

ME3180 Syllabus

Machine Design, Section A, 3 Credit Hours

Summer 2026

Instructor Information

Instructor: Jonathan Gaines

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General Course Information

Description

The analysis, selection, and synthesis of machine components, as applied to springs, bearings, shafts, gears, fasteners, and other elements in a mechanical system.

This course begins as the synthesis of theory from introductory courses that focus on stress/strain analysis, materials, and structures. It introduces methods for analysis that answer the questions of why components fail and how they fail. The course then shifts its focus to specific components to explore specific modes of failure and considerations for component selection.

Tools useful for machine design applications are introduced that provide a strong basis for the types of methods for synthesis and analysis that are often found as real-world problems are explored.

Course Learning Outcomes

Outcome 1: To teach students how to apply the fundamentals of engineering science to analyze and design commonly used mechanical components to meet specifications.

- 1.1 Students will demonstrate the ability to apply fundamentals of engineering science to make proper assumptions, perform correct analyses, and draw upon different mechanical engineering subject areas in the analysis of bolted joints, shafts, bearings, springs, gears, and other components covered.
- 1.2 Students will demonstrate the ability to design mechanical components using the analyses mentioned above.

Outcome 2: To enable students to learn how to identify and quantify the specifications and trade-offs for the selection and application of components that are commonly used in the design of complete mechanical systems.

- 2.1 Students will demonstrate the ability to take technical, economical, safety, quality, and other issues (such as environmental) into account when selecting and/or designing mechanical components. The breadth and depth of the issues taken into account by students are measurable indicators of their performance.

Outcome 3: To illustrate to students the variety of mechanical components available and emphasize the need to keep learning.

- 3.1 Students will demonstrate the ability to seek and learn new material outside the class topics through the completion of open-ended tasks including homework, report, term paper,

computer assignment, and/or project. The amount and depth of new material identified and used by the student are measurable indicators of the student's performance.

Required Course Materials

Text: Shigley's Mechanical Engineering Design, 11th ed.

Author: Richard Budynas, ISBN: 1260407616

Homework: McGraw-Hill Connect

Registration: <https://connect.mheducation.com/class/j-gaines-summer-2026-mwf-2pm>

Access: <http://connect.mcgraw-hill.com/>

Grading Policy:

Your grade will be based on your performance on 3 tests, 10 homework assignments, and 10 quizzes. In order to do well in the course it is recommended that you attend every lecture and submit all assignments that are required for your grade. In addition, videos will be posted each week. Students are expected to watch video lectures and will be responsible for knowing video lecture content. A summary of assessment is

Type	Description	Total
Homework	10 homework assignments for 1% each	10%
Quizzes	10 quizzes for 2% each	20%
Tests	Test 1 = 20%, Test 2 = 25%, Final Exam = 25%	70%

Here is a summary of the high-stakes assignments.

Assignment	Weight (Percentage, points, etc)
Test 1	20%
Test 2	25%
Final Exam	25%

Tests are required to be taken during class time unless special accommodations are made.

Grading Scale

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Description of Graded Components

Test 1 and Test 2: Test 1 will strongly emphasize static failure theories. Test 2 will strongly emphasize fatigue failure theories. Both tests will include 3-5 multi-part questions. Quizzes are intended to give you a feel for pacing and expectations on how these questions might be structured.

Homework: Homework assignments typically consist of 8-12 questions that are graded for completion and content. It is expected that students spend 6-10 hours on homework per week.

Quizzes: Quizzes will be given during class and will be structured as a follow-up to completed homework assignments. Quizzes will be timed with 20 minutes allocated per quiz. If the student completes all homework assignments and is present every day during class, the quiz will build upon the knowledge gained with strong similarities.

Final exam: The final exam is cumulative. It will include static failure, fatigue failure, and topics on shaft design and components. The final exam will be 5-6 multi-part questions structured similarly to Test 1 and Test 2.

Course Policies

Attendance and/or Participation

Attendance is encouraged but not required. All content will be recorded and provided asynchronously. In the event a student has an excused absence they will be permitted to make up the work. They will be able to access the necessary previous lectures via Canvas through lecture recordings.

This course will follow all Institute restrictions related to attendance including the excused absence policy. Please see <https://catalog.gatech.edu/rules/4/> for more information.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review [Georgia Tech's Honor Code](#) and the student [Code of Conduct](#).

Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Core IMPACTS

[Core IMPACTS](#) is the University System of Georgia's General Education curriculum. If you are teaching a course that counts towards Core IMPACTS, you should include a syllabus statement about the Core area and associated [career competencies](#). [This resource](#) developed by the Center for Excellence in Teaching and Learning and Online Education at Georgia State University includes template syllabus statements for each of the Core IMPACTS areas that you may adapt for your course.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, [contact the Office of Disability Services](#) (404-894-2563) as soon as possible to make an appointment to discuss

your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. [The Student-Faculty Expectations](#) articulate some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek. Therefore, I encourage you to remain committed to the ideals of Georgia Tech while in this class.

Pre- &/or Co-Requisites

Prerequisites: ME 2110 Creative Decisions and Design and COE 3001 Mechanics of Deformable Bodies

The learning outcomes that are most relevant for Machine Design are from COE 3001. Outcome 2 from this course is particularly important which states that “Students will demonstrate an ability to set up and solve strength of materials problems such as beam bending and stress transformation.” It is difficult to do well with the theory in Machine Design if the student does not possess a good understanding of the topics relevant to strength of materials. Students will also rely heavily on strong skills from statics which are needed for success in COE 3001.

Extra Credit Opportunities

N/A

Collaboration, Group Work, and Use of Generative AI

You are likely to use generative AI such as ChatGPT this semester. As with other any other tool or resource, remember two important things:

- 1) You are ultimately responsible for what you submit.
- 2) In order to facilitate review of your work, provide appropriate references. For generative AI, this may include prompts used, the specific AI used, and a short description of your methodology (how did you use it). We will have a chance to discuss use of generative AI in class.

Uncited use of generative AI will be considered a violation of academic honesty and reported through appropriate channels.

Extensions, Late Assignments, & Re-Scheduled/Missed Exams

A deadline is a deadline. No unexcused late assignments or missed exams will be considered. These assignments will be assessed as a zero. Excused absences or missed assignments will not be penalized.

If special accommodations must be made or if there are extenuating circumstances, it is expected that the student notify me before the due date if at all possible. Certain opportunities such as a career fair or a job interview may be excused if notice is given beforehand. These are not likely to be excused if mentioned after the assignment due date.

Inclement Weather and Digital Learning Days

If any weather related event happens or a circumstance happens beyond our control the class schedule will be adjusted. I will communicate the adjustment via email.

Student Use of Mobile Devices in the Classroom

Students may use mobile devices in the classroom as they see fit as long as these devices do not distract from other students.

Additional Course Policies

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Academic Honor Code, please visit <http://www.catalog.gatech.edu/policies/honor-code/> or <http://www.catalog.gatech.edu/rules/18/>.

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Collaboration & Group Work

No collaboration on group work is permitted during quizzes and tests. For homework, collaboration is expected and encouraged.

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Campus Resources for Students

Undergraduate Student Academic Success Resources:

- Academic Support: Academic Success and Advising (a unit in the Office of Undergraduate Education & Student Success) provides free support for your courses. Students can attend scheduled supplemental review (PLUS) sessions, stop by Drop-In Tutoring, or schedule a one-on-one appointment through Knack. To explore what options work best for you, please visit us online at success.gatech.edu/tutoring, email us at tutoring@gatech.edu, or come see us at Clough Undergraduate Learning Commons, Suite 283.

Student Well-Being:

At Georgia Tech, we are concerned about your overall physical, social, and mental well-being. A [comprehensive list](#) of wellness related resources has been compiled and maintained by the Office of the Vice President for Student Engagement and Well-being ([student-resource-guide \(gatech.edu\)](#))

