ME 26400
Introduction to Manufacturing for Mechanical Design

Course Outcomes [Related ME Program Outcomes in brackets]

1. Understand material properties and behavior for design and manufacturing [1,2]
2. Gain a fundamental knowledge of *manufacturing processes*. [2, 3]
3. Gain knowledge of the *practice of measurements and manufacturing processes* through laboratory experiments. [2, 3]
4. Enhance knowledge on the selection of materials and manufacturing processes for product design [1,2, 3, 4, 5,7]
5. Enhance *technical communication skills* through short technical lab reports. [3]

Metrology, Quality Control, and Materials

1. Metrology and quality measures
2. Measurement principles and Techniques
3. Properties of Materials

Machining Processes

1. Mechanics of Machining Processes
2. Cutting Tools
3. Tool Life and Machinability
4. Production Machining Processes
5. CNC machining

Processing of Non-metallic Materials

1. Processing and Design of Composite Materials
2. Processing of Plastics

Other Manufacturing Processes

1. Forming Processes
2. Casting
3. Sheet metal forming
4. Additive Manufacturing

Design-Manufacturing Interface

1. Material selection for design
2. Design for manufacturing
3. Design for assembly and component integration

Laboratory Experiments

Typical laboratory experiments will include, but are not limited to:

1. Basic Measurement Principles and Practice (Dimension, Tolerance, Surface Roughness, and Geometry)
2. Basic Operation of Machine Tools (Lathe and Milling Machine)
3. CNC programming and CNC machining
4. 3D printing
5. Finishing, component integration, assembly, inspection and test

COURSE NUMBER: ME 26400

COURSE TITLE: Introduction to Manufacturing for Mechanical Design

REQUIRED COURSE OR ELECTIVE COURSE: Required

TERMS OFFERED: Fall and Spring

TEXTBOOK/REQUIRED MATERIAL:
TBD

PRE-REQUISITIES:
MFET 163 -- Graphical Communication and Spatial Analysis

COORDINATING FACULTY: Francisco Montalvo

COURSE DESCRIPTION: Introduction to manufacturing processes for typical engineering materials. Basics of material properties and behavior for manufacturing processes. Material selection and manufacturing process selection for mechanical design. Hands-on projects in the lab reinforce the knowledge of manufacturing processes.

COURSE OUTCOMES [Related ME Program Outcomes in brackets]:
1. Understand material properties and behavior for design and manufacturing [1,2]
2. Gain a fundamental knowledge of manufacturing processes. [2, 3]
3. Gain knowledge of the practice of measurements and manufacturing processes through laboratory experiments. [2, 3]
4. Enhance knowledge on the selection of materials and manufacturing processes for product design [1,2, 3, 4, 5,7]
5. Enhance technical communication skills through short technical lab reports. [3]

ASSESSMENTS TOOLS:
1. Homework
2. Lab reports
3. Group Assignments
4. Final Reports and Presentations

NATURE OF DESIGN CONTENT: Choosing appropriate materials and manufacturing processes for mechanical design; design for manufacturing.

RELATED ME PROGRAM OUTCOMES:
1. Engineering fundamentals
2. Engineering design
3. Communication skills
4. Ethical/Prof. responsibilities
5. Teamwork skills
6. Experimental skills
7. Knowledge acquisition

PROFESSIONAL COMPONENT:
1. Engineering Topics: Engineering Science – 40%
   Engineering Design – 60%

COMPUTER USAGE: The lab projects require students to write reports and conduct data analysis.

COURSE STRUCTURE/SCHEDULE:
Lecture - 2 days per week at 50 minutes
Lab - 2 days per week at 110 and 50 minutes

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REVISION DATE: October 23, 2024

Proposed Topics and Labs

Lecture	Topic	Lab	Lab Group G1	Lab Group G2
1	Introduction to manufacturing	1A		
2	Dimensions, tolerances, and surfaces 1	1B	Lab introduction and team/group selection	
3	Dimensions, tolerances, and surfaces 2	2A	Metrology 1	Manual Machining 1
4	Machining Operations 1	2B	Manual Machining 1	Manual Machining 2
5	Labor Day	3A	Manual Machining 2	Metrology 1
6	Machining Operations 2	3B	Manual Machining 3	Manual Machining 3
7	Sheet-metalworking processes 1	4A	Optional 1: Woodworking/Welding	Sheet metalworking 1
8	Sheet-metalworking processes 2	4B	Metrology 2	Sheet metalworking 2
9	Woodworking	5A	Sheet metalworking 1	Optional 1: Woodworking/Welding
10	Materials for manufacturing 1	5B	Sheet metalworking 2	Metrology 2
11	Materials for manufacturing 2	6A	Mastercam 1	
12	CNC machining 1	6B	Mastercam 2	
13	CNC machining 2	7A	Mastercam 2	
14	Project introduction	7B	CNC Introduction to Turning	
15	Fall / Spring Break	8A	Fall / Spring Break	
16	Cutting tool technology	8B	No lab	
17	Quality, defect, inspection, go/no-go	9A	Mastercam 4	
18	**Industry speaker - Quality/ GD&T**	9B	CNC Introduction to Milling	
19	Design for manufacturability 1	10A	Metrology 3	
20	Design for manufacturability 2	10B	Project Operational Plan	
21	Joining: welding/soldering 1	11A	Project: Design and Manufacturing 1	
22	Joining: welding/soldering 2	11B	Project: Design and Manufacturing 2	
23	Joining: assembly (bolts, nuts, and screws)	12A	Project: Manufacturing 1	
24	Assembly and Component Integration 1	12B	Project: Manufacturing 2	
25	Assembly and Component Integration 2	13A	Project: Component Integration, Assembly, Testing, and Modification 1	
26	Laser cutting	13B	Project: Component Integration, Assembly, Testing, and Modification 2	
27	**Industry speaker – Additive Manufacturing**	14A	Project: Competition and Validation 1	
28	Additive manufacturing 1	14B	Project: Competition and Validation 2	
29	Additive manufacturing 2	15A	Thanksgiving Break / Project and Report Preparation	
30	Thanksgiving Break / No lecture	15B	No lab / Project and Report Preparation	
31	No lecture	16A	Project Presentation and Report	
32	No lecture	16B	Project Presentation and Report	