**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. | | | |
| **COURSES:**  **TERM 3** | **ALL Common Courses are designated as MACH&** | **HOURS**  **(LEC/LAB)** | | **CREDIT VALUE** |
| |  | | --- | | MACH&130 CAD/CAM Systems  131 Math (Trig) Applications  133 CNC Operations and Programming II  135 Production Environment  137 Inspection GD&T  139 Material Removal III | | **TOTAL** | | 10/20  20/0  20/60  10/20  10/20  20/40 | | 2  2  5  2  2  4  **17** |
| **17** |
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| **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, Apprentice  Shop Assistant  Entry 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 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   * **MasterCAM training Guides** | | |

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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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| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Post and prove program using machine simulator, machine graphics, or verification software * Online training program like Immerse2learn. | | |
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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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| **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 Testing  Part 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 2. Shop Reference for Students & Apprentices, 2nd Edition/Christopher McCauley 3. Machinists’ Ready Reference, 9th Edition/C. Weingartner, & Jim Effner | | |

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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. 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 | | |