



## COURSE OUTLINE: MAC305 - CMPLX MILLING TECH

Prepared: Peter Corbett

Approved: Corey Meunier, Chair, Technology and Skilled Trades

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| <b>Course Code: Title</b>                                     | MAC305: COMPLEX MILLING 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>                                         | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Hours/Week:</b>                                            | 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Total Hours:</b>                                           | 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <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>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
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| 1. Describe safe working procedures when setting up and operating milling machines. | 1.1 Identify potential safety hazards which may occur during milling set-up and operating procedures.<br><br>Demonstrate safe working habits including: <ul style="list-style-type: none"><li>- protective clothing</li><li>- protective equipment and gear</li><li>- good housekeeping</li><li>- start up and shut off procedures</li><li>- securing and stabilizing of workpiece</li><li>- lock out procedures</li><li>- use of lifting devices</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Course Outcome 2</b>                                                             | <b>Learning Objectives for Course Outcome 2</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2. Identify milling attachments used for complex milling operations. (3 hrs)        | 2.1 Identify attachments used for complex milling operations: <ul style="list-style-type: none"><li>- slotting head</li><li>- right angle attachment</li><li>- vertical/horizontal attachment</li><li>- high speed attachment</li><li>- boring/facing heads</li><li>- swivel attachments</li><li>- dividing heads</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Course Outcome 3</b>                                                             | <b>Learning Objectives for Course Outcome 3</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 3. Develop a plan for complex milling operations. (2 hrs)                           | 3.1 Interpret engineering drawings, CAD data, or process sheets to determine: <ul style="list-style-type: none"><li>- workpiece material</li><li>- number of workpieces</li><li>- form and shape of workpiece</li><li>- machining operations</li><li>- tolerances</li><li>- surface finish</li><li>- machining sequences</li></ul><br>Identify complex milling techniques: <ul style="list-style-type: none"><li>- gear cutting</li><li>- helical milling</li><li>- line boring</li><li>- back boring</li><li>- cam milling (CNC application)</li></ul><br>Identify workholding devices by determining: <ul style="list-style-type: none"><li>- application</li><li>- operating principles</li><li>- graduation values</li><li>- angular and rotation settings</li><li>- workpiece characteristics</li><li>- positioning, mounting and securing procedures</li><li>- discrimination</li></ul><br>Identify required cutting tools, tool holding devices, and accessories by determining: |

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|                                                                                               | <ul style="list-style-type: none"> <li>- type and application</li> <li>- clearances</li> <li>- tolerances</li> <li>- surface finish</li> <li>- machining operations and sequences</li> <li>- cutting fluid requirements</li> <li>- operating principles</li> <li>- toolholding and support requirements</li> <li>- speed and feed values</li> <li>- workpiece characteristics</li> <li>- handling, storing, and maintenance procedures</li> </ul> <p>Describe measuring and checking procedures.</p>                                                                                                                                                                                                                                                                                                                                                |
| <b>Course Outcome 4</b>                                                                       | <b>Learning Objectives for Course Outcome 4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 4. Describe procedures for using mill workholding devices and accessories. (3 hrs)            | <p>4.1 Identify mill workholding devices:</p> <ul style="list-style-type: none"> <li>- dividing head</li> <li>- mandrels</li> <li>- rotary table</li> </ul> <p>Describe workholding device set-up procedures by determining:</p> <ul style="list-style-type: none"> <li>- application</li> <li>- operating principles</li> <li>- type</li> <li>- size</li> <li>- function</li> <li>- tool selection</li> <li>- type of tool</li> <li>- workpiece features</li> <li>- holding characteristics</li> <li>- mounting characteristics</li> <li>- location accessibility</li> <li>- workpiece characteristics</li> <li>- handling procedures</li> <li>- storing procedures</li> <li>- maintenance procedures</li> </ul> <p>Describe contact surface cleaning procedures.</p> <p>Demonstrate mounting, positioning, aligning, and securing procedures.</p> |
| <b>Course Outcome 5</b>                                                                       | <b>Learning Objectives for Course Outcome 5</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 5. Describe the assembly of cutting tools and holders for complex milling operations. (2 hrs) | <p>5.1 Identify cutting tool geometry (nomenclature).</p> <p>Describe milling cutting tools and tool holders:</p> <ul style="list-style-type: none"> <li>- gear cutters</li> <li>- solid carbide</li> <li>- boring tools</li> <li>- boring and facing heads</li> </ul> <p>Describe required cutting tools and tool holders by determining:</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

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|  |                                                     | <ul style="list-style-type: none"><li>- type and size</li><li>- cutting tool material</li><li>- shape</li><li>- application</li><li>- holding/mounting characteristics</li><li>- cutting and shaping characteristics</li><li>- tolerances</li><li>- surface finish</li></ul> <p>Demonstrate the assembly of cutting tools and holders.</p> |
|  | <b>Course Outcome 6</b>                             | <b>Learning Objectives for Course Outcome 6</b>                                                                                                                                                                                                                                                                                            |
|  | 6. Demonstrate complex milling operations. (31 hrs) | 6.1 Describe helical milling techniques.<br><br>Describe cam milling techniques.<br><br>Demonstrate the milling of complex geometric shapes.                                                                                                                                                                                               |
|  | <b>Course Outcome 7</b>                             | <b>Learning Objectives for Course Outcome 7</b>                                                                                                                                                                                                                                                                                            |
|  | 7. Perform routine maintenance. (1 hr)              | 7.1 Describe routine maintenance and cleaning procedures.<br><br>Describe lubrication procedures.<br><br>Describe dismantling, handling, and storage of tools, tooling, 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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