

SAN JOSE STATE UNIVERSITY  
Department of Chemical & Materials Engineering

MatE 210  
Experimental Methods in  
Materials Engineering

Fall 2005  
W. Richard Chung

**Course Syllabus**

**Course Description:** Advanced study of experimental techniques used in materials engineering, including data acquisition and analysis, experiment design strategy and hands-on operation of advanced equipment. (Lecture 2 hour/lab 3 hours, 3.0 units)

**Objectives:** To familiarize students with experimental methods and techniques used in Materials Engineering field, the key elements include, but not limited to, how to design experiments and how to analyze experimental data so that they are meaningful. This is a hands-on course. During the semester you will operate the equipment in the department. You will also design, conduct, analyze and report on one full-length experiment. Equipment that you will use during laboratory periods will include metallographic apparatuses, the Instron/MTS, hardness testers, particle size analysis equipment, furnaces, etc. There will also be field trips to laboratories in the vicinity so that you will be exposed to equipment that the University does not have. You will have to write, and turn in trip reports for grading. You are to decide on your own "full-length" experiment and submit a "proposal" for instructor approval no later than **September 19, 2005**. If you don't know how to choose a topic, please ask the instructor. He will provide you a topic. You will also be required to do class presentations on topics that are assigned to you. The class presentations will focus on measurement techniques for specific properties of materials. The theme for the Fall 05 semester will be testing of biomedical implants and nanotechnology devices.

Development of team work skills is another important aspect of this course. Students will be divided into groups by the instructor. Each student will belong to two different groups – one for the class presentation and one for the term project. All team members in a team will receive the same grade for a particular assignment, based on their performance as a team.

**Prerequisites:** Graduate standing; MatE 115 and MatE 141 (or equivalent).

**Class Hours:** Lecture: Mondays, 1930-2120, E-403  
Laboratory: Mondays, 1630-1920, 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:** [wrchung@email.sjsu.edu](mailto:wrchung@email.sjsu.edu)

**Recommended Texts:**

Jack P. Holman, Experimental Methods for Engineers, McGraw-Hill: New York, New York, (2001). ISBN: 0073660558

Sheldon Jeter and Jeffrey Donnell, Writing Style and Standards in Undergraduate Reports, 2004, College Publishing: Glen Allen, Virginia. ISBN: 09679121-7-2.

Additional readings will be distributed in class from time to time.

**Assignments** will be handed out from time to time, and must be submitted on the due date. All trip reports and laboratory reports will be due in exactly one week from the date of completion. **No late assignments will be accepted.**

**Term Project:** All students are to plan and conduct a semester long experimental term project. A proposal outlining the term project, including its significance, method of investigation, equipment and materials needed, and method of analysis, is to be submitted for instructor approval no later than **September 19, 2005**. A background literature search using on line data bases must be conducted, and the results submitted no later than **October 17, 2005**. The proposal and literature search together carry 5 of the 25% assigned for the term project.

The deadline for turning in the final term paper is **November 21, 2005**. 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 is expected to last at least 10 minutes, followed by a 2-3 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.

**Lab Reports:** All students are to turn in lab reports for each of the labs done in this class. The reports will be due one week after the laboratory is completed. These lab reports will consist of the following:

- a. An Objective statement, which should be clear, concise, and to the point.
- b. A Results section which contains the results obtained during the experiment.
- c. A Discussion section which addresses the validity of the results, including statistical validity, problems encountered that may affect the validity of the results, etc.
- d. A Conclusion statement.
- e. Appendix(ces) of raw data, and other pertinent information that does not belong in the body of the lab report.

**Attendance:** Punctual attendance during lectures and laboratory sessions is mandatory.

**Grading:** Attendance 10%

Class Presentations	25%
Laboratory Reports	25%
Trip Reports & Assignments	10%
<u>Term Project and presentation</u>	<u>30%</u>
Total	100%

***Notes of Importance:***

1. No late assignments will be accepted.
2. There will be no make-up assignments.
3. Be prompt in getting to class and in returning from breaks.
4. Say what you think to the group; private conversations while someone else is speaking are disrespectful.
5. Remain open minded; ask questions.
6. All cell phones and pagers must be turned off when you enter the classroom.

**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.

## Tentative Lecture and Laboratory Schedule

<i>Week of</i>	<i>Lecture</i>	<i>Laboratory</i>
Aug 29	Class organization Measurements vs. Experiment	Report Writing Lab Safety Procedures
<b>Sept 5</b>	<b>No Class – Labor Day Holiday</b>	
Sept 12	Statistical Analysis of Experimental Data	Hardness Measurements Charpy Test
Sept 19	Measurement of Mechanical Properties	Tensile Testing
Sept 26	Weibull Statistics	3-Point Bend Test
Oct 3	Surface & Bulk Analytical Techniques	Cold Rolling, Metallography, Group Presentations
Oct 10	Temperature Measurements, Metallography Testing on Biomedical Devices	Heat Treatment of Metals, Group Presentation
Oct 17	Corrosion Measurements and Dynamic Mechanical Analysis (DMA)	<b>BAE Systems :Emerging Technologies</b> <i>Mr. John Turns and Dr. Lee Hornberger</i>
Oct 24	Electrical and Optical Measurement	E-315, Dr. Emily Allen
Oct 31	Adhesion of Thin Films	Sessile Drop and Wetting Force Balance, MTS;
Nov 7	Nanomaterials Fabrication and Characterization	<b>Pacific Nanotechnology (AFM)</b> <i>Mr. Daniel Kleinen, Mr. Brook Hamilton, Ms. Tracy Nollin</i>
Nov 14	Fractographic Investigation (Case Studies: Failure Analyses)	<b>Exponent Failure Analysis Associates</b> <i>Dr. Jude Foulds</i>
Nov 21	Fatigue testing of Biomedical Implants	Term Project Due, Group Presentations
Nov 28	Design of Experiments	Term Project Presentations
Dec 5	<i>Last day of Instruction</i>	Term Project Presentations

## **Course Learning Objectives**

1. Develop an ability to apply knowledge of mathematics, science and engineering
2. Operate measurement and testing equipment with a safe procedure
3. Explain and control the accuracy and precision of an apparatus
4. Design and construct experiments, as well as collect, organize, analyze and interpret data
5. Present data in an effective way
6. Characterize materials with respect to structure-property-processing relationships
7. Function and communicate effectively in a team
8. Explain the impact of engineering solutions in a global and societal context
9. Demonstrate the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

## MatE 210: TERM PROJECT EVALUATION CRITERIA

NAME: \_\_\_\_\_

	Max. Points	Your Score
1. Title Page & Abstract	10	
2. Introduction (Significance of Problem)	10	
3. Theory	15	
4. Experimental Procedure (Equipment/ Materials)	10	
5. Results	10	
6. Discussion of Results	15	
7. Conclusion	10	
8. References	10	
9. Overall Impression (Subjective)	10	
	<hr/>	
	100	
	<hr/>	

## REFERENCES

1. A. J. Wheeler and A. R. Ganji, Introduction to Engineering Experimentation, Prentice Hall, Englewood Cliffs, New Jersey (1996)
2. ASM Metals Handbook, Volume 8, Mechanical Testing and Evaluation, ASM International, Materials Park, Ohio (2000). ISBN: 0-87170-389-0
3. ASM Metals Handbook, Ninth Edition, Volume 10, Materials Characterization, ASM International, Materials Park, Ohio (1986). ISBN: 0-87170-016-6
4. ASM Metals Handbook, Ninth Edition, Volume 11, Failure Analysis and Prevention, ASM International, Materials Park, Ohio (1986). ISBN: 0-87170-017-4
5. ASM Metals Handbook, Ninth Edition, Volume 12, Fractography, ASM International, Materials Park, Ohio (1987). ISBN: 0-87170-018-2
6. A. W. Adamson, Physical Chemistry of Surfaces, Interscience Publishers (1967)
7. B. S. Massey, Measures in Science and Engineering, John Wiley & Sons, New York, New York (1986)
8. C. P. Wright, Applied Measurement Engineering, Prentice Hall, Englewood Cliffs, New Jersey (1995). ISBN: 0-13-253477-0
9. D. C. Baird, Experimentation: An Introduction to Measurement Theory and Experiment Design, Prentice Hall, Englewood Cliffs, New Jersey (1988)
10. D. Briggs and M. P. Seah, Practical Surface Analysis, John Wiley & Sons, New York, New York (1983)
11. F. C. Nachod and J. J. Zuckerman, Determination of Organic Structures by Physical Methods, Academic Press (1971)
12. V. J. Colan and F. A. Heiser, Analysis of Metallurgical Failures, John Wiley & Sons, New York, New York (1987)

**MATE 210 - CLASS PRESENTATION ASSIGNMENTS & SCHEDULE**

<b>Date</b>	<b>Group Members</b>	<b>Presentation Topic</b>
Oct.3	Jorge Duque, Chialin Sheu, Shoaib Mujtaba	Stents for Superficial Femoral Artery
Oct. 3	Brendan Croom, Brian McCoy, Scott Poveromo	Artificial Muscles
Oct. 10	Frank Chang, Jonathan Lin, Christina Monis, Behzad Khosrowmoabed	Surgical Sealants (Stitchless Glues)
Oct. 10	Teresita Fernandez, Minerva Cruz, Ming-Chun Kuo	Hip/Knee Joint Replacements

**MatE210 - TERM PROJECT GROUPS & TITLES**

<b>Group Members</b>	<b>Term Project Title</b>