

COURSE SYLLABUS



COURSE TITLE: MENG 244 - Manufacturing Processes 2

CLASS SECTION: X01 – A, B, and C

TERM: W2023

COURSE CREDITS: 3

DELIVERY METHOD(S): Lecture, Labs

For COVID-19 information please visit <https://camosun.ca/about/covid-19-updates>

Camosun College campuses are located on the traditional territories of the Lək̓ʷəŋən and WSÁNEĆ peoples. We acknowledge their welcome and graciousness to the students who seek knowledge here.

Camosun College requires mandatory attendance for the first-class meeting of each course. If you do not attend and do not provide your instructor with a reasonable explanation in advance, you will be removed from the course and the space offered to the next waitlisted student.

INSTRUCTORS DETAILS

Salah Elfurjani - Lectures and Labs (X01 A, B, and C)

Lecture: Friday, 09:30 – 11:20 am.

Laboratory Time table:

Monday, Tuesday, and Wednesday: 14:30 – 17:20 (X01, C, B, and A respectively)

EMAIL: elfurjanis@camosun.bc.ca

OFFICE: TEC 261

Office HOURS: Schedule on the office door or email me to arrange an appointment.

Laboratory technicians: Anika Anderson aandersen@camosun.bc.ca and

Pat Nicholson NicholsonP@camosun.bc.ca

As your course instructor, I endeavour to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me. Camosun College is committed to identifying and removing institutional and social barriers that prevent access and impede success.

CALENDAR DESCRIPTION

Students will be introduced to automated machine tools including CNC (Computer numerical control) lathes and milling machines. Using the CAD/CAM software (Computer-aided design & computer-aided manufacturing), which is used to design and manufacture prototypes, finished products, and production runs of products. Also, students will specify tools, set speeds, and feeds, and generate toolpaths to create machined parts. Work-holding methods and tool selection will be reviewed. The use of laser cutting, Waterjet, and 3D printing will also be explored.

PREREQUISITE(S): one of

All of:

C in MENG 141

PRE OR CO-REQUISITES

All of:
C in MENG 152

COURSE LEARNING OUTCOMES / OBJECTIVES

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

- 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 use the 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 the 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 the machine knows where the workpiece is
- Offset tool length on all tools so the machine knows the length of each tool and the location of each tooltip
- Offset the tool radius on the appropriate tool
- Run the CNC program for a new setup without a tool crash
- Calculate and make minor tool adjustments to produce parts within the spec
- Utilize the PC-based commercial "CAM" software, to produce Computer Numerical Control (CNC) machine tool programs and prepare professional reports.
- Ensure that our students are well-trained in interpersonal skills and teamwork.

REQUIRED MATERIALS & RECOMMENDED PREPARATION / INFORMATION

Texts: No textbook is required for this course. In addition to the lecture notes, occasional handouts will be provided.

Other:

- Safety glasses,
- 6" Digital Caliper,
- USB flash drive,
- Notebook

COURSE SCHEDULE, TOPICS, AND ASSOCIATED PREPARATION / ACTIVITY / EVALUATION

The following schedule and course components are subject to change with reasonable advance notice, as deemed appropriate by the instructor.

Lab Topics (Spread over the 14-week term):

Students will obtain hands-on experience working on projects using typical machine shop equipment. Lab experience will reinforce understanding of lecture topics

WEEK or DATE RANGE	ACTIVITY or TOPIC-Lecture	ACTIVITY or TOPIC- Lab
1	<p>Workshop Safety</p> <p>Introduction to NC/CNC machines, applications of NC, History of various NC machines and their development, and Machine Control Unit (MCU) in CNC.</p> <p>Introduction to Computer-Aided Manufacturing (SolidWorks CAD/CAM package)</p>	<p>Workshop Safety Overview:</p> <ul style="list-style-type: none"> Workshop Clothing Safety Awareness Personal Conduct & workshop Etiquette General Safety Practices CNC Safety Practices <p>Introduction to programming using CAD/CAM system:</p> <ul style="list-style-type: none"> 2-D contour Pockets/Nameplate Pocketing, Slot, Milling, Chamfer, Milling <p>CNC Operation:</p> <ul style="list-style-type: none"> Identify the CNC machine Control. Identify the Keyboard. Describe the Start/Home Machine procedure. Describe the Load Tools procedure. Describe the Tool Length Offset for each tool. Verify part zero offset (XY) using MDI. Describe the setting tool offset. Verify Tool Length offset using MDI.

2	<p>Principle of operation of a numerically controlled machine</p> <p>Computer control concepts and introduction to CNC Machine programming, Automatic tool changer standard tool carousel Commonly used preparatory G-codes Commonly used miscellaneous M-codes</p> <p>Introduction to programming using CAD/CAM system</p>	<p>Computer-Aided Manufacturing/ Manufacturing of: 2D milling and drilling. Toolpaths by Type and Use 2D Machining Features 2D Toolpath Terminology Facing, 2D Contouring Hole Making (Center Drill, Drilling)</p> <p>CNC Operation: Describe the procedure of the load CNC program. Describe the procedure for saving the CNC program. Explain how to run the CNC program. Describe the use of cutter diameter compensation. Describe the shutdown program. Shut Down CNC</p>
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WEEK or DATE RANGE	ACTIVITY or TOPIC-Lecture	ACTIVITY or TOPIC- Lab
3	<p>Part programming fundamentals, Manual part programming methods</p> <p>Classification of CNC machines Motors, Stepper Motors, Servo Motors, Encoders</p>	<p>CNC Milling/conversational programming 2D milling and drilling.</p> <p>Opening a Solid Model File in SolidWorks CAM: SolidWorks CAM User Interface Machine Job Setup and Geometry Creation, Generating Machining Tool Paths, Tool Path Verification and Simulation and Post Processing</p>
4	<p>Coordinate Systems Cartesian Coordinate System Machine reference systems and Tool offsets</p>	<p>Computer-Aided Manufacturing/ Manufacturing of: 3-D Machining using ball nose cutters</p>
5	<p>CNC Language and Structure Program Format Creating a Manual part of the program Absolute vs. Incremental (XYZ vs. UVW) Inch/Metric Input Designation</p>	<p>Computer-Aided Manufacturing/ Manufacturing of: Multi-Surface Features and 3 Axis Contouring with SOLIDWORKS CAM</p>
6	<p>2D Milling Toolpaths Using Canned cycles: Create the program to spot and drill</p>	<p>Computer-Aided Manufacturing/ Manufacturing of: CNC lathe / conversational programming Lathe CAM Programming. Profiling, Facing, Turning, Tapering, Auto Chamfer, Line, Arcs, Cut-off.</p>

7 and 8	<p>Straight-line milling – linear interpolation and circular interpolation,</p> <p>Working principle of CNC Lathe, Turning Centers</p>	<p>Computer-Aided Manufacturing/ Manufacturing of:</p> <p>Lathe Conversational Programming: Profiling, Threading, Grooving, Facing, Turning, Tapering, Drilling and Tapping, Auto Chamfer, Line, Arcs, Cut-off.</p>
9	<p>Cutter radius/tool nose radius compensation Concept: Tool Nose Radius and Wear Offset Tool Nose Compensation and Tool Length Geometry Tool Nose Compensation in Canned Cycles</p> <p>Automating support functions: Skip Function and Program interrupt Function</p> <p>Microprograms and differences from Subprograms</p>	<p>Computer-Aided Manufacturing/ Manufacturing of:</p> <p>4-axis toolpath to machine a rotary helical/spiral flute</p>
WEEK or DATE RANGE	ACTIVITY or TOPIC-Lecture	ACTIVITY or TOPIC- Lab
10 and 11	<p>Programming CNC turning centers</p> <p>Preparatory Functions (G-Codes) and Miscellaneous Functions (M-Codes)</p> <p>Tool Function, Feed Function, Spindle Function</p>	<p>Computer-Aided Manufacturing/ Manufacturing of:</p> <p>Rapid prototyping using subtractive technology and CNC laser cut</p>
12 and 13	<p>Coordinate Systems for the Programming of CNC Turning Centers</p> <p>Program Structure for CNC Turning Centers, Multiple Repetitive Cycles, Programming for the Tool Nose Radius</p>	<p>Working on the final project</p>
14	<p>Review</p> <p>CNC programming and the project process</p>	<p>Working on the final project</p>

Students registered with the Centre for Accessible Learning (CAL) who complete quizzes, tests, and exams with academic accommodations have booking procedures and deadlines with CAL where advanced notice is required. Deadlines can be reviewed on the [CAL exams page](http://camosun.ca/services/accessiblelearning/exams.html). <http://camosun.ca/services/accessiblelearning/exams.html>

EVALUATION OF LEARNING

DESCRIPTION	WEIGHTING
Assignments	15
Quizzes	06
Midterm	15
Final Exam	25
Labs and	24
Project and final report	15
	TOTAL
	100%

If you have a concern about a grade you have received for an evaluation, please come and see me as soon as possible. Refer to the [Grade Review and Appeals](http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf) Policy for more information. <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf>

COURSE GUIDELINES & EXPECTATIONS

Lecture, laboratories, and tutorials Attendance

In order to pass the course, attendance is mandatory during lectures and successful completion of any assigned labs.

Due Dates and Late Assignments

The due dates are established in accordance with the course and term duration. The purpose of the due dates is to help both you and I to get the assignments done so that they can be assessed in a timely manner. Just as you need time to complete the assignments, I need enough time to grade them. As such, the due dates are fixed (unless you have an approved academic accommodation through CAL) and it is expected that students will hand in assignments on time. Assignment marks, comments, and feedback will be returned to students in a timely manner, usually within 1-3 weeks, depending on the length of the assignment.

All assignments must be handed in by the time indicated (on the assignment, or on D2L). Late assignments may be graded but marks equivalent to 10% of the total value of the assignment will be deducted for each day, inclusive of days on the weekend, past the deadline. If assignments have already been marked and returned, a late assignment will not be accepted. Assignments will not be accepted that are late more than three days, inclusive of days over the weekend.

Exam Procedures

All exams must be written at the scheduled times with the exception of students requiring an accommodation by CAL. It is understood that emergency circumstances do occur (e.g. severe illness or family emergency); for such circumstance's accommodation may be offered at the discretion of the instructor, provided the student:

- a) notifies the instructor in advance of the exam (not after), and
- b) provides documented evidence of the circumstance (e.g. medical certificate).

If an exam is missed with an excused absence, it is up to the instructor's discretion as to how the mark will be made up. In most cases, an oral exam will be scheduled for the student as soon as possible.

Be sure not to make travel plans for the end of semester until the final exam schedules are finalized and posted. Please ask any family members who might make travel plans on your behalf to consult you before booking tickets.

Please note: the use of cell phones during a test or quiz is not allowed and may result in a zero for that assessment.

Study Habits

Good and regular study habits are essential to do well in this course. You should plan on a weekly minimum of 6 hours outside of scheduled class time for the completion of readings, assignments and for general studying. Joining a study group can help make this more achievable.

Lecture presentations will be uploaded to the course website. These should be used as a study guide, not as your sole source of information. You will need to write down additional key words for examples and explanations given during lecture and review text and videos to support your understanding. It is also recommended practice to transform lecture notes into a study-friendly format after each lecture, incorporating additional information from your textbook. Study these notes before the next class to prepare yourself for new material, which will often build on previously covered material. Please take advantage of office hours if you need extra clarification and help.

SCHOOL OR DEPARTMENTAL INFORMATION

Taking Good Care of Yourself:

A note to remind you to take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep and taking some time to relax like meditation, yoga. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. You are not alone.

STUDENT RESPONSIBILITY

Enrolment at Camosun assumes that the student will become a responsible member of the College community. As such, each student will display a positive work ethic, assist in the preservation of College property, and assume responsibility for their education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

SUPPORTS AND SERVICES FOR STUDENTS

Camosun College offers a number of services to help you succeed in and out of the classroom. For a detailed overview of the supports and services visit <http://camosun.ca/students/>.

Academic Advising	http://camosun.ca/advising
Accessible Learning	http://camosun.ca/accessible-learning
Counselling	http://camosun.ca/counselling
Career Services	http://camosun.ca/coop
Financial Aid and Awards	http://camosun.ca/financialaid
Help Centers (Math/English/Science)	http://camosun.ca/help-centres
Indigenous Student Support	http://camosun.ca/indigenous
International Student Support	http://camosun.ca/international/
Learning Skills	http://camosun.ca/learningskills
Library	http://camosun.ca/services/library/
Office of Student Support	http://camosun.ca/oss
Ombudsperson	http://camosun.ca/ombuds
Registration	http://camosun.ca/registration
Technology Support	http://camosun.ca/its
Writing Centre	http://camosun.ca/writing-centre

If you have a mental health concern, please contact Counselling to arrange an appointment as soon as possible. Counselling sessions are available at both campuses during business hours. If you need urgent support after-hours, please contact the Vancouver Island Crisis Line at 1-888-494-3888 or call 911.

COLLEGE-WIDE POLICIES, PROCEDURES, REQUIREMENTS, AND STANDARDS

Academic Accommodations for Students with Disabilities

The College is committed to providing appropriate and reasonable academic accommodations to students with disabilities (i.e. physical, depression, learning, etc). If you have a disability, the [Centre for Accessible Learning](http://camosun.ca/services/accessible-learning/) (CAL) can help you document your needs, and where disability-related barriers to access in your courses exist, create an accommodation plan. By making a plan through CAL, you can ensure you have the appropriate academic accommodations you need without disclosing your diagnosis or condition to course instructors. Please visit the CAL website for contacts and to learn how to get started: <http://camosun.ca/services/accessible-learning/>

Academic Integrity

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e1.13.pdf> for policy regarding academic expectations and details for addressing and resolving matters of academic misconduct.

Academic Progress

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e1.1.pdf> for further details on how Camosun College monitors students' academic progress and what steps can be taken if a student is at risk of not meeting the College's academic progress standards.

Course Withdrawals Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e2.2.pdf> for further details about course withdrawals. For deadline for fees, course drop dates, and tuition refund, please visit <http://camosun.ca/learn/fees/#deadlines>.

Grading Policy

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf> for further details about grading.

Grade Review and Appeals

Please visit <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.14.pdf> for policy relating to requests for review and appeal of grades.

Mandatory Attendance for First Class Meeting of Each Course

Camosun College requires mandatory attendance for the first class meeting of each course. If you do not attend, and do not provide your instructor with a reasonable reason in advance, you will be removed from the course and the space offered to the next waitlisted student. For more information, please see the "Attendance" section under "Registration Policies and Procedures"

(<http://camosun.ca/learn/calendar/current/procedures.html>) and the Grading Policy at <http://camosun.ca/about/policies/education-academic/e-1-programming-and-instruction/e-1.5.pdf>.

Medical / Compassionate Withdrawals

Students who are incapacitated and unable to complete or succeed in their studies by virtue of serious and demonstrated exceptional circumstances may be eligible for a medical/compassionate withdrawal. Please visit <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.8.pdf> to learn more about the process involved in a medical/compassionate withdrawal.

Sexual Violence and Misconduct

Camosun is committed to creating a campus culture of safety, respect, and consent. Camosun's Office of Student Support is responsible for offering support to students impacted by sexual violence. Regardless of when or where the sexual violence or misconduct occurred, students can access support at Camosun. The Office of Student Support will make sure students have a safe and private place to talk and will help them understand what supports are available and their options for next steps. The Office of Student Support respects a student's right to choose what is right for them. For more information see Camosun's Sexualized Violence and Misconduct Policy: <http://camosun.ca/about/policies/education-academic/e-2student->

services-and-support/e-2.9.pdf and camosun.ca/sexual-violence. To contact the Office of Student Support: oss@camosun.ca or by phone: 250-370-3046 or 250-3703841

Student Misconduct (Non-Academic)

Camosun College is committed to building the academic competency of all students, seeks to empower students to become agents of their own learning, and promotes academic belonging for everyone. Camosun also expects that all students to conduct themselves in a manner that contributes to a positive, supportive, and safe learning environment. Please review Camosun College's Student Misconduct Policy at <http://camosun.ca/about/policies/education-academic/e-2-student-services-and-support/e-2.5.pdf> to understand the College's expectations of academic integrity and student behavioural conduct.

Changes to this syllabus: Every effort has been made to ensure that information in this syllabus is accurate at the time of publication. The College reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.