

## Precision Machining | Scope & Sequence

### Year 1, Semester 1

PM101 - Precision Machining I

#### District Pre-Assessment

##### **Unit Name: (1) Introduction to Machining** (1 week)

- Intro to Machining, Careers in Machining
- Workplace Skills
- Intro to Safety

CTSO Integration (Leadership Skills): Officer Elections, Chapter Meeting

Professional Skills: 1.A-1.D, 2.A-2.C, 4.B-4.E, 7.A-7.C, 8.C-8.F, 8.G-8.I

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.W.9

Work-based Learning: Career Exploration

Technical Standard: 1.1-.4, 2.1, 2.2, 2.3

##### **Unit Name: (2) Blueprint Reading** (6 weeks)

- Blueprint Symbols
- Dimensioning & Tolerances
- Drawing Views

CTSO Integration (Leadership Skills): Chapter Meeting, Officer Training

Professional Skills: 1.A-1.D, 2.A-2.C, 4.B-4.E, 8.C-8.F, 8.G-8.I

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 8.G.B.7

Work-based Learning: Guest Speaker

Technical Standard: 4.1-.4, 5.1

##### **Unit Name: (3) Semi-Precision and Precision Measurement** (6 weeks)

- Measurement Systems
- Machine Tool Math
- Semi-Precision and Precision Measurement

CTSO Integration (Leadership Skills): Chapter Meeting, Fundraiser

Professional Skills: 1.A-1.D, 2.A-2.C, 4.B-4.E, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.RI.10, ELA.11-12.W.4, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3, G-GMD.A.3

Work-based Learning: Field Trip

Technical Standard: 3.1-.4

**Certification: NIMS- Level 1 Measurement, Materials & Safety Exam**

##### **Unit Name: (4) Bench Work and Layout** (1 week)

- Hand Tools
- Layout Techniques

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA Fall Conference

Professional Skills: 2.A-2.C, 4.B-4.E, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.W.5, ELA.11-12.W.6, ELA.11-12.L.6, 5.NF.B.6, 6.RP.A.3

Work-based Learning: Simulated Lab Experience, Community Projects

Technical Standard: 5.2-.5

**Certification: NIMS- Level 1 Job Planning, Bench Work and Layout Exam**

##### **Unit Name: (5) Intro to the Drill Press** (1 week)

- Drill Speeds & Hand Tapping
- Drilling and Reaming

CTSO Integration (Leadership Skills): Chapter Meeting

Professional Skills: 2.A-2.C, 4.B-4.E, 8.C-8.F, 9.A-9.C

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2

Work-based Learning: Simulated Lab Experience, Community Projects

Technical Standard: 5.6, 6.1-.4, 12.1-.6

**Certification: NIMS- Level 1 Drill Press Skills Exam**

##### **Unit Name: (6) Intro to the Manual Lathe**(1 week)

- Identify Parts of the Lathe
- Explain Basic Operation

CTSO Integration (Leadership Skills): Chapter Meeting, Competition Prep

Professional Skills: 2.A-2.C, 3.A-3.E, 4.B-4.F, 5.A, 5.B, 6.A-6.C,9.A-9.C

Academic Standards: ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2,

Work-based Learning: Guest Speaker, Simulated Lab Experience, Community Projects

Technical Standard: 7.1, 7.2

##### **Unit Name: (7) Intro to the Manual Mill** (1 week)

- Identify Parts of the Lathe
- Explain the Basic Operation

CTSO Integration (Leadership Skills): Chapter Meeting, Competition Prep

Professional Skills: 2.A-2.C, 3.A-3.E, 4.B-4.E, 5.A, 5.B, 9.A-9.C

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2

Work-based Learning: Simulated Lab Experience, Community Projects

Technical Standard: 8.1, 8.2

#### Semester Exam

### Year 1, Semester 2

PM – 102 Precision Machining II

##### **Unit Name: (8) Work and Tool Holding Devices for the Lathe** (1 week)

- Identify Work with Holding Devices
- Identify Tool Holding Devices
- Explain Function and Application

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA Regional Conference

Professional Skills: 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B

Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.6

Work-based Learning: Resume Writing

Technical Standard: 7.3

**Unit Name: (9) Machining Operations on the Lathe (8 weeks)**

- Demonstrate Turning, Boring and Facing Operations
- Describe Form Cutting
- Off Center Turning
- Indicate the Part

CTSO Integration (Leadership Skills): Chapter Meeting, Community Service Event,

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 8.A--8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Service Learning, Student-Based Enterprise, Guest Speaker

Technical Standard: 7.4

**Certification: NIMS- Turning Operations-Between Centers and Chucking Skills**

**Unit Name: (10) Tools, Tool holding, and Work holding for the Vertical Milling Machine (1 week)**

- Identify Work Holding Devices
- Identify Tool Holding Devices
- Explain Function and Application

CTSO Integration (Leadership Skills): Chapter Meeting, Skills USA Competition Preparation

Professional Skills: 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B

Academic Standards: ELA.11-12.SL.4, ELA.11-12.SL.6, ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, 5.NF.B.6

Work-based Learning: Student-Based Enterprise, Mock Interviews

Technical Standard: 8.3

**Unit Name: (11) Vertical Milling Machining Operations (8 weeks)**

- Demonstrate End Mill Cutting
- Describe Fly Cutting
- Identify Speeds and Feeds

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA State Conference

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Simulated Lab Experience, Community Projects

Technical Standard: 8.5

**Unit Name: (12) Indexing on the Manual Milling Machine (3 weeks)**

- Setup and Operating the Indexer
- Setup and Operating the Rotary Tables
- Speeds and Feeds
- Safety Review

CTSO Integration (Leadership Skills): Chapter Meeting

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Guest Speaker

Technical Standard: 8.4, 8.5

**Certification: NIMS- Level 1 Manual Milling Skills**

**Unit Name: (13) Precision Grinding Operations (1 week)**

- Precision Grinding Machines
- Grinder Components and Functions

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA National Conference

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6

Work-based Learning: Student-Based Enterprise

Technical Standard: 9.1-.4

**District Post-Assessment**

**Year 2, Semester 1**

PM201 - Precision Machining III

**Unit Name: (1) Intro to Computer Numerical Control (1 week)**

- History of CNC
- G-Code basics
- M Codes
- Machine Controls

CTSO Integration (Leadership Skills): Officer Elections, Chapter Meeting

Professional Skills: 1.A-1.D, 2.A-2.C, 4.B-4.E, 7.A-7.C, 8.C-8.F, 8.G-8.I

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.W.5, ELA.11-12.W.6, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.6, 6.EE.A.2

Work-based Learning: Career Exploration, Simulated Lab Experience

Technical Standard: 10.1-.4

**Unit Name: (2) CNC Lathe Programming (4 weeks)**

- G & M codes for turning
- Program Structure
- Cartesian Coordinate Systems in relation to CNC Lathe
- Tool Compensation
- Canned Cycles for the lathe

CTSO Integration (Leadership Skills): Chapter Meeting, Officer Training

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 8.A-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Guest Speaker

Technical Standard: 11.1-.4

**Certification: OSHA 10**

**Unit Name: (3) Machining Center Programming (4 weeks)**

- G & M codes for milling
- Program Structure
- Cartesian Coordinate Systems in relation to CNC Mill
- Tool Compensation
- Canned Cycles for milling

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA Fall Conference

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Field Trip

Technical Standard: 12.3, 12.4

**Unit Name: (4) Intro to CNC Turning (2 weeks)**

- Identify parts of CNC Lathe
- Explain Part Fixturing
- Turning Cycles
- Explain Coordinate Systems

CTSO Integration (Leadership Skills): Chapter Meeting

Professional Skills: 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 9.A-9.C

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.6, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Simulated Lab Experience, Community Projects

Technical Standard: 12.1, 12.2

**Unit Name: (5) CNC Lathe Setup & Operation (8 weeks)**

- Tooling for the Turning Center
- Tool Setup and Offsets
- Work Location and Geometry Offsets
- Demonstrate Safe Setup and Program Prove-out Procedures
- Run Parts on CNC Lathe

CTSO Integration (Leadership Skills): Chapter Meeting, Competition Prep

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.A, 5.B, 6.A-6.C, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Guest Speaker

Technical Standard: 11.5., 11.6

**Certification: NIMS- CNC Turning Operator and Programming Exam**

**Year 2, Semester 2**

PM202 - Precision Machining IV

**Unit Name: (6) Intro to CNC Milling (2 weeks)**

- Identify Parts of CNC Mill
  - Explain Parts Fixturing
  - Milling Cycles
  - Explain Coordinate Systems
- CTSO Integration (Leadership Skills): Chapter Meeting, Fundraiser, SkillsUSA Regional Conference

Professional Skills: 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.C-5.E, 9.A-9.C

Academic Standards: ELA.11-12.W.4, ELA.11-12.W.5, ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.6, 6.RP.A.3

Work-based Learning: Student-Based Enterprise, Resume Writing

Technical Standard: 12.1, 12.2

**Unit Name: (7) Machining Center Setup & Operation (8 weeks)**

- Machine Center Tooling
- Tool Setup and Tool Length Offsets
- Work Fixture Offsets
- Demonstrate Safe Setup and Program Prove-Out Procedures
- Run Parts on CNC Mill

CTSO Integration (Leadership Skills): Chapter Meeting, Community Service Event, Skills USA Competition Preparation

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.C-5.E, 6.A-6.C, 8.C-8.F

Academic Standards: ELA.11-12.SL.4, ELA.11-12.SL.6, ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Service Learning, Student-Based Enterprise, Mock Interviews, Guest Speaker

Technical Standard: 12.5, 12.6

**Certification: NIMS-CNC Milling Operator and Programming Exam**

**Unit Name: (8) Computer-Aided Design/Computer-Aided Manufacturing (9 weeks)**

- Wire-Frame, Surface and Solid Model Drawing
- 2D and 3D Toolpath Creation
- Post Processing
- Additive Manufacturing
- 3D Printing

CTSO Integration (Leadership Skills): Chapter Meeting, SkillsUSA State Conference, SkillsUSA National Conference

Professional Skills: 1.A-1.D, 2.A-2.C, 3.A-3.E, 4.A-4.E, 5.C-5.E, 6.A-6.C, 8.C-8.F

Academic Standards: ELA.11-12.RI.7, ELA.11-12.W.8, ELA.11-12.SL.3, ELA.11-12.L.6, ELA.11-12.RI.10, 5.NF.B.3, 5.NF.B.6, 6.RP.A.3, 6.EE.A.2, 7.EE.B.3

Work-based Learning: Student-Based Enterprise, Simulated Lab Experience, Community Projects, Guest Speaker

Technical Standard: 13.1, 13.2, 13.3, 13.4

**ADE Technical Skills Assessment**

**Arizona Department of Education (ADE)**

**Common AZCCR Math Standards (CAMS)**

**English Language Arts Standards (ELAS)**

**National Institute for Metalworking Skills (NIMS)**