**MACHINE TECHNOLOGY PROGRAM OVERVIEW**

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| **MACH TECH** | **TOPIC**: **CERTIFICATE OF COMPLETION** | | **CREDITS: 35** | |
| **PURPOSE**: | To provide students with the foundational skills necessary to compete for an entry level position in a working machine shop environment, under supervision, and/or to acquire the prerequisite knowledge of machine tool technology to successfully advance to a higher level machining program. | | | |
| **OUTCOMES**: | * Be able to consistently demonstrate safe shop practices and procedures. * Interpret and apply basic documentation and engineering specifications. * Develop the ability to use basic precision measurements. * Solve Technical Math Problems applicable to the machining trade. * Perform fundamental material removal processes. * Use fundamental skills to include writing, reading, interpretation, computing, speaking and listening to meet the needs of the workplace. * Demonstrate fundamental work ready skills required for success in a team oriented workplace. | | | |
| **COURSES:**  **TERM 1**  **TERM 2** | **ALL Common Courses are designated as MACH&** | **HOURS**  **(LEC/LAB)** | | **CREDIT VALUE** |
| |  | | --- | | **MACH&103** Safety  107 Precision Measurements  109 Work Ready Skills  111 Interpret/Apply Engineering Specs  115 Solve Technical Math Problems  119 Material Removal Processes I | |  | | MACH&120 Intro to CNC Operation  121 Intro to CNC Programming  125 Shop Math Applications  127 Geometric Dimensioning and Tolerancing  129 Precision Measurement II  129 Material Removal Processes II | | **TOTAL** | | 10/0  10/40  10/0  10/20  40/0  20/100  20/40  20/0  30/0  20/0  10/20  20/40 | | 1  3  1  3  4  7  **18**  4  2  3  2  2  4  **17** |
| **35** |
| **PROGRAM DESIGN** | This program is designed to accommodate the needs of students with little to no machine tool or actual shop experience. | | | |
| **KEY EXPECTATIONS** | Students will have acquired the basic communication, computation and interpretive skills required to succeed in applied shop and problem solving situations. | | | |
| **POTENTIAL ENTRY LEVEL POSITIONS** | Apprentice/Helper  Machinist Helper  Shop Assistant | | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&103** | **TOPIC**: Safety | **TIME**: LEC 10 | |
| **PURPOSE**: | Establish a culture of Safe Practices | | |
| **OUTCOMES**: | Given verbal and written instructions students will be able to demonstrate the use of safe shop practices in a shop environment. | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Use of Safe Practices while in a shop environment ( like lifting lock out tag out ) * Interpret SDS (MSDS) Sheets * Use of PPE (Personal Protective Equipment ) * Interpret Machinery Caution Signs and Labels * General Shop Safety (Chips, sharp objects, dangers of compressed air, chemicals) * Fire, Earthquake/ Evacuation * Machine Guards/ Safety Guards * Equipment Specific Safety Practices * Defective Tools or Equipment | | **2/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0** |
| **ASSESSMENT MEASURES** | * Safety Check sheets * Knowledge exam ofmultiple choice questions @ 80% or better * Demonstrating safe practices | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Safety videos * Safety quizes * online Training * Demonstration of safe practices * Manual and Mechanical Safe Lifting | | |
| **SUGGESTED KEY REFERENCES**: | * **Text books**  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  * Machinists’ Ready Reference, 9th Edition/C. Weingartner, & Jim Effner * **Videos** * **Online Training Resources** (Tooling U) | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&107** | **TOPIC**: Precision Measurement I | **TIME**: LEC 10/LAB 40 | |
| **PURPOSE**: | Introductory course covering the use of precision measuring tools such as micrometers, calipers, gage blocks and indicators. | | |
| **OUTCOMES**: | * Given precision measuring tools, students will read and interpret measurements within the degree of accuracy for the measuring tools or setup tools * Given proper reference material for machine shop formulas, students will select appropriate formula to calculate size/dimension verifications and angle calculations. * Given indicators and common machine shop machinery, students will align machinery, fixtures and/or work pieces within the shop standard. | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Introduction to tolerance applications * Use of Inspection tools to verify or measure work piece * Introduction to documentation common to inspection * Choose the appropriate measuring tool for the required degree of accuracy. * Operate common measuring tools such as micrometers and gages to the resolution of the instrument. * Align machines and work pieces to establish an accurate foundation for machining to engineering specifications. * Accurately calculate dimensions required for size verification using process specific formulas. | | **1/2**  **1/5**  **1/2**  **1/1**  **3/15**  **2/10**  **1/5** |
| **ASSESSMENT MEASURES** | * Assess comprehension through the use of electronic/textbook handout media. * Measuring exercises performed on selected machined samples, and/or assigned projects to established standards. * Alignment exercises on selected machinery, fixtures and work pieces to the established standards | | |
| **SUGGESTED KEY REFERENCES**: | * **Text books**  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  * **Other**: OnLine (Tooling U); Handouts; Example documents | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&109** | **TOPIC**: Work Ready Skills | **TIME**: LEC 10 | |
| **PURPOSE**: | Introductory course to work ready skills | | |
| **OUTCOMES**: | Given verbal or written instructions students will demonstrate the ability to work and study within a diverse shop & classroom environment | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Intro to Work Ready Skills * Team work exercises * Employer attendance policies * Industry appropriate attire * Effective communications techniques * Industry communications * Effective time management * Conflict resolution * Professional Hygiene * Assessing Work ready Competency * Review | | **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0**  **1/0** |
| **ASSESSMENT MEASURES** | * Attendance records * Meeting assignment deadliness * Instructor’s behavior checklist * Self-evaluation checklist | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Teamwork exercises * Conflict resolution drills * Hygiene and attire models * Communication exercises | | |
| **SUGGESTED KEY REFERENCES**: | * Keytrain (listening for comprehension, reading for information, teamwork) * Handouts * Textbooks  1. Inter Act: Interpersonal Communication, concepts, skills, and contexts, 12 Edition/Kathleen Verberber 2. Get A Job!, 5th Edition/Cunningham  * Electronic textbooks * Internet accessed behavior check sheets | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&111** | **TOPIC**: Interpret/Apply Engineering Specs | | **TIME**: LEC 10/LAB 20 |
| **PURPOSE**: | Interpret, apply, and understand engineering drawings, specifications and documentation. | | |
| **OUTCOMES**: | * Upon successful completion of this course, students will have the basic foundation to interpret beginning-level engineering drawings and specifications. * Given examples of inspector’s documentation, students will research and locate appropriate standards information such as thread specifications in American National Standard Unified Inch Threads. * Given precise step-by-step production documentation, student will model proper adherence to direction, and understand purpose. | | |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** | |
| * Basic components of a print * Print Lines & Symbols * Drawing views and projections * Dimensions * Title Blocks & Notes * Introducing GD &T * Part Tolerances * Threads * Inspection Documents * Production documentation | **1/1**  **1/1**  **1/1**  **1/3**  **1/1**  **1/1**  **1/3**  **1/4**  **1/3**  **1/2** | |
| **ASSESSMENT MEASURES** | 25% : Attendance/Participation  25% : Lab Work  25% : Homework assignments  25% : Quizzes and Final  100% Total grade | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Work Sheets * Research paper * Reading assignments * Measuring a part * Producing a part from a drawing * Team exercises where students produce and interpret each other’s documents | | |
| **SUGGESTED KEY REFERENCES**: | * Part prints produced to Industry standards * Text book  1. Blueprint Reading for Machine Trades, 7th Edition/Russ Schultz & Larry Smith 2. Blueprint Reading Basics, 3rd Edition/Warren Hammer 3. Machine Trades Print Reading, 5th Edition/Michael A. Barsamian & Girchard A. Gizelbach 4. Machine Trades Print Reading, 4th Edition/ Michael A. Barsamian & Girchard A. Gizelbach  * Written tests * Producing a part, filling out paper work * American National Standard Unified Inch Threads | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&115** | **TOPIC**: Solve Technical Math Problems | | **TIME**: LEC 20 | |
| **PURPOSE**: | Introductory course covering basic applied math related to machining technology. | | | |
| **OUTCOMES**: | Upon completion of this course, students will perform calculations using decimal and common fractions, ratios and measuring tools to solve mathematical problems to a minimum test score of 70% | | | |
| **TIMING:** | **TOPIC**: | | | **LEC/LAB HOURS** |
| * Common & Decimal Fractions & Mixed Numbers | **3** | | |
| * Percentages | **3** | | |
| * Order of Operations | **1** | | |
| * Ratios and Proportions | **2** | | |
| * Linear Measurements (Common US/Metric) | **1** | | |
| * Tolerance, Clearance, Interference | **1** | | |
| * Use of Gage Blocks and other measuring tools | **3** | | |
| * Cartesian coordinates | **1** | | |
| * Decimal Fractions | **5** | | |
| **ASSESSMENT** | * Complete all homework with a score of at least 70% * Complete all quizzes with an average score of 70% * Pass Mid-term & Final Exams with a score of at least 70% | | | |
| **KEY EXERCISES/**  **VIDEOS**: | * Canvas Homework and Quizzes * Mid-term & Final Math Exam * Videos: www.shoreline.edu/clindberg/CNC113index.html | | | |
| **KEY REFERENCES**: | **Textbook**   1. Mathematics for Machine Technology, 6th edition Ch. 1- 32 & Ch.75 (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 | | | |

**TERM 1 COURSE OVERVIEW**

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| **MACH&119** | TOPIC: Intro to Material Removal | TIME: LEC 20 LAB 100 | |
| **PURPOSE**: | Introductory course on the removal of material in a modern machine shop. | | |
| **OUTCOMES**: | Upon completion of this course student will be able to demonstrate the setup and operation of lathes and milling machine to industry standards. | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Safe setup and operation of a lathe * Safe setup and operation of a milling machine. * Correct speed, feed, and chip load calculations for milling and turning operations * OD Turning including single point thread * 2D milling—climb / conventional cutting * Hole machining operations * Basic tool geometry and tool bit grinding | | **4/25**  **4/25**  **3/15**  **3/15**  **3/10**  **2/5**  **1/5** |
| **ASSESSMENT MEASURES** | * Check sheets * Online tests * Projects * NIMS Credentials | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Plan set up and make projects * Team exercises * Measure projects * Tooling-U | | |
| **SUGGESTED KEY REFERENCES**: | * **Text books**  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** * **Online references** (Tooling U) | | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&120** | **TOPIC**: Intro To CNC Operation | **TIME**: LEC 20 / LAB 40 | |
| **PURPOSE**: | Introduction to setup and operation of CNC machines | | |
| **PREREQUISITES** | Intro to CNC Programming previously or concurrently | | |
| **OUTCOMES**: | * Using verbal or written instructions students will safely setup and operate the CNC machine to produce a part within tolerance. * Using verbal or written instructions students will start up, perform maintenance, and shut down the CNC machine to shop standards | | |
| **TOPICS**: |  | | **HOURS**: **LEC/LAB** |
|  | CNC axes destination movement | | **1.0/1.0** |
| What is a Program Reference Zero | | **1.0/2.0** |
| Safely Initializing and Shutting down a CNC Machine | | **.5/2.0** |
| Responding to a CNC malfunction | | **1.0/1.0** |
| Loading a program in the CNC machine | | **1.0/2.0** |
| Controller modes and their functions | | **2.0/4.0** |
| Safely Starting a new program | | **1.0/2.0** |
| Perform a safe setup first run of a part, tear down and clean up | | **5.0/9.0** |
| Utilizing CNC work holding devises | | **1.0/2.0** |
| Proper use and selection of tools and tool holders | | **1.0/2.0** |
| Components and mechanics of a CNC machine | | **1.0/1.0** |
| Editing programs on a CNC machine | | **1.0/4.0** |
| Performing Operator Preventative Maintenance | | **1.0/3.0** |
| Maintaining CNC Machine Coolant | | **1.0/1.0** |
| Job Planning | | **.5/1.0** |
| Setting Machine Offsets – Adjusting Cutter Compensation | | **1.0/3.0** |
| **ASSESSMENT MEASURES** | * Written and/or on-line tests * NIMS CNC Mill Operator or NIMS CNC Lathe Operator for example * Lab Exam * Student demos he/she can successfully load selected CNC program, setup/run CNC proj. * Student demonstrates to the instructor that they can measure/inspect machined part * Can control part feature profile is made to print specifications: +/-.002 * Instructor Observation * Instructor observes that the student cleans and shut down CNC machine to shop specs | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Perform the various operations of a CNC Machine * Operate the CNC machine to produce parts * Worksheets, Tests, Field trips | | |
| **SUGGESTED KEY REFERENCES**: | * **Text books**  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 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 (Tooling U); Videos/Youtube, Machine manufacturer training material * Machine manuals | | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&121** | **TOPIC:** Introduction To CNC Programming | **TIME:** LEC 20 / LAB 0 | |
| **PURPOSE**: | Introduce students to the manual programming of a CNC machine. | | |
| **OUTCOMES**: | Given the CNC programming codes and explanations, students will produce handwritten CNC programs to control the operation of a CNC machine in an accurate and safe manner. | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Axis Coordinates XYZ ABC * Proper Calculations of speeds and feeds * G, M, and additional CNC programming code * Tool Call up/Changes and Offsets T# = H# = D# * Canned Cycles and Modal/Non-Modal Commands * Programming format and Programming Syntax * Incremental VS absolute * Edge of part and Centerline of Tool path * Cutter Compensation * Crash Avoidance * Control Specific Codes VS Industry Standard * Lathe code vs. Mill code | | **1**  **1**  **3**  **1**  **3**  **1**  **2**  **2**  **2**  **1**  **1**  **2** |
| **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 written CNC program | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Writing and proving program using machine simulator, machine graphics, or verification software * Online training program like Immerse2learn. * Write and run simple programs * Read, troubleshoot and plot CNC code | | |
| **SUGGESTED KEY REFERENCES**: | * **Online training** (Immerse2learn; CNC Simulation software; 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  * **Programming Handouts** | | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&125** | **TOPIC**: Shop Math II Applications | **TIME**: LEC 30/ 3cr. | |
| **PURPOSE**: | Applying Intermediate Math in the Shop | | |
| **OUTCOMES**: | Upon completion of this course, students will rearrange equations using principles of equality to solve for an unknown; multiply, divide, add, subtract algebraic expressions; apply formulas of cutting speed, revolutions per minute; use geometric principles to calculate values. | | |
| **TIMING:** | **TOPIC**: | | **LEC/LAB HOURS** |
| * Algebraic operations | | **9** |
| * Thread formulas | | **1** |
| * Arc Length formula | | **1** |
| * Applications of Formulas to Cutting Speed, Revolutions per Minute, | | **2** |
| * Feeds and Speeds | | **6** |
| * Geometric Principles (Angles, Pythagorean Theorem, Triangles, Circles) | | **8** |
| * Principles of Equality | | **3** |
| **ASSESSMENT** | * Quizzes * Homework Assignments * Pass Final Math Exam with 70% or better | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Canvas Homework and Quizzes * Videos: www.shoreline.edu/clindberg/CNC106index.html | | |
| **SUGGESTED KEY REFERENCES**: | * **Textbooks**   1. Mathematics for Machine Technology, 6th edition Ch. 1- 32 & Ch.75 (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 | | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&127** | **TOPIC**: Introduction to Geometric Dimensioning & Tolerancing (GD&T) | **TIME**: LEC 20 |
| **PURPOSE**: | This course is intended to prepare the student to use Geometric Dimensioning and Toleranceing concepts to inspect part features and contrast them with the engineering drawing specifications. | |
| **OUTCOMES**: | Upon successful completion of this course, students will identify and apply Geometric Dimensioning and Toleranceing symbols and language to engineering drawings to the standards set by the program | |
| **TIMING:** | **TOPIC**: | **LEC/LAB HOURS** |
| * Geometric Symbols and terminology * Feature Control Frames * Rules 1, 2 and 3 * Virtual Condition * Bonus Tolerance   Coordinate vs. Geometric Dimensioning   * Coordinate and geometric Tolerances * Datums, Tolerances of form, orientation, profile, location, and runout | **5/0**  **2/0**  **2/0**  **3/0**  **5/0**  **1/0**  **2/0** |
| **ASSESSMENT MEASURES** | * Measure parts * Do diagnostic evaluations using GD&T standards | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Canvas Homework and Quizzes * Textbook * Electronic Textbook * Videos: | |
| **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 | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&129** | **TOPIC**: Precision Machining II | **TIME**: LEC 10 / LAB 20 | |
| **PURPOSE**: | Build proficiency in measurement inspection, tools and techniques | | |
| **OUTCOMES**: | At the competition of this course students will be able to perform intermediate measuring techniques for inspection and layout to meet shop standards. | | |
| **TIMING:** | **TOPIC**: | | **HOURS**: **LEC/LAB** |
| * Selection of fixturing for inspection * surface plate techniques for inspection and layout * Selection of measuring tools * Datums and Features * Hardness Measuring * calibration theory * Selection of inspection tooling * Surface Finishes | | **2/3**  **1/3**  **1/3**  **2/3**  **1/3**  **1/2**  **1/2**  **1/1** |
| **ASSESSMENT MEASURES** | * Students will inspect other students parts or pre-inspected parts | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Worksheets * Setup and measuring parts * Team measuring exercise * Measuring physical standards to develop sensory accuracy * Measuring complex features and other inspection challenges | | |
| **SUGGESTED KEY REFERENCES**: | * **Text books**  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 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** (Tooling U) * **Online references** | | |

**TERM 2 COURSE OVERVIEW**

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| **MACH&129** | **TOPIC**: Material Removal II | **TIME**: LEC 20/LAB 40 | |
| **PURPOSE**: | Intermediate course on material removal in a modern machine shop | | |
| **OUTCOMES**: | At the completion of this course student will be able to use intermediate metal removal techniques on lathes and milling machines to make parts to industry standards. | | |
| **TIMING:** | **TOPIC**: | | **HOURS LEC/LAB**: |
| * Process planning for machining operation lathe / Mill * Advanced cutting techniques * Selection of Carbide grades * Tool geometry * Interpret surface feet and chip load tables * Tooling &work holding * Machining sequence of operations * Tighter tolerance considerations * High speed tooling * Efficient material removal * Chip Control | | **1/2**  **2/2**  **2/2**  **2/2**  **1/3**  **2/3**  **1/1**  **2/10**  **2/10**  **3/3**  **2/2** |
| **ASSESSMENT MEASURES** | * Check sheets * Online tests * Intermediate projects * NIMS Credentials | | |
| **SUGGESTED KEY EXERCISES/**  **VIDEOS**: | * Electronic text books and media * Making parts to specifications * Tooling-U | | |
| **SUGGESTED KEY REFERENCES**: | * **Online data** * **Text Books**  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 references** (Tooling U) * **Phone App** (Machinists Friend) | | |