

**EMA 4714**  
**Section 2983**  
**Materials Selection and Failure Analysis**  
**Spring Semester 2017**

**Objectives**

If a single word could be used to describe what it is that engineers do, it would be "design". Materials engineers, regardless of their individual discipline, will be required to select a candidate material from a large list of options with which to fabricate components to be used either alone, or as part of an assembly. The design process necessarily will involve an association of intended performance [behavior] with capacity to perform [properties] - this you have been doing for some time. You will also be required to integrate functionality into your analysis - to understand what it is that the component is supposed to do with respect to the total service environment. This area would include, among other things: distribution of mechanical forces during operation, duration and kinetics of these mechanical forces; heat, mass, fluid and electrical transport; and environmental stability of the materials selected. Beyond that, to complicate matters, there will also be a subset of design considerations which derive from microstructural changes associated with materials processing - heat treating, tempering, annealing and the like. Add to this other design constraints such as cost, availability, environment concerns, etc., and the simple problem becomes a challenge of Ambrosian dimensions.

This course is intended to expose the student to use of the design methodology from which a procedure can be implemented which will lead to the selection of the optimum material for the particular application being considered. By the time you will have completed this course, you will be able to:

1. describe, both conceptually and analytically, how system components work and to model function or performance using scientific and engineering principles learned as part of your undergraduate education.
2. Participate in an integrated design activity using fundamentals of "systems engineering", where performance and behavior have to be analyzed in light of consumer expectations and merchantability of the design
3. to gain experience in the selection of materials and optimization of behavior by using a systematic methodology which combines materials properties with the engineering function of the process or product design.
4. to defend materials selection effectively both orally and in written form.
5. to select and use appropriate industrial literature and library resources in the solution of materials selection and failure analysis problems.

## Syllabus

- Lectures will be T-7 and R – 6 and 7
- The instructor for this course will be:

John J. Mecholsky, Ph.D.  
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- The textbook is:

### **Engineering Design**

5<sup>th</sup> edition  
George E. Dieter  
Linda C. Schmidt  
McGraw Hill [2009]  
ISBN 978-0-07-339814-3

- Strongly recommended for your own reference use is ASM Handbook, Volume 20, **Materials Selection and Design** ASM International [1997] and "Materials Selection in Mechanical Design", Pergamon Press [1992] by M.F. Ashby.

### **- Grading Policy**

Problem Sets .....	= 0.20
Quizzes, lowest dropped.....	= 0.20
Midterm Exams [2].....	= 0.30
Design Project.....	= 0.30
Total.....	= <b>1.00</b>

### **- Grade Scale:**

92-100 = A	68 – 71.9 = C
88 – 91.9 = A-	65 – 67.9 = C-
84 – 87.9 = B+	62 – 64.9 = D+
80 – 83.9 = B	59 – 61.9 = D
76 – 79.9 = B-	56 – 58.9 = D-
72 – 74.9 = C+	0 – 55.9 = E