



University of Central Florida

Mechanical, Materials & Aerospace Engineering Department

EMA 3012C

Experimental Techniques in Mechanics and Materials

Spring Semester 2005

INSTRUCTOR:

Dr. Samar Jyoti Kalita (“Dr. Samar”)
Assistant Professor of Materials Science & Engineering
Office: ENG I, Room 245
Phone: (407) 283-3159
E-mail: samar@mail.ucf.edu
Office Hours: Tuesday, Wednesday; 10:30-11:20 A.M.
Other times by appointment

TEACHING ASSISTANT:

Mr. Vikas Somani,
Office: ENG I, Room 157
E-mail: somanivikas@rediffmail.com
Office Hours: M & W 12:30-2:30 P.M.

COURSE CREDIT AND ORGANIZATION:

3 credit hours. The course comprises of hands on laboratory training and classroom lectures. The class (all sections) meets on Monday, Wednesday; 11:30 A.M.–12:20 P.M. in Classroom building I Room 105. The laboratory schedule for all sections is presented below.

Section 0011	Monday	12:30 PM – 2:30 PM	ENG 157
Section 0012	Tuesday	01:30 PM – 3:30 PM	ENG 157
Section 0013	Wednesday	12:30 PM – 2:30 PM	ENG 157
Section 0014	Friday	12:30 PM – 2:30 PM	ENG 157

PREREQUISITES/ COREQUISITES:

EGN 3365 Structure and Properties of Materials
EML 3601 Solid Mechanics
[Please see me immediately if you have not satisfied the above PR/ CR]

TEXTBOOK:

Materials Science and Engineering - An Introduction, William D. Callister Jr., John Wiley & Sons Inc., 6th Edition, 2002.

COURSE OBJECTIVES:

1. To realize the importance of various experimental techniques in understanding the behavior of engineering materials.
2. To learn, appreciate and correlate the importance of microstructure with various mechanical properties of metals.
3. To gain hands on knowledge on various experimental techniques used in understanding materials.
4. To appreciate the structure-property relationship in materials science and engineering.
5. To be able to use the knowledge gained for materials design and selection in engineering.

COURSE DESCRIPTION:

The course will provide hands-on experience with various experimental techniques that are used in characterizing materials, which include crystal structures, microstructures and mechanical properties such as hardness, strength and toughness. The course will consist of two hours (50 min each) of lecture and two hours of laboratory every week. The lectures will cover topics including atomic structure, microstructure and metallography, optical and scanning electron microscopy, X-ray diffraction, heat treatment of steels, failures in metals, tensile testing, hardness testing, impact testing, compression testing, creep and fatigue failures and corrosion behavior. Emphasis in the laboratory will be on hands-on experience.

At the completion of the course, the students are expected to be fully familiar with broad spectrum of techniques available for materials characterization. The students will also be able to decide on the best technique(s) to characterize the given material for a specific application.

GRADING:

Homework	5%
Quizzes	10%
Laboratory reports	35% (30% + 5%)
Midterm Exam I	10%
Midterm Exam II	10%
Final Exam Part A	15% (Comprehensive, Theory)
Final Exam Part B	15% (Comprehensive, Practical)

The final grade assigned will include +/- modifiers.

ASSIGNMENTS:

Reading: You should read the assigned topics before the class in which they will be discussed. This will make the lecture more understandable and will enable you to be prepared to ask questions.

Written: Homework problems will be assigned and collected. However, only one question will be graded. Quizzes and exams will contain questions related to homework problems.

GENERAL POLICIES:

1. There will be no make-up exam and quizzes given. In case of emergency/ illness, special arrangement will be made on one-to-one basis.
2. Homework solutions will be made available in <http://webct.ucf.edu> on the day of submission after 5:00 PM. No homework will be accepted after the solutions are posted.
3. Feedback and suggestions are always welcome.
4. Class participation is strongly encouraged and attendance is important.
5. To enhance learning and for your convenience, some class notes will be made available to you through <http://webct.ucf.edu/>. You will have to log on to the web using your PID and password. If you have any question or if you are not convenient with webCT, please contact WebCT Specialist Ms. Kim Okamoto in Room 289 ENG I; Telephone: 407-823-5248.

APPROACH:

- I. Practice Oriented Learning
- II. Visualization/Application
- III. Qualitative

REFERENCES:

1. Foundations of Materials Science and Engineering by W.F. Smith, McGraw Hill, Third edition, 2004.
2. Introduction to Materials Science for Engineers: Shackelford, James F., Prentice Hall.
3. The Principles of Engineering Materials, Barrett, Nix and Tetelman, Prentice Hall, Englewood Cliffs, NJ.
4. Mechanical Metallurgy, George E. Dieter, McGraw Hill
5. Introduction to Physical Metallurgy, Sidney H Avner, McGraw Hill



University of Central Florida

Mechanical, Materials & Aerospace Engineering Department

EMA 3012C

Experimental Techniques in Mechanics and Materials

Instructor: Prof. Samar J. Kalita

Spring 2005

Lecture Schedule

Week	Date	Topic	Chapter
1	January 10 (M)	Introduction to EMA 3012C	1
	January 12 (W)	Mechanical Properties of Metals: Hardness Testing	6
2	January 17 (M)	Holiday (No class)	
	January 19 (W)	Mechanical Properties of Metals: Hardness Testing	6
3	January 24 (W)	Atomic Bonding in Solids	2
	January 26 (M)	Basics of Metallography (special lecture notes)	
4	January 31 (M)	Optical Microscopy	4
	February 02 (W)	Phase Diagrams	9
5	February 07 (M)	Iron-Iron Carbide Phase Diagram	9
	February 09 (W)	Iron-Carbon alloys	9
6	February 14 (M)	Phase Transformation in Metals	10
	February 16 (W)	Heat Treatment of Steels	10
7	February 21 (M)	MID-TERM EXAMINATION I	
	February 23 (W)	Ferrous alloys: Nomenclature	11
8	February 28 (M)	Mechanical Properties of Metals: Tensile Testing	6
	March 02 (W)	Mechanical Properties of Metals: Compression Test	6
9	March 07 (M)	Shear and Impact Testing	8
	March 09 (W)	Failures: Ductile and Brittle	8
10	March 14 (M)	SPRING BREAK!!!	
	March 16 (W)	SPRING BREAK!!!	

11	March 21 (M)	Fatigue Failures	8
	March 23 (W)	MID-TERM EXAMINATION II	
12	March 28 (M)	Creep and High Temperature Failures	8
	March 30 (W)	Structure of Crystalline Solids	3
13	April 4 (M)	X-ray diffraction (use CD/ book website)	
	April 6 (W)	Electron Microscopy	4
14	April 13 (W)	Scanning Electron Microscopy (special lecture)	
	April 18 (M)	Corrosion and Degradation of Materials	17
15	April 20 (M)	Review for Final Examination	
16	April 27 (W)	FINAL EXAMINATION, 10:00 AM - 12:50 P.M. (Theory, Mandatory)	

Dates for laboratory examination (Mandatory) will be announced in class.

Time: M, W, F 12:30 – 2:30 PM and T 1:30 – 3:30 PM



University of Central Florida
Mechanical, Materials & Aerospace Engineering Department

EMA 3012C
Experimental Techniques in Mechanics and Materials
Fall Semester 2004

Laboratory Schedule

Lab 1	Rockwell Hardness Testing
Lab 2	Vickers Hardness Testing
Lab 3	Optical Metallography: Basics of Specimen Preparation
Lab 4	Optical Metallography: Microscopic Observation and Analyses
Lab 5	Effect of Heat Treatment on Hardness of Steels
Lab 6	Effect of Heat Treatment on Microstructure of Steels
Lab 7	Estimation of Hardenability by Jominy End Quench Test
Lab 8	Tensile Testing
Lab 9	Shear Testing and Impact Testing
Lab 10	Structure Determination by X-ray Powder Diffraction Method
Lab 11	Scanning Electron Microscopy (no lab report)
Lab 12	Tour of Materials Characterization Facility (MCF) at UCF (no lab report)
