**MACHINE TECHNOLOGY PROGRAM OVERVIEW**

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| **MACH TECH** | **TOPIC**: **CERTIFICATE OF PROFICIENCY** | **CREDITS: 17** |
| **PURPOSE**: | To provide students with the fundamental precision machining and production skills necessary to compete for an entry-level position in a working machine shop environment, and/or to acquire the prerequisite knowledge of machine tool technology to successfully advance to a higher level machining program.  |
| **OUTCOMES**: | * Consistently demonstrate safe shop practices and procedures.
* Interpret and apply documentation and engineering specifications in a production environment.
* Demonstrate basic precision measurements applying Geometric Dimensioning & Tolerance.
* Solve Technical Trig Problems applicable to the machining process.
* Perform material removal processes with focus on improved speed, efficiency, and consistency.
* Consistently demonstrate work ready skills required for success in a team oriented workplace.
* Successfully produce basic CAD/CAM programs.
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| **COURSES:****TERM 3** | **ALL Common Courses are designated as MACH&** | **HOURS****(LEC/LAB)**  | **CREDIT VALUE** |
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| MACH&130 CAD/CAM Systems131 Math (Trig) Applications133 CNC Operations and Programming II135 Production Environment137 Inspection GD&T139 Material Removal III |
| **TOTAL** |

 | 10/2020/020/6010/2010/2020/40 | 225224**17** |
| **17** |
|  |
| **PROGRAM DESIGN** | This program is designed to augment the knowledge and experience acquired from the Certificate of Completion.  |
| **KEY EXPECTATIONS** | Students will have acquired the introductory machining skills and overall knowledge of machining tools and produce precision parts on a more routine basis with limited supervision and within specification.  |
| **POTENTIAL ENTRY LEVEL POSITIONS** | Machinist Helper, ApprenticeShop AssistantEntry Level Machinist |

**TERM 3 COURSE OVERVIEW**

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| **MACH&130** | **TOPIC**: Introduction to CAD/CAM Systems | **TIME**: LEC 10 / LAB 20 |
| **PURPOSE**: | Introduce students to CAD/CAM systems for CNC Programming |
| **OUTCOMES**: | Given a print or model, students will produce simple CNC programs to control the operation of a CNC machine in an accurate and safe manor utilizing CAD/CAM Systems. |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** |
| * CAD/CAM Interface CAD/CAM Help/Contents capability
* Create a basic 2D wireframe and 3D solid model geometry using the CAD functions
* Work Coordinates (WCS)
* Construction Planes and Graphics Views
* Machine type, material and tool settings
* Operations Manager
	+ 2.5D tool path (Cutter compensation and speeds and feeds)
* Creating Cutting tools, Holders, or Utilize Cutter Library
* Verifying toolpath
* CNC code posting
 | **.5 /.5****2 / 6****1 / 2****1 / 2****.5 / .5****.5 / .5****2 / 5****1 / 1****1 / 2****.5 / .5** |
| **ASSESSMENT MEASURES** | * Written and/or on-line tests
* Assignments/Worksheets
* Prove program using machine simulator, machine graphics, verification software and/or CNC machine
* Instructor review of CAD/CAM CNC program
 |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Post and prove program using machine simulator, machine graphics, or verification software
* Online training program like Immerse2learn.
 |
| **SUGGESTED KEY REFERENCES**: | * **Online training** ( Immerse2learn; SolidWorks Tutorials)
* **Textbooks**

1. Machining and CNC Technology with Student Resource DVD, 3rd Edition/Michael Fitzpatrick2. Technology of Machine Tools, 7th Edition/Stephen F. Krar & Albert F. Check 3. Precision Machining Technology/Peter J. Hoffman, Eric S. Hopewell, Brian Janes, & Kent M. Sharp Jr.4. Machining Fundamentals, 8th Edition/John R. Walker * **Reference Books**

1. Machinery’s Handbook, 29th Edition/Erik Oberg 2. Shop Reference for Students & Apprentices, 2nd Edition/Christopher McCauley3. Machinists’ Ready Reference, 9th Edition/C. Weingartner, & Jim Effner * **MasterCAM training Guides**
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**TERM 3 COURSE OVERVIEW**

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| **MACH&131** | **TOPIC**: Shop Math III | **TIME**: LEC 20  |
| **PURPOSE**: | Applying trigonometry to the machining process.  |
| **OUTCOMES**: | Upon completion of this course, students will identify triangles to perform trigonometric calculations, and use geometric principles to solve mathematical machining problems. |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** |
| * Trigonometric Functions
 | **2**  |
| * Review of Geometric Principles
 | **2** |
| * Finding triangles
 | **12** |
| * Law of Sines and Law of Cosines
 | **2** |
| * Review of Trigonometry
 | **2** |
| **ASSESSMENT** | * Quizzes
* Homework Assignments
* Midterm & Final Exam
 |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Canvas Homework and Quizzes
* Midterm Exam, Final Math Exam
* Videos: www.shoreline.edu/clindberg/CNC120ndex.html
 |
| **SUGGESTED KEY REFERENCES**: | **Textbooks:** 1. Mathematics for Machine Technology (Smith & Peterson) 6th edition Ch. 60, 62- 67 (electronic chapters available for $3.50/ chapter)/Robert D. Smith & John C. Peterson
2. Technical Shop Mathematics, 3rd Edition/Thomas Achatz

**Reference Books:**1. Machinery’s Handbook, 29th Edition/Erik Oberg
2. Shop Reference for Students & Apprentices, 2nd Edition/Christopher McCauley
3. Machinists’ Ready Reference, 9th Edition/C. Weingartner, & Jim Effner
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**TERM 3 COURSE OVERVIEW**

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| **MACH&133** | **TOPIC**: Introduction to CAD/CAM Systems | **TIME**: LEC 10 / LAB 20 |
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| **OUTCOMES**: | Given a print or model, students will produce simple CNC programs to control the operation of a CNC machine in an accurate and safe manor utilizing CAD/CAM Systems. |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** |
| * CAD/CAM Interface CAD/CAM Help/Contents capability
* Create a basic 2D wireframe and 3D solid model geometry using the CAD functions
* Work Coordinates (WCS)
* Construction Planes and Graphics Views
* Machine type, material and tool settings
* Operations Manager
* 2.5D tool path (Cutter compensation and speeds and feeds)
* Creating Cutting tools, Holders, or Utilize Cutter Library
* Verifying toolpath
* CNC code posting
 | **.5 /.5****2 / 6****1 / 2****1 / 2****.5 / .5****.5 / .5****2 / 5****1 / 1****1 / 2****.5 / .5** |
| **ASSESSMENT MEASURES** | * Written and/or on-line tests
* Assignments/Worksheets
* Prove program using machine simulator, machine graphics, verification software and/or CNC machine
* Instructor review of CAD/CAM CNC program
 |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Post and prove program using machine simulator, machine graphics, or verification software
* Online training program like Immerse2learn.
 |
| **SUGGESTED KEY REFERENCES**: | * **Online training** ( Immerse2learn; SolidWorks Tutorials)
* **Textbooks**

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**TERM 3 COURSE OVERVIEW**

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| **MACH&135** | **TOPIC**: Production Environments | **TIME**: LEC 10 / LAB 20 |
| **PURPOSE**: | Introduction to working in production machine shop environments. |
| **PREREQUISITES**  | Principles of Precision Machining Certificate.  |
| **OUTCOMES**: | Upon completion of this course students will be able to set up a production run on a CNC machine working with written instruction that meet industry standards and determine if the production process meets both engineering print specifications as well as job planning requirements. |
| **TOPICS**: |  | **LEC/LAB HOURS** |
|  | * Job Planning Sheets
 | **2.0/0** |
| * Working from Set Up Sheets
 | **2.0/8.0** |
| * Maintaining Part Feature Dimensions During Production
 | **1.0/2.5** |
| * Statistical Process Control (SPC)
 | **1.0/1.5** |
| * Fixturing: Maintaining Part Feature Integrity
 | **1.5/4.0** |
| * Operator Tie In Sheets
 | **.5/1.0** |
| * First Article Inspections
 | **1.0/1.0** |
| * Basic Production Planning
 | **1.0/0** |
| **ASSESSMENT MEASURES** | * **Written and/or lab tests**
	+ Can define requirements described in a job plan
* **Instructor Observation**
	+ Student demonstrates that he or she can successfully replicate a setup by working from written job planning
	+ Student is able to create a fixture for a CNC machine production run
	+ Demonstrates that they are able to complete a first article inspection and determine whether or not the part meets job plan and engineering requirements.
 |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Set up a production run on a CNC machine using a job plan.
* Monitoring production
* Written communications
* Inspection
 |
| **SUGGESTED KEY REFERENCES**: | * **Textbooks**
1. Machining and CNC Technology with Student Resource DVD, 3rd Edition/Michael Fitzpatrick
2. Technology of Machine Tools, 7th Edition/Stephen F. Krar & Albert F. Check
3. Precision Machining Technology/Peter J. Hoffman, Eric S. Hopewell, Brian Janes, & Kent M. Sharp Jr.
4. Machining Fundamentals, 8th Edition/John R. Walker
* **Reference Books**
1. Machinery’s Handbook, 29th Edition/Erik Oberg
2. Shop Reference for Students & Apprentices, 2nd Edition/Christopher McCauley
3. Machinists’ Ready Reference, 9th Edition/C. Weingartner, & Jim Effner
* **Online training,** example: ToolingU; Videos/Youtube
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**TERM 3 COURSE OVERVIEW**

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| **MACH&137** | **TOPIC**: Inspection (GD&T)  | **TIME**: LEC 10/LAB 20  |
| **PURPOSE**: | This course is an application of GD&T principles.  |
| **OUTCOMES**: | Upon successful completion of this course, students will have inspected part features in order to contrast the measurements with the print Geometric Tolerancing specification.  |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** |
| * Review engineering drawing
* Interpret Feature Control Frames
* Develop an inspection plan
* Setup and inspect part features
* Apply inspection measurements to Geometric Tolerances
* Interpret results
 | **1/2****2/3****1/2****2/8****2/3****2/2** |
| **ASSESSMENT MEASURES** | Paper or Electronic TestingPart feature measurements to tolerance standards |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Review engineering drawings
* Part feature measurement exercises
* Apply measurement to print tolerances
 |
| **SUGGESTED KEY REFERENCES**: | **Textbooks:** 1. Interpreting Geometric Dimensioning and Tolerancing, 3rd Ed./Daniel Punchochar
2. Geometric Dimensioning and Tolerancing: Baed on ASME Y14.5- 2009, 8th Edition/ David A. Madsen
3. Fundamentals of Geometric Dimensioning and Tolerancing, 3rd Edition/Alex Krulikowski
* **Reference Books**
1. Machinery’s Handbook, 29th Edition/Erik Oberg
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**TERM 3 COURSE OVERVIEW**

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| **MACH&129** | **TOPIC** Material Removal III | **TIME**: LEC 20/LAB 100 |
| **PURPOSE**: | Advanced course on material removal in a modern machine shop |
| **OUTCOMES**: | * Given successful completion of Material Removal II, students will be able to improve upon skills and techniques learned in Material Removal II, with a focus on speed and efficiency.
* Upon successful completion of this course, students will understand advanced processes like threading and thread milling, boring and multi-axis.
 |
| **TIMING:** | **TOPIC**: Topics build on foundation started in MACH&129 | **HOURS/MINUTES**: |
| * Select Carbide grades
* Tool geometry
* Tooling/work holding
* Machining sequence of operations
* Efficient removal of material
* Chip Control
* Threading and thread milling
* Boring, both lathe and mill
* Multi-axis lathe and mill
 | **2/5****3/7****1/20****1/20****1/20****1/2****3/7****3/7****5/12** |
| **ASSESSMENT MEASURES** | Assign project or projects with time constraints, produced within established parameters. |
| **SUGGESTED KEY EXERCISES/****VIDEOS**: | * Work Sheets
* Online study guides like Tooling U
* Creating parts to specification
* Creating parts in a given timeframe
* Demonstration of understanding
 |
| **SUGGESTED KEY REFERENCES**: | * **Prints produced to Industry standards**
* **Online & Online Research** (Tooling U)
* **Textbooks**
1. Machining and CNC Technology with Student Resource DVD, 3rd Edition/Michael Fitzpatrick
2. Technology of Machine Tools, 7th Edition/Stephen F. Krar & Albert F. Check
3. Precision Machining Technology/Peter J. Hoffman, Eric S. Hopewell, Brian Janes, & Kent M. Sharp Jr.
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