

MT. PLEASANT AREA TECHNICAL CENTER
MACHINE TRADES I, II
Course Syllabus

INSTRUCTOR(S):
Paul Driggers

PARA-PROFESSIONAL(S):

DATE: 10/03

MICHIGAN CAREER PATHWAY(S): Engineering, Manufacturing
and Industrial Technology

PROGRAM DESCRIPTION:

This program prepares the student for an entry-level job in tool and die, mold-making, or machining industries. Students will learn to use hand tools, precision measuring devices, drill presses, lathes, milling machines, and precision grinding machines. The program includes instruction in computations for speeds, feeds, precision measuring, and layout work. Students will also have the opportunity to experience Computerized Numerical Control (CNC) machining as well as Computer Aided Machining (CAM) technology. Excellent preparation is provided for advanced degrees in engineering or manufacturing technologies.

PROGRAM CIP CODE: 48.0501

P.S.N. 00099

U.S. DEPARTMENT OF EDUCATION CAREER CLUSTER(S): Manufacturing, and Science,
Technology, Engineering and Mathematics

TEXTBOOK(S): including edition(s), author(s), publisher(s), copyright(s)

Technology of Machine Tool - 3rd Edition, S.F. Krar, J.W. Oswald, J.E. St.Amand, Gregg Division/ McGraw-Hill Book Co., 1984, Machining Fundamentals – From Basic to Advanced Techniques, J.R. Walker, Goodhart-Willcox, 1993, Machine Tool Technology-3rd Edition, W.J. McCarthy, R.E. Smith, McKnight & McKnight, 1968

SOFTWARE: MasterCAM, Microsoft Office98

SPECIAL FEATURES OF THE PROGRAM:

Students gain “real world” experience as they work on projects from industry and the local community. Work-based learning opportunities are available. Articulated college credit is available from Ferris State University.

**JOB TITLES AVAILABLE
AT MPATC:**

Benchworker
Sawing & Cutting Machine Operator
Drill Machine Operator
Grinding Machine Operator
Tool Grinder
Lathe/Turning Machine Operator
Milling Machine Operator
Machine Tool Operator
Machine Tool Setter
CNC Operator
CNC Programmer
Layout Technician/Inspector
Machinery Maintenance Worker
Precision Grinder

**JOB TITLES REQUIRING FURTHER
TRAINING/CERTIFICATION/EDUCATION:**

Tool & Die Maker
Inspection/Quality Control
Machinist
Mill Wright
Plastic Mold & Die Cast Maker
CNC Machinist
Die Designer
Machine Repairer
Manufacturing Engineer
Metallurist

FIRST SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Safety:

1. Operate safely in the lab in compliance with appropriate guidelines (OSHA and EPA).
2. List machine shop safety rules and regulations.

Mathematical Calculations:

3. Convert common fractions to decimal fractions and vice versa.
4. Determine tap drill size with formula and charts.
5. Convert customary measurements to metric and vice versa.
6. Use calculator to perform mathematical operations.
7. Verify the accuracy of calculations derived with a calculator.
8. Calculate the amount of stock required.
9. Calculate feeds and speeds.
10. Determine sine bar set-up with formulas and charts.
11. Calculate measurements of right triangles.

Performing Measurement:

12. Measure using direct reading instruments (scales, protractors, and precision levels).
13. Measure using transfer instruments (plain inside and outside calipers, telescoping gages, adjustable hole gages and adjustable parallels).
14. Measure using precision measuring instruments (micrometers, gage blocks, verniers, dial indicators and digital calipers).
15. Measure using comparison instruments (radius gages, squares, cutter tooth gages and center gages).
16. Measure using other instruments (optical comparators, coordinate measuring machines/CMM).
17. Measure pitch diameters using thread wires.

Blueprint Reading:

18. Interpret blueprints, including common drafting symbols.
19. Make a sketch from a finished workpiece.
20. Calculate tolerances and allowances.
21. Calculate missing dimensions.

FIRST SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Safety:

1. Operate safely in the workshop in compliance with appropriate guidelines.
2. List machine shop safety rules and regulations.

Mathematical Calculations:

3. Convert customary measurements to metric and vice versa.
4. Use calculator to perform mathematical operations.
5. Verify the accuracy of calculations derived with a calculator.
6. Calculate the amount of stock required.
7. Calculate part and feature dimensions and locations.
8. Convert revolutions per minute (rpm) to surface feet per minute (sfpm).
9. Calculate feeds and speeds.
10. Determine tapers for machine set-up per formulas and charts.
11. Determine sine bar set-up with formulas and charts.
12. Perform angular and simple indexing calculations.
13. Calculate measurements of right triangles.

Performing Measurement:

14. Measure using direct reading instruments (scales, protractors, and precision levels).
15. Measure using transfer instruments (plain inside and outside calipers, telescoping gages, adjustable hole gages and adjustable parallels).
16. Measure using precision measuring instruments (micrometers, gage blocks, verniers, dial indicators and digital calipers).
17. Measure using surface plate instruments (height gages, angle plates, and sine bars and plates).
18. Measure using comparison instruments (radius gages, squares, cutter tooth gages and center gages).
19. Measure using other instruments (optical comparators, coordinate measuring machines/CMM).
20. Measure pitch diameters using thread wires.

Blueprint Reading:

21. Interpret blueprints, including common drafting symbols.
22. Calculate tolerances and allowances.
23. Calculate missing dimensions.
24. Use geometric dimensioning and tolerancing.

SECOND SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Work Planning:

1. Use Machinery's Handbook to plan work.
2. Plan sequence of part layout based on blueprint information.
3. Plan sequence of machining operations.

Inspection:

4. Inspect part using hand tools (scales, micrometers, verniers and protractors).
5. Inspect part using optical comparator.

Quality Control:

6. Follow a quality plan.

Performing Layout and Bench work:

7. Use and care for hand tools.
8. Cut materials with hand hacksaw.
9. Mark locations with prick and center punches.
10. Locate holes with transfer screws and transfer punches.
11. Bench file/deburr workpiece.
12. Cut threads with die.
13. Cut threads with hand tap.
14. Ream holes with hand reamer.
15. Grind and shape tools on pedestal/bench grinder.
16. Use abrasives/whetting/polishing/lapping.
17. Straighten workpiece on arbor press.
18. Assemble and disassemble workpiece with arbor press.

Material Science:

19. Identify types of metals and related materials.

SECOND SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Work Planning:

1. Use Machinery's Handbook to plan work.

Inspection:

2. Inspect part using hand tools (scales, micrometers, verniers and protractors).
3. Inspect part using surface plate instruments (indicators, height gages, angle plates, height-transfer gages and sine bars and plates).
4. Inspect part using optical comparator.
5. Inspect part using CMM (coordinate measuring machines – when one is purchased).

Quality Control:

6. Participate in capability study
7. Analyze the performance of a single part production process.
8. Analyze the performance of a production process.

Performing Layout and Bench Work:

9. Use and care for hand tools.
10. True and dress grinding wheels on pedestal/bench grinder.
11. Grind using appropriate hand grinder.
12. Remove damaged screws.
13. Remove broken drills and taps.
14. Remove and install dowel pins.
15. Install a thread insert.
16. Straighten workpiece on arbor press.
17. Assemble and disassemble workpiece with arbor press.
18. Broach workpiece with broaching tool.
19. Assemble and disassemble precision parts.

Material Science:

20. Identify types of metals and related materials.
21. List properties that affect machinability.
22. Correlate types of materials to their properties.
23. List major cutting tool variables.
24. Perform heat treatment process.
25. Test workpiece for hardness with and without hardness tester.
26. Interpret time-temperature-transformation diagrams (with permission of instructor-3rd year students).
27. Identify the effect of heat treatment on materials “ “ “

THIRD SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Power Saws:

1. Employ power saw safety guidelines.
2. Perform power saw care and maintenance.
3. Cut and weld band saw blades.
4. Select and set speeds and feeds on power saw.
5. Cut material to length with power saw.
6. Select and apply cutting fluids.
7. Contour saw to scribed line.

Operating Drill Presses:

8. Employ drill press safety guidelines.
9. Perform drill press care and maintenance.
10. Set up and clamp workpiece to drill press table.
11. Select drill type based on job requirements.
12. Determine cutting tool variables prior to use.
13. Set up drill press according to calculated feeds and speeds.
14. Select and apply cutting fluids.
15. Drill holes to specification using manual feed.
16. Countersink hole to specifications.
17. Counterbore hole to specifications.
18. Spotface to specific dimensions.
19. Mount workpiece on V-blocks.
20. Power ream hole to size.
21. Hand tap hole using drill press.
22. Sharpen drills at a pedestal grinder or with grinding attachments and specialized grinders.

Operating Lathes:

23. Employ lathe safety guidelines.
24. Perform lathe care and maintenance.
25. Align lathe centers using test bar and dial indicators.
26. Select cutting tool based on job requirements.
27. Calculate feeds and speeds for lathe set-up.
28. Free-hand grind turning and facing tools.
29. Select and apply cutting fluids.
30. Operate lathe controls.
31. Face workpiece and center drill.

THIRD SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Power Saws:

1. Employ power saw safety guidelines.
2. Perform power saw care and maintenance.
3. Select blade type for sawing operations and materials.
4. Cut and weld band saw blades.
5. Select and set speeds and feeds on power saw.
6. Cut material to length with power saw.
7. Select and apply cutting fluids.
8. Contour saw to scribed line.
9. Saw internal contours with band saw.

Operating Drill Presses:

10. Perform drill press care and maintenance.
11. Select drill type based on job requirements.
12. Drill holes to specification using manual feed.
13. Drill holes to specification using automatic feed.
14. Use drill jigs and bushings.
15. Tap hole with tapping attachment.
16. Perform taper reaming and subsequent pipe tapping.
17. Sharpen drills at a pedestal grinder or with grinding attachments and specialized grinders.
18. Set up radial drill press.

Operating Lathes:

19. Employ lathe safety guidelines.
20. Perform lathe care and maintenance.
21. Indicate workpiece in four-jaw chuck.
22. Bore holes
23. Countersink holes.
24. Counterbore holes.
25. Cut Acme threads.
26. Cut tapers by offset tailstock.
27. Cut external tapered surface with taper attachment.
28. Cut internal tapered surface with taper attachment.

FOURTH SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Lathes (con't):

1. Set up tooling.
2. Turn workpiece between centers.
3. Indicate workpiece in four-jaw chuck.
4. Drill holes.
5. Ream holes.
6. Knurl parts.
7. Free-hand grind 60-degree threading tool.
8. Chase external/internal threads.
9. Use compound rest to cut short external/internal tapered surfaces.
10. Align workpiece on faceplate.
11. Perform lathe filing.
12. Polish workpiece.
13. Use form tooling.

Operating Milling Machines:

14. Employ milling machine safety guidelines.
15. Perform care and maintenance of milling machines.
16. Tram (align) mill head.
17. Select milling machine attachments according to job requirements.
18. Align workpiece mounted on machine table.
19. Calculate feeds and speeds and set up mill accordingly.
20. Select and apply cutting fluids.
21. Select cutting tool based on job requirements.
22. Square up workpiece in milling vise using face mill.
22. Mill workpiece with end mill.
23. Locate work with edge finder.
24. Drill holes with milling machine.
25. Ream holes.
26. Use form cutter to mill workpiece.
27. Machine workpiece mounted on V-blocks.
28. Machine external straight keyway.
29. Mill simple and compound angles.
30. Use digital readout.

FOURTH SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Lathes (con't):

1. Align workpiece on faceplate.
2. Turn or thread long workpieces using follower and steady rest.
3. Use mandrel.

Operating Milling Machines:

4. Employ milling machine safety guidelines.
5. Perform care and maintenance of milling machines.
6. Tram (align) mill head.
7. Select milling machine attachments according to job requirements.
8. Align workpiece mounted on machine table.
9. Calculate feeds and speeds and set up mill accordingly.
10. Select and apply cutting fluids.
11. Select cutting tool based on job requirements.
12. Square up workpiece in milling vise using face mill.
13. Mill workpiece with end mill.
14. Locate work with edge finder.
15. Drill holes with milling machine.
16. Ream holes.
17. Bore holes with milling machine.
18. Use form cutter to mill workpiece.
19. Machine workpiece mounted on V-blocks.
20. Machine external straight keyway.
21. Machine woodruff keyway.
22. Mill simple and compound angles.
23. Mill an external radius with rotary table.
24. Mill an internal radius with rotary table.
25. Mill workpiece using simple indexing operation.
26. Use digital readout.
27. Machine workpiece by straddle milling.
28. Perform gang milling (at Instructor's discretion).

FIFTH SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Grinders:

1. Employ grinder safety guidelines.
2. Perform grinder care and maintenance.
3. Inspect and ring-test grinding wheel.
4. True and dress machine tool grinding wheel.
5. Grind workpiece on magnetic chuck using power feed.
6. Square up workpiece on surface grinder.
7. Indicate workpiece to be ground.
8. Grind angular surfaces.
9. Grind straight and tapered surfaces.

Tool and Cutter Grinding:

10. Employ tool and cutter grinding safety techniques.
11. Perform care and maintenance of tool and cutter grinder.
12. Inspect and ring-test grinding wheels.
13. Select and mount grinding wheel.
14. True and dress grinding wheel.
15. Set up machine.
16. Sharpen cutters on tool and cutter grinders.
17. Sharpen endmill.

Computerized Numerical Control(CNC):

18. Employ CNC machine safety guidelines.
19. Perform care and maintenance.
20. Calculate coordinates and dimensions needed for CNC program.
21. Write program for CNC machine.
22. Write program using G & M Code.
23. Set up a CNC machine.
24. Machine workpiece with CNC machine.

Leadership Competencies:

25. Develop and maintain a code of professional ethics.
26. Maintain a good professional appearance.
27. Perform basic tasks related to securing and terminating employment.

FIFTH SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Operating Grinders:

1. Employ grinder safety guidelines.
2. Perform grinder care and maintenance.
3. Select and apply cutting fluids.
4. Inspect and ring-test grinding wheel.
5. Balance grinding wheel.
6. Select and mount grinding wheel.
7. True and dress machine tool grinding wheel.
8. Grind workpiece on magnetic chuck using power feed.
9. Square up workpiece on surface grinder.
10. Indicate workpiece to be ground.
11. Dress form on grinding wheel.
12. Grind form into part.
13. Grind angular surfaces.
14. Grind straight and tapered surfaces.

Tool and Cutter Grinding:

15. Employ tool and cutter grinding safety techniques.
16. Perform care and maintenance of tool and cutter grinder.
17. Inspect and ring-test grinding wheels.
18. Select and mount grinding wheel.
19. True and dress grinding wheel.
20. Set up machine.
21. Sharpen cutters on tool and cutter grinders.

Computerized Numerical Control (CNC):

22. Employ CNC machine safety guidelines.
23. Perform care and maintenance.
24. Calculate coordinates and dimensions needed for CNC program.
25. Write program for CNC machine.
26. Write program using G & M Code.
27. Set up a CNC machine.
28. Machine workpiece with CNC machine.

Leadership Competencies:

29. Develop and maintain a code of professional ethics.
30. Maintain a good professional appearance.
31. Perform basic tasks related to securing and terminating employment.

SIXTH SIX-WEEK MARKING PERIOD FIRST YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Leadership Competencies:

1. Demonstrate an understanding of VICA, its structure and activities.
2. Demonstrate an understanding of one's personal values.
3. Perform tasks related to effective personal management skills.
4. Demonstrate interpersonal skills.
5. Demonstrate etiquette and courtesy.
6. Demonstrate effectiveness in oral and written communication

Employability Competencies:

7. Develop and explain a short-term career plan and resume.
8. Complete job application form and demonstrate interviewing skills.

SIXTH SIX-WEEK MARKING PERIOD SECOND YEAR STUDENTS

PERFORMANCE OBJECTIVES:

Each student will perform the following objectives as measured in actual laboratory conditions or on written tests with at least 80% accuracy.

Students will be able to:

Electric Discharge Machines(EDM):

1. Operate a plunge (ram-type) electric discharge machine.
2. Operate a wire electric discharge machine (not yet online).

Leadership Competencies:

3. Demonstrate an understanding of VICA, its structure and activities.
4. Demonstrate an understanding of one's personal values.
5. Perform tasks related to effective personal management skills.
6. Demonstrate interpersonal skills.
7. Demonstrate etiquette and courtesy.
8. Demonstrate effectiveness in oral and written communication

Employability Competencies:

9. Develop and explain a short-term career plan and resume.
10. Complete job application form and demonstrate interviewing skills.

