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Course Outline for WLDT 79

MANUFACTURING PROCESSES

Effective: Fall 2015

I. CATALOG DESCRIPTION:

WLDT 79 — MANUFACTURING PROCESSES — 2.00 units

This course examines the processes and equipment used in modern manufacturing. This course provides an excellent introduction to today's manufacturing processes, as well as an overview of the processes and equipment used in modern manufacturing. The course concentrates on the five major types of industrial materials; metals, plastics, ceramics, woods, and composites. It provides thorough coverage of the forming, separating, fabricating, conditioning, and finishing processes related to each material. The course also includes the materials and manufacturing processes used in packaging finished goods. The proper and safe use of hand tools, basic shop tools, manufacturing and welding equipment will be covered. Understanding the relationship between manufacturing processes, materials properties, materials processing and design.

1.50 Units Lecture 0.50 Units Lab

Grading Methods:

Letter or P/NP

Discipline:

	MIN
Lecture Hours:	27.00
Lab Hours:	27.00
Total Hours:	54.00

II. NUMBER OF TIMES COURSE MAY BE TAKEN FOR CREDIT: 1

III. PREREQUISITE AND/OR ADVISORY SKILLS:

IV. MEASURABLE OBJECTIVES:

Upon completion of this course, the student should be able to:

- A. Distinguish the difference between basic hand tools, demonstrate their proper usage and application, as well as illustrate safe practices for basic hand tools;
- B. Illustrate the difference between basic power tool types, demonstrate and explain their proper usage and application, as well as apply safe practices for basic power tools;
- C. Identify basic welding equipment types, demonstrate safe practices when welding and perform simple visual evaluation of the weld produced;
- D. Differentiate, using the physical and mechanical properties of the material, which modern manufacturing processes and equipment can be used to process the following material types:
 1. Metals
 2. Plastics
 3. Ceramics
 4. Wood
 5. Composites
- E. Identify and explain the application of the following manufacturing processes and their use with metals, plastics, ceramics, wood and composites:
 1. Welding
 2. Heat Treating
 3. Sawing
 4. Plate Shearing
 5. Punch Press
 6. Sheet Metal Stamping
 7. Press Brake
 8. Roll Forming
 9. Plasma Cutting
 10. Oxy-Fuel Cutting
 11. Laser Cutting and processing
 12. Abrasive Water Jet Cutting
 13. Hole Making Processes
 14. Planers
 15. Broaching
 16. Surface Grinders
 17. Milling Machine

18. Engine Lathe
19. CNC Machine Work
20. Electrical Discharge Machining (EDM)
21. Industrial Robotics
22. Forging
23. Powered/Sintered Metal Processes
24. Hot Isostatic Pressing (HIP)
25. Rapid Prototyping
26. Direct Metal Manufacturing
27. Sheet Metal Coil Processing
28. Sheet Metal Shearing and Blanking
29. Hydroforming
30. Injection Molding
31. Blow Molding
32. Rotational Molding
33. Centrifugal Casting
34. Permanent Mold Casting
35. Die Casting
36. Sand Casting
37. Investment Casting – Lost Wax Process
38. Metal Matrix Composite Processing
39. Carbon Fiber Processing
40. Fiberglass Processing
41. Plastic Machining and assembly
42. Just-In-Time (JIT) Manufacturing
43. Finishing
44. Packaging;

F. Develop a manufacturing traveler document that will connect and evaluate the use of the following manufacturing and processing parameters:

1. Materials processing
2. Materials properties
3. Manufacturing processes
4. Design

V. CONTENT:

- A. Basic hand tools safety and usage
- B. Basic shop power tools safety and usage
- C. Basic welding equipment safety and usage
- D. Material Types and Properties
 1. Metals
 2. Plastics
 3. Ceramics
 4. Wood
 5. Composites
- E. Manufacturing processes and methods:
 1. Welding
 2. Heat Treating
 3. Sawing
 4. Plate Shearing
 5. Punch Press
 6. Sheet Metal Stamping
 7. Press Brake
 8. Roll Forming
 9. Plasma Cutting
 10. Oxy-Fuel Cutting
 11. Laser Cutting and processing
 12. Abrasive Water Jet Cutting
 13. Hole Making Processes
 14. Planers
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 20. Electrical Discharge Machining (EDM)
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 27. Sheet Metal Coil Processing
 28. Sheet Metal Shearing and Blanking
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 30. Injection Molding
 31. Blow Molding
 32. Rotational Molding
 33. Centrifugal Casting
 34. Permanent Mold Casting
 35. Die Casting
 36. Sand Casting
 37. Investment Casting – Lost Wax Process
 38. Metal Matrix composite Processing
 39. Carbon Fiber Processing
 40. Fiberglass Processing
 41. Plastic Machining and Assembly
 42. Just-in-time (JIT) Manufacturing
 43. Finishing
 44. Packaging

F. Manufacturing Traveler and the processing connections between:

1. Materials processing
2. Materials properties
3. Manufacturing processes
4. Design

VI. METHODS OF INSTRUCTION:

- A. **Lecture** -
- B. Textbook reading assignments; additional Internet and/or assignments
- C. Class and group discussions
- D. **Research** -
- E. **Field Trips** -
- F. **Lab** -
- G. Presentation of audio-visual materials

VII. TYPICAL ASSIGNMENTS:

- A. Lectures:
 1. Basic Hole Making
 2. Thermal Cutting
 3. Welding and Forging
- B. Reading:
 1. Read the textbook chapter on Abrasive Waterjet Cutting
 2. Locate and read an article off the internet authored in the last 90 days on the subject of sheet metal processing, write a summary of what you read.
- C. Homework:
 1. Read the textbook chapter on Milling Machines and answer these questions:
 - a. What is a horizontal milling machine?
 - b. What is a shell mill and when might we use it?
 - c. What is the purpose of being able to adjust RPM on the spindle?
- D. Class and group discussions:
 1. What is the purpose of Rapid Prototyping in an industrial environment? What are the costs of rapid prototyping verses conventional manufacturing methods?
 2. When would we use CNC manufacturing techniques and processes? What are the advantages of CNC processing? What are the disadvantages?
- E. Audio-visual materials:
 1. Video of forging processes
- F. Field Trip:
 1. Visit a local manufacturing company
- G. Lab Work:
 1. Safely use basic hand and shop tools to make the sheet metal part shown on the attached blueprint
 2. Using a drill press, drill and tap, six 0.250-20-UNC threaded holes on a 4" bolt circle
 3. Capstone Lab Assignment: Using the technical drawing provided, develop a plan, define what tools or equipment you will need to manufacture the component. Using the material provided, make the part using the manufacturing methods covered in lecture/lab to meet the drawing requirements.
- H. Research project:
 1. You are leader of your own manufacturing company. You just got an order to make 1000 of this item. The drawing gives you the material required. What manufacturing processes and equipment would you select, and explain in detail how you would make the item. Prepare a presentation and describe your method of manufacturing to the class.

VIII. EVALUATION:

A. **Methods**

1. Exams/Tests
2. Quizzes
3. Research Projects
4. Papers
5. Home Work
6. Lab Activities
7. Other:
 - a. Quizzes
 - b. Objective examinations (for lecture and text reading assignments)
 - c. Analysis and evaluation of homework assignments
 - d. Analysis and evaluation of lab assignments
 - e. Research project:
 1. Written proposal
 2. Outline
 3. First draft
 4. Evaluation of final

B. **Frequency**

1. Weekly Quizzes
2. Midterm and Final Examinations
3. Weekly homework and lab evaluation
4. End-of-term evaluation of research project & lab project

IX. TYPICAL TEXTS:

1. Duvall, Barry, and David Hillis. *Manufacturing Processes*. 3rd ed., Goodheart-Wilcox, 2012.
2. Lincoln Electric *Procedure Handbook of Arc Welding*. 14th ed., James F Lincoln Foundation, 2008.
3. O'Con, Robert J., and Richard H. Carr *Metal Fabrication – A Practical Guide*. 3rd ed., Fabricators & Manufacturers Association, 2010.
4. Society of Manufacturing Engineers. *Fundamental Manufacturing Processes*. 3rd ed., Society of Manufacturing Engineers, 2012.

X. OTHER MATERIALS REQUIRED OF STUDENTS:

- A. Safety Glasses
- B. Gloves
- C. Closed toe shoes