

Precision Machining Program: Scope & Sequence

Semester 1, Year 1

PM101 - Precision Manufacturing Foundations 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

Semester 2, Year 1

PM – 102 Precision Manufacturing Foundations 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

Semester 1, Year 2

PM201 - Intermediate Precision Machining

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

Technical Standard: 11.5, 11.6

Certification: NIMS- CNC Turning Operator and Programming Exam

Semester 2, Year 2

PM202 - Advanced Precision Machining

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)