



## COURSE OUTLINE: MAC303 - METROLOGY III

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Approved: Corey Meunier, Chair, Technology and Skilled Trades

<b>Course Code: Title</b>	MAC303: METROLOGY III
<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 inspection and checking techniques using measuring and checking equipment, and, describe measuring and checking techniques using Optical Comparators and Coordinate Measuring Machines (CMM).
<b>Total Credits:</b>	1
<b>Hours/Week:</b>	1
<b>Total Hours:</b>	6
<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  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.  Grade Definition Grade Point Equivalent A+ 90 - 100% 4.00 A 80 - 89% B 70 - 79% 3.00 C 60 - 69% 2.00 D 50 - 59% 1.00 F (Fail) 49% and below 0.00 CR (Credit) Credit for diploma requirements has been awarded. S Satisfactory achievement in field /clinical placement or non-graded subject area. U Unsatisfactory achievement in field/clinical placement or non-graded subject area. X A temporary grade limited to situations with extenuating circumstances giving a student additional time to complete the requirements for a course. NR Grade not reported to Registrar's office. W Student has withdrawn from the course without academic penalty.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 Publisher: McGraw - Hill Edition: 8 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 measuring and checking equipment.	<p>1.1 Identify potential safety hazards which may occur during the set-up and operating of measuring and checking equipment.</p> <p>Demonstrate safe work habits including:</p> <ul style="list-style-type: none"> <li>- protective clothing</li> <li>- protective equipment and gear</li> <li>- good housekeeping</li> <li>- stabilizing workpieces</li> <li>- operating procedures</li> <li>- securing workpieces</li> <li>- storage and handling of equipment</li> </ul>
<b>Course Outcome 2</b>	<b>Learning Objectives for Course Outcome 2</b>
2. Describe the fundamentals of measuring, checking, and gauging equipment. (1 hr)	<p>2.1 Describe measuring, checking, and gauging equipment:</p> <ul style="list-style-type: none"> <li>- sine bar and sine plate</li> <li>- compound sine plate</li> <li>- precision cylindrical square</li> <li>- precision level</li> <li>- precision rollers</li> <li>- precision balls</li> <li>- tooling balls</li> <li>- thread wires</li> <li>- precision weight gauge</li> <li>- plug gauges</li> <li>- ring gauges</li> <li>- snap gauges</li> <li>- surface texture gauge</li> <li>- square</li> <li>- dial test gauges</li> <li>- mechanical comparator</li> <li>- optical flats</li> <li>- gauge blocks</li> <li>- optical comparators</li> <li>- electrical comparator</li> <li>- air gauges</li> </ul>
<b>Course Outcome 3</b>	<b>Learning Objectives for Course Outcome 3</b>
3. Describe the components, adjusting mechanisms, and working principles of an optical comparator. (1 hr)	<p>3.1 Describe parts of an optical comparator:</p> <ul style="list-style-type: none"> <li>- illumination mechanism</li> <li>- surface illumination</li> <li>- table</li> <li>- dials</li> <li>- mylars</li> <li>- screen</li> <li>- micrometer dial</li> <li>- read out</li> <li>- angular settings/adjustments</li> <li>- linear settings/adjustments</li> </ul>

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	<ul style="list-style-type: none"> <li>- locks</li> <li>- magnification</li> <li>- on/off</li> </ul>
<b>Course Outcome 4</b>	<b>Learning Objectives for Course Outcome 4</b>
4. Set up workholding devices and accessories for an optical comparator. (0.5 hrs)	<p>4.1 Identify workholding devices and attachments:</p> <ul style="list-style-type: none"> <li>- vise</li> <li>- Vee-block</li> <li>- angle plates</li> <li>- fixtures</li> <li>- centres</li> </ul> <p>Demonstrate mounting, positioning, aligning, and securing procedures.</p>
<b>Course Outcome 5</b>	<b>Learning Objectives for Course Outcome 5</b>
5. Describe terminology and measuring techniques for an optical comparator. (0.5 hrs)	<p>5.1 Describe terms used in optical comparator measurement techniques:</p> <ul style="list-style-type: none"> <li>- accuracy</li> <li>- precision</li> <li>- tolerances</li> <li>- reliability</li> <li>- limits</li> <li>- fits</li> <li>- datums</li> <li>- discrimination</li> </ul> <p>Identify error sources in measurement and machine limitations:</p> <ul style="list-style-type: none"> <li>- inherent instrument error</li> <li>- observational error</li> <li>- manipulative error</li> <li>- bias error</li> <li>- parallel error</li> <li>- angular error</li> <li>- profile illumination</li> </ul>
<b>Course Outcome 6</b>	<b>Learning Objectives for Course Outcome 6</b>
6. Demonstrate operational procedures for an optical comparator. (1 hr)	<p>6.1 Describe cleaning techniques of calibrated test specimen surfaces.</p> <p>Identify features of workpiece to be checked.</p> <p>Select indicating gauges and comparators by determining:</p> <ul style="list-style-type: none"> <li>- type and applications</li> <li>- component to be checked</li> <li>- vibration errors</li> <li>- accessibility to location</li> <li>- predetermined values</li> <li>- temperature variations</li> <li>- graduating values</li> <li>- checking ranges</li> <li>- measuring ranges</li> <li>- surface comparison</li> <li>- magnification</li> </ul>

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	- illumination of part profile/part surface
<b>Course Outcome 7</b>	<b>Learning Objectives for Course Outcome 7</b>
7. Demonstrate measuring and checking techniques using an optical comparator. (1 hr)	7.1 Demonstrate cleaning techniques of workpiece surfaces. Describe geometric features to be measured and/or checked. Demonstrate measurement and checking of geometric features. Demonstrate inspection and recording techniques.
<b>Course Outcome 8</b>	<b>Learning Objectives for Course Outcome 8</b>
8. Describe the functions and operating principles of Coordinate Measuring Machines (CMM). (1 hr)	8.1 Describe cleaning techniques of workpiece surfaces. Describe calibration/orientation techniques. Identify features to be measured and/or checked. Describe recording techniques.

**Evaluation Process and Grading System:**

Evaluation Type	Evaluation Weight
Attendance, Participation and Attitude	5%
Final Test	50%
Mid term	25%
Quiz 1	10%
Quiz 2	10%

**Date:** September 3, 2020

**Addendum:** Please refer to the course outline addendum on the Learning Management System for further information.

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