lectures and discussion sessions is required and mandatory.

Learning Outcomes

General Education Assessment: I Series ENMA201

Criterion

1. The Question: Engages the I-Series course question
2. The Issues: Reveals complexity of the I-Series course question
3. The Disciplinary Context: Represents the disciplinary context of the I-Series course question

General Education Assessment: Natural Sciences & Engineering ENMA 201

<p>1. The Approach: The Students will learn how to define and set up the approach to tackle complex problems in science, technology and engineering.</p>
<p>2. The Concepts: The Students will learn how to identify the concepts to be employed in solving complex societal problems in technology and determined by scientific and engineering constraints.</p>
<p>3. The Solution: The Students will learn how to apply the concepts in a manner that provides a solution to the problem</p>