**ME 3210 Design, Materials, and Manufacture (Required)**

**Catalog Description:** ME 3210 Design, Materials, and Manufacture (3-0-3)

Prerequisites: ME 2110, MSE 2001

Major manufacturing processes, capabilities, and costs. Interaction between design, materials and manufacturing process selection.

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

**Course Outcomes:**

* To understand the major manufacturing processes
* To understand the interaction between design, materials, and manufacturing
* To be able to select the appropriate manufacturing processes given a set of design and material constraints

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

* 1. Students will demonstrate the ability to identify and describe the major manufacturing processes, and their capabilities and limitations
  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 Program Student Outcomes:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| ME 3210 | | | | | | | | | | | | |
|  | Mechanical Engineering Program Student Outcomes | | | | | | | | | | | |
| Course Outcomes | a | b | c | d | e | f | g | h | i | j | k |
| 1.1 | X |  |  |  |  |  |  |  |  |  | X |
| 1.2 | X |  |  |  |  |  |  |  |  |  | X |
| 2.1 | X |  | X |  | X |  |  | X |  |  | X |
| 3.1 | X |  | X |  | X |  |  |  |  |  | X |
| 3.2 | X |  | X |  | X |  |  |  |  |  | X |
| 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 (3g1 orally, 3g2 written)

(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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