ME 6101 – Engineering Design

G. W. Woodruff School of Mechanical Engineering
Georgia Institute of Technology

Course Information

Course Number: ME 6101
Course Title: Engineering Design
Semester: Fall 2026
Class Meetings: see OSCAR/Course Schedule
Location: In person; online materials via Canvas
Course Website: https://canvas.gatech.edu/

Instructor Information

Instructor: Dr. Jianxin "Roger" Jiao
Office: GTMI 262
Office Hours: Immediately following class. Additional times by appointment if you have class conflicts with scheduled office hours.
Email: rjiao@gatech.edu
Phone: 404-894-9633
Students should use their Georgia Tech email for all course-related communication.

Course Description

ME 6101 is a graduate-level course that provides a systematic and theory-grounded introduction to engineering design. The course emphasizes design as a decision-making and knowledge-intensive process, integrating product design and development, design theory and methodology, and analytical tools for engineering decision making.

Students will study foundational design theories (e.g., axiomatic design, requirement engineering, modularity, platform design), modern product development practices, and methods for modeling, evaluating, and justifying design decisions. Through assignments, paper reviews, and a term paper or approved course project, students will learn how to articulate design problems rigorously, synthesize alternative solutions, and evaluate designs using appropriate technical and analytical frameworks.

This course is intended to prepare students for advanced design research, capstone-level projects, and industry-oriented system design problems.

Course Learning Outcomes

By the end of this course, students will be able to:

- Formulate and articulate engineering design problems at the system level
- Apply structured design methodologies to analyze and synthesize design solutions
- Interpret and critique engineering design literature
- Model customer requirements, functions, and design structures using formal methods

- Make informed design decisions using analytical and multi-criteria evaluation tools
- Clearly communicate design rationale, methodology, and results in written and oral form

Prerequisites

- Prior exposure to basic engineering design concepts (e.g., undergraduate capstone or equivalent)
- Familiarity with fundamental mechanical engineering principles

Reference prerequisite material will be provided through lecture notes and readings as needed.

Textbook and Reference Materials

Required Textbook: None

Recommended References:

- Ulrich, K. T., and Eppinger, S. D., *Product Design and Development*, McGraw-Hill
- Pahl, G., Beitz, W., Feldhusen, J., and Grote, K.-H., *Engineering Design: A Systematic Approach*, Springer
- Suh, N. P., *Axiomatic Design: Advances and Applications*, Oxford University Press

Additional papers and reading materials will be provided on Canvas.

Course Topics and Scope

The course is organized into five modules:

1. Understanding the Big Picture of Design
   – Engineering design in industrial and enterprise contexts
   – Design thinking and innovation perspectives
2. Product Design and Development
   – Product development process
   – Concept development and prototyping
   – Case studies from prior capstone and industrial projects
3. Design Theory and Methodology
   – Axiomatic Design
   – Requirement Engineering (e.g., Kano model)
   – Universal design and usability
   – Modular design and product platforms
4. Design Decisions in Engineering
   – Functional modeling (IDEF0)
   – Use-case and system modeling
   – Design Structure Matrix (DSM)
   – Design evaluation and multi-objective decision making
5. Course Deliverables and Peer Review
   – Technical paper reviews
   – Term paper or approved project presentation

Course Pedagogy

This course emphasizes graduate-level design reasoning rather than hands-on fabrication alone. Compared with undergraduate capstone courses, the focus is on:

- rigorous problem formulation
- systematic application of design theory and methods
- clear articulation of design rationale and trade-offs
- independent and critical thinking

Grading Policy and Weighting

Component	Weight
Assignments (3 individual assignments)	30%
In-class Paper Review Presentation (team, peer-reviewed)	15%
Term Paper or Approved Design Project & Presentation	45%
Quality of Peer Reviews	10%
Total	100%

There is no midterm or final exam. The term paper or project serves as the primary summative assessment.

Course Deliverables

1. Assignments (Individual)
   Three graded assignments focusing on design methods and analysis.
2. Paper Review and Presentation (Team)
   Team-based presentation of selected design research papers, including peer evaluation.
3. Term Paper or Approved Course Project (Individual or Approved Team)
   Students will apply course concepts to a concrete design problem, case study, or critical review of state-of-the-art design practice.

Assignment Submission and Deadlines

- All submissions are made electronically via Canvas
- Due dates will be announced in advance on Canvas
- Late submissions may incur penalties unless prior arrangements or documented excused absences apply

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Attendance and Participation

Regular attendance and active participation are expected. Students are responsible for keeping up with course materials, announcements, and deadlines.

Academic Integrity and Use of AI

Students are expected to adhere to the Georgia Tech Academic Honor Code.

- All sources, including AI tools, must be clearly cited
- Generative AI tools may be used only with instructor approval and proper disclosure
- Violations will be handled through the Office of Student Integrity

Accommodation and Disability Services

Students requiring accommodations should contact the Office of Disability Services (ODS) and notify the instructor as early as possible.

Additional Notes

- Course materials are for enrolled students only and may not be redistributed.

This syllabus is subject to revision. Any changes will be announced in class and on Canvas.