

MSE 4410: Capstone Engineering Design I (required)

Catalog Description: (2-3-3)
Prerequisite: Senior Standing
A capstone engineering design course covering the principles of concurrent product/process design and development. Team-based projects will explore product/process design and development.

Textbook: K.T. Ulrich and S.D. Eppinger, Product Design and Development, McGraw-Hill, Fifth Edition, 2010

Additional Resources: Articles related to contemporary developments in product design and development will be distributed during the course to enhance the understanding of real-world issues in the engineering design of products and processes.

Prepared by: Dr. Sundaresan Jayaraman

Topics Covered:

1. Design as a Competitive Advantage
2. Design and Product Life-Cycle
3. The Engineering Design Process: Key Steps from Concept to Market
4. Understanding & Translating the Customer's Needs: Principles of Quality Function Deployment (QFD)
5. Fundamentals of Concurrent Engineering
6. DFX: Design for Manufacturability, Modularity, Quality, Affordability, Usability, Safety, Maintainability ...
7. ECD: Environmentally-Conscious Design
8. Industrial Design
9. Information Technology in Engineering Design
10. Design Management including Planning, Budgeting and Reporting
11. Intellectual Property: Strategies and the Protection Process Including Patents
12. Engineering Ethics and Professional Responsibilities as an Engineer

Course Outcomes: Specifically, at the end of the course the students will be able to:

1. Complete an open-ended team-based design project that will culminate in a project report and a final oral presentation.
2. Integrate knowledge of mathematics, science, and engineering to the design of a materials engineering system.
3. Apply and integrate knowledge from the structure, properties, processing, and performance of materials to solve materials selection and design problem.
4. Design a system, component, or process to specified performance objectives and needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

5. Appreciate diversity in design projects.
6. Identify, formulate, and solve materials engineering problems.
7. Understand the professional and ethical responsibility as a materials engineer.
8. Communicate effectively in both written reports and oral presentations.
9. Demonstrate a broad understanding of the impact of materials engineering solutions in a global, economic, environmental, and societal context.
10. Recognize the need for, and the ability to engage in, life-long learning.
11. Demonstrate knowledge of contemporary issues.

Correlation between Course Outcomes and Student Outcomes:

Course Outcomes	Student Comes										
	a	b	c	d	e	f	g	h	i	j	k
1. Complete an open-ended team-based design project that will culminate in a project report and a final oral presentation	x	x	x	x	x	x	x	x	x	x	x
2. Integrate knowledge of mathematics, science, and engineering to the design of a materials engineering system	x		x								
3. Apply and integrate knowledge from the structure, properties, processing, and performance of materials to solve materials selection and design			x		x						
4. Design a system, component, or process to specified performance objectives and needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability			x			x					
5. Appreciate diversity in design projects				x				x			
6. Identify, formulate, and solve materials engineering problems					x						x
7. Understand the professional and ethical responsibility as a materials engineer						x					
8. Communicate effectively in both written reports and oral presentations							x				
9. Demonstrate a broad understanding of the impact of materials engineering solutions in a global, economic, environmental, and societal context								x			
10. Demonstrate knowledge of contemporary issues										x	
Entire Course	3	2	3	3	3	3	3	3	1	3	3
0 = None or insignificant; 1 = Some; 2 = Moderate; 3 = Strong											

School of Materials Science and Engineering Student Outcomes:

- a) an ability to apply knowledge of mathematics, science and engineering
- b) an ability to design and conduct experiments, as well as to analyze and interpret data
- c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- d) an ability to function on multidisciplinary teams
- e) an ability to identify, formulate, and solve engineering problems
- f) an understanding of professional and ethical responsibility
- g) an ability to communicate effectively
- h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- i) a recognition of the need for, and an ability to engage in life-long learning
- j) a knowledge of contemporary issues
- k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice