

Right Skills Now Curriculum Outline

Revised October 2015



Right Skills Now Background

The Right Skills Now initiative is a fast-track training program that provides participants with college credit, four industry-recognized credentials and the opportunity to work at an accelerated manufacturing internship. The model is created as a 16- to 24-week hands-on training program that provides industry demanded competency-based skills and credentials needed for the machining industry.

The Right Skills Now for manufacturing program was started in 2011, at a time that manufacturers were reporting significant difficulty recruiting skilled candidates to fill more open positions.

Right Skills Now was designed by NIMS, in partnership with ACT and The Manufacturing Institute, the 501(c)3 affiliate of the National Association of Manufacturers (NAM). Inaugural program educational partners included Dunwoody College of Technology and South Central Community College, both located in Minnesota. Right Skills Now programs have since spread across the country.

Recognition

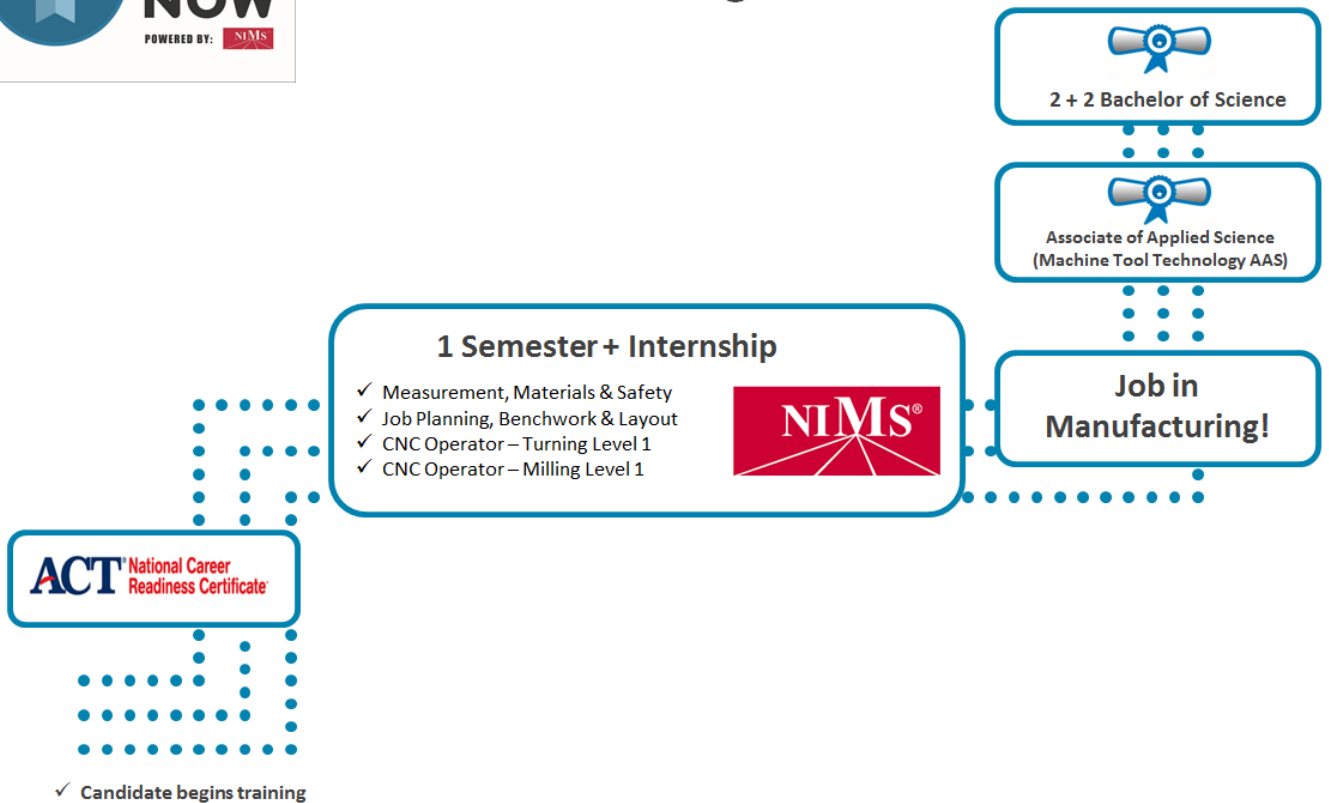
A special thank you to the leadership of Dunwoody College of Technology and South Central College for their support in the development of the Right Skills Now program. This curriculum outline was originally provided by E.J. Daigle, Dunwoody College of Technology and Doug Laven, South Central College.

Curricular Goals

1. Provide high quality training that leads to immediate entry-level jobs.
2. Provide skilled personnel (Entry Level CNC Operators) to an industry that is in desperate need.
3. Provide educational pathways that allows students a lifetime of learning and exposure to the manufacturing field.



Fast-track Training Model



CURRICULAR CONCERNS

Differences in credits (yet similar in clock hours):

- Depending on the state, a school may be required to obtain approval and accreditation by both the State Office of Higher Education and Regional Accrediting Agencies to offer financial aid eligible certificates and because of this every school has strict school guidelines they must adhere to in regards to contact hours per credit and certificate total credits.
 - (A) Term lengths (quarter, semester, number of weeks) vary from school to school
 - (B) Contact hours per credit varies from school to school
 - (C) Cost per credit varies from school to school
- The model requires credit to be provided for the program.
- When piloting, the following total contact hours were offered:
 1. Dunwoody College of Technology – 558 hours
 2. South Central College – 544 hours

Internship:

- Appendix E includes a course syllabus for an instructor-driven internship that will last approximately 8 weeks and varies from 3-4 credits depending on campus.

Internship is credit-based and the student is charged tuition.

Credit will be issued for completion of the internship and course competencies will be developed and assessed as collaboration between student, instructor and employer.

The experience will be limited to a paid internship with a minimum of 20 hours per week but not to exceed 40 hours per week. Students will not receive their certificate until completion of the required internship competencies. Students are encouraged to take additional courses towards AAS degree requirements while participating in the internship.

SAMPLE CREDITS AND CONTACT HOURS STRUCTURE

Dunwoody College of Technology	Semester	Lecture Credits (hrs)	Lab Credits (hrs)	Total Credits (hrs)
Measurement Materials & Safety	1	1 (18)	1 (54)	2 (72)
Job Planning, Benchwork & Layout	1	1 (18)	1 (54)	2 (72)
CNC Milling Level 1	1	1 (18)	2 (108)	3 (126)
CNC Turning Level 1	1	1 (18)	2 (108)	3 (126)
Algebra, Trig, Geometry	1	3 (54)	0 (0)	3 (54)
Math for Machinists	2	3 (54)	0 (0)	3 (54)
Internship	2	0 (0)	3 (162)	3 (162)
Grand Total		10 (180)	9 (486)	19 (666)

Dunwoody Articulation 19 credits into the following Machine Tool AAS

MACH1110	Machine Tool Fundamentals Lab	(5 cr)
MACH1120	Machine Tool Fundamentals Theory	(4 cr)
MDES1110	Engineering Drawings	(4 cr)
MATH1050	Algebra, Trig & Geometry	(3 cr)
MATH1200	Math for Machinists	(3 cr)

19 credits towards AAS

**Please note: Dunwoody College of Technology has included two MATH courses into the training program.*

South Central College	Lecture Credits (hrs)	Lab Credits (hrs)	Total Credits (hrs)
Measurement Materials & Safety	1 (16)	2 (64)	3 (80)
Job Planning, Benchwork & Layout	1 (16)	2 (64)	3 (80)
CNC Milling Level 1	2 (32)	3(96)	5(128)
CNC Turning Level 1	2 (32)	3 (96)	5 (128)
Internship		4 (128)	
Grand Total	6 (96)	14 (448)	20 (544)

* The completion of this certificate is then articulated into South Central College's Computer Integrated Machining AAS Degree in the following manner:

Right Skills Now Certificate (16 credits) = Semester 1 of Computer Integrated Machining AAS (72 Credits)

Semester 1 Courses (16 credits with 544 contact hours)

CIM1115	Measurement Materials & Safety	(3 cr)
CIM1125	Job Planning, Benchwork & Layout	(3 cr)
CIM1135	CNC Milling Level 1	(5 cr)
CIM1135	CNC Turning Level 1	(5 cr)
CIM1145	Internship	(4 cr)

STAGGERED ENROLLMENT

It is possible to stagger the enrollment. Below is an example from Dunwoody College of Technology and South Central College:

South Central Mankato	South Central Fairbault	Dunwoody Minneapolis
January: Spring startup	March: Mid Spring startup	January: Spring startup
May: Graduation	July: Graduation	May: Graduation
June: Internship	August: Internship	June: Internship
August: Fall startup	October: Mid Fall startup	August: Fall startup
December: Graduation	February: Graduation	December: Graduation

WEEKLY SCHEDULE

The program requires approximately 400 classroom contact hours to be completed in 16 weeks and a minimum of 8 weeks on a paid internship.

DAYTIME CLASSROOM SCHEDULE (26 CONTACT HOURS PER WEEK FOR 16 WEEKS)

MONDAY	TUESDAY	WEDNESDAY	THURSDAY
7:30AM-2:00PM	7:30AM-2:00PM	7:30AM-2:00PM	7:30AM-2:00PM

EVENING CLASSROOM SCHEDULE (26 CONTACT HOURS PER WEEK FOR 16 WEEKS)

MONDAY	TUESDAY	WEDNESDAY	THURSDAY
3:30PM-10:00PM	3:30PM-10:00PM	3:30PM-10:00PM	3:30PM-10:00PM

INDUSTRY STUDY

Dunwoody College of Technology and South Central College conducted a survey of manufacturing companies that have hired their graduates. The study was intended to determine which skills are absolutely necessary for someone to safely and accurately operate a CNC machine tool. The survey was sent out to the following companies and the survey and results are listed below.

Dunwoody Survey Participants

Top Tool
Tom Larson Custom Training
Boston Scientific
Iscar
Entegris
Performance Tool

South Central Participants

New Ulm Precision
K & G
SPX-OTC
Winegar
Dotson
MRG
V-Tek

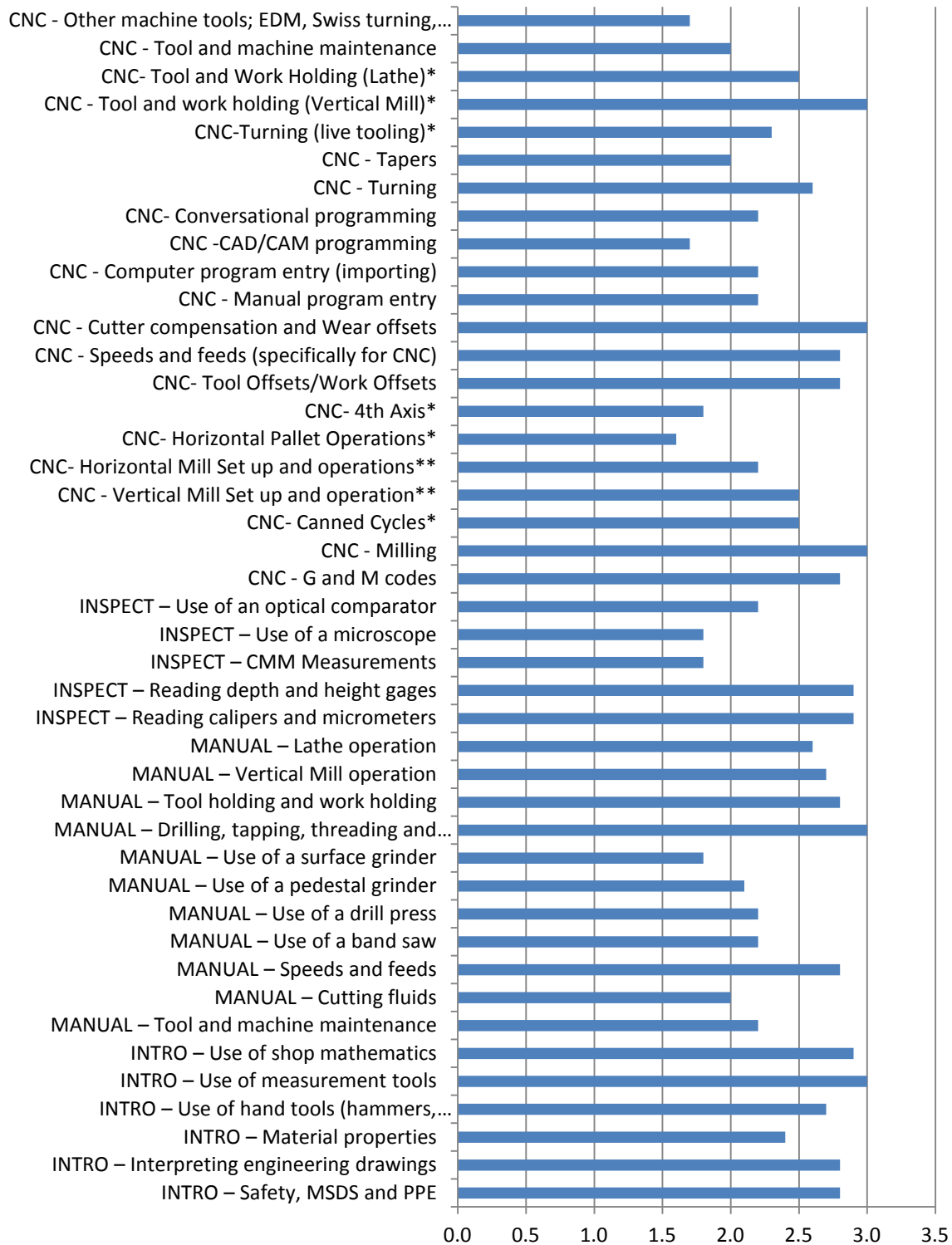
The directions sent to the companies on how to take the survey were as follows:

*This survey is being conducted to determine industry needs in regard to **entry level CNC operator** training. Dunwoody College of Technology and South Central College are working together on an accelerated solution to meet increasing industry needs in this area. As you take the survey, please consider whether each skill is vital to the position of an entry level CNC operator. Please remember this survey is not aimed at the skills required for an entry-level machinist, but rather the skills necessary to feel comfortable hiring someone to **operate** your machine tools.*

Survey Findings: Out of the 43 skills assessed on a scale of 1.0 to 3.0 (3.0 being the highest level of importance of mastery), 22 skills were found to be at or above 2.5 on our survey. These skills are aggregated in the “vital skill” category. This is not meant to discredit any of the other skills on the list. These may also require exposure during the program.

Skills ≥ 2.5:	INTRO Safety, MSDS and PPE	CNC Tool and Work Holding (Lathe)
	INTRO Interpreting Engineering Drawings	CNC Tool and Work Holding (Vert Mill)
	INTRO Use of Hand Tools	CNC Turning
	INTRO Use of Measurement Tools	CNC Cutter compens. and Wear offsets
	INTRO Use of Shop Mathematics	CNC Speeds & Feeds
	MANUAL Lathe Operation	CNC Tool offsets and Work offsets
	MANUAL Vertical Mill Operation	CNC Vertical Mill Setup/Operation
	MANUAL Speeds & Feeds	CNC Canned Cycles
	MANUAL Drilling, Tapping, Threading & Ream	CNC Milling
	MANUAL Tool Holding and Work Holding	CNC G&M Codes
	INSPECT Reading Calipers and Micrometers	INSPECT Reading Depth and Height Gages

CNC Operator Overall Skill Importance



Measurement, Materials, and Safety

Course Information

Course Number	In accordance with college policy
Potential Hours of Instruction	Determined by the college
Total Credits	Determined by the college

Description

This course provides an exploration of the basics in machining, raw materials, use of hand tools, safety and maintenance. Topics include an overview of measurement techniques, materials, safety, machine tool math, quality control and maintenance. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included.

Types of Instruction

Instruction Type	Contact Hours	Credits
Lecture	TBD	TBD
Lab	TBD	TBD

Recommended Textbooks

Peter J. Hoffman, Eric S. Hopewell, Brian Janes, Kent M. Sharp, Jr.. *Precision Machining Technology*. Delmar. 2012. **ISBN:** 13:978-1-4354-4767-7.

David Lenzi, James Hillwig. *Precision Machining Technology Workbook and Project Manual*. Delmar. **ISBN:** 978-1-4354-4768-4.

Exit Learning Outcomes

Core Abilities

- A. Critical Thinking
- B. Professionalism
- C. Mechanical Aptitude: Determine the Proper Method/Equipment to Manufacture and Measure Characteristic of a Part
- D. Technological Literacy
- E. Recognize and Avoid Shop Hazards

Competencies

1. Explore Shop Floor Layout

Learning Objectives

- a. Explain General Shop layout
- b. Differentiate Conventional Machinist, Programmer, CNC Machinist
- c. Apply Housekeeping Standard
- d. Demonstrate Mechanical Aptitude

2. Identify Safety

Learning Objectives

- a. Explain Key Safety Terms
- b. Demonstrate Personal Protective Equipment (PPE)
- c. Apply Lockout\Tag-out
- d. Use Guards and Barriers
- e. Adapt Personal Protective Equipment (PPE)
- f. Acknowledge OSHA Guidelines

3. Explain Types of Machines

Learning Objectives

- a. Demonstrate Safety Practices
- b. Explain Personal Protective Equipment (PPE)
- c. Apply Lockout/Tag-out procedure
- d. Use Guards and barriers

4. Apply Measurement Systems and Machine Tool Math

Learning Objectives

- a. Explain the English System
- b. Explain the Metric System
- c. Apply Fractional Operations
- d. Use Basic Geometry, Trigonometry and Ratios
- e. Demonstrate Fractional/Decimal Conversions
- f. Recognize Tolerances on a Print
- g. Explain numbering they find on a print (Tenths, 150 millionths, etc)
- h. Articulate Numbering Systems found on Prints (Tenths, Millionths, etc)

5. Define Major Machine Tools

Learning Objectives

- a. Explain Machine Differences
- b. Use Drill Press
- c. Demonstrate Sawing Machine
- d. Differentiate Hand Tools
- e. Identify Lathe, Mill and various "Axes"
- f. Learn the names and to identify types of Drills, Mills, and Insert Tooling

6. Utilize Semi-Precision Measurement Tools

Learning Objectives

- a. Explain Key Measurement Terms
- b. Demonstrate Calipers Use
- c. Use Adjustable Squares
- d. Apply Angular Measurements
- e. Demonstrate Fixed Gage Applications

7. Utilize Precision Measurement Hand Tools

Learning Objectives

- a. Explain Precision Measurement
- b. Use Precision Fixed Gages
- c. Demonstrate Surface Plates
- d. Characterize Vernier Measuring tools
- e. Use Micrometers

8. Learn Special Measurement Tools

Learning Objectives

- a. Identify Coordinate Measuring Machine
- b. Define Optical Comparator Operation
- c. Explain Toolmaker's Microscope

9. Apply Quality Assurance Planning

Learning Objectives

- a. Apply Quality Practices
- b. Compare Inspection and Preventative Processes
- c. Calculate Average, Standard Deviation, and Determine Capability Range (Average +/- 3 Standard Deviations)
- d. Develop Sampling Plan
- e. Create Inspection Plan
- f. Define Statistical Process Control (SPC)
- g. Define differences between Attributes and Variables (Surface Finish/Appearance vs. Measurable)

10. Differentiate Raw Material Composition

Learning Objectives

- a. Explain Ferrous Metals
- b. Explain Nonferrous Metals
- c. Define Tempering
- d. Describe Heat Treatment Process
- e. Characterize Hardness Scales and Test Variety of Specimens

11. Adopt Maintenance Schedules

Learning Objectives

- a. Communicate Lubrication Needs
- b. Use Cutting Fluids
- c. Demonstrate Measuring of Cutting Fluid Techniques
- d. Explain Methods of Application

12. Categorize Heat Treatment of Metals

Learning Objectives

- a. Distinguish Direct, Surface and Case Hardening
- b. Distinguish Tempering, Anodizing and Normalizing
- c. Analyze Hardness Scales and Testing

13. Communicate Knowledge

Learning Objectives

- a. Take Detailed Notes
- b. Ask Questions to Industry Representatives
- c. Practice Problem-Solving and Manual Dexterity
- d. Communicate with Team members
- e. Identify and Properly name Shop Tools, Components, Supplies, and Equipment

Job Planning, Benchwork and Layout

Course Information

Course Number	In accordance with college policy
Potential Hours of Instruction	Determined by the college
Total Credits	Determined by the college

Description

This course provides an exploration of the basics of hand tools, understanding drawings, manual machines and layout. Upon completion of this course the student will be able to interpret drawing information, describe basic symbols and notation and interpret basic GD&T feature control frames. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included.

Types of Instruction

Instruction Type	Contact Hours	Credits
Lecture	TBD	TBD
Lab	TBD	TBD

Recommended Textbooks

Peter J. Hoffman, Eric S. Hopewell, Brian Janes, Kent M. Sharp, Jr.. *Precision Machining Technology*. Delmar. 2012. ISBN: 13:978-1-4354-4767-7.

David Lenzi, James Hillwig. *Precision Machining Technology Workbook and Project Manual*. Delmar. ISBN: 978-1-4354-4768-4.

Exit Learning Outcomes

Core Abilities

- A. Critical Thinking
- B. Professionalism
- C. Mechanical Aptitude: Determine the Proper Method/Equipment to Manufacture and Measure Characteristic of a Part
- D. Technological Literacy
- E. Recognize and Avoid Shop Hazards

Competencies

1. **Access Drawings**
Learning Objectives
 - a. Explain Key Terms
 - b. Utilize the Components of Engineering Drawings
 - c. Create Title Block
 - d. Describe Line Types
2. **Identify Basic Symbols and Notation**
Learning Objectives
 - a. Explain Fillet
 - b. Interpret Rounds and Counter-bore
 - c. Identify Drawing Nomenclature
 - d. Use Symbols and Notation
3. **Determine Tolerances**
Learning Objectives
 - a. Explain Bilateral Tolerances
 - b. Explain Unilateral Tolerances
 - c. Acknowledge Limit Tolerances
 - d. Apply Maximum Material Condition (MMC)
 - e. Apply Tolerance Specifications
4. **Explain Types of Machines**
Learning Objectives
 - a. Adapt safety practices with Machines
 - b. Demonstrate Basic Machine Maintenance
 - c. Identify Tool and Blade Materials
 - d. Develop an Understanding of Tool and Blade Characteristics
5. **Apply Classes of Fit**
Learning Objectives
 - a. Define Classes of Fit
 - b. Demonstrate Allowances between Parts
 - c. Describe Classifications of Fits
 - d. Use Machinery Handbook
6. **Define Geometric Dimensioning and Tolerancing (GD&T)**
Learning Objectives
 - a. Explain GD&T
 - b. Use Drawing to Define Datum
 - c. Demonstrate the Use of a Feature Control Frame
 - d. Identify Flatness, Circularity and Cylindricity.
 - e. Define Profile and Location Tolerances
 - f. Apply Run-out Tolerances
 - g. Describe Modifiers

- 7. Apply Layout Fundamentals**
Learning Objectives
 - a. Explain Key Layout Terms
 - b. Use Layout Fluid
 - c. Demonstrate Dye Remover Technique
- 8. Demonstrate Semi-Precision Layout**
Learning Objectives
 - a. Explain Semi-Precision Layout
 - b. Use Scriber
 - c. Demonstrate Layout with a Combination Set
 - d. Demonstrate Angle Layout with a Combination Set
 - e. Use Center Punches and Other Hand Tools
- 9. Demonstrate Precision Layout**
Learning Objectives
 - a. Use Height Gage
 - b. Demonstrate the Use of the Precision Angular
 - c. Demonstrate the Use of the Vernier Bevel Protractor
 - d. Use Sine Tools
- 10. Apply Proper Hand Tool Use**
Learning Objectives
 - a. Identify Shop Tools
 - b. Demonstrate Proper Tool Use
 - c. Demonstrate Safe Shop Practices
- 11. Demonstrate Clamping Methods**
Learning Objectives
 - a. Explain the Different Clamping Methods
 - b. Use C-Clamp
 - c. Use Parallel Clamp
 - d. Use Hinged Clamp
- 12. Exhibit Deburring Skills**
Learning Objectives
 - a. Explain File Classifications
 - b. Define the Basic Parts of a File
 - c. Select Proper File for Job
 - d. Demonstrate File Cleaning
- 13. Use Abrasives**
Learning Objectives
 - a. Explain Abrasives
 - b. Choose Abrasive Material
 - c. Demonstrate Deburring

14. Apply Knowledge to Saws and Cutoff Machines

Learning Objectives

- a. Adapt Quality Terms
- b. Compare Inspection and Preventative Processes
- c. Calculate Speed and Feed
- d. Develop Sampling Plan
- e. Create Inspection Plan
- f. Define Statistical Process Control (SPC)

15. Develop Workholding Skills

Learning Objectives

- a. Explain Ferrous Metals
- b. Explain Nonferrous Metals
- c. Define Tempering
- d. Describe Heat Treatment Process
- e. Characterize Hardness Scales and Testing

16. Use Drill Press

Learning Objectives

- a. Demonstrate Drilling Operations
- b. Apply Countersinking, Spot-facing, and Counterboring Practices
- c. Identify Various Tap Types and Tap Drill Selection
- d. Demonstrate Tap Removal Techniques

17. Maintain Speeds and Feeds

Learning Objectives

- a. Perform Speed and Feed Operations
- b. Demonstrate Lubrication
- c. Use Cutting Fluids
- d. Demonstrate Measuring of Cutting Fluid Techniques
- e. Explain Methods of Application

CNC Operator: Milling Level I

Course Information

Course Number	In accordance with college policy
Potential Hours of Instruction	Determined by the college
Total Credits	Determined by the college

Description

This course provides the student an introduction to basic milling operations. Upon completion of this course the student will have an understanding of manual and CNC milling practices as well gain knowledge in tooling, machining practices and applied mathematics. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included.

Types of Instruction

Instruction Type	Contact Hours	Credits
Lecture	TBD	TBD
Lab	TBD	TBD

Recommended Textbooks

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Exit Learning Outcomes

Core Abilities

- A. Critical Thinking
- B. Professionalism
- C. Mechanical Aptitude: Determine the Proper Method/Equipment to Manufacture and Measure Characteristic of a Part
- D. Technological Literacy
- E. Recognize and Avoid Shop Hazards

Competencies

1. Demonstrate Shop Safety

Learning Objectives

- a. Explain Key Terms
- b. Demonstrate Proper Mill Power UP and Power Down Procedures
- c. Demonstrate Proper Lockout/Tag-out Procedures

2. Identify CNC Milling Machine Types

Learning Objectives

- a. Identify and Explain Vertical and Horizontal Spindle Machines
- b. Describe the Machine Axes Used for Milling
- c. Explain Manufacturing Cell

3. Identify Basic Components of a CNC Milling Machine

Learning Objectives

- a. Analyze CNC Mill Operations Manual
- b. Identify Work Envelope
- c. Identify Control Panel

4. Use Work Holding Solutions

Learning Objectives

- a. Explain Workholding Techniques
- b. Demonstrate Various Workholding Applications
- c. Demonstrate Workpiece Clamping
- d. Use Machine Vices
- e. Apply Workholding Solutions with Chucks, Collet Closers and Indexing Fixtures

5. Use Tool Holding Solutions

Learning Objectives

- a. Acknowledge Cutting Tool
- b. Identify Spindle Types
- c. Demonstrate Tool Attachment to Various Tool Holders

6. Demonstrate Milling Machine Canned Operations

Learning Objectives

- a. Explain Canned Cycles
- b. Apply Holemaking Operations
- c. Demonstrate Peck Drilling Cycles
- d. Demonstrate Single-Pass Drilling

7. Explore Indexing and Rotary Table Operations

Learning Objectives

- a. Define Parts of the Rotary Table
- b. Perform Rotary Table Setup
- c. Explain Indexing Head
- d. Perform Indexing Head Setup

8. Demonstrate CNC Machining Basics

Learning Objectives

- a. Demonstrate Face Milling
- b. Demonstrate Squaring a Block
- c. Demonstrate Slot Milling
- d. Perform Keyseat Milling Operation

9. Describe the two major types of ATCs

Learning Objectives

- a. Define Automatic Tool Changers
- b. Identify Swing -Arm Type Tool Changer
- c. Explain Carousel-Type Tool Changer

10. Utilize Coordinate Geometry

Learning Objectives

- a. Explain the X, Y and Z Axes
- b. Align Coordinate Positioning
- c. Demonstrate Workpiece X, Y and Z Offsets
- d. Calculate Tolerances

11. Identify Control System

Learning Objectives

- a. Identify Types of CNC Control Panels
- b. Demonstrate Soft Key Use
- c. Analyze Control Panel Screen Function Labels
- d. Explain MDI and Auto Modes

12. Explain Program Planning

Learning Objectives

- a. Explain Part Overview
- b. Identify Part Material Composition
- c. Define Type of Motion for Milling Part
- d. Calculate Tool-Change

13. Demonstrate Programming G and M Codes

Learning Objectives

- a. Explain G and M Codes
- b. Define Screen Display and Keyboard
- c. Demonstrate Linear Interpolation for CNC Milling
- d. Demonstrate Circular Interpolation for CNC Milling
- e. Demonstrate Two-Dimensional CNC Milling

14. Explain Offsets

Learning Objectives

- a. Interpret Work Offsets
- b. Explain Machine Origin and Workpiece Origin
- c. Define Workshift
- d. Calculate X, Y and Z Offset Settings

15. Activate Homing Procedure

Learning Objectives

- a. Demonstrate Machine Power-Up
- b. Demonstrate Homing Procedure
- c. Demonstrate Jog Operation
- d. Activate Zero Return Operation

16. Describe Coordinate Systems

Learning Objectives

- a. Acknowledge Machine Coordinate Move Operations on Control Panel
- b. Explain Work Coordinate System
- c. Identify Cartesian Coordinate System

17. Utilize Different Methods for Loading Programs

Learning Objectives

- a. Explain Program Entry
- b. Demonstrate Manual Typing of Program into the Control Panel
- c. Demonstrate Uploading Program to the Mill from a PC
- d. Demonstrate Downloading Program from a PC to the Mill

CNC Operator: Turning Level I

Course Information

Course Number	In accordance with college policy
Potential Hours of Instruction	Determined by the college
Total Credits	Determined by the college

Description

This course provides the student an introduction to basic lathe operations. Upon completion of this course the student will have an understanding of manual and CNC lathe turning practices as well gain knowledge in tooling, machining practices and applied mathematics. Teamwork, critical thinking, and problem solving are emphasized. Hands-on experience and practical applications are included.

Types of Instruction

Instruction Type	Contact Hours	Credits
Lecture	TBD	TBD
Lab	TBD	TBD

Recommended Textbooks

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David Lenzi, James Hillwig. *Precision Machining Technology Workbook and Project Manual*. **ISBN:** 978-1-4354-4768-4.

Exit Learning Outcomes

Core Abilities

- A. Critical Thinking
- B. Professionalism
- C. Mechanical Aptitude: Determine the Proper Method/Equipment to Manufacture and Measure Characteristic of a Part
- D. Technological Literacy
- E. Recognize and Avoid Shop Hazards

Competencies

1. Apply Shop Safety

Learning Objectives

- a. Explain Key Terms
- b. Adapt Basic OSHA Requirements
- c. Demonstrate Proper Chip Handling
- d. Demonstrate Proper Lockout/Tag-out Procedures
- e. Clean Workstation

2. Identify Basic Components of a CNC Lathe

Learning Objectives

- a. Identify and Explain the Carriage
- b. Identify and Explain the Spindle
- c. Identify and Explain the Headstock and Tailstock
- d. Identify and Explain the Bed and Ways
- e. Use Control Panel

3. Describe CNC Machine Modes

Learning Objectives

- a. Analyze Manual Data Input (MDI)
- b. Identify the Jog Feature
- c. Acknowledge Feed Rate Override and Rapid Override Feature
- d. Demonstrate Machine Home Position Sequence

4. Use Workholding Solutions

Learning Objectives

- a. Explain the Difference between Universal and Independent-type Chucks
- b. Demonstrate Various Chuck Applications
- c. Demonstrate Various Collet Applications
- d. Demonstrate Faceplates, Centers and Mandrels Applications
- e. Apply Workholding Solutions with Turning Operation

5. Explain Depth of Cut, Speed & Feed and Time Calculation

Learning Objectives

- a. Explain Cutting Rates
- b. Identify Material
- c. Calculate Spindle RPM for Various Cutting Operations
- d. Calculate Machining Time

6. Demonstrate Facing and Turning Operations

Learning Objectives

- a. Apply Facing Operation
- b. Apply Turning Operation
- c. Describe Basic Tool Geometry
- d. Use Filing and Polishing Methods

7. Demonstrate Center Drilling

Learning Objectives

- a. Explain Reasons for Center Drilling
- b. Perform Center Drilling
- c. Use Spotting Drill
- d. Create a Hole using the Lathe
- e. Apply Reaming, Boring, Counter-boring and Countersinking Methods

8. Learn Grooving, Cutoff and Knurling Operations

Learning Objectives

- a. Create Internal Shoulder
- b. Demonstrate Form Cutting
- c. Produce Parts using Grooving and Cutoff Methods
- d. Perform Knurling Operation

9. Demonstrate Lathe Threading

Learning Objectives

- a. Define Thread Terminology
- b. Perform Calculations required for Thread Cutting
- c. Demonstrate Proper Setup for Cutting Threads
- d. Verify Thread Measurement and Classes of Fit

10. Demonstrate Taper Turning

Learning Objectives

- a. Define a Taper
- b. Perform Taper Calculations
- c. Recognize Taper Per Inch (TPI) and Taper Per Foot (TPF)
- d. Demonstrate Setup Procedures for Taper Turning

11. Identify CNC Lathe Components

Learning Objectives

- a. Identify Types of CNC Lathes
- b. Define Axes
- c. Analyze Programming Approach
- d. Explain Lathe Features and Specifications

12. Utilize Coordinate Geometry

Learning Objectives

- a. Explain Real Number System
- b. Explain Rectangular Coordinates
- c. Explain Point of Origin
- d. Explain Quadrants
- e. Define Axes and Planes

13. Identify Control System

Learning Objectives

- a. Explain General Description of Operation Panel
- b. Define Screen Display and Keyboard
- c. Select Parameter Settings
- d. Explain System Memory and Defaults

14. Acknowledge Part Drawing

Learning Objectives

- a. Interpret Part Drawing
- b. Review Title Block
- c. Explain Dimensioning
- d. Calculate Tolerances

15. Explain Program Planning

Learning Objectives

- a. Define Part Complexity
- b. Choose Steps in Program Planning
- c. Demonstrate Programming

16. Identify M & G Codes

Learning Objectives

- a. Analyze Coordinate Positioning
- b. Acknowledge Types of Motion
- c. Identify Various Interpolation
- d. Adapt Offset Commands
- e. Administer M-Codes

17. Demonstrate Coordinate Positioning for CNC Turning

Learning Objectives

- a. Demonstrate Radial and Diametral Programming
- b. Demonstrate Linear and Circular Interpolation for CNC Turning
- c. Demonstrate Non-Axis Motion Commands
- d. Demonstrate Tool Nose Radius Compensation (TNRC) for CNC Turning

18. Describe Canned Cycles for CNC Turning Applications

Learning Objectives

- a. Demonstrate Holemaking Canned Cycles
- b. Apply Tapping Canned Cycles
- c. Demonstrate Rough and Finish Turning Canned Cycles

Internship

Course Information

Course Number	In accordance with college policy
Potential Hours of Instruction	A minimum of 8 weeks
Total Credits	Determined by the college

Description

This course is an eight week paid internship designed to facilitate learning in the manufacturing environment. Course competencies are developed and approved as a cooperative learning contract between employer, student and course instructor. Students are required to perform bi-weekly reports and a final presentation to present their individual learning competencies to the rest of their class. Instructors make at least two site visits during the eight week internship to assess progress.

Instruction Type	Contact Hours	Credits
Practicum/Internship	TBD	TBD

Textbooks

Internship Handbook – Developed by the college and Includes Learning Contract that must be approved prior to starting internship.

Exit Learning Outcomes

Core Abilities

- A. Critical Thinking
- B. Professionalism
- C. Mechanical Aptitude: Determine the Proper Method/Equipment to Manufacture and Measure Characteristic of a Part
- D. Technological Literacy
- E. Recognize and Avoid Shop Hazards

Competencies

- 1. Demonstrate applicable shop safety standards
- 2. Operate CNC equipment to produce real-world product
- 3. Inspect parts for quality
- 4. Other competencies as laid out in learning contract

This Curriculum Outline is provided by NIMS.

For more information, please contact Melanie Stover, Director of Strategic Initiatives, by e-mail at MSTOVER@NIMS-SKILLS.ORG.

The Right People, Right Skills, Right Now.