University of Kansas
Department of Aerospace Engineering
AE 510 Materials and Processes
Fall 2003, Dr. Rick Hale

Course Objectives:

The course objectives are to provide each student with:

1. an understanding of material selection criteria
2. a familiarity with the material behavior of engineering materials, particularly alloys of iron (steel), aluminum and titanium as well as ceramics, plastics and composites
3. a familiarity with manufacturing processes common to the aerospace industry.

Course topics will be presented in a manner to provide students the knowledge required to produce designs of aerospace systems with appropriate material and process specifications.

Texts:

1. Manufacturing Engineering and Technology, Serope Kalpakjian, 4th edition, Addison-Wesley, 2001.
2. Excerpts from MIL-HDBK-5E

Course Topics:

I. Material Behavior and Selection

Metal Alloys	Ceramics
Polymers	Composites

II. Manufacturing Processes

Forming	Material Removal
Joining	Surface Treatment
Measurement	Testing and Inspection
Automation	Computer Aided Manufacture
Economics	Environmental Compliance

III. Design Application

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Special Events:
One or two field trips will be taken. Past trips have been to Wichita to tour Boeing, Raytheon or Cessna, and the TWA Rework Facility at KCI airport. If there is enough interest in an overnight trip, a tour of Boeing facilities in St. Louis can be arranged. Each student is expected to attend at least one of these trips.

Evaluation:
Grades will be based on homework (20%), an individual research project (10%), a group manufacturing project (15%), two exams (20% each), and a final group design project (15%). Each student is expected to actively participate in class discussions and design reviews.

Any student in this course who has a disability that may prevent him or her from demonstrating his or her full abilities should contact me personally as soon as possible to discuss necessary accommodations.

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Syllabus I -- Material Behavior & Selection

lsn	date	topic	reading	homework (tentative)	due
1,2	Aug 21,26	Introduction Integrated Product Dvlpmnt. Design for Manufacturing	General Intro		
3,4	Aug. 28, Sep. 2	Communication, Teaming Business aspects of engrg.	Ch. 1	1.22, 1.25, 1.27, 1.28 1.30, 1.32, 1.35a	Sep 2
5	Sep 4	Structure of Metals	Ch. 2 2.30, 2.36, 2.38	2.17, 2.27, 2.29	Sep 5
6,7	Sep 9, 11	Introduction to Manuf. Lab		Rivet Design Project	Sep 23
8	Sep 16	Structure of Metals Mechanical Properties Research Project Intro.			 Sep 23 (abstracts) Oct 21 (papers/websites)
9,10	Sep 18, 23	Mechanical Properties Physical Properties Fatigue, Surface Treatment	Ch. 3	SP-1	Sep 30
11	Sep 25	Metal Phase Diagrams	4.1-4.6	4.1, 4.2, 4.5	Oct. 2
12,13	Sep 30, Oct 2	Metal Heat Treatment	4.7-4.13	4.9, 4.11, 4.14, 4.16, 4.19, 4.30, 4.32, 4.33	Oct. 7
14,15	Oct 7, 9	Steels (Iron Alloys) Intro. Manuf Project	Ch. 5	5.7, 5.17, 5.23 SP-2	Oct 14 Oct 14
16	Oct 14	Aluminum Alloys	6.1-6.4	6.1, 6.2, 6.5, 6.12, 6.15, 6.17	Oct 21

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Syllabus I -- Material Behavior & Selection

lsn	date	topic	reading	homework (tentative)	due
17	Oct 16	Review			
18	Oct 21	***** EXAM 1 *****	Chs. 1-6		
		Research projects complete			
	Oct 23	Fall Break			

Syllabus II -- Manufacturing Processes

19.	Oct 28	Exam review,			
		Titanium; Nickel & High Temperature Alloy	6.5-6.14		
20	Oct 30	Environmental Effects, Corrosion			
21,22	Nov 4,6	Casting	Chs. 10-12	10.20, 10.22, 11.25	Nov 11
		Rolling & Forging	Chs. 13-14	13.34	
23,24	Nov 11,13	Extrusion, Drawing	Chs. 15-16	16.47, 16.56	Nov. 18
		Sheet Metal Formation			
25	Nov 18	Cutting & Machining	Chs. 20-26	22.43, 22.47, 23.49	Nov 25
		Welding, Bonding & Fastening	Chs. 27-30	23.52, SP-3	
		Final Design Project Intro. (DP2)			
26,27	Nov 20,25	Polymers, Ceramics & Composites	Chs. 7-9	7.18, 7.28, 9.2 , SP4	Dec. 2
		Plastics & Composites	Chs. 18-19		
		Surfaces & Treatments	Chs. 31-37	36.40, 36.41	Dec 2
		Metrology & Quality Assur.			

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Syllabus III – Synthesis, applications and demonstrations

lsn	date	topic	reading	homework (tentative)	lsn due
	Nov 27	Thanksgiving Break			
28	Dec 2	DP2 Presentation of Manufacturing Article			
29	Dec 4	DP2 Conceptual Design Briefs Manufacturing Projects Complete			
30	Dec 9	DP2 Prelim. Design Briefs			
31	Dec 11	DP2 Final Design Briefs			
	Dec 15-19	Final Exams			