THE UNIVERSITY OF TEXAS AT AUSTIN
Department of Aerospace Engineering and Engineering Mechanics

ASE 324L AEROSPACE MATERIALS LABORATORY
SPRING 2008

SYLLABUS

Unique Number:	12975, 12980, 12985			
Instructor:	Kenneth M. Liechti WRW 110C, 471-4164, kml@mail.utexas.edu			
CLASS TIME:	MW 2-3 p.m.		GEO 3.222	
LAB TIME:	12875	T	3:30-6:00p	WRW 5W
	12880	W	3:30-6:00p	WRW 5W
	12885	Th	3:30-6:00p	WRW 5W
Location:	GEO3.222/WRW5W			
Teaching Assistant:	Justin Babcock, Masa Wakamatsu, Ken Hunziker			
Web Page:	Blackboard and http://www.ae.utexas.edu/courses/ase324l/.			

Catalog Description:
Study of the deformation and fracture behavior of materials used in aerospace vehicles. Structure-property relations, methods of characterizing material behavior, use of properties in the design process. Case histories. Written reports. Two lecture hours and three laboratory hours a week for one semester. Prerequisite: Engineering Mechanics 319.

Course Objectives: Learn how to characterize the elastic and inelastic deformation and fracture behavior of common aerospace materials. To understand the material and environmental factors that affect the behavior of materials.

Prerequisites: Mechanics of Materials EM 319.

Knowledge, Skills, and Abilities Students Should Have Before Entering This Course:
Calculate stress and strain, reduce data obtained from computer data acquisition systems, communicate via technical writing, use spreadsheets, word processors, and statistical analysis software.
Knowledge, Skills, and Abilities Students Gain from this Course (Learning Outcomes):
Understand the deformation and fracture characteristics of common aerospace materials. Conduct ramp and creep tension tests and fracture tests. Link the behavior of materials to their microstucture.

Impact On Subsequent Courses In Curriculum:
This course helps students with materials selection in subsequent classes.

Relationship of Course to Program Outcomes:
This course contributes to the following ABET Criterion 3 outcomes and those specific to the EAC accredited program.

Outcome	√	Outcome	√
a. An ability to apply knowledge of mathematics, science, and engineering	√	g. An ability to communicate effectively	√
b. An ability to design and conduct experiments, as well as to analyze and interpret data	√	h. the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.	√
c. an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.		i. A recognition of the need for and an ability to engage in life-long learning	
d. An ability to function on multi-disciplinary teams		j. A knowledge of contemporary issues	
e. An ability to identify, formulate, and solve engineering problems	√	k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	√
f. An understanding of professional and ethical responsibility			

ABET Program Criteria Achieved:
Program criteria are unique to each degree program and are to be compiled from the program criteria given for each degree program and listed in table format below. The faculty should check which of the program criteria are achieved in the course.

Criterion	√	Criterion	√	Criterion	√
A. Aerodynamics		G. Orbital Mechanics		M. Preliminary/Conceptual Design	√
B. Aerospace Materials	√	H. Space Environment		N. Other Design Content	√
C. Structures	√	I. Attitude Determination and Control		O. Professionalism	
D. Propulsion		J. Telecommunications		P. Computer Usage	√
E. Flight Mechanics		K. Space Structures	√		
F. Stability and Control		L. Rocket Propulsion			

Topics:
Deformation behavior of hot and cold rolled steel (2) (a, b, e, g, h, k), (B, C, M, N, P)
Microstructure and dislocations (2) (a, b, e, g, h, k), (B, C, M, N, P)
Deformation behavior of a heat-treated aluminum alloy (2) (a, b, e, g, h, k), (B, C, M, N, P)
Solid solutions and crystalline structure (2) (a, b, e, g, h, k), (B, C, M, N, P)
High temperature creep (2) (a, b, e, g, h, k), (B, C, M, N, P)
Deformation behavior of polymers (2) (a, b, e, g, h, k), (B, C, M, N, P)
Deformation behavior of fiber reinforced composites (2) (a, b, e, g, h, k), (B, C, M, N, P)
Ceramics and Glasses(2) (a, b, e, g, h, k), (B, C, M, N, P)
Fractography and fracture toughness (2) (a, b, e, g, h, k), (B, C, M, N, P)
Environmental effects on fracture resistance (2) (a, b, e, g, h, k), (B, C, M, N, P)
Fatigue strength and Fatigue crack growth (2) (a, b, e, g, h, k), (B, C, M, N, P)
Materials Selection (2) (a, b, e, g, h, k), (B, C, M, N, P)

Professionalism Topics:
Safety, broad education.

Design Assignments:
Materials selection.

Laboratory Assignments:
Tensile ramp tests, tensile creep tests, fracture toughness tests, Charpy impact tests, microscopy, hardness tests, fatigue tests.
Tensile tester, strain gages, displacement transducers, microscope, hardness testers, impact tester, fatigue testers, computer data acquisition

Computer:
All topics listed above require personal computer usage.

Text:
Engineering Materials 1 & 2 (3rd edition) by M.F. Ashby and D.H. Jones
Laboratory manual (posted on Blackboard in weekly installments).

Class Format:
Lecture and laboratory.

Class Schedule:
See below.

Class Outline:
See below and laboratory manual

Grading:

Reports	35%
Pop quiz	5%
Mid semester test	30%
Final Exam	30%

Homework Policy:
There will be about 6 formal lab reports as identified in the lab manual. Questions that accompany the lab exercise must be carefully considered and answered in the report. Reports must be neat, concise, and timely. Reports / homeworks not turned in at the next subsequent lab meeting are considered late. Reports that are turned in no more than a week late are penalized 50%. Reports more than one week late will be penalized 100%.

Examinations:
There will be random pop quizzes, a mid semester exam and a final exam. The mid semester exam will cover the material in Labs 1-6. The final will cover the material Labs 7-12. The questions are designed to check the student's ability to apply the knowledge gained to problems.

Attendance:
Regular attendance is expected.

Office Hours:
M/W/F 4-5 pm.

Important Dates:

WEEK	LAB	TOPIC
Jan 14/16		Organization, Introduction & Steel
Jan 21		No class: Martin Luther King
Jan 23	1	Steel
Jan 28/30	2	Microstructure & Dislocations
Feb 4/6	3	Aluminum
Feb 11/13	4	Heat Treatment and Alloy
Feb 18/20	5	High Temperature Creep
Feb 25/27	6	Polymers
March 10		Spring Break
Mar 17		**Review**
Mar 19		**Mid semester exam (2-4pm, Labs 1-6)**
Mar 24/26	7	Ceramics & Glasses
Mar 31/ Apr 2	8	Composites
Apr 7/9	9	Fractography & Fracture Toughness
Apr 14/16	10	Charpy Impact Test
Apr 21/23	11	Fatigue Strength & Crack Propagation
Apr 28/30	12	Materials Selection
May 12, 9 am to 12 noon		**FINAL** (Labs 7-12)

Special Notes:
The University of Texas at Austin provides upon request appropriate academic adjustments for qualified students with disabilities. For more information, contact the Office of the Dean of Students at 471-6259, 471-4641 TDD or the College of Engineering Director of Students with Disabilities at 471-4321.

Evaluation:
The Measurement and Evaluation Center forms for the College of Engineering will be used during the last week of class to evaluate the course and the instructor.

Prepared by: Kenneth M. Liechti Date: 1/14/2008