Precision Machining |Scope & Sequence

Year 1, Semester 1

PM101 - Precision Machining I

District Pre-Assessment

Unit Name: (1) Introduction to Machining (1 week [4 days class/1 day lab])
●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-.7, 2.1-.5, 5.1, 5.4
Certification: NIMS- Level 1 Measurement, Materials & Safety Exam

Unit Name: (2) Semi-Precision and Precision Measurement (6 weeks [20 days class/10 day lab])
●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: 4.1-.4

Unit Name: (3) Blueprint Reading (6 weeks [15 days class/ 15 day lab])
●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: 3.1-.5, 5.2, 5.3

Unit Name: (4) Bench Work and Layout (1 week [2 days class/2 day lab])
●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: 6.1-.7-
Certification: NIMS- Level 1 Job Planning, Bench Work and Layout Exam

Unit Name: (5) Intro to the Drill Press (1 week [4 days class/1 day lab])
●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 [3days class/2 day lab])
●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-.4

Unit Name: (7) Intro to the Manual Mill (1 week [2 days class/2 day lab])
●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-.5

Semester Exam

Year 1, Semester 2

PM – 102 Precision Machining II

Unit Name: (8) Work and Tool Holding Devices for the Lathe (1 week [3 days class/2 day lab])
●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 [15 days class/25 day lab])
●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 [2 days class/2 day lab])
●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 [8 days class/32 day lab])
•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 [5 days class/10 day lab])
•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 [1 days class/4 day lab])
•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, 9.2

District Post-Assessment

Year 2, Semester 1

PM201 - Precision Machining III

Unit Name: (1) Intro to Computer Numerical Control (1 week [4 days class/1 day lab])
●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-.5

Unit Name: (2) CNC Lathe Programming (4 weeks [5 days class/ 15 day lab])
●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 [10 days class/10 day lab])
●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 [5 days class/5day lab])
●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: 11.1-.7

Unit Name: (5) CNC Lathe Setup & Operation (8 weeks [15 days class/25 day lab])
●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 [2 days class/8 day lab])
●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-.7

Unit Name: (7) Machining Center Setup & Operation (8 weeks [8 days class/32 day lab])
●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 [18 days class/ 27 day lab])
●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-.4, 14.1-.5, 15.1-.6

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)