

San José State University
Department of Mechanical Engineering
ME157 Mechanical Systems Design, Section 01(46101), Fall 2018

Course and Contact Information

Instructor:	Dr. Raymond K. Yee
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Office Hours:	Monday 1-2PM, Tuesday 11-12noon
Class Days/Time:	MW 10-11:45AM
Classroom:	Engineering Building Room 331
Prerequisites:	ME154 with a C- or better, co-requisite: ME110

Course Format

This is an in-class lecture mode course. Students are expected to be present each class for learning.

Course Description

This is a senior capstone class. It covers “Introduction to the Mechanical Design Process: Design specification development, conceptual design, and product design process”. Application of the fundamentals from statics, dynamics, strength of materials, static and fatigue failure theories are applied to specific machine components. Emphasis will be placed on the integration of the mechanical engineering disciplines and systematic integrated approach to design of machine elements and systems. Plastics materials in design will be briefly introduced. Also fundamental of fracture mechanics will be covered in this course. The required group design project will increase the students' understanding of the design process. 3 units.

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

By the end of the course, students should 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 Texts/Readings

Textbook

- (1) Ullman, D.G., "The Mechanical Design Process", 6th Ed., 2018 ISBN 978-0-9993578-0-4
- (2) Robert L. Norton, "Machine Design", 5th Edition, Prentice Hall, 2014 (MD) ISBN 978-0-13-335671-7
- (3) Handout Notes

Other Readings

1. Juvinall and Marshek, "Fundamentals of Machine Component Design", 5th edition, Wiley, 2012.
2. Shigley, Mischke, and Budynas, "Mechanical Engineering Design", 10th edition, McGrawHill, 2014.
3. Baumeister, Avallón, et al, Marks Handbook for Mechanical Engineers.
4. American Society for Metals, Metals Handbook, Vols. 8 & 10.
5. Young and Budynas, Roark's Formulas for Stress and Strain, 7th ed, McGraw Hill, 2002.
6. Rolfe, Barsom, Fracture and Fatigue Control in Structure, Prentice Hall, 1977.
7. Dudley, W.D., Practical Gear Design, McGraw Hill, 1984
8. Ertas, Atila and Jones, Jesse, The Engineering Design Process, Wiley, 1993

Course Requirements and Assignments

a. Projects: Design project will be required for this course. 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 handout for details.

b. Exams: One midterm and one final exam.

c. Homework: Weekly reading of the text and homework problems. Usually due in one week unless notice otherwise.

Note: Late homework assignments will not be accepted unless with valid excuse approved by the University!

d. Class Participation: Students are encouraged to actively participate in class discussion and example problem solving.

Note: Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of forty-five (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.

Final Examination

FINAL Exam: **Tuesday December 18, 2018 from 9:45 to 12noon** (No alternative arrangement)

Grading Information

HW Assignments	15%
Midterm	25%
Design Project	25%
Final Exam	35%
Total	100%

Determination of Grades

Grading Percentage Breakdown

91% and above	A
90% - 88%	A-
87% - 86%	B+
85% - 83%	B
82% - 80%	B-
79% - 77%	C+
76% - 74%	C
73% - 70%	C-
69% - 67%	D+
66% - 64%	D
63% - 60%	D-
below 60%	F

Classroom Protocol

To ensure that every student, current and future, who takes courses in the **campus building**, has the opportunity to experience an environment that is safe, attractive, and otherwise conducive to learning, the College of Engineering at San José State University has established the following classroom policies:

Eating:

Eating and drinking (except water) are prohibited in the building classrooms. Students with food will be asked to leave the classroom. Students who disrupt the course by eating and do not leave the classroom will be referred to the Judicial Affairs Officer of the University.

Cell Phones:

Students will turn their cell phones off or put them on vibrate mode while in class. They will not answer their phones in class. Students whose phones disrupt the course and do not stop when requested by the instructor will be referred to the Judicial Affairs Officer of the University.

Computer Use:

In the classroom, faculty allow students to use computers only for class-related activities. These include activities such as taking notes on the lecture underway, following the lecture on Web-based PowerPoint slides that the instructor has posted, and finding Web sites to which the instructor directs students at the time of the lecture. Students who use their computers for other activities or who abuse the equipment in any way, at a minimum, will be asked to leave the class and, at a maximum, will be referred to the Judicial Affairs Officer of the University for disrupting the course. (Such referral can lead to suspension from the University.) Students are urged to report to their instructors computer use that they regard as inappropriate (i.e., used for activities that are not class related).

University Policies

Per University Policy S16-9, university-wide policy information relevant to all courses, such as academic integrity, accommodations, etc. will be available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>"

Academic Honesty:

I have read the honor code below and agreed with its provisions. My continued enrollment in this course constitutes full acceptance of this code.

To preserve academic integrity, I will not:

1. Take an exam in place of someone else, or have someone take an exam in my place
2. Give information or receive information from unauthorized source during an exam
3. Use more reference material during an exam than is allowed by the instructor
4. Obtain a copy of an exam prior to the time it is given
5. Alter an exam after it has been graded and return it to the instructor for re-grading

Students who are caught cheating will be reported to the Judicial Affairs Officer of the University, as prescribed by [Academic Senate Policy S04-12](#)

ME157 Mechanical Systems Design, Fall 2018, Tentative Course Schedule

This schedule is subject to change with fair notice via announcement in class or notification via Canvas.

Course Schedule

Week	Date	Topics, Readings, Assignments
1	8/22	Course organization. Introduction to design process (Ch 1, 4, 5 in Ullman)
2	8/27	Project discussion. Introduction to design process (Ch 1, 4, 5 in Ullman)
2	8/29	Planning phase; Identification of a need; Specifications development. (Ch 5, 6 in Ullman)
3	9/3	No Class, Labor Day Holiday
3	9/5	Concept generation (Ch 7 in Ullman)
4	9/10	Concept generation (Ch 7 in Ullman) Concept evaluation (Ch 8 in Ullman)
4	9/12	Concept evaluation (Ch 8 in Ullman)
5	9/17	Product generation; Evaluation for function and performance; Evaluation for Assembly. (Ch 10, 11 in Ullman)
5	9/19	Evaluation for function and performance; Evaluation for Assembly; Human factors in design (Ch 11 & 12, Appendix D in Ullman)
6	9/24	Evaluation for function and performance; Evaluation for Assembly; Human factors in design (Ch 11 & 12, Appendix D in Ullman)
6	9/26	Review of design for dynamic loads (fatigue). (Ch 6 in MD)
7	10/1	Rolling contact bearings selection. (Ch 11 in MD)
7	10/3	Midterm in class (Wed)
8	10/8	Rolling contact bearings selection. (Ch 11 in MD)
8	10/10	Design of mechanical springs; extension, compression & torsion (Ch 14 in MD)
9	10/15	Design of mechanical springs; extension, compression & torsion (Ch 14 in MD)
9	10/17	Spring design for static and fatigue loading (Ch 14 in MD) Midterm problems discussion
10	10/22	Spring design for static and fatigue loading (Ch 14 in MD) Midterm problems discussion
10	10/24	Gear types; kinematic gear trains (conventional & planetary) (Ch 12 in MD)
11	10/29	Gear types; kinematic gear trains (conventional & planetary) (Ch 12 in MD)
11	10/31	Spur gear design based on bending and surface fatigue strength; AGMA design code (Ch 12 in MD)

Week	Date	Topics, Readings, Assignments
12	11/5	Spur gear design based on bending and surface fatigue strength; AGMA design code (Ch 12 in MD)
12	11/7	Spur gear design based on bending and surface fatigue strength; AGMA design code (Ch 12 in MD)
13	11/12	No Class, Veteran's Day Holiday
13	11/14	Helical gear design (Ch 13 in MD)
14	11/19	Fatigue design using fracture mechanics approach, plastic zone, fracture toughness, stable crack propagation rate. (Notes)
14	11/21	No Class on campus, due to upcoming Thanksgiving Holidays
15	11/26	Fatigue design using fracture mechanics approach, plastic zone, fracture toughness, stable crack propagation rate. (Notes)
15	11/28	Design with plastic materials, Thermosetting plastics, Thermoplastics. (Notes)
16	12/3	Design project presentation in class (from 10:30 to 12PM)
16	12/5	Design project presentation in class (from 10:30 to 12PM)
17	12/10	Course review – Note: project report is due in my office on 12/11 (Tues) by noon.
Final Exam	12/18	In class, 9:45 to 12noon (no exception)