

ME 4213 Materials Selection and Failure Analysis (Elective)

Catalog Description: ME 4213 Materials Selection and Failure Analysis (3-0-3)
Prerequisites: COE 3001 Deformable Bodies
Principles of selecting both materials and processes required for mechanical design as well as failure analysis. Mechanics and materials knowledge used in solving practical problems.

Textbook: Michael F. Ashby, *Materials Selection in Mechanical Design*, 3rd Edition, Butterworth-Heinemann, 2005.

Topics Covered:

1. Course goals and overview of the design process
2. Engineering materials and their properties
3. Sources of material property data
4. Introduction to materials selection software
5. Materials selection charts
6. Materials selection without shape
7. Case studies of material selection without shape
8. Selection of material and shape
9. Case studies of selection of material and shape
10. Material processing and process charts
11. Case studies of selection of process
12. Aesthetics and environmental considerations
13. Principles of failure analysis
14. Case studies of failure analysis for metals, ceramics, polymers and composites

Course Outcomes:

Outcome 1: To provide the students a thorough systematic approach to the selection of metals, ceramics, polymers, and composites required for mechanical design.

- 1.1 Students will demonstrate knowledge of mechanics analysis for a variety of components.
- 1.2 Students will demonstrate how performance indexes based on mechanics analyses can be overlaid on material property charts to identify promising materials for specific applications using both manual and computer techniques.

Outcome 2: To familiarize the students with material properties and materials fabrication processes and an approach for selecting a process capable of producing a component possessing the size, shape, properties, and cost dictated by the design.

- 2.1 Students will construct and use material property charts to identify a small set of materials meeting mechanical, physical, and cost requirements for numerous case studies.
- 2.2 Students will use material processing charts to select suitable fabrication processes considering size, section thickness, complexity of shape, tolerance, surface finish, hardness, melting point, cost, and environmental impact.

Outcome 3: To introduce the students to the principles of failure analysis for metals, ceramics, polymers, and composites so that the causes of failures may be identified and avoided.

- 3.1 Students will demonstrate recognition of failure mechanism and identify alternate materials and/or service conditions that prolong component life.

Correlation between Course Outcomes and Program Educational Outcomes:

ME 4213												
	Mechanical Engineering Program Educational Outcomes											
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k	l
Course Outcome 1.1	X				X						X	X
Course Outcome 1.2	X		X		X		X				X	X
Course Outcome 2.1	X		X		X		X	X	X	X	X	X
Course Outcome 2.2	X		X		X		X	X	X	X	X	X
Course Outcome 3.1	X	X			X	X			X		X	X