

## **ENMA 150 The Materials of Civilization**

Course schedule: TBA

Course Location: TBA

**Course website: <http://bb.eng.umd.edu>**

**Most course materials will be posted on the website rather than handed out in class.**

### **Instructor**

**R.M. Briber, Professor and Chair**

Department of Materials Science and Engineering

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Office Location: Room 2135 Chemical & Nuclear Engineering Building

Office hours for Prof. Briber: TBA

Also by appointment (appointments are strongly encouraged!)

### **Teaching Assistant**

**TBA**

### **Course Description**

A general introductory course at the 100 level designed primarily for non-science or non-engineering majors.

The discovery of new materials has shaped history and built civilizations. Materials have played such an important role that scholars have named periods of history including the Stone Age, the Bronze Age and the Iron Age.

The study of world history generally focuses on wars, the rulers who governed and the formation and (subsequent) downfall of empires. Little if anything is said about the materials that have often lead to the success (and sometimes failure) of these empires. This trend continues in modern civilization with the advances in materials preceding many of the leaps in technology that we have come to take for granted as part of our society. For example: the use of plastics is so common in every day living and essentially every consumer good that it would be difficult to imagine a world with only the more “traditional” materials of wood, stone, ceramic and metal, yet modern plastics have been in wide use for less than 75 years. The computer and electronic revolution is completely built upon silicon and our ability to change the electrical properties of this most unusual material. Rapid, reliable, modern air transportation is completely dependent on the use of aluminum and other lightweight and strong materials. What are the future changes in materials that will lead to revolutions in our society? Advances in health care, the promise of nanotechnology, the colonization of space are all exciting ideas with tremendous potential that will be predicated in some part on advances in the materials that may make these things possible.

This course will trace the utilization, properties and production techniques of materials from the Bronze Age up through modern times and into the future. We will start with a description of properties of the first materials utilized by man such as stone, fiber and copper. These materials, are explained by considering their atomic structure, the binding forces between atoms and their

arrangement. The properties of iron and steel are explained along with the history of iron and steel making. The electronic properties of materials are also covered from a historical as well as from a scientific point of view.

### **Course Goals**

- 1.) A general understanding of different types of materials and their structure
- 2.) A general understanding of the role of new materials on advances in technology, society and civilizations.

### **Text:**

“The Substance of Civilization”, Stephen, L. Sass, Arcade Publishing, 1999

### **Additional Background reading:**

Callister, William D., "Materials Science and Engineering: An Introduction", 5<sup>th</sup> or 4<sup>th</sup> edition, John Wiley & Sons, New York, 1999.

There will be approximately 4 guest lectures during the semester on different topics of modern materials. Materials from Guest Lectures will be covered on the exams.

### **Guest Lectures**

There will be a number of guest lectures during the semester. Guest lecture materials will be posted on the course website and are considered an integral part of the course and may show up in homework assignments and on exams.

## Grading

Midterm	15%	The midterm is based on materials presented up to and including the lecture before the midterm. Material from guest lectures may be on the exam.
Lab Reports for 3 take home labs	15% each	Lab reports must be computer generated (typed) and follow the format that will be discussed in class.
Term paper (10 pages text and figures) 1" margins, 12 point, double spaced, references are not part of the 10 pages	15%	Term paper due in class at the last lecture of the semester.
Final	15%	Final exam will be cumulative on all course materials. Material from guest lectures may be on the exam.
Homework sets and short papers	10%	All written assignments must be computer generated (typed). Calculations can be done by hand.

## Course Outline

### I. Classification of Materials

Metals, Ceramics, Polymers, Electronic Materials Course Notes

### II. Historical Development of Materials

The first materials: Stone and Clay	Chapter 1 in Sass
The first metals: Copper and Bronze	Chapters 2 and 3 in Sass
Gold and Silver and the basis of wealth	Chapter 4 in Sass
Mechanisms and Properties of Metals	Course notes
The basics of structure	
The basics of mechanical properties	
The Discovery of Iron	Chapter 5 in Sass
A New Material: Glass	Chapters 6 - 8 in Sass
Steel: The Modern Metal	Chapters 9 - 11 in Sass

**III. Polymers: A Modern Class of Materials** Chapters 12 in Sass and Course notes

The Discovery of Polymerization  
Mechanisms and Properties:  
    What are Polymers?  
    The Unique Properties of Polymers  
The Growth of a Science and an Industry  
Modern Lifecycle of Plastics: Synthesis, Use and Recycling

**IV. The Electronic Properties Materials** Chapter 15 in Sass

The Age of Electronic Materials  
Mechanisms and Properties  
Basics of Electronic and Magnetic Properties  
The Semiconductor Revolution  
The Information Age

**V. Other Modern Materials** Chapter 13 and 14 in Sass and Course Notes

**Take-Home Labs**

There will be 3 lab reports for the course, based on either take home samples or a demonstration done in the materials teaching lab (room 1135 Kim Engineering Building) with the data posted on Blackboard.

Rubber Ball Lab:

Shape Memory Alloy lab

Mechanical Properties Lab

Other topics to be announced

**Lab Reports, Papers and Homework**

In general, all assignments turned in for this course need to be prepared on a computer. There are numerous computer labs around campus and you can learn more about access from the campus office of information technology: <http://www.oit.umd.edu>

All sources in reports and papers must be referenced. It does not matter whether the source is a book, magazine, journal article or the web. *All sources must be referenced.*

In addition, any figures used in any papers or reports that are not created by you need to be referenced as to the source.

Reports, papers and homework will be due in class, in hard copy form with all pages stapled together. There will be a penalty for late work. It is not the instructor's responsibility to keep unstapled pages together.

## **Other Items**

### **Access to Blackboard <http://bb.eng.umd.edu>**

Since the Blackboard website is used extensively for distribution of course materials and announcements, it is important that you check it regularly. If you can't login, you should follow the help instructions on the website home page. Neither the instructor or the T.A. can give you access to the website.

### **Academic Accommodations:**

If you have a documented disability, you should contact Disability Support Services 0126 Shoemaker Hall. Each semester students with documented disabilities should apply to DSS for accommodation request forms which you can provide to your professors as proof of your eligibility for accommodations. The rules for eligibility and the types of accommodations a student may request can be reviewed on the DSS web site at [http://www.counseling.umd.edu/DSS/receiving\\_serv.html](http://www.counseling.umd.edu/DSS/receiving_serv.html).

### **Religious Observances:**

The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs, students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. It is the responsibility of the student to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period. Faculty should further remind students that prior notification is especially important in connection with final exams, since failure to reschedule a final exam before the conclusion of the final examination period may result in loss of credits during the semester. The problem is especially likely to arise when final exams are scheduled on Saturdays.

### **Academic Integrity:**

The University of Maryland has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit <http://www.studenthonorcouncil.umd.edu/whatis.html>

The University of Maryland is one of a small number of universities with a student-administered Honors Code and an Honors Pledge, available on the web at <http://www.jpo.umd.edu/aca/honorpledge.html>. The code prohibits students from cheating on exams, plagiarizing papers, submitting the same paper for credit in two courses without authorization, buying papers, submitting fraudulent documents, and forging signatures. The University Senate encourages instructors to ask students to write the following signed statement on each examination or assignment: "I pledge on my honor that I have not given or received any unauthorized assistance on this examination (or assignment)."