

San José State University
Department of Mechanical Engineering
ME 273 Finite Element Methods in Engineering
Section 01 (41171), Fall 2022

Course and Contact Information

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|-------------------------|---------------------------------------|
| Instructor: | Dr. Eduardo Chan |
| Office Location: | ENG 213; Online via Zoom |
| Telephone: | (408) 418-8535 |
| Email: | Eduardo.Chan@sjsu.edu |
| Office Hours: | TR 8:45pm – 9:15pm and by appointment |
| Class Days/Time: | TR 7:30pm – 8:45pm |
| Classroom: | ENG 213 & Zoom |
| Prerequisites: | BSME or Instructor Consent |

Course Web Page

Copies of the course materials such as the syllabus, major assignment handouts, etc. may be found on Canvas at <https://sjsu.instructure.com>. You need to be registered for the course to have access on Canvas. You are responsible for regularly checking for course handouts and assignments on Canvas (or other communication system as indicated by the instructor).

Course Description

Introduction to various finite element methods for developing stiffness equation. Truss, beam, 2-D, 3-D and axisymmetric elements. Applications using commercial FEA software packages.

Course Learning Objectives (CLO)

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

1. Describe the Finite Element Analysis (FEA) procedure.
2. Identify the application and characteristics of FEA elements such as bars, beams, planar elements, and common 3-D elements.
3. Develop the stiffness equation for common FEA elements, and assemble element stiffness equations into a global equation.

4. Identify and apply suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
5. Apply existing 3-D computer-aided design (CAD) skills to prepare models for finite element analysis.
6. Set up and solve 1-D, 2-D, and 3-D structural problems using commercial FEA tools.
7. Optimize engineering parts using FEA.
8. Interpret results obtained from FEA, not only in terms of conclusions, but also awareness of limitations.

Program Learning Objectives (PLO)

1. A strong foundation beyond the undergraduate level in their chosen focus area as well as in mathematics, basic science and engineering fundamentals, to successfully compete for technical engineering positions in the local, national and global engineering market, advance in their current position or pursue doctoral studies.
2. Professional and lifelong learning skills to be able to apply and extend theory to solve practical contemporary engineering problems.
3. The expertise necessary to design mechanical engineering systems with possible specialization in areas such as: energy systems, electronics cooling, electronics packaging & reliability, finite element analysis & CAD, mechatronics & MEMS, product design, robotics, automation & manufacturing.

Required Texts/Readings

Textbook

First Course in the Finite Element, Enhanced 6th Edition by Daryl L Logan.
Published by Cengage, 2022, ISBN 978-0357676424.

Optional Reference

Finite Element Simulation with ANSYS Workbench 2021 by H. Lee.
Published by SDC Publications, ISBN 978-1630574567.

Classroom Protocol

The students are expected to attend class regularly and actively participate in classroom discussions. Please arrive on time so as not to distract other students, especially during computer lab sessions. Use of cell phones is prohibited in class or lab.

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 calendar](#) web page located at http://www.sjsu.edu/academic_programs/calendars/academic_calendar/. 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/>.

Technology Requirements

Students are required to have an electronic device (laptop, desktop, or tablet) with a camera and microphone. SJSU has a free [equipment loan program](#) available for students.

Students are responsible for ensuring that they have access to reliable Wi-Fi during tests. If students are unable to have reliable Wi-Fi, they must inform the instructor, as soon as possible or at the latest one week before the test date to determine an alternative. See [Learn Anywhere](#) website for current Wi-Fi options on campus.

Zoom Classroom Etiquette

Mute Your Microphone: To help keep background noise to a minimum, make sure you mute your microphone when you are not speaking.

- **Be Mindful of Background Noise and Distractions:** Find a quiet place to “attend” class, to the greatest extent possible.
 - Avoid video setups where people may be walking behind you, people talking/making noise, etc.
 - Avoid activities that could create additional noise, such as shuffling papers, listening to music in the background, etc.
- **Position Your Camera Properly:** Be sure your webcam is in a stable position and focused at eye level.
- **Limit Your Distractions/Avoid Multitasking:** You can make it easier to focus on the meeting by turning off notifications, closing or minimizing running apps, and putting your smartphone away (unless you are using it to access Zoom).
- **Use Appropriate Virtual Backgrounds:** If using a virtual background, it should be appropriate and professional and should NOT suggest or include content that is objectively offensive and demeaning.

Recording Zoom Classes

This course or portions of this course (i.e., lectures, discussions, student presentations) will be recorded for instructional or educational purposes. The recordings will only be shared with students enrolled in the class through Canvas. The recordings will be deleted at the end of the semester. If, however, you would prefer to remain anonymous during these recordings, then please speak with the instructor about possible accommodations (e.g., temporarily turning off

identifying information from the Zoom session, including student name and picture, prior to recording).

Students Are Not Allowed To Record

Students are prohibited from recording class activities (including class lectures, office hours, advising sessions, etc.), distributing class recordings, or posting class recordings. Materials created by the instructor for the course (syllabi, lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. This university policy ([S12-7](#)) is in place to protect the privacy of students in the course, as well as to maintain academic integrity through reducing the instances of cheating. Students who record, distribute, or post these materials will be referred to the Student Conduct and Ethical Development office. Unauthorized recording may violate university and state law. It is the responsibility of students that require special accommodations or assistive technology due to a disability to notify the instructor.

Proctoring Software and Exams

Exams will be proctored in this course through *Respondus Monitor*, *LockDown Browser* and Zoom video meeting. Please note it is the instructor's discretion to determine the method of proctoring. If cheating is suspected the proctored videos may be used for further inspection and may become part of the student's disciplinary record. Note that the proctoring software does not determine whether academic misconduct occurred but does determine whether something irregular occurred that may require further investigation. Students are encouraged to contact the instructor if unexpected interruptions (from a parent or roommate, for example) occur during an exam.

Please refer to the online exam instructions for details of the setup and requirements.

Technical difficulties

Internet connection issues:

Canvas autosaves responses a few times per minute as long as there is an internet connection. If your internet connection is lost, Canvas will warn you but allow you to continue working on your exam. A brief loss of internet connection is unlikely to cause you to lose your work. However, a longer loss of connectivity or weak/unstable connection may jeopardize your exam.

Other technical difficulties:

Immediately notify the instructor and explain the problem you are facing. Your instructor may not be able to respond immediately or provide technical support. However, the current state of your exam and communication will provide a record of the situation.

Contact the SJSU technical support for Canvas:

Technical Support for Canvas

Email: ecampus@sjsu.edu

Phone: (408) 924---2337

<https://www.sjsu.edu/ecampus/support/>

Assignments and Grading Policy

The grading components of this course are listed as follows:

20% for Homework Assignments

25% for Midterm Exam, Popped Quizzes

25% for Term Project (details to be announced in class)

30% for Final Exam

Submissions of homework assignments, labs and final term project reports should be done via Canvas. **Late or email submissions will not be accepted without a university-authorized excuse. The student must participate in all grading components to obtain a passing grade.**

Grades are assigned according to the following table:

| Letter Grade | GPA Scale | Percent Scale | Borderline |
|--------------|-----------|---------------|------------|
| | (4.30) | 100.0 | |
| | (4.15) | 98.4 | |
| A | 4.00 | 96.8 | |
| | 3.85 | 95.2 | A / A- |
| A- | 3.70 | 93.6 | |
| | 3.50 | 91.4 | A- / B+ |
| B+ | 3.30 | 89.3 | |
| | 3.15 | 87.7 | B+ / B |
| B | 3.00 | 86.1 | |
| | 2.85 | 84.5 | B / B- |
| B- | 2.70 | 82.9 | |
| | 2.50 | 80.7 | B- / C+ |
| C+ | 2.30 | 78.6 | |
| | 2.15 | 78.0 | C+ / C |
| C | 2.00 | 75.4 | |
| | 1.85 | 73.8 | C / C- |
| C- | 1.70 | 72.1 | |
| | 1.50 | 70.0 | |

This percent scale sets a lowest adequate score at 70, which is the minimum threshold for a grade of “C-“.

University Policies

Academic integrity

Your commitment as a student to learning is evidenced by your enrollment at San Jose State University. The [University's Academic Integrity policy](http://www.sjsu.edu/senate/docs/s16-15.pdf), located at <http://www.sjsu.edu/senate/docs/s16-15.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](http://www.sjsu.edu/studentconduct/) is available at <http://www.sjsu.edu/studentconduct/>.

Instances of academic dishonesty will not be tolerated. **Cheating on exams or plagiarism (presenting the work of another as your own, or the use of another person's ideas without giving proper credit) will result in a failing grade and sanctions by the University.** For this class, all assignments are to be completed by the individual student unless otherwise specified. If you would like to include your assignment or any material you have submitted, or plan to submit for another class, please note that SJSU's Academic Policy S07-2 requires approval of instructors.

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 make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the [Accessible Education Center](http://www.sjsu.edu/aec) (AEC) at <http://www.sjsu.edu/aec> to establish a record of their disability.

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Course Schedule

By default, most Tuesdays will focus on FEA theory and most Thursdays will focus on FEA applications with Ansys. However, exceptions are possible and will be updated throughout the semester. The primary topics for each week are tabulated below, but there will be instances of topic overlap. The textbook chapters that are listed are approximate only, and more specific reading sections will be specified as the semester progresses.

| Week | Dates | Topics & Readings | |
|------|--------------|-----------------------------------|---|
| | | Tuesdays | Thursdays |
| 1 | 8/23, 8/25 | Course Admin; Introduction | Introduction to FEA (Ch. 1) |
| 2 | 8/30, 9/1 | Introduction to FEA (Ch. 1) | Introduction to FEA (Ch. 1) |
| 3 | 9/6, 9/8 | Springs (Ch. 2) | Springs (Ch. 2) |
| 4 | 9/13, 9/15 | Springs (Ch. 2) | Ansys Introduction |
| 5 | 9/20, 9/22 | Springs (Ch. 2) & Trusses (Ch. 3) | Trusses (Ch. 3) |
| 6 | 9/27, 9/29 | Trusses (Ch. 3) | Ansys Truss Models |
| 7 | 10/4, 10/6 | Trusses (Ch. 3) | Beams (Ch. 4) |
| 8 | 10/11, 10/13 | Beams (Ch. 4) | Ansys Beam Models |
| 9 | 10/18, 10/20 | Beams (Ch. 5) & Midterm Review | Midterm (Oct 20) |
| 10 | 10/25, 10/27 | Introduction to Elasticity | Ansys 2D Models |
| 11 | 11/1, 11/3 | Introduction to Elasticity | Ansys 3D Models |
| 12 | 11/8, 11/10 | Plane Solids (Ch. 6 & 10) | Ansys Design Sensitivity |
| 13 | 11/15, 11/17 | Plane Solids (Ch. 6 & 10) | Ansys Design Optimization |
| 14 | 11/22, 11/24 | Finite Element Modeling (Ch. 7) | Thanksgiving Day (No Class) |
| 15 | 11/29, 12/1 | Finite Element Modeling (Ch. 7) | Finite Element Modeling (Ch. 7) |
| 16 | 12/6, 12/8 | Project Presentations | Final Exam (Dec 8, 19:45 - 22:00) |