

Course Syllabus

Course number ME 131
 Course title Manufacturing Processes
 Section THV
 Course credit 4 units
 Class schedule TTh 11:30-1 pm ME 3

Instructor M. Lapeña
 Consultation hours TTh 1-5PM, WF 9AM-1PM
 ME department
 E-mail mtlapena@gmail.com

Course description Principles in metal production. Pattern making & foundry processes. Cold & hot working, welding, brazing, soldering, and other joining processes. Materials production and selection. Projects.

Course goals At the end of this course, students must

- Understand the different engineering materials and their properties.
- Acquire an understanding of the different casting, forming and joining processes available.
- Know the difference between cold and hot working processes and its application.
- Apply this knowledge in the wise selection of materials and manufacturing processes for every intended use.

Course schedule	Topic	Sub-Topic	Specific Objective	Activities, references and/or requirements
Day 0	Introduction, expectation, and student survey		Understand course objectives, requirements, grading system. Express one's expectations on the course.	Course syllabus
Lecture 1	Properties of Materials	Static and dynamic, temperature effects, machinability, formability and weldability, etc.	Review of basic material properties.	Read DeGarmo Chapter 2 Additional reference: http://www.astm.org/Standards/steel-standards.html
Lecture 2	Ferrous Metals and Alloys	Iron and Steel	Explain the difference between Iron and Steel. Be familiar with different types of steel, their properties, designation, and application.	Read DeGarmo Chapter 6.1 to 6.4
Lecture 3		Stainless steels, tool steels, and cast steel and iron alloys		Read DeGarmo Chapter 6.5 to 6.7
Lecture 4	Nonferrous Metals and Alloys	Copper and copper alloys	Explain the difference between nonferrous metals and alloys. Identify important properties. Link these properties to suitable application. Be familiar with standard designation.	Read DeGarmo Chapter 7.1 and 7.2
Lecture 5		Aluminum and aluminum alloys		Read DeGarmo Chapter 7.3
Lecture 6		Magnesium and magnesium alloys		Read DeGarmo Chapter 7.4
Lecture 7		Zinc, titanium and nickel based alloys. Superalloys, lead, tin and alloys. Metallic glasses and graphite.		Read DeGarmo Chapter 7.5 to 7.12
Lecture 8	Nonmetallic Materials	Plastics and elastomers *	Identify nonmetallic engineering materials. Be familiar with its usage in the industry. Identify applications where using nonmetallic materials are more advantageous than metallic materials	Read DeGarmo Chapter 8.1 to 8.3
Lecture 9		Ceramics and composites *		Read DeGarmo Chapter 8.4 to 8.5
Lecture 10	Material Selection	The design process, procedures and aids for material selection, factors to consider, and material	Be familiar with the design process, especially the material selection. Successfully link material properties to design	Submit case study/final paper proposal.

		substitution	requirements and manufacturing processes.	
TBA	First Long Exam			
Lecture 11	Casting Processes	Fundamentals of Casting	Be familiar with casting terminologies, cast structures and patterns. Interpret and analyze cooling curves and the solidification process. Determine design considerations.	Read DeGarmo Chapter 11
Lecture 12		Expendable-Mold Casting	Be able to identify different expendable-mold casting processes. Analyze where each process is best used based on their advantages and disadvantages.	Read DeGarmo Chapter 12
Lecture 13		Multiple-Use-Mold Casting	Be able to identify different multiple-use-mold casting processes. Analyze where each process is best used based on their advantages and disadvantages.	Read DeGarmo Chapter 13
Lecture 14	Powder Metallurgy	Basic Process, Powder Properties, Design of P/M products, process advantages and disadvantages *	Identify basic processes involved in P/M. Analyze the correlation of powder properties to final product properties and choice of P/M process. Be familiar with design parameters and consideration of P/M products.	Read DeGarmo Chapter 18
Lecture 15	Forming Processes	Fabrication of Plastics Rubbers, and Elastomers	Be familiar with the different fabrication techniques for plastics, rubbers and elastomers. Analyze how we can use known properties to choose which process to utilize. Identify and analyze design criteria and consideration.	Read DeGarmo Chapter 14.2 to 14.3
Lecture 16	Forming Processes	Fabrication of Ceramics and Composites *	Be familiar with the different fabrication techniques for ceramics and composites. Analyze how we can use known properties to choose which process to utilize. Identify and analyze design criteria and consideration.	Read DeGarmo Chapter 14.4 to 14.5
TBA	2nd Long Exam			
Lecture 17	Forming Processes	Fundamentals of Metal Forming	Be familiar with the fundamental concept in metal forming. Analyze the correlation of independent and dependent variables. Identify general considerations in metal forming	Read DeGarmo Chapter 15
Lecture 18		Bulk Forming Processes: Rolling, Forging, Extrusion *	Be familiar with bulk forming processes, their advantages, disadvantages, and applications.	Read DeGarmo Chapter 16.1 to 16.6
Lecture 19		Bulk Forming Processes: Wire, Rod and Tube Drawing, Cold forming, Cold	Identify and explain the design considerations in designing the products to be formed by discussed processes.	Read DeGarmo Chapter 16.7 to 16.11

		forging, and impact extrusion, Piercing and other squeezing processes *		
Lecture 20		Sheet Forming Processes	Be familiar with sheet forming processes, their advantages, disadvantages, and applications. Identify and explain the design considerations in designing the products to be formed by discussed processes.	Read DeGarmo Chapter 17
Lecture 21	Rapid Prototyping *			
TBA	3rd Long Exam			
Lecture 22	Joining Processes	Gas Flame and Arc Processes	Be familiar with gas flame and arc processes used in joining materials. Analyze the components of these processes. Identify applications of each process.	Read DeGarmo Chapter 31
Lecture 23		Resistance and Solid-state Welding Processes	Differentiate major types of welding processes. Be able to describe the process of how a weld is produced. Identify applications of each process.	Read DeGarmo Chapter 32
Lecture 24	Joining Processes	Other Welding Processes, Brazing and Soldering *	Differentiate brazing and soldering. Identify advantages, disadvantages and applications of each process.	Read DeGarmo Chapter 33
Lecture 25		Adhesive Bonding, Mechanical Fastening, and Joining of Non-metals *	Identify alternative ways of joining materials. Analyze their advantages and disadvantages with respect to each other. Be able to decide what type of process is applicable in a given scenario.	Read DeGarmo Chapter 34
Lecture 26	Special Topic			
Lecture 27	Special Topic			
TBA	4th Long Exam			
TBA	Case Study/ Final Paper discussion Presentation / Special Topics discussion			

Teaching Strategies

This particular course is information heavy. Memory work is inevitable but we also want you to fully understand each process that we will discuss. To facilitate deeper learning, you will be required to read the prescribed readings before coming to class.

Evaluation

ME 131 Final Grade = 70% Lecture + 30% Lab

Lecture Grade Breakdown:

4 Long Exams	50%
Final Paper	20%
Reporting	15%
<u>Recitation/HW</u>	<u>15%</u>
Total	100%

Evaluation details

All papers or case studies to be submitted should follow the following format.

- 12pts, Calibri, 1.0 spacing, 1 inch margins on all sides, A4 size paper. No cover page.

Answer sheets for all long exams should be submitted one meeting before the scheduled exam. Answer sheets should be labeled with your name, student number, and date of exam at the upper right hand corner of the A4 size bond paper.

Case study / Final Paper

We will discuss the mechanics of this requirement further as the semester progresses.

Class Policies

- Attendance will be checked each meeting, fifteen (15) minutes after the official start of class. A student can only have a maximum of six (6) absences. Students exceeding the maximum allowable absences will be given a grade of 5.

- Put gadgets in silent mode during class hours. Disruptions in class will not be tolerated.
- No make-up exams will be given for missed exams without a valid reason.
- This course is composed of two components: the lecture part and the laboratory part. You must pass both components to pass this course. A failing average in one of the components will result in a grade of 5.

Grade Equivalence

COURSE GRADE	Grade	COURSE GRADE	Grade
93 and higher	1.0	73 to below 77	2.25
89 to below 93	1.25	69 to below 73	2.5
85 to below 89	1.5	65 to below 69	2.75
81 to below 85	1.75	60 to below 65	3
77 to below 81	2.0	Lower than 60	5