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CUYAHOGA COMMUNITY COLLEGE
OFFICIAL COURSE OUTLINE
Mapped

SUBJECT AREA TITLE
Mechanical Engineering Technology/Manufacturing Industrial Engineering Technology

COURSE TITLE
Machine Tools and Manufacturing Processes

SUBJECT AREA CODE-COURSE NUMBER
MET - 1240

COURSE CREDIT HOURS
3.00

I. DESCRIPTION OF COURSE:

A. CATALOG DESCRIPTION: Application of traditional and contemporary machine tools processes to accomplish the mechanical parts production or the maintenance and/or repairs of mechanical parts or equipment. Laboratory experiences include measuring and inspection, layout and fundamentals of machine tool setup and techniques for drilling, turning, milling and grinding. Manufacturing processes including the production of metals and alloys, polymers and plastics, forming, machining, fabrication, conditioning and finishing of metallic, plastic and composite engineering parts.

B. LECTURE HOURS: 2.0

C. LAB HOURS: 3.00

D. OTHER REQUIRED HOURS: 00

E. PREREQUISITE(S):
Eligibility for MATH-1280 Intermediate Algebra, or departmental approval: work experience

II. GENERAL EDUCATION OUTCOMES:

Upon satisfactory completion of MET 1240 - Machine Tools and Manufacturing Processes, the student should be able to perform the following outcomes and supporting objectives:

Outcome:

III. OUTCOMES/OBJECTIVES:

Upon satisfactory completion of MET 1240 - Machine Tools and Manufacturing Processes, the student should be able to perform the following outcomes and supporting objectives:

A. Outcome: Apply the principles of machine tool and correctly use machine tools to produce engineering parts.

Supporting Objectives:

1. Follow safety precautions in the use of machine tools and demonstrate safe behavior on the shop floor.
2. Read measuring and inspection tools used in the machine shop.
3. Layout parts using steel rule, vernier high gage and gage block, micrometers, calipers, divider, center-punches and scribers.

B. Outcome: Properly set up and operate drilling machines to accurately make holes in on a work piece.

Supporting Objectives:

1. Select a setup a drilling machine.
2. Select desired size drill bits, center drill, and tap drill size, and taps.
3. Select proper drill speed for drilling, reaming, counter-boring and counter-sinking.
4. Drill holes, ream holes, tap holes, counter-sink and counter-bore holes.
5. Check holes for dimensional and geometrical accuracy and consistency.

C. Outcome: Properly set up and operate the Lathe to accurately produce basic mechanical parts.

Supporting Objectives:

1. Discuss principles of lathe operation.
2. Recognize work pieces that can be produced on the lathe.

3. Identify lathe parts and their functions.
4. Demonstrate a proper work piece set-up on the lathe.
5. Demonstrate a proper tool set-up on the lathe.
6. Select lathe operations parameters: speed, feed and appropriate depth of cuts.
7. Describe turning between centers and appropriate application.
8. Turn taper or conical surfaces on the lathe.
9. Produce threads on the lathe.

D. Outcome: Properly set up and operate Milling machines to accurately produce basic mechanical parts.

Supporting Objectives:

1. Describe Milling machines and milling operations.
2. Recognize work pieces that can be produced on the Milling.
3. Identify milling machines' parts and their functions.
4. Describe different types of milling machines.
5. Demonstrate a proper work piece set-up on the milling machines.
6. Demonstrate the knowledge of tools, their application and proper tool set-up on the milling machine.
7. Select milling operations parameters: speed, feed and appropriate depth of cuts.
8. Produce an assigned work piece on the milling machine.

E. Outcome: Properly set up and operate grinding machines to accurately produce basic mechanical parts.

Supporting Objectives:

1. State safety rules in the use of grinding machines.
2. Read surface symbols, select and test grinding wheels for safe operations.
3. Identify different type grinding machines, their parts and proper applications.
4. Describe differentiate between surface and cylindrical grinding.
5. Demonstrate a proper work piece set-up on the grinding machines.
6. Demonstrate the knowledge of the technology of grinding wheels: grade, grits, etc.
7. Select grinding operations parameters: speed, feed and appropriate depth of cuts.
8. Produce a assigned work piece on the grinding machine.
9. Test ground surfaces for grades of surface finish.

F. Outcome: Properly set up and use power saws to cut materials on a shop floor.

Supporting Objectives:

1. Identify power different types of power saw
2. State safety rules in the use of power saws
3. Select and set-up saw blades for given material cutting operation
4. Demonstrate the knowledge of material removal technique of a saw blade
5. Produce assigned work piece on a power saw.

G. Outcome: Apply knowledge of manufacturing principles.

Supporting Objectives:

1. Explain the relationship between process, design, and material in manufacturing.
2. Use the Taxonomy of Manufacturing Processes to locate and describe manufacturing processes.
3. Analyze product features to identify manufacturing processes that may have been used.
4. Describe examples of how different manufacturing processes can be used to produce the same product.
5. Suggest manufacturing processes required to make a product design from an engineering drawing and explain why the recommended suggestions were made.

H. Outcome: Apply knowledge of the process of Metal Forming and Joining.

Supporting Objectives:

1. Describe each of the following processes—welding, casting, forming, and forging—including work piece materials, consumable materials, safety procedures, necessary equipment, and manufacturing applications.
2. Differentiate between various processes within the categories of welding, casting, forming and forging, and identify which process would be most applicable and cost-effective for a given product.
3. Describe and interpret manufacturing process data (including materials, machines, and process parameters) in reference manuals.
4. Explain the proper procedures for the operation of basic sheet metal forming machines such as a box and pan brake, shear, and piercing and blanking machines.
5. Explain the proper procedures to operate at least one basic welding machine such as gas metal arc welding, gas tungsten arc welding, shielded metal arc welding, or oxygen acetylene cutting.
6. Explain proper procedures for green-sand casting of parts.

I. Outcome: Apply knowledge of plastics and composite material processing.

Supporting Objectives:

1. Define terms related to plastics and plastics processes.
2. Explain each of the following processes: injection molding, extrusion, blow molding, rotational molding, and thermoforming.
3. Identify process selection considerations and limitations, including design, volume, dimensions, tolerances, and cost.
4. Describe the physical method of processing and the machinery and tooling used for each of the following processes: injection molding, extrusion, blow molding, rotational molding, and thermoforming.
5. Identify process variables (including time, temperature, and pressure) which may affect product quality and how these variables affect the mechanical properties of materials during processing.
6. Identify the process used to make a plastics product.
7. Use reference materials (such as Material Safety Data Sheets and Modern Plastics encyclopedia) to locate relevant information about plastics processes and materials.

IV. COURSE CONTENT:

A. CONCEPTS

1. Material forming processes
2. Extrusion process
3. Wire drawing process
4. Sheet metal shearing process
5. Bending process
6. Stretching process
7. Drawing process
8. Material removal processes
9. Cutting tools operation
10. Machine tools operation and maintenance
11. Layout techniques
12. Prints interpretation techniques
13. Measuring techniques
14. Inspection techniques
15. Traditional manufacturing principles and processes
16. Contemporary manufacturing principles and processes
17. Metal casting processes, design and applications
18. Metal Manufacturing Process

19. Plastic Manufacturing Process
20. Composite manufacturing process
21. Plastic materials processing
22. Composite materials processing
23. Lathe operation principles
24. Drilling machine operation principles
25. Milling machine operation principles
26. Grinding machine operation principles
27. Power saw operation principles
28. Safety precautions
29. Safe shop floor behavior
30. Taxonomy of Manufacturing processes
31. Material Safety Data Sheets
32. Modern Plastics Encyclopedia
33. Green-sand casting procedures

B. SKILLS

1. Operate lathes to produce parts
2. Operate milling machines to produce parts
3. Operate drill presses to produce parts
4. Select manufacturing processes to accomplish production of given parts
5. Select processes to accomplish the maintenance or repair of defective equipment or machines parts.
6. Measure and inspect parts for geometrical and dimension accuracy
7. Select and set up tools on machine tools
8. Calculate speed and feeds
9. Operate grinding machines to produce parts.
10. Select and interpret shop detail drawings.
11. Select proper PPE for the operation.
12. Set up a mill vise operation.
13. Perform drilling operations using a drill press.
14. Lay-out and fabricate a selected project to specified tolerances.
15. Read, and record angular measurements using the correct instruments.

C. ISSUES

1. Safe operations and maintenance of machine tools
2. Safe handling of hand tools
3. Applying maintenance concepts in problems resolution

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V. METHODS OF STUDENT EVALUATION MAY INCLUDE ANY OF THE FOLLOWING:

A. Inspection and grading of projects
B. Quizzes and assignments
C. Midterm examination

D. Final examination

VI. RESOURCES MAY INCLUDE ANY OF THE FOLLOWING:

A. Altintas, Yusuf. *Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and Cnc Design*. Cambridge Univ Pr, 2012.
B. Kalpakjian, Serope and Steven Schmid. *Manufacturing, Engineering & Technology*. 7e Upper Saddle River, NJ., 2014.
C. Kibbe, Robert, et al.. *Machine Tool Practices*. 9th Ed. Prentice Hall, 2010.
D. Neely, John and Thomas Bertone. *Practical Metallurgy and Materials of Industry*. 6th Ed. Upper Saddle River, NJ., 2003.
E. Falcioni, John, ed.. *Mechanical engineering : The Journal of the American Society of Mechanical Engineers* (10-01-2007). New York : The Society, 1919-.

VII. ADDITIONAL RESOURCES:

Handouts
Assignments supplied by the Instructor
Videos
Internet