

Course Syllabus

Course

Description Elasticity, plasticity, anelasticity; deformation mechanisms; effect of microstructure and imperfections; fatigue; creep, fracture; materials design, selection, and applications. (Lecture 2hrs/Lab 1 hr; 3 units)

Objectives: The course is designed to enhance the understanding of the fundamental knowledge of mechanical responses in engineering materials upon the application of loads. Emphasis will be placed on how to perform various mechanical tests, how to resolve stresses from one axis system to another, how to analyze the stress and strain in the presence of defects, how to interpret the relationships between structure configuration and property data, and how to explain material's mechanical behavior using micro and macroscopic approaches in a given service condition. Deformation mechanisms and failure modes will be discussed as well.

Prerequisites: Junior core, CE 99, ChE162, and Engr. 100W

Class Hours: Lecture: Mondays, 0900 - 1050, E-335
Laboratory: Wednesdays, 0900 - 1150, E-105

Office Hours: Tuesdays: 0900-1200 & Wednesdays:1400-1600, other times by appointment only.

Office Room: E-385E

Office Phone: (408) 924-3927 **E-mail address:** wchung@email.sjsu.edu

Textbook: Dowling, Norman E. **Mechanical Behavior of Materials**, Prentice-Hall, Upper Saddle River, New Jersey, 2nd Edition, 1999. (ISBN0-13-905720-X) TA404.8 D68

References: Antolovich, S.D., Ritchie, R.O. and Gerberich, W.W. (editors), **Mechanical Properties and Phase Transformations in Engineering Materials**, A Publication of the Metallurgical Society, Warrendale, Pennsylvania, 1986. (ISBN 0-87339-012-1) TA 401.3 M4155

Barrett, Craig R., Nix, William D. and Tetelman, Alan S. **The Principles of Engineering Materials**, Prentice-Hall, Upper Saddle River, New Jersey, 1973. (ISBN 0-13-709394-2) TA403.B24.

Broek, David **Elementary Engineering Fracture Mechanics**, Martinus Nijhoff Publishers, Hingham, Massachusetts, 3rd Edition, 1984. (ISBN 90-247-2656-5)

Courtney, Thomas H. **Mechanical Behavior of Materials**, McGraw Hill, New York, 2nd Edition, 2000. (ISBN0-07-028594-2) TA405.C859

Dieter, George E. **Mechanical Metallurgy**, McGraw Hill, New York, 3rd Edition, 1986. (ISBN 0-07-016853-8) TA405.D53

Green, W.A. and Micunovic, M. (editors), **Mechanical Behavior of Composites and Laminates**, Elsevier Applied Science Publishing, New York, 1986. (ISBN 1-85166-144-1) TA418.9C6 E976

Gere, James M. and Timoshenko, Steven P. **Mechanics of Materials**, PWS-KENT Publishing, Boston, Massachusetts, 3rd Edition, 1990. (ISBN 0-534-92174-4) TA405.G44

Hertzberg, Richard W. **Deformation and Fracture Mechanics of Engineering Materials**, John Wiley & Sons, New York, 3rd Edition, 1989. (ISBN 0-471-63589-8) TA417.6H46 (current edition – 4th edition, 1995)

Sanford, R.J. **Principles of Fracture Mechanics**, Prentice-Hall, Upper Saddle River, New Jersey, 2003. (ISBN 0-13-092992-1) TA409.S26.

Grading Basis: There will be one midterm and one final examination. Examinations are comprehensive; including subjects from all assigned readings, lectures, laboratory activities, and classroom demonstrations. Homework assignments and quizzes will consist of essay questions and problem solving cases. The laboratory component affects 25% of the course grade. A term project report must be completed and submitted by November 16th.

Homework and Quizzes.....	15%
One midterm exam.....	20%
Laboratory activities.....	25%
Term project with oral presentation.....	15%
Final Examination.....	25%
Total: 100%	

For all graded work, course letter grades will be assigned according to the corresponding ranges of cumulative averages listed below.

A+ 97 -- 100	A 94 -- 96	A- 90 -- 93
B+ 87 -- 89	B 84 -- 86	B- 80 -- 83
C+ 77 -- 79	C 74 -- 76	C- 70 -- 73
D+ 67 -- 69	D 64 -- 66	D- 60 -- 63
F below 60		

Add/Drop Policy: Students wanting to enroll in the class must sign the roster, provided space is available. Last day to drop this class without a “W” grade is **September 6**.

Important Dates: Midterm examination date: **Oct. 12**

Final exam date: **Wednesday, December 14, 0715 – 0930**

Term project report submission date: **Nov. 16**

Term project report presentation date: **Nov. 23**

Course Website: <http://www.engr.sjsu.edu/wrchung/courses.html#195>

The instructor will provide his notes, resources and additional information on the course website (URL listed above). You may need to periodically visit the course website for reading assignments, homework problems and solutions, and course updates. The site also has some links to other websites for learning purposes, e.g. some websites to learn how to draw/analyze the Mohr's Circle for plane stresses.

http://www.efunda.com/formulae/solid_mechanics/mat_mechanics/mohr_circle.cfm

<http://www.aoe.vt.edu/~jing/MohrCircle.html>

<http://www.isr.umd.edu/~sebastn/sebastn.d/mohr.html>

Homework: Work the homework problems on one side of a paper only. You need to number all the pages if more than one page is submitted. On top of each page write down your name, the course number, the semester, and the submission date. List the problem numbers in the Dowling textbook and restate the statement of the problem including simple sketches, if applicable. You must show the working steps and circle the numeric solutions. Underline them and don't forget units! The instructor will pay attention to these requirements.

Note: A few points will be docked if you don't provide any formulas or working steps. It is imperative that you provide one or two sentences at the end of calculations to describe its physical meaning and your deposition. It will be a brief statement used to state the physical significance or implication of your answer.

No late assignments will be accepted, as the problem solutions will be posted immediately after the submission date.

Laboratory: A **Laboratory (Activity) Logbook** will be purchased and kept by each student. It must be checked and initialed by the instructor before beginning the first lab exercise. The logbook must be 8 1/2 x 11 inches, NOT spiral bound. You will use it to record a detailed log of all lab activities, data, sketches of experimental setups and results, and records of references used for class projects. Mark it clearly on the cover with your name, group number, class and section, instructor, and semester. Each page should be numbered and dated and each lab activity labeled. You may record your partners' names, phone numbers, and schedules inside the cover for future consultation for a lab report. A written group report will be submitted by the end of each lab activity. The due date is generally a week from the lab completion day.

Term Project: A **Term Project** must be completed. The term project will involve a literature search involving material's performance in a device/system/application. You will start with finding an interesting topic, then collect published articles (at least three) in this area, read the collected articles, and write a short summary of your study. This written report must be supported by technical merit, impact on scientific world, innovative testing methods, etc. The instructor will provide a few topics/ examples in class at a later date to help you select an appropriate topic. Completed term project reports will be at least 8-10 pages in length, double spaced not including illustrations or appendices, and will follow the CME department thesis format (check department website). An electronic copy has to be submitted via turnitin.com. The details will be discussed in class. An oral presentation on the term project must be conducted in class starting on November 23.

An (individual) oral presentation on the term project is expected to last at least 10 minutes, followed by a 3-5-minute discussion period. The presentation should be technical and include view graphs or visual aids related to the chosen subject area. Ideally the presentations should be conducted using the PowerPoint format. The instructor will provide a portable notebook computer along with an LCD projector in class for presentation purpose. Transparencies, films, and/or VCR recordings (VHS) can be used, but may not replace spoken reporting. A guideline with tips of presentation requirements will be distributed in class at a later date.

Academic Dishonesty: Strict University policy on academic dishonesty will be enforced in this course. Students who violate the policy will receive an F on the specific test or assignment and be reported to the University after the incident. (Refer to Academic Integrity Policy S04-12 in SJSU Catalog for Academic Dishonesty Policy.)

Cheating means getting unauthorized help on an assignment, quiz, or examination. (1) You must not receive from any other student or give to any other student any information, answers, or help during an exam. (2) You must not use unauthorized sources for answers during an exam. You must not take notes or books to the exam when such aids are forbidden, and you must not refer to any book or notes while you are taking the exam unless the instructor indicates it is an "open book" exam. (3) You must not obtain exam questions illegally before an exam or tamper with an exam after it has been corrected.

Plagiarism means submitting work as your own that is someone else's. For example, copying material from a book or other source without acknowledging that the words or ideas are someone else's and not your own is plagiarism. If you copy an author's words exactly, treat the passage as a direct quotation and supply the appropriate citation. If you use someone else's ideas, even if you paraphrase the wording, appropriate credit should be given. You have committed plagiarism if you purchase a term paper or submit a paper as your own that you did not write.

Mat E 195 Course Activity Outline

Week	Starting Date	Reading: Chapter #	Homework Assignments	Laboratory (Wedn.)
1	Aug. 24	Ch.1 & Ch.2 Introduction		No lab activity
2	Aug. 29	Ch.3 A Survey of Engineering Materials	3.2, 3.6, 3.7, 3.10, 3.12	Lab tour/safety; material failure (failure modes)
3	Sept. 7	Labor Day --No Class on Sept. 5	Read page 167-177	Impact test
4	Sept. 12	Ch. 4 Mechanical Testing (Other Tests)	4.6, 4.8, 4.18, 4.20, 4.24	Hardness test
5	Sept.19	Ch. 4 Mechanical Testing (Tension Test)	4.28, 4.30, 4.31, 4.36, 4.37	Tensile test of material (strain rate, temp)
6	Sept. 26	Ch.5 Stress-Strain Relationships	5.4, 5.6, 5.13, 5.20, 5.23	Flexure test and failure modes
7	Oct. 3	Ch.5 Stress-Strain Relationships	5.26, 5.28, 5.30, 5.32 (use Table 5.2)	Mohr's Circles
8	Oct.10	Ch.6 Complex and Principal States of Stress and Strain	6.1, 6.7, 6.9, 6.10, 6.12	Midterm Exam Oct. 12
9	Oct. 17	Ch.6 Complex and Principal States of Stress and Strain	6.16, 6.18, 6.20, 6.24, 6.28	Mechanical tests on thermoplastic and thermoset composites (I)
10	Oct. 24	Ch. 7 Yielding and Fracture under combined Stresses	7.11, 7.12, 7.14, 7.16, 7.25	Mechanical tests on thermoplastic and thermoset composites(II)
11	Oct. 31	Ch. 8 Fracture of Cracked Members	8.2, 8.4, 8.7, 8.15, 8.21	SEM sample preparation
12	Nov. 7	Ch. 9 Fatigue of Materials	9.3, 9.4, 9.6, 9.12, 9.16	SEM fractography
13	Nov. 14	Ch. 9 Fatigue of Materials	9.18, 9.19, 9.24, 9.21, 9.26	MTS testing – fatigue test
14	Nov. 21	Ch. 11 Fatigue Crack Growth	Report Due -Nov. 16	Polymers
15	Nov. 28	Ch. 11 Fatigue Crack Growth	11.4,11.6, 11.8, 11.10, 11.13	Project Presentations Nov. 23
16	Dec. 5	Ch. 15 Time-Dependent Behavior: Creep and Damping	15.2, 15.5, 15.7, 15.12, 15.14	Problem Solving
	Dec. 8	Review of the Course	Last Day of Instruction	
		Final Examination:	Wednesday, Dec. 14, 0715 – 0930	

MatE 195 Course Learning Objectives

Upon the completion of this course, the student will be able to:

1. Conduct mechanical test methods to characterize the mechanical behavior of engineering materials including tension, compression, hardness, impact, flexure, fatigue and creep tests and interpret the collected data.
2. Apply the basic principles of elasticity and plasticity and the importance of brittle-ductile transformation and elastic and plastic behavior of materials to industrial applications.
3. Describe the concept of fracture mechanics and its application to product design, manufacturing method, and service reliability.
4. Perform the mathematical calculation of a multi-axial or complex stress state and relate it to the uni-axial stress state and the yielding condition.
5. Describe and predict the mechanical behavior of crystalline solids using the concepts of dislocation theory and a micro-mechanical approach.
6. Improve fracture toughness and deflect a crack's propagation through the understanding of the microstructural alignment and the associated mechanical anisotropy.
7. List environmental factors affecting material performance in a service condition.
8. Use various yield criteria to explain material deformation mechanisms and to prevent material from a catastrophic failure
9. Construct Mohr's circles to help solve and predict stress and strain distribution in a given structure
10. Describe material fracture behavior using spring and dash-pot models
11. Explain how notch sensitivity will affect material behavior when undergoing a mechanical loading
12. Develop and formulate equations for a problem solving related to material application

MatE Program Outcomes Supported

- 1.2 Can infer and predict materials properties based on knowledge of materials structure.
- 1.3 Can measure and identify the materials properties appropriate to a specific application (e.g. mechanical, electrical, etc.)
- 2.3 Can analyze results of experiments using appropriate theoretical and empirical models