Mechanical Engineering Dept. Department

Syllabus
ME 420: Materials Selection and Design (3-0-3)

Course Catalog Description:

Mechanical design process, materials properties and indices, product shape, multiple constraints, conflicting objectives, hybrid materials, impact of materials selection on the environment, extensive case studies.

Course Pre-requisites:

- ME 205: Materials Science
- ME 207: Materials Science for CHE
- ME 216: Materials Science and Engg.

Course Objectives:

1. To provide students a thorough systematic approach to the selection of materials required in mechanical design.
2. To familiarize the students with material properties and materials manufacturing processes and a process selection based on a component size, shape, properties, and cost.
3. To teach students how to deal with multiple constraints and conflicting objectives including realistic constraints involving the economics, environment, manufacturability, and sustainability.
4. To introduce the students to the methodologies for designing hybrid materials.

Course Learning Outcomes:

CLO1. Demonstrate how performance indices are derived and combined with material property charts to identify potential materials for specific applications

CLO2. Construct and use material property charts to identify a small set of materials meeting mechanical, physical, and cost constraints

CLO3. Use material processing charts to select fabrication processes that meet design requirements

CLO4. Construct a translation table for problems involving either multiple constraints or conflicting objectives, and systematically identify candidate materials

CLO5. Design hybrid materials that fill gaps on the material property charts

CLO6. Work in small teams to apply material selection processes on a term project involving a relevant local challenge related to material selection and present the findings in a presentation/ poster

Learning Resources:

- Ashby, M. F., Materials Selection in Mechanical Design, 5th ed., 2017.

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Quiz 5	11	4.0%
Assignment 5	11	3.0%
Assignment 6	13	3.0%
Final Exam	16	25.0%
Project	16	17.0%
Assignment 1	3	3.0%
Quiz 1	3	4.0%
Assignment 2	5	3.0%
Quiz 2	5	4.0%
Quiz 3	7	4.0%
Assignment 3	7	3.0%
Midterm Exam	8	20.0%
Assignment 4	9	3.0%
Quiz 4	9	4.0%

Lecture Weekly Schedule:

Week#	Topics
1	Introduction: Materials and Design
2	Engineering Materials and Their Properties
3	Material Property Charts (Using Granta EduPack Software if available)
4	Materials Selection – The Basics
5	Materials selection (without shape) – Case Studies
6	Processes and Their Effect on Properties
7	Processes Selection and Cost
8	Multiple Constraints and Conflicting Objectives
9	Multiple Constraints and Conflicting Objectives – Case Studies
10	Selection of Material and Shape
11	Material and Shape – Case Studies
12	Designing Hybrid Materials

Week#	Topics
13	Hybrids – Case Studies
14	Materials and the Environment
15	Sustainable Response to Forces for Change