Mechanical Engineering Dept. Department

Syllabus
ME 418: Adv. Manufacturing and Design (2-3-3)

Course Catalog Description:

CNC machining, Abrasive and non-traditional metal removal processes, Powder metallurgy, and ceramics processing. Manufacturing with Polymers. Design considerations in manufacturing. Rapid Prototyping and 3D Printing current applications and future trends. Design for Manufacturability and Economics of Manufacturing, Cycle times and cost analysis.

Course Pre-requisites:

- ME 322: Manufacturing Processes

Course Objectives:

1. To provide a specialized understanding of conventional and non- conventional material removal processes, processing plastics, metal and ceramics powders, rapid prototyping/3D printing
2. To introduces students to manufacturing automation and computer numerical control (CNC) systems through project/exercises, video lessons and CNC demonstrations (self-study).
3. To enable the students to design detailed process plans for the manufacturing processes or to develop detailed product designs by applying design for manufacturing (DFM) concepts
4. To highlight the influence of process variables on the quality of the products and economy of the processes.

Course Learning Outcomes:

CLO1. Demonstrate an understanding of the method of working for abrasive and nontraditional machining processes.

CLO2. Be able to identify the main design components of CNC machines and their method of working

CLO3. Acquire skills needed to design and program a CNC machining process using CAM software and virtual machining

CLO4. Understand ceramics and metal powders processing technologies, and various plastics processing technologies, and know their applications

CLO5. Understand fundamentals of additive manufacturing processes also known as Rapid Prototyping/3D Printing (Digital Manufacturing) Technologies based upon different materials, and current applications and trends.

CLO6. Have hands-on experience on several manufacturing processes, through lab work. And being able to communicate the implemented design ideas by writing technical reports.

CLO7. Understanding economics and productivity aspects of Manufacturing Processes and develop ability to determine optimal process parameters to meet desired process and product outputs.

Learning Resources:

- M. P. Groover, Principles of Modern Manufacturing: Materials, Processes, and Systems Global Edition John Wiley & Sons, Singapore, 2017
- Lecture and lab PowerPoints slides and handout.

Lecture Assessment Plan:

Assessment Task	Week Due	Weight
Midterm Exam	None	25.0%
Final Exam	None	25.0%
Quizzes	None	10.0%
Homework	None	5.0%

Lab Assessment Plan:

Assessment Task	Week Due	Weight
Lab reports	None	20.0%
Lab Project	None	15.0%

Lecture Weekly Schedule:

Week#	Topics
1	1. Grinding and Abrasive machining
2	1. Grinding and Abrasive machining (Continue)
3	2. Nontraditional material removal processes.
4	2. Nontraditional material removal processes. (Continue)
5	3. Powder metallurgy.
6	3. Powder metallurgy. (Continue)
7	4. Ceramics and Ceramics Processing
8	4. Ceramics and Ceramics Processing (Continue)
	5. Processing of polymers and PMC
9	5. Processing of polymers and PMC (Continue)
10	5. Processing of polymers and PMC (Continue)
11	6. Overview of manufacturing automation and CNC Systems.
12	7. Rapid Prototyping
13	8. 3D Printing and Fundamentals of Additive Processes Technologies

Week#	Topics
14	8. 3D Printing and Fundamentals of Additive Processes Technologies (Continue)
	9. Design for Manufacturability-Guidelines (DFM)
15	10. Manufacturing Economics

Lab Weekly Schedule:

Week#	Topics
1	1- Grinding
2	1- Grinding (Continue)
	2- CAD/CAM and virtual machining
3	2- CAD/CAM and virtual machining (Continue)
4	2- CAD/CAM and virtual machining (Continue)
	3- CNC Machining project Lathe, 3D Milling, 5-Axis machining.
5	3- CNC Machining project Lathe, 3D Milling, 5-Axis machining. (Continue)
6	3- CNC Machining project Lathe, 3D Milling, 5-Axis machining. (Continue)
7	3- CNC Machining project Lathe, 3D Milling, 5-Axis machining. (Continue)
	4- Reverse Engineering and Rapid Prototyping and 3D printing
8	4- Reverse Engineering and Rapid Prototyping and 3D printing (Continue)
9	4- Reverse Engineering and Rapid Prototyping and 3D printing (Continue)
10	4- Reverse Engineering and Rapid Prototyping and 3D printing (Continue)
	5- Powder Metallurgy
11	5- Powder Metallurgy (Continue)
12	5- Powder Metallurgy (Continue)
	6- Polymer injection
13	6- Polymer injection (Continue)
	7- Course Project
14	7- Course Project (Continue)
15	7- Course Project (Continue)