



**CAMOSUN COLLEGE**  
School of Trades and Technology  
Department of Mechanical Engineering  
**MENG -244 Manufacturing Processes – II Winter 2021**

**COURSE OUTLINE**

The calendar description is available on the web @  
<http://camosun.ca/learn/calendar/current/web/meng.html#MENG244>

**Instructors:**

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**Lab Assistant:**

**Jese Dardengo**

**Pat Nicholson**

Lecture: Monday, 14:30 – 16:20 ..... [Remotely]

**Laboratory Time**

Tuesday, 11:30 – 14:20.....(BX01D)

Tuesday, 14:30 – 17:20.....(BX01C)

Thursday, 08:30 – 11:20.....(BX01B)

Friday, 08:30 – 11:30.....(BX01A)

Online office Hours: Monday: 12:30-13:00

Thursday: 11:30-12:30

**Short Description**

Students will be introduced to automated machine tools including CNC lathes and milling machines.

Using software, students will specify tools, set speeds and feeds and generate toolpaths to create machined parts. Work holding methods and tool selection will be reviewed. Use of laser cutter and 3D printing will also be explored.

**Detailed Description**

CAD/CAM is designed to help the student acquire knowledge and skill in the use of computer numerical control (CNC) using our Hass VF3, Tormach PCNC 1100 machines. Using software, students will specify tools, set speeds and feeds and generate toolpaths to create machined parts. Work holding methods and tool selection will be reviewed. Use of laser cutter “Hurricane Lasers” and Ultimake 3D printing will also be explored. Basic

concepts in numerical control and CNC machine tools, and programming procedures using G and M codes. Much of the learning will result from hands-on experience in manually programming, software design and setting up a CNC machines. Students will become familiar with CAD/CAM software to aid in programming our CNC machines. An emphasis will be placed on the synthesis of the skills, information, and ideas required for managerial decision-making.

### **Intended Learning Outcomes**

Upon successful completion of this course a student will be able to:

- Identify commonly used G and M codes used in Computer Numerical Control (CNC) machine tool programming.
- Apply computer aided manufacturing (CAM) software to specify tools, define the toolpath, and set feeds and speeds to create machining code for CNC lathes and milling machines.
- Specify different toolpath strategies.
- Select appropriate cutting tools for the machining operation.
- Plan the operation sequence for efficient part production.
- Plan a work holding strategy using jigs or fixtures.
- Manufacture a 2D part using a laser cutter.
- Manufacture a 3D part using a 3D printer.

### **In addition Outcomes:**

- Develop an understanding of the characteristics and scope of technology, identify theories, fundamentals, and specialized knowledge in the industrial operations control
- Understand the different components of CAM Environments and the relevance of CNC Systems
- Summarize the history of CNC machining
- Plan the operation sequence for efficient part production
- Describe the major mechanical and control components of a CNC machine and their functions
- Program a CNC machine and edit programs using common G codes, canned cycles, subprograms and M codes commands and how to write CNC programs with proper headers and footers
- Create a CNC program from a CAD drawing using a CAM for CNC lathes and milling machines
- Select appropriate cutting tools for the machining operation and specify different toolpath strategies and to use CNC control panel to edit a CNC Program
- create basic tool paths using CAM software
- translate drawing between CAD and CAM software
- turn on, initialize CNC machines and properly turn off CNC machines
- Choose and design an appropriate clamping mechanism (jigs or fixtures) for CNC milling machine
- Download a CNC program from a computer to CNC machines

- Solve computer numerical control machines problems in CAM
- Select and prepare work holding device(s) to hold parts of CNC machining operations and select and install proper cutting tools for CNC machining operations
- Zero set CNC machine so machine knows where the work piece is
- Offset tool length on all tools so machine knows the length of each tool and the location of each tool tip
- Offset the tool radius on appropriate tool
- Run CNC program for a new setup without a tool crash
- Calculate and make minor tool adjustments to produce parts within spec
- Utilize the PC-based commercial "CAM" software, to produce Computer Numerical Control (CNC) machine tool programs and prepare professional reports.

| <b>Evaluation Method:</b> | <b>Percentage</b> |
|---------------------------|-------------------|
| Quizzes                   | 05%               |
| Assignments               | 15%               |
| Midterm                   | 15%               |
| Laboratories              | 30%               |
| Project                   | 10%               |
| Final Exam                | 25%               |

**Supplies & Supplemental Materials:**

- Safety glasses,
- Safety boots,
- Electronic Vernier Caliper,
- USB flash drive,
- Notebook

**Teaching and Learning Methods**

- Lectures//Demonstration
- Practical training / laboratory
- Class activity
- Assignments
- Computer work/Email/ Desire-2-Learn (D2L)

**LABS:** Labs will be conducted using computers in TEC 145 and CNC machines in TEC 129.

**Laboratory Reports:**

Formal laboratory reports are expected for each lab. The reports are due one week after the lab period. There will be one lab report for each student.

**Important Notes:**

In order to pass the course, attendance is mandatory during lectures and successful completion of all labs. There will be no make-up quizzes, assignments or exams. If you miss any, you will be assigned a grade of Zero for that particular evaluation type.

## College Supports, Services and Policies

### COVID-19 Safety Plan

- Please complete your COVID 19 Safety Training  
<https://webservices.camosun.ca/covid-safestart-student/story.html>
- Use the BC COVID-19 Self-Assessment tool before attending campus for the first time and self-monitor for symptoms on a daily basis for each subsequent visit  
<https://bc.thrive.health/covid19/en>
- Follow established COVID-19 protocols and guidelines
- Report any observed unsafe conditions or acts as they pertain to COVID-19 to faculty or staff
- Understand how, and when, to report potential COVID-19 exposure incidents



### Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <http://camosun.ca/about/mental-health/emergency.html> or <http://camosun.ca/services/sexual-violence/get-support.html#urgent>

### College Services

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <http://camosun.ca/>

### College Policies

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <http://camosun.ca/about/policies/>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

A. GRADING SYSTEMS <http://www.camosun.bc.ca/policies/policies.php>  
 The following two grading systems are used at Camosun College:

1. Standard Grading System (GPA)

| Percentage | Grade | Description                          | Grade Point Equivalency |
|------------|-------|--------------------------------------|-------------------------|
| 90-100     | A+    |                                      | 9                       |
| 85-89      | A     |                                      | 8                       |
| 80-84      | A-    |                                      | 7                       |
| 77-79      | B+    |                                      | 6                       |
| 73-76      | B     |                                      | 5                       |
| 70-72      | B-    |                                      | 4                       |
| 65-69      | C+    |                                      | 3                       |
| 60-64      | C     |                                      | 2                       |
| 50-59      | D     |                                      | 1                       |
| 0-49       | F     | Minimum level has not been achieved. | 0                       |

2. Competency Based Grading System (Non GPA)

This grading system is based on satisfactory acquisition of defined skills or successful completion of the course learning outcomes

| Grade | Description   |
|-------|---|
| COM   | The student has met the goals, criteria, or competencies established for this course, practicum or field placement.   |
| DST   | The student has met and exceeded, above and beyond expectation, the goals, criteria, or competencies established for this course, practicum or field placement. |
| NC    | The student has not met the goals, criteria or competencies established for this course, practicum or field placement.  |

## B. Temporary Grades

Temporary grades are assigned for specific circumstances and will convert to a final grade according to the grading scheme being used in the course. See Grading Policy at <http://www.camosun.bc.ca/policies/E-1.5.pdf> for information on conversion to final grades, and for additional information on student record and transcript notations.

| <b>Temporary Grade</b> | <b>Description</b>  |
|------------------------|---|
| I                      | <i>Incomplete:</i> A temporary grade assigned when the requirements of a course have not yet been completed due to hardship or extenuating circumstances, such as illness or death in the family.   |
| IP                     | <i>In progress:</i> A temporary grade assigned for courses that are designed to have an anticipated enrollment that extends beyond one term. No more than two IP grades will be assigned for the same course.   |
| CW                     | <i>Compulsory Withdrawal:</i> A temporary grade assigned by a Dean when an instructor, after documenting the prescriptive strategies applied and consulting with peers, deems that a student is unsafe to self or others and must be removed from the lab, practicum, worksite, or field placement. |