

ENMA 150: The Materials of Civilization

Course schedule: Tu, Th 3:30 - 4:45 plus recitation section W or Th

Course Location: ONLINE

Course website: elms.umd.edu

All course materials will be posted on the website

Instructor

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Office Hours: M, W, F 7-8 pm on Zoom (use the course Zoom link)

Also by appointment - feel free to ask for one-on-one Zoom meetings

Teaching Assistant Robert Blanchard (gray.blanchard@outlook.com)

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 plus high temperature alloys for jet engines. 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 materials. We then will take a shallow dive into the science of materials, explained by considering their atomic structure, the binding forces between atoms and their arrangements and how these arrangements can be changed and controlled with processing. 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. Finally, we will consider the broader societal impacts of old and new materials by discussing waste, recycling, pollution, exploitation and global warming.

Course Goals:

Course Goals

I-Series Course Goals

- Look at complex questions and identify the science in the question and how it impacts and is impacted by political, social, economic, and ethical dimensions
- Understand the limits of scientific knowledge
- Critically assess and formulate basic science arguments
- Find information using various sources and evaluate the veracity of the information
- Communicate scientific ideas effectively
- Relate science to a personal situation

Additional Course Goals Specific to ENMA150

- A general understanding of different types of materials and their structure
- A general understanding of the role of new materials on advances in technology, society and civilizations
- A general understanding of what you can do and influence to make a more positive impact of materials on society and the environment.

Text:

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

Guest Lectures

There will be hopefully a couple 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.

Other Readings and Videos:

The 4 “Making Stuff” produced by PBS NOVA will be shown in Discussion Section. These are also available for viewing on ELMS in the *Course Video -> Video Catalog* section. A 2-3 page study guide for each video will be posted emphasizing the important points of the videos. Content from these videos is considered part of the course and may be on exams.

There will be other short readings posted on ELMS throughout the semester. These include: “A Short History of Metals” by Alan Cramb

“SHARPER - Bob Kramer and the secret lives of knives” by Todd Oppenheimer (from *The New Yorker* 11/24/2008)

+ other readings as assigned.

Grading

All homeworks, exams and the term paper will be submitted online by the due date and time to ELMS

3 Midterms	15% each	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.
Homework Sets	35% total	All written assignments must be computer generated (typed). Calculations can be done by hand.
Term paper (10 pages text and figures) 1” margins, 12 point, double spaced, references are not part of the 10 pages	20%	Term paper due online on the last day of instruction at the due time. Topics to be assigned about 2/3rds of the way thru the course.
NO Final	0%	Under guidance from the Dean, I will be skipping a final this year - you're welcome

Some assignments may have extra credit parts to them. ***There will be no extra credit assignments for individuals who want to bring their grade up.***

Generally the course grades follow the standard grading curve by default, though the instructor reserves the right to change the overall curve depending on the grade distribution. The final curve will be posted on ELMS when final grades are submitted.

The total points for the semester may deviate from 1000 depending on the number of assignments, etc. In all cases an individual's final grade will be based on a percentage calculated from (individual's # points)/(total # points in the course).

Typically in previous years the grading curve has been:

ENMA150 Grading curve	
A+	100-97
A	96-93
A-	92-90
B+	89-86
B	85-83
B-	82-80
C+	79-76
C	75-73
C-	72-70
D+	69-65
D	64-62
D-	61-59
F	58-below

Grades shown on ELMS are rounded to the nearest integer value to determine the letter grade.

Course Outline

0. Overview of the Course

I. What are materials, materials science, material properties

Materials of Fantasy

Materials Discovery - How do you find them?

Briefly: Metals, Ceramics, Polymers, Electronic Materials

Physical, mechanical, chemical, electronic, magnetic, optical, . . .

II. The Science

Periodic table, bonding, crystals

More in depth: Metals, Ceramics, Polymers, Electronic Materials

Microstructures and Processing

III. Historical Development of Materials

The first materials: Stone and Clay, bone and hide

The Metals of Antiquity: Copper and Bronze

Gold and Silver and the basis of wealth

Iron, Steel, Polymers . . .

Microelectronics, jet engines, bioimplants, . . .

IV. Materials and Politics Over The Ages

When materials caused problems with governments - Trade routes, wars, embargoes, espionage

V. Materials and The Environment

How materials can help or hurt the environment - Mining, deforestation, emissions

VI. Materials and Society

How materials have hurt people - Conflict minerals, slavery, underdeveloped countries, economic bubbles

Copyright

Lectures and course materials, including power point presentations, tests, outlines, and similar materials, are protected by copyright. The instructors are the exclusive owner of copyright in those materials they create. Students may take notes and make copies of course materials for their own use. They may not, and may not allow others, to reproduce or distribute lecture notes and course materials publicly without the instructor's express written consent.

Paper and Homeworks

In general, all assignments turned in for this course need to be prepared on a computer.

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 online by the due date and time. Late work will result in a grade of **ZERO**. I'd suggest setting a personal due date that is before the actual one if you have difficulty with deadlines.

Other Items

Access to ELMS (elms.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.

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)."