San José State University
Department of Mechanical Engineering
ME 154 Mechanical Engineering Design, Section 02, Spring 2022

Course and Contact Information

Class Days and Time:	Mondays and Wednesdays 10:30 AM to 12:10 PM
Classroom:	ENG 329
Registration Code:	23002, 4 units
Prerequisites:	ME 20, MatE 25, ME 101, CE 112, all with C- or better
Corequisite:	Tech/ME 41 (either completed previously or co-enrolled)
Instructor:	Sang-Joon (John) Lee
Email:	sang-joon.lee@sjsu.edu
Telephone:	408-924-7167
Office Location:	Online by default in Spring 2022 (link posted in Canvas)
Office Hours:	Mondays and Wednesdays 1:30 PM to 2:30 PM

Course Format

This is a mixed-mode class, with both in-person and online components. The class will heavily use the Canvas learning management system (LMS) https://sjsu.instructure.com/ and at times require use of Zoom video conferencing https://sjsu.zoom.us/, for which online meetings require a microphone and speakers. Successful completion of course requirements necessitates accessing the course website frequently. Technical support for Canvas is available at http://www.sjsu.edu/ecampus/. Important communications regarding this class may be sent via Canvas or to student email addresses listed in MySJSU, and thus each student is expected to maintain up-to-date contact information in both systems.

Course Description: https://catalog.sjsu.edu/preview_course_nopop.php?catoid=10&coid=44348

Introduction to the design and analysis of mechanisms and machine elements. Linkage synthesis. Kinematic and dynamic analysis of mechanisms. Application of statics, dynamics, strength of materials, static failure theories and fatigue theory to the design of machine components. Threaded fasteners. Group design project.

Course Learning Outcomes

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

1. Apply the concept of kinematics pairs (joints) and determine the number of degrees of freedom for a given mechanism.
2. Identify the different types of four-bar mechanisms and their classifications.
3. Identify the toggle positions and to determine the minimum transmission angle and mechanical advantage of a given mechanism.
4. Synthesize a four-bar mechanism using graphical and analytical methods for a given motion or function generation task.
5. Perform a kinematics analysis of a mechanism to determine position, velocity, and acceleration of all members.
6. Perform a kinetic analysis of a mechanism to determine the forces on all joints and the torque required to drive the mechanism.

7. Determine the magnitude and location of the maximum stress (principal stresses, maximum shear stress and von Mises stress) on a component.
8. Design and analyze short and long columns.
9. Design and analyze thin and thick walled cylinders under pressure and to select proper interference fits for press or shrink fits.
10. Design and analyze ductile and brittle machine components under static loads using appropriate failure criterion.
11. Estimate the value of stress concentration factor.
12. Design and analyze machine components under cyclic loads to guard against fatigue failure.
13. Design bolted joints in tension and shear.
14. Work as a team to accomplish a project goal.

Required Textbooks

1. *Design of Machinery*, 6th ed., by R. L. Norton, McGraw-Hill, 2020. Available in a lean version for ME 154 via ISBN 9781264001330 from Spartan Bookstore. Multiple other formats are available: https://www.mheducation.com/highered/product/design-machinery-norton/M9781260113310.html
2. *Machine Design*, An Integrated Approach, 6th ed., by R. L. Norton, Prentice Hall, 2014. Multiple formats are available: https://www.pearson.com/store/p/machine-design-an-integrated-approach/P100002946749/

Software Requirements

The course requires routine use of 3-D CAD software (e.g., SOLIDWORKS or equivalent). Information for available site licenses will be provided in class. Students may also access supported software via the Virtual Desktop Infrastructure (VDI) https://www.sjsu.edu/ecs/vdi/ provided by the College of Engineering.

Course Requirements and Assignments

University policies relevant to syllabi are posted at https://www.sjsu.edu/curriculum/courses/syllabus-info.php. As stated, "Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally 3 hours per unit per week with 1 of the hours used for lecture) for instruction or preparation/studying or course related activities including but not limited to internships, labs, clinical practica. Other course structures will have equivalent workload expectations as described in the syllabus."

In addition to textbook reading and class participation, course requirements and assignments are as follows:

- Design Project: A major (and hopefully enjoyable!) part of this course is the Design Project. Students are responsible for working in a team to design a mechanism (both synthesis and analysis) and to build a prototype that demonstrates its functionality. Details are provided via separate documentation.
- Exams: There are two midterms and one final exam. All exams will begin with a synchronous online meeting during which time open questions for clarification are welcome. A fixed amount of additional time will then be allowed for independent completion of the exam in take-home format. All exam work must be completed strictly on an individual basis with no communication or help from any other person.
- Homework: Routine homework will be assigned approximately one week before the deadline. Collaborating among classmates on general strategies and cross-checking intermediate values are welcome and encouraged. However, all homework must still be freshly prepared and submitted individually. Raw copying of solutions or exact duplication of figures is cheating. In addition to completeness and correctness, format compliance, legibility, and professionalism (e.g., name, date, class, and assignment identified, problems arranged in order) may be also weighed in grading.
- Participation Tasks: Throughout the semester there will be several participation tasks to promote active engagement. Specific examples include assigned discussion posts, online quizzes or surveys, and peer evaluations. Accordingly, it is important to check Canvas regularly with no lapses of more than a few days.

Grading Information

The course grade is calculated from a weighted sum of all graded components as follows:

- 15% for Homework
- 10% for Participation Tasks
- 20% for Design Project
- 30% for two Midterm Exams (15% each)
- 25% for Final Exam

Graded percentage points correspond to letter grades as follows:
93.0-100 A | 90.0-92.9 A minus | 87.0-89.9 B plus | 83.0-86.9 B | 80.0-82.9 B minus
77.0-79.9 C plus | 73.0-76.9 C | 70.0-72.9 C minus | 67.0-69.9 D plus | 63.0-66.9 D | 60.0-62.9 D minus | 0-59.9 F

Assignment Submission: All graded assignments must be submitted using the designated assignment tool in the Canvas course shell. Assignments will not be accepted over email.

Team Assignments and Peer Grading: Team assignments will be used for some portions of the course, and some assignments may involve peer grading. Alternative options will be considered for compelling reasons, but arrangements must be pre-approved in writing with ample time before corresponding deadlines (i.e. several days in advance).

Late Policy: Unless otherwise specified for a particular assignment, work that is submitted late will be accepted with reduced credit according to a depreciation rate of 1.5% for each late hour breached. Exams, however, are strictly limited to designated times; late exams are not accepted.

Exceptions: Any grading appeals or petitions must be communicated promptly in writing (or email). Exceptions will normally be evaluated at the very end of the semester in context with an individual's overall semester track record and all other exceptions class-wide. Special consideration for truly unavoidable and extenuating circumstances will depend on timeliness and supporting documentation (e.g., doctor's note, police report).

University Policies

In accordance with University Policy S16-9 http://www.sjsu.edu/senate/docs/S16-9.pdf, the following link contains university-wide policy information relevant to all courses, such as academic integrity, accommodations, and related concerns: https://www.sjsu.edu/curriculum/courses/syllabus-info.php.

Academic Technology Requirements

Students are required to have an electronic device (laptop, desktop or tablet) with audio. Campus-level resources for technology needs (including equipment loans) are described at https://www.sjsu.edu/learnanywhere/equipment/.

Recording Policy

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 (lectures and lecture notes, presentations, etc.) are copyrighted by the instructor. University Policy S12-17 https://www.sjsu.edu/senate/docs/S12-7.pdf 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 who require special accommodations or assistive technology due to a disability to notify the instructor.

Course Schedule

This schedule is a tentative plan, subject to change with updates to be communicated in class or notification via Canvas.

Dates	Topics	Related Chapters
1/26	Course organization, linkages, joints, degrees of freedom	DoM* Ch 2
1/31, 2/2	Common planar mechanisms: four-bar linkages, crank-sliders, cams, etc. Mechanical advantage, transmission angles, toggle positions	DoM Ch 2
2/7, 2/9	Graphical linkage synthesis of four-bar linkages Driver dyads, quick-return and dwell mechanisms	DoM Ch 3
2/14, 2/16	Vectors in complex polar notation, closed loop vector equations, position analysis Analytical linkage synthesis (brief introduction from limited parts of DoM Ch 5)	DoM Ch 4
2/21, 2/23	Review of planar kinematics of rigid bodies Velocity analysis for four-bar linkages and crank-sliders	DoM Ch 6
2/28, 3/2	Acceleration analysis for four-bar linkages and crank-sliders Kinematics of cams (brief introduction from limited parts of DoM Ch 8)	DoM Ch 7
3/7, 3/9	Mechanism kinematics review and practice **1st Midterm Exam** (launches Wednesday)	
3/14, 3/16	Forces on mechanisms, self-consistent free-body diagram notation Matrix solution method for linear equations	DoM Ch 11
3/21, 3/23	Review of stress and strain, applied stresses, principal stresses Multiaxial loading and combined stresses, stress concentrations	MD** Ch 2 MD Ch 4
3/28, 3/30	*(No class meetings – spring recess)*	
4/4, 4/6	Failure theories for static loads (maximum shear stress, distortion-energy, Coulomb-Mohr) Design against static failure	MD Ch 5
4/11, 4/13	Stress analysis review and practice **2nd Midterm Exam** (launches Wednesday)	
4/18, 4/20	Column loading and design against buckling failure Other applied stress scenarios (pressurized cylinders, interference fits)	MD Ch 4
4/25, 4/27	Failure theory for cyclic loads, high cycle fatigue, S-N curve Effect of mean stress on fatigue life, design against fatigue failure	MD Ch 6
5/2, 5/4	Threaded fasteners and failure modes Bolted joint preload and design against separation failure	MD Ch 15
5/9, 5/11	Semester review and practice	
5/16	Design Project presentations	

* Design of Machinery textbook ** Machine Design textbook

All students are expected to be available during the university-designated final exam period for this class, as listed at https://www.sjsu.edu/classes/final-exam-schedule/spring-2022.php.

The 2021-2022 academic calendar is posted at https://www.sjsu.edu/provost/docs/Academic_Calendar-AY2021-22.pdf.