

ME 3210 Design, Materials, and Manufacture (Required)

Catalog Description: ME 3210 Design, Materials, and Manufacture (3-0-3)
Prerequisites: MSE 2001 Principles and Applications of Engineering Materials and ME 2110 Creative Decisions and Design
Major manufacturing processes, capabilities, and costs. Interaction between design, materials, and manufacturing process selection.

Textbook: Michael F. Ashby, *Materials Selection in Mechanical Design*, 4th Edition, Butterworth-Heinemann, 2011.
Rob Thompson, *Manufacturing Processes for Design Professionals*, Thames and Hudson, 2007.
Faculty course notes.

Software: CES EduPack, Granta Design

Topics Covered:

1. Basics:
 - a) Review of design processes
 - b) Review of materials
 - c) Taxonomy of manufacturing processes
 - d) Selection under constraints and objectives
 - e) Cost modeling of manufacturing processes
 - f) Eco-selection issues
 - g) Selection of manufacturing processes based on design and material constraints and objectives
2. Manufacturing Processes:
 - a) Casting
 - b) Bulk deformation (e.g., forging, rolling, drawing, extrusion)
 - c) Sheet metal forming
 - d) Mechanical material removal (e.g., cutting, grinding)
 - e) Non-mechanical material removal (e.g., ECM, EDM, laser, electron beam, water jet)
 - f) Polymer and polymer composites processing (e.g., injection molding, extrusion)
 - g) Joining and fastening (e.g., welding, adhesives, rivets)

Course Outcomes:

Outcome 1: To train the student to be able to understand the major manufacturing processes.

- 1.1 Students will demonstrate the ability to identify and describe the major manufacturing processes and their capabilities and limitations.
- 1.2 Students will demonstrate knowledge of process capabilities of major manufacturing processes.

Outcome 2: To train the student to convert design requirements into selection constraints and objectives.

- 2.1 Students will demonstrate the ability to convert design requirements into constraints and objectives for selection of manufacturing processes.

Outcome 3: To train the student to select manufacturing processes based upon design requirements and to synthesize manufacturing processes and systems.

- 3.1 Students will demonstrate the ability to select manufacturing processes under single and multiple constraints.
- 3.2 Students will demonstrate the ability to select manufacturing processes under single and multiple objectives.
- 3.3 Students will demonstrate the ability to make use of process capability information to select and/or synthesize manufacturing processes and systems.

Correlation between Course Outcomes and Student Outcomes:

ME 3210											
	Mechanical Engineering Student Outcomes										
Course Outcomes	a	b	c	d	e	f	g	h	i	j	k
Course Outcome 1.1	X										X
Course Outcome 1.2	X										X
Course Outcome 2.1	X		X		X			X			X
Course Outcome 3.1	X		X		X						X
Course Outcome 3.2	X		X		X						X
Course Outcome 3.3	X		X		X						X

GWW School of Mechanical 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

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