

San Jose State University
Department of Mechanical Engineering
ME 157-Mechanical Systems Design, Fall 2021

Course and Contact Information

Class Days/Time:	No days/time; i.e. asynchronous
Optional Discussion Sessions:	Tu & Th 16:30-17:30 via Zoom: https://sjsu.zoom.us/my/armani
Classroom:	NA
Pre-requisites:	ME 154, ME 130 with a C- or better
Co-requisite:	ME 110
Instructor:	Dr. Amir Armani
Office Location:	Engineering 310E
Telephone:	(408) 924-8354
Email Address:	amir.armani@sjsu.edu
Office Hours:	Tu & Th 15:30-16:30 via Zoom: https://sjsu.zoom.us/my/armani
Grader:	Mr. Kaushik Katti
Email Address:	kaushiklaxminarayan.katti@sjsu.edu

Course Format

This is an asynchronous online class. It requires use of the Canvas learning management system, accessed via <https://sjsu.instructure.com>. Course materials, including syllabus, lecture videos, slides, assignments, and projects will be gradually uploaded on Canvas. Successful completion of course requirements necessitates accessing the course website frequently, typically at least twice a week on a regular basis. Technical support for Canvas is available at <http://www.sjsu.edu/at/ec/canvas>. Important communications regarding this class may be sent via Canvas or to email addresses listed in MySJSU, and thus each student is expected to maintain up-to-date contact information in both systems.

Course Description

Introduction to the mechanical design process. Design and selection of specific machine components including springs, bearings, brakes, clutches and gears. Introduction to fatigue design using fracture mechanics. Application of plastics, composite materials and finite element methods in design. Group design project. Computer applications in the design process and in design optimization.

Learning Outcomes

Upon successful completion of this course, students will be able to:

1. Select a product to design or modify an existing one, based on market research, and carry it through the design process up to building the CAD prototype and evaluation for function.
2. Apply the mechanical design process and learned methodology to the project.
3. Determine the location and magnitude of the maximum stress on a component.
4. Estimate the value of the stress concentration factor and apply it correctly to the stress component.
5. Design a machine component to guard against yielding or fracturing under static load using the appropriate failure criteria and safety factors.

6. Design a machine component to guard against fatigue failure, either using the classical approach or the fracture toughness approach.
7. Identify factors that have an influence on the design and selection of different machine components.
8. Design a spring, given the applied load and desired deflection, and select it from catalogs.
9. Select a suitable bearing from catalogs by knowing the bearing loads (radial and thrust), bearing life and reliability.
10. Design a gear reducer (planetary or conventional) to obtain a certain output speed and use AGMA code to determine the allowable load and select a suitable gear from catalogs.
11. Aware of the choices they have when it comes to material selections: metals as compared to plastics.
12. Work as a team to accomplish the project goals.

Required Textbooks

1. *The Mechanical Design Process*, 6th ed., D.G. Ullman, 2018. ISBN 978-0-9993578-0-4
2. *Machine Design*, 5th ed., R.L. Norton, Prentice Hall, 2014. ISBN 978-0-13-335671-7

Supplementary Textbooks

1. *Shigley's Mechanical Engineering Design*, 11th ed., Budynas, Nisbett, McGraw-Hill, 2020.
2. *Fundamentals of Machine Component Design*, 5th ed., Juvinall and Marshek, Wiley, 2012.
3. *Marks Handbook for Mechanical Engineers*, 11th ed., Baumeister, Avallon, et al., McGrawHill, 2007.
4. *Metals Handbook*, Vols. 8 & 10, American Society for Metals, 2018.
5. *Roark's Formulas for Stress and Strain*, Young and Budynas, 7th ed., McGraw Hill, 2002.

Course Requirements and Assignments

SJSU classes are designed such that in order to be successful, it is expected that students will spend a minimum of forty-five hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, and so on. More details about student workload can be found in University Policy S12-3 at <http://www.sjsu.edu/senate/docs/S12-3.pdf>.

- **Exams:** One midterm and one final exam. Exams will be proctored and students are expected to turn on their cameras. If cheating is suspected, the proctored videos may be used for further inspection and may become part of the student's disciplinary record. All students are expected to complete exams as scheduled. There are no make-up exams, but for truly unavoidable and extenuating circumstances with firm documentation, a student may petition to have weight redistributed to the final exam. Disability accommodations must be coordinated through the Accessible Education Center <http://www.sjsu.edu/aec>.
- **Project:** Students are asked to design either a brand new product/system or improve an existing product/system substantially that is related to human daily life. Refer to project description for details.
- **Homework:** Homework problems will be assigned corresponding to lecture topics and reading assignments from the textbooks. Late submission receives zero credit. See "Exceptions" below regarding petition for extenuating circumstances.

- Participation Tasks: Students are expected to watch all the lecture videos within one week from their upload date.

Grading Policy

The course grade will be weighted as follows:

10% for Homework
 5% for Participation Tasks
 25% for Midterm Exam
 25% for Design Project
 35% for Final Exam

The overall course grade is calculated from a weighted sum of all graded components. Graded percentage points correspond to letter grade as follows:

$93 \leq \rightarrow A$	$90 \leq < 93 \rightarrow A-$	
$87 \leq < 90 \rightarrow B+$	$83 \leq < 87 \rightarrow B$	$80 \leq < 83 \rightarrow B-$
$77 \leq < 80 \rightarrow C+$	$73 \leq < 77 \rightarrow C$	$70 \leq < 73 \rightarrow C-$
$67 \leq < 70 \rightarrow D+$	$63 \leq < 67 \rightarrow D$	$60 \leq < 63 \rightarrow D-$
$< 60 \rightarrow F$		

Exceptions: Any grading appeals or late petitions must be petitioned promptly in writing (or email). Exceptions will normally be evaluated at the very end of the semester in context with semester track record and all other exceptions class-wide. Special consideration for truly unavoidable and extenuating circumstances will depend on timing and strength of supporting documentation (e.g., doctor's note, jury summons, military orders).

University Policy F13-1 at <http://www.sjsu.edu/senate/docs/F13-1.pdf> states: “All students have the right, within a reasonable time, to know their academic scores, to review their grade-dependent work, and to be provided with explanations for the determination of their course grades.”

General Expectations, Rights and Responsibilities of the Student

As members of the academic community, students accept both the rights and responsibilities incumbent upon all members of the institution. Students are encouraged to familiarize themselves with SJSU's policies and practices pertaining to the procedures to follow if and when questions or concerns about a class arises. See University Policy S90–5 at <http://www.sjsu.edu/senate/docs/S90-5.pdf>. More detailed information on a variety of related topics is available in the SJSU catalog, at <http://info.sjsu.edu/web-dbgen/narr/catalog/>. In general, it is recommended that students begin by seeking clarification or discussing concerns with their instructor. If such conversation is not possible, or if it does not serve to address the issue, it is recommended that the student contact the Department Chair as a next step.

Dropping and Adding

Students are responsible for understanding the policies and procedures about add/drop, grade forgiveness, etc. Refer to the current semester's Catalog Policies section at <http://info.sjsu.edu/static/catalog/policies.html>. Add/drop deadlines can be found on the current academic year calendars document on the Academic Calendars webpage at

http://www.sjsu.edu/provost/services/academic_calendars/. The Late Drop Policy is available at <http://www.sjsu.edu/aars/policies/latedrops/policy/>. Students should be aware of the current deadlines and penalties for dropping classes. Information about the latest changes and news is available at the Advising Hub at <http://www.sjsu.edu/advising/>.

Academic Integrity

Your commitment, as a student, to learning is evidenced by your enrollment at San Jose State University. The University Academic Integrity Policy S07-2 at <http://www.sjsu.edu/senate/docs/S07-2.pdf> requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the office of Student Conduct and Ethical Development. The Student Conduct and Ethical Development website is available at <http://www.sjsu.edu/studentconduct/>.

Campus Policy in Compliance with the American Disabilities Act

If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please inform me in writing as soon as possible (email acceptable). Presidential Directive 97-03 at http://www.sjsu.edu/president/docs/directives/PD_1997-03.pdf requires that students with disabilities requesting accommodations must register with the Accessible Education Center (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

Student Technology Resources

Computer labs for student use are available in the Academic Success Center at <http://www.sjsu.edu/at/asc/> located on the 1st floor of Clark Hall and in the Associated Students Lab on the 2nd floor of the Student Union. Additional computer labs may be available in your department/college. Computers are also available in the Martin Luther King Library. A wide variety of audio-visual equipment is available for student checkout from Media Services located in IRC 112. These items include DV and HD digital camcorders; digital still cameras; video, slide and overhead projectors; DVD, CD, and audiotape players; sound systems, wireless microphones, projection screens and monitors.

SJSU Writing Center

The SJSU Writing Center is located in Clark Hall, Suite 126. All Writing Specialists have gone through a rigorous hiring process, and they are well trained to assist all students at all levels within all disciplines to become better writers. In addition to one-on-one tutoring services, the Writing Center also offers workshops every semester on a variety of writing topics. To make an appointment or to refer to the numerous online resources offered through the Writing Center, please see <http://www.sjsu.edu/writingcenter>.

Tentative Course Schedule

Week	Topics
1	Course organization; Course project discussion; Design process (Ch 1, 4 in Ullman)
2	Project and product definition (Ch 5, 6 in Ullman)
3	Concept generation and evaluation (Ch 7, 8 in Ullman)
4	Product generation and evaluation (Ch 9, 10, and 11 in Ullman)
5	Shafts (Ch 10 in MD)
6	Shafts (Ch 10 in MD)
7	Bearings (Ch 11 in MD)
8	Bearings (Ch 11 in MD)
9	Midterm
10	Introduction to gears (Ch 12 in MD)
11	Design of gears (Ch 12, 13 in MD)
12	Design of gears (Ch 13 in MD)
13	Weldments (Ch 16 in MD)
14	Springs, brakes, and clutches (Ch 14, 17 in MD)
15	Fracture mechanics; Design with plastics and composites
16	Design project presentation

The Final Exam will be held on **Thursday, December 9, 17:15-19:30**.