Course Description
EMA 4913 – Research in Materials Science & Engineering I (1 credit)

Catalogue Description: Short research problems in materials science & engineering, including a protocol report & final thesis. Two parts to the course: (1) class lectures and presentations; (2) laboratory research.

Text: No text required

Reference Texts: as needed

Instructor: Professor J. J. Mecholsky, Ph.D.
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Office Hours: W-:3 Period; M: 4 Period or by appointment

Prerequisite: Senior level standing.

Meeting Time: M-3 (MCCA 2196)

Course: To introduce the student to methods for creating a research protocol, for setting up an experimental design procedure, for solving research or design problems, for identifying engineering ethics issues, for developing interview techniques and for developing technical presentation skills.

At the end of the course, the student should be able to identify the safety precautions necessary and laboratory procedures required regarding the proper use of equipment, chemicals and notebooks; to be able to identify a specific area of research that is of mutual interest to the student and professor; to be able to select a specific problem around which a research or design project can be formulated, implemented and completed within a two-semester time frame; and to effectively communicate the results of his/her research in the form of written reports, publishable manuscripts and oral presentation.

Prerequisites by Topic: Introduction to Metals, Ceramics, Polymers and Electronic Materials, Mechanical Behavior of Materials, Engineering Statistics, Materials Laboratory.

Topics:

1. Overview of Senior Thesis/Literature Search/Report Writing
2. Global Awareness, Diversity and Engineering Ethics
3. Making Effective Technical Presentations
4. Interviewing Techniques
5. Experimental Design/Error Analysis
6. Safety/ Draft of Experimental Protocol Due
7. Experimental Protocol Due (Written)
8. Research Presentations – 5 minute presentations
9. Written research or design report (End of 2nd semester)

Grading: Participation (20%); Quizzes (20%); Protocol Presentation (30%); Protocol Report (30%)

Grading Scale:	≥92	≥88	≥84	≥80	≥76	≥72	≥68	≥65	≥62	≥59	≥56	<56
	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E

This course addresses the following MSE Program Outcomes:

1. To acquire and demonstrate knowledge in mathematics, science engineering basics, and the fundamentals of materials science and engineering. (Intermediate coverage)
This course develops the fundamental strategy in the approach to, and solution of, engineering research and/or design problems.

2. To apply mathematics, science, engineering basics and fundamentals of materials science to envision solutions to engineering problems and to solve engineering problems. (High Coverage)
This course is a capstone course in that it is intended to utilize all of the previous and current course material in solving engineering problems.

3. To design and execute experiments to solve engineering problems, and to analyze the results of those experiments. (High Coverage).
The basis of the course is the design and execution of experiments to solve an engineering problem. The recording of appropriate data, statistical analysis of that data, the technical analysis of data and reporting in an acceptable form is the essence of this course.

4. To design a materials system or process to meet desired needs. (High Coverage)
The students are required to fabricate or obtain materials and measure properties for those materials. In many cases this requires the design and manufacture of a new testing apparatus. In other cases, a new material needs to be formulated to meet certain design needs. These are typical types of projects in these courses.

5. To work effectively in multi-disciplinary teams. (Low Coverage)
As part of their work in the laboratory, the students are expected to work with graduate and other undergraduate students. We discuss the importance of diversity of disciplines in solving engineering problems.

6. To communicate effectively regarding engineering issues. (High Coverage)
A lecture is given outlining the principles for presenting an effective technical oral report. The students are required to present this at least twice in one semester and once in the second semester. In addition a written protocol report is required, as well as a final report on their research or design topic.

7. To demonstrate a knowledge of issues affecting the practice of engineering as a professional, such as professional ethics and responsibilities, and sustained learning. (Low Coverage)
A lecture is delivered on engineering ethics. A discussion is held to sensitize the students to issues of conflict of interest, ethical practice in engineering, potential problems in the field, etc., and to present examples of recent ethical issues in engineering.

8. To demonstrate a knowledge of issues affecting society such as safety, the environment, the global economy, and intellectual property, and the impact of these issues on the practice of engineering. (Low Coverage).
All students are required to obtain safety training. This training is in preparation for safe practices in the laboratory. Lectures are presented on environmental issues as well as the patent process. The importance of accurate recording of data in an appropriate notebook is emphasized.