Machining 3

*This exam is in pilot status. No certificate is available.

Exam Information

Exam number
583

Items
35

Points
45

Prerequisites
Machining 1
Machining 2

Recommended course length
One semester

National Career Cluster
Agriculture, Food, & Natural Resources
Manufacturing

Performance standards
Included (Optional)

Certificate available
No

Description

The Machining 3 industry certification exam assesses technical knowledge and skills to plan and manufacture projects using machine lathes, mills, drill presses, and other equipment in safe working conditions to promote the manufacturing industries.

Exam Blueprint

Standard	Percentage of exam
1. Personal Development	0%
2. Workplace Readiness	0%
3. Safe Practices	9%
4. Mathematical Concepts	11%
5. Engineering Documents	16%
6. Measurement Inspections	31%
7. CNC Machining Processes	33%

Standard 1

Student will participate in personal and leadership development activities through SkillsUSA or another appropriate career and technical student organization.

Objective 1 Student will be dependable, reliable, steady, trustworthy, and consistent in performance and behavior.

1. Set and meet goals
2. Prioritize, plan, and manage work to complete on time.

Objective 2 Student will be accountable for results.

1. Standard Workflow
2. Accurately and constantly perform documentation professionally
3. File a regular written report on progress toward completion of timeline.
4. Demonstrate ethics, e.g. fair, honest.

Objective 3 Be familiar with the legal requirements and expectations of the course.

1. Be familiar with the course disclosure statement and all requirements for successful completion of the course.
2. Demonstrate workplace ethics, e.g. fair, honest, disciplined.

Standard 1 Performance Evaluation included below (Optional)

Standard 2

Student will participate in work-place readiness activities.

Objective 1 Student will demonstrate employability skills.

1. Use a career search network to find career choices.
2. Write a resume for a career in machining.

Objective 2 Student will participate in a work-based learning experience outside the classroom.

1. Student will plan and implement a work-based learning experience aligned with their career goal.

Standard 2 Performance Evaluation included below (Optional)

Standard 3

Students will be able to understand safe practices and professional machine shop procedures.

Objective 1 Follow safety manuals and all safety regulations and requirements.

Objective 2 Use PPE (personal protective equipment).

1. Use PPE - Personal Protective Equipment.
2. Maintain and use appropriate protective guards and equipment on machinery.
3. Demonstrate safe machine operations at all times.

Objective 3 Maintain a clean and safe work environment.

1. Keep work areas clean.
2. Clean machine and hand tools when work is completed.
3. Put tools away when work is finished.
4. Keep aisles clear of equipment and materials.
5. Perform preventive maintenance as required.
6. Understand chemical hazards and the use of Material Safety Data Sheets (MSDS).
7. Keep storage rooms well organized and free of clutter.

Standard 3 Performance Evaluation included below (Optional)

Standard 4

Students will be able to apply mathematical concepts.

Objective 1 Perform basic trigonometric functions.

1. Solve for unknown angles.
2. Solve for unknown sides.
3. Calculate bolt hole patterns.
4. Calculate surface foot
5. Calculate gage blocks up to 5" and 10" sine plates.

Objective 2 Calculate speeds and feeds for machining.

1. Given appropriate reference materials, calculate RPM for various metals and tools.
2. Given appropriate reference materials, calculate the proper feed for various metals, tools, and depths of cut.

Objective 3 Locate basic machining points from a Datum Point.

1. Identify points using the Cartesian coordinate system.
2. Identify points using the absolute dimensioning system.

Standard 4 Performance Evaluation included below (Optional)

Standard 5

Students will be able to interpret engineering drawings and control documents.

Objective 1 List the purpose of each type of drawing.

   1. Identify and describe the purpose of orthographic (three views) drawings.

Objective 2 Practice geometric dimensioning and tolerancing (GD&T) methodology.

   1. Describe the purpose of GD&T.
   2. Understand and demonstrate the use of basic GD&T symbols and functions.

Standard 5 Performance Evaluation included below (Optional)

Standard 6

Students will be able to properly measure and inspect parts according to drawing and document specifications.

Objective 1 Select proper measurement tools as they best relate to part characteristics and specified accuracy.

   1. Discuss how measurement tool selection can contribute to part accuracy/inaccuracy.
   2. Demonstrate proper use and care of precision measuring tools.
   3. Demonstrate proper use of a optical comparator.
   4. Demonstrate first article inspection vs first piece inspection vs In-process vs sampling.

Objective 2 Accurately perform measurements with/for:

   1. Calipers
   2. Micrometer
   3. Height gage
   4. Surface plate
   5. Part squareness
   6. Thread measurement
   7. Dial indicators
   8. Optical comparator
   9. Bore gage
   10. Gage pins
   11. Go/no-go (Ring and Plug)
   12. Datums
   13. Flatness
   14. Parallelism
   15. Runout
   16. Squareness
   17. Positional
   18. Concentricity
   19. Gage blocks

Standard 6 Performance Evaluation included below (Optional)

Standard 7

Students will be able to understand CNC machining processes.

Objective 1 Demonstrate proper planning for CNC machining.

1. Prepare and plan for CNC machining operations.
2. Demonstrate proper cleaning, care lubrication and operation of CNC machines.
3. Properly identify common types of CNC machines and describe their size and general applications.
4. Demonstrate ability to read and interpret complex blueprints.
5. Create a plan of operation for CNC machining.
6. Calculate speeds, feeds, and depths of cut for CNC machine operations.
7. Use the Machinery's Handbook as a reference for CNC machining applications.

Objective 2 Select and use CNC tooling systems.

1. Describe the machinability index and how it affects CNC machining.
2. Identify tooling components and discuss their specific applications.
3. Based on geometry, identify common carbide inserts and discuss their general applications.
4. Based on material to be machined and part characteristics, select an appropriate insert and tooling system.
5. Demonstrate ability to properly change inserts and set up tooling systems to industry standards.
6. Identify common CNC operations.
7. Identify common CNC machine control systems and describe their major differences and applications.
8. Demonstrate the proper applications of absolute and incremental coordinate systems.
9. Create a plan of operation and manually write programs for CNC mills.
10. Create a plan of operation and manually write programs for CNC lathes.
11. Using a CAD-CAM system, post and load a pre-existing program onto a controller.
12. Using a CAD-CAM system create a drawing for a part and create a machine program for that part. load it on to a controller and take all necessary steps to create the part.

Objective 3 Demonstrate proper use of CNC Machining Equipment.

1. Demonstrate the proper care, setup, lubrication, and operation
2. Select and properly install and align appropriate work holding devices to applicable standards.
3. Demonstrate proper loading and aligning materials into the machine.
4. Demonstrate proper loading of tools into machine.
5. Install soft jaws as required.
6. Demonstrate proper techniques of establishing accurate tool offsets for each tool.
7. Demonstrate proper techniques of establishing accurate work offsets if needed.
8. Establish/set machine and part references to within appropriate tolerances.
9. Load programs into a controller.
10. Demonstrate working knowledge of all controls.
11. Demonstrate proper operation of CNC machine to include single block, and final production.
12. Edit CNC programs for accuracy.
13. Operate machine in DNC mode, if that capability exists. (optional)

Objective 4 Program CNC machines using CAD-CAM systems.

1. Create plan of operation for machining assigned parts.

2. Construct part geometry.
3. Program tool path for roughing and finishing operations.
4. Verify tool path.
5. Generate CNC code.
6. Prove program.
7. Generate part to match required specifications.
8. Inspect part to verify accuracy.

Standard 7 Performance Evaluation included below (Optional)

Machining 3

Performance assessments may be completed and evaluated at any time during the course. The following performance skills are to be used in connection with the associated standards and exam. To pass the performance standard the student must attain a performance standard average of 8 or higher on the rating scale. Students may be encouraged to repeat the objectives until they average 8 or higher.

Student's Name: _____

Class: _____

Performance standards rating scale

0	Limited skills	2	→	4	Moderate skills	6	→	8	High skills	10

Performance Skills   **Score:**

- Use PPE - personal protective equipment.
- Maintain a clean and safe work environment.
- Each student should earn a score of 100% on a required safety exam relating to general shop safety and each machine tool he/she will be operating.
- Perform basic trigonometric functions.
- Calculate speeds and feeds for machining.
- Locate basic machining points from a Datum Point.
- Perform calculations for sine bar and sine plate.
- Practice geometric dimensioning and tolerancing (GD&T) methodology.
- Accurately perform measurements with hand-held instruments.
- Accurately perform measurements on a surface plate.
- Identify common materials and explain basic properties.
- Program common CNC machines.
- Demonstrate proper use of CNC Machining
- Program CNC machines using CAD-CAM systems.

Performance standard average score:

Evaluator Name: _____

Evaluator Title: _____

Evaluator Signature: _____

Date: _____