



## Principles for Machining

### Course Description

If you want to integrate Science, Technology, Engineering, and Math (STEM) content into your training program, *Principles for Machining* is the answer. This course aligns with the STEM National Standards as they apply to the CAD-CAM-CNC process. *Principles for Machining* can be used as a standalone pre-Mastercam class. Take your students to the next level by improving your students' background and skills in Science, Technology, Engineering, and Math as they apply to machining. Adding *Principles for Machining* to the Mastercam Mill Design and Toolpaths course creates the most robust online CAM training available for the educational market. *Principles for Machining* includes a study guide in PDF format and a framework chart with the standards as they apply to each module.

### Course Outline

#### Basics of Engineering Design

- Basic design principles, specifications, and stages
- Management and concurrent engineering
- Print reading

#### Conversions, Measurement, and Tools

- Measurement terms
- Machinist Scale - Fractional and Metric
- Reading a Dial Caliper - calibration and application examples
- Reading a Micrometer
- Conversions - Metric to Metric, Metric to US customary, US customary to Metric

#### Simple Metallurgy

- Structures of matter and metallurgic properties
- Metallurgy terminology
- Testing and heat treating
- Keys to remember

#### Mathematics

- Fractions - addition, subtraction, multiplication, and division
- Decimals Overview - addition and subtraction
- Geometry - lines, angles, arcs, plane figures, and solid figures
- Cartesian Coordinates - plane overview, Mastercam viewports, and coordinate plane
- Triangles - types, triangles, and the Pythagorean Theorem
- Trigonometry Functions - sine, cosine, and tangent
- Measurement Units - US customary and Metric

#### Cutting Speeds and RPM

- Cutting speeds and calculations
- Cutting feed, feed rates, and calculations
- RPM and calculations
- Practical examples
- Area rough, rest rough

#### Chip Formation, Load, and Removal Rates

- Chip formation, load, and depth of cut
- Chip formation practical applications

#### Introduction to Machining Tolerances

- Mechanical removal techniques, drilling, milling, reaming, and tapping
- CAD/CAM terminology
- Introduction to milling machines
- Explore machining processes

#### Cutting Tools and Tool Holders

- Cutting tools introduction and geometry
- Cutting tools and machining practices
- Cutting tool shapes
- Cutting applications
- Cutting tool materials
- Proper holding



## Principles for Machining

### Research Projects and Exercises

	National STEM Standards Addressed
<p><b>Design Research - Overview and Purpose</b></p> <p>The student teams will develop their understanding of how to design products based on questions and specifications articulated during the front-end analysis before design actually begins. The teams will then demonstrate their understanding of the design process by working through the engineering design process, developing a virtual product, and presenting it to the class.</p>	<p>National Science Standards  <b>Standard E</b> - E1, E3, E4            National Technology Standards  <b>Standards</b> - 8, 9, 10, 11, 12, 17, 19            National Engineering Standards  <b>Standards</b> C, D, G, K</p>
<p><b>Machine Tool History - Overview and Purpose</b></p> <p>The student will investigate the history and development of the NC and CNC. Students will collaborate and share information with the group. They will create a timeline/chart of economic and social change in business and industry as part of their project.</p>	<p>National Science Standards  <b>Standard E</b> - E1  <b>Standard F</b> - F5, F6  <b>Standard G</b> - G1, G2, G3            National Technology Standards  <b>Standards</b> - 3, 7, 10, 13            National Engineering Standards</p>
<p><b>Materials Research - Overview and Purpose</b></p> <p>Students will be able to search the periodic table to identify and classify elements. This allows students to research the basics of elements and what makes them suitable for creating compounds during material selection purposes.</p>	<p>National Science Standards  <b>Standard A</b> - A1, A2, A3  <b>Standard B</b> - B1, B2  <b>Standard G</b> - G3            National Technology Standards</p>

### Course Schedule

Online, this course can be taken at any time and at the student's own pace. At an educational institution, this class will require approximately 20 - 30 hours to complete. This includes lab time to complete all research projects.

### Multiple Choice Test Overview

There is a pre- and post- test for each module, as well as a final multiple choice test for the course. A Certificate of Completion (PDF format) is awarded upon completion of all of the course material, which will display each post-test and final grade. Students should have at least 30 - 45 minutes to complete each test.

### Materials

The *Principles for Machining* course requires:

- High speed internet connection
- Computer that meets the [Mastercam System Requirements](#)

### Course Policies

- This course is designed for one student.
- The Certificate of Completion will be stored at Mastercam University with a unique student ID number. It remains available under the student's account even after the course expires.