



## COURSE OUTLINE: MAC306 - CMPLX GRINDING TECH

Prepared: Peter Corbett

Approved: Corey Meunier, Chair, Technology and Skilled Trades

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| <b>Course Code: Title</b>                                     | MAC306: COMPLEX GRINDING TECHNOLOGY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Program Number: Name</b>                                   | 6347: GENERAL MACHINIST L3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Department:</b>                                            | MECHANICAL TECHNIQUES PS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Semesters/Terms:</b>                                       | 20F, 21F, 22F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Course Description:</b>                                    | This course is designed to provide Level III General Machinist Apprentices the ability to demonstrate milling of complex geometric shapes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Total Credits:</b>                                         | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hours/Week:</b>                                            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Total Hours:</b>                                           | 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Prerequisites:</b>                                         | There are no pre-requisites for this course.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Corequisites:</b>                                          | There are no co-requisites for this course.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Course Evaluation:</b>                                     | Passing Grade: 50%, D<br><br>A minimum program GPA of 2.0 or higher where program specific standards exist is required for graduation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Other Course Evaluation &amp; Assessment Requirements:</b> | Other Course Evaluation Requirements: Smart watches, smart phones and similar devices are not allowed during tests or quizzes and must be removed.<br><br>Grade<br>Definition Grade Point Equivalent<br>A+ 90 - 100% 4.00<br>A 80 - 89%<br>B 70 - 79% 3.00<br>C 60 - 69% 2.00<br>D 50 - 59% 1.00<br>F (Fail) 49% and below 0.00<br>CR (Credit) Credit for diploma requirements has been awarded.<br>S Satisfactory achievement in field /clinical placement or non-graded subject area.<br>U Unsatisfactory achievement in field/clinical placement or non-graded subject area.<br>X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course.<br>NR Grade not reported to Registrar's office.<br>W Student has withdrawn from the course without academic penalty. |
| <b>Books and Required Resources:</b>                          | Technology Of Machine Tools by Steve F. Krar, Arthur R. Gill, Peter Smid, Robert J. Gerritsen<br>Publisher: McGraw - Hill Edition: 8<br>ISBN: 9781260565782                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

In response to public health requirements pertaining to the COVID19 pandemic, course delivery and assessment traditionally delivered in-class, may occur remotely either in whole or in part in the 2020-2021 academic year.



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**Course Outcomes and Learning Objectives:**

| <b>Course Outcome 1</b>                                                                     | <b>Learning Objectives for Course Outcome 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Describe safe working procedures when setting up and operating grinders.                 | 1.1 Identify potential safety hazards which may occur during grinder set-up and operating procedures.<br><br>Demonstrate safe working habits including: <ul style="list-style-type: none"><li>- protective clothing and equipment</li><li>- good housekeeping</li><li>- start up and shut off procedures</li><li>- securing and stabilizing of workpiece</li><li>- guards and dust extraction system</li><li>- dressing and inspection of grinding wheel</li><li>- lock out procedure</li><li>- maximum wheel RPM</li><li>- ring test of wheel</li></ul> |
| <b>Course Outcome 2</b>                                                                     | <b>Learning Objectives for Course Outcome 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 2. Describe internal grinding techniques and processes. (1.5 hrs)                           | 2.1 Identify machining processes and components of plain or universal cylindrical grinders: <ul style="list-style-type: none"><li>- universal cylindrical grinding</li><li>- tool post grinding</li><li>- tool and cutter grinder</li><li>- I/D grinder</li><li>- jig grinder</li></ul> Describe cutting fluid applications.                                                                                                                                                                                                                             |
| <b>Course Outcome 3</b>                                                                     | <b>Learning Objectives for Course Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 3. Identify workholding devices and/or attachments used for internal grinding. (1.5 hrs)    | 3.1 Describe workholding devices, accessories, and attachments used in internal grinding techniques: <ul style="list-style-type: none"><li>- wheel dressing attachment</li><li>- radius and tangent wheel dresser</li><li>- angular wheel dresser</li><li>- radius dresser</li><li>- three-jaw chuck</li><li>- four-jaw chuck</li><li>- magnetic chuck</li><li>- collets chuck</li><li>- crush roll forming</li><li>- steady rest</li><li>- arbors</li><li>- universal work-head</li><li>- internal grinding attachment</li></ul>                        |
| <b>Course Outcome 4</b>                                                                     | <b>Learning Objectives for Course Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 4. Describe grinding wheels used for internal grinding and sharpening of end mills. (2 hrs) | 4.1 Identify grinding wheels: <ul style="list-style-type: none"><li>- straight</li><li>- recessed</li><li>- cup</li><li>- dish</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|  |                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--|------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                              | <ul style="list-style-type: none"> <li>- flared</li> <li>- cut-off</li> <li>- mounted</li> </ul> <p>Describe mounting, truing, and dressing of grinding wheels.</p> <p>Identify cutting tool geometry on an end mill by determining:</p> <ul style="list-style-type: none"> <li>- land</li> <li>- heel</li> <li>- flutes</li> <li>- helix angle</li> <li>- rake angle</li> <li>- tooth face</li> <li>- peripheral cutting edge</li> <li>- relief angles (clearance)</li> <li>- peripheral and end face clearance angles</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
|  | <b>Course Outcome 5</b>                                                      | <b>Learning Objectives for Course Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  | 5. Develop a plan for internal grinding and sharpening of end mills. (2 hrs) | <p>5.1 Interpret drawings, CAD data or process sheets to determine:</p> <ul style="list-style-type: none"> <li>- workpiece material characteristics</li> <li>- form and shape of workpiece</li> <li>- surface finish</li> <li>- tolerance</li> <li>- machining operations and sequences</li> </ul> <p>Identify grinding techniques:</p> <ul style="list-style-type: none"> <li>- plunge grinding</li> <li>- I/D grinding</li> <li>- profile grinding</li> <li>- parallel grinding</li> <li>- internal taper grinding</li> <li>- centre gashing</li> <li>- form grinding</li> <li>- cut off grinding</li> <li>- grinding primary and secondary angles</li> </ul> <p>Identify workholding devices and/or attachments:</p> <ul style="list-style-type: none"> <li>- tooth rest and support</li> <li>- centre height gauge</li> <li>- wheel dressing attachment</li> <li>- collets chuck</li> </ul> |
|  | <b>Course Outcome 6</b>                                                      | <b>Learning Objectives for Course Outcome 6</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  | 6. Demonstrate internal grinding and end mill sharpening. (10 hrs)           | <p>6.1 Demonstrate end mill sharpening.</p> <p>Demonstrate internal grinding.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | <b>Course Outcome 7</b>                                                      | <b>Learning Objectives for Course Outcome 7</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  | 7. Perform routine maintenance. (1 hr)                                       | <p>7.1 Demonstrate routine maintenance and cleaning procedures.</p> <p>Demonstrate lubrication procedures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

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|                                               | Demonstrate dismantling, handling, and storage of tools, tooling and workholding devices, and measuring equipment.                                                                                                                                                                                                                     |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------|----------------------------------------|----|----------------------------------|-----|----------|-----|--------|-----|--------|-----|
| <b>Evaluation Process and Grading System:</b> | <table> <tr> <th>Evaluation Type</th><th>Evaluation Weight</th></tr> <tr> <td>Attendance, Participation and Attitude</td><td>5%</td></tr> <tr> <td>Final Test and Practical Project</td><td>50%</td></tr> <tr> <td>Mid term</td><td>25%</td></tr> <tr> <td>Quiz 1</td><td>10%</td></tr> <tr> <td>Quiz 2</td><td>10%</td></tr> </table> | Evaluation Type | Evaluation Weight | Attendance, Participation and Attitude | 5% | Final Test and Practical Project | 50% | Mid term | 25% | Quiz 1 | 10% | Quiz 2 | 10% |
| Evaluation Type                               | Evaluation Weight                                                                                                                                                                                                                                                                                                                      |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| Attendance, Participation and Attitude        | 5%                                                                                                                                                                                                                                                                                                                                     |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| Final Test and Practical Project              | 50%                                                                                                                                                                                                                                                                                                                                    |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| Mid term                                      | 25%                                                                                                                                                                                                                                                                                                                                    |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| Quiz 1                                        | 10%                                                                                                                                                                                                                                                                                                                                    |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| Quiz 2                                        | 10%                                                                                                                                                                                                                                                                                                                                    |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| <b>Date:</b>                                  | September 3, 2020                                                                                                                                                                                                                                                                                                                      |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |
| <b>Addendum:</b>                              | Please refer to the course outline addendum on the Learning Management System for further information.                                                                                                                                                                                                                                 |                 |                   |                                        |    |                                  |     |          |     |        |     |        |     |

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