The **University** *of* **Western Ontario**
Department of Mechanical & Materials Engineering

MME 4459a – "Computer Numerically Controlled (CNC) Machining"

COURSE OUTLINE - 2013-2014

CALENDAR DESCRIPTION:

Principle of CNC part programming; tooling and work-holding devices; machine tool position and motion control systems; automatic tool changers and machining centres; kinematics and mechanics of milling operations; part programming using CAD/CAM systems.

PREREQUISITES:

MME 3381a/b.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

COURSE INFORMATION:

Instructor: Professor R. Tutunea-Fatan
Office: SEB 2063A; Phone 519-661-2111, ext. 88289
E-mail: rtutunea@eng.uwo.ca

Lectures: M, W 9:30-10:30 (SEB 2094)

Labs: M 2:30-4:20 or Tu 2:30-4:20 or Tu 4:30-6:20 or W 3:30-5:20 or W 5:30-7:20 (all in SEB 37A)

CONSULTATION HOURS:

To be announced.

ACCREDITATION UNITS:

Engineering Science = 75%, Engineering Design = 25%

TOPICS:

1. Introduction to Computer Numerical Control Systems
2. Word Address Programming
3. Milling Operations
4. CNC Position and Motion Control Systems
5. Shop Activities
6. CNC Machining Centers
7. Modern Computer-Aided Part Programming

SPECIFIC OBJECTIVES:

At the end of each section you should be able to understand and apply in practice the knowledge accumulated on the following subjects:

Section 1
- historical notes on CNC technology
- conventional vs. NC vs. CNC machining technology
- structure and axes of motion for CNC machine tools

Section 2
- NC programming language (G-code) format
- linear and circular interpolation in part programming
- "canned" programming cycles for drilling and auxiliary hole operations
- part origin and tool length offset setup
- advantages and restrictions in using cutter diameter compensation
- NC programming with cutter diameter compensation on

Section 3
- basics of machining and milling operations

- classification of milling operations
- climb (down) milling vs. conventional (up) milling
- cutting tools: types, geometry and materials
- cooling fluids
- determination of process parameters for milling
- three vs. five-axis CNC machining

Section 4
- types of numerical controllers
- open and closed loop control systems
- components for position and motion of control systems
- measures of accuracy and repeatability of CNC machines

Section 5
- typical tool shop activities
- workholding principles and devices

Section 6
- types of CNC machining centers
- tool holding principles and devices
- tool/workpiece changing systems

Section 7
- types of part programming
- automated part programming using CAM software
- CL data and NC post-processors
- additive manufacturing/3D printing
- future trends in CNC technology: STEP-NC

GENERAL LEARNING OBJECTIVES:

Knowledge Base	X	Individual Work	X	Ethics and Equity	
Problem Analysis	X	Team Work	X	Economics and Project Management	X
Investigation	X	Communication	X	Life-Long Learning	
Design	X	Professionalism	X		
Engineering Tools	X	Impact on Society	X		

CONTACT HOURS: 2 lecture hours, 2 tutorial hours per week, 0.5 laboratory hour, half course.

RECOMMENDED TEXTBOOK: Valentino, J. V. and Goldenberg, J., *Introduction to Computer Numerical Control (CNC)*, 5th Edition, Prentice Hall, 2012.

Tickoo, S., *Edgecam 11.0 for Manufacturers*, CADCIM Technologies, 2007.

UNITS: SI

EVALUATION: Term assignments and projects will be handed out and collected according to the following **tentative** schedule:

Evaluation Format	Weight	Handed Out	Deadline
Assignment 1	5%	Week of Sep. 30th	Week of Oct. 21st
Assignment 2	5%	Week of Oct. 28th	Week of Nov. 18th
Assignment 3	5%	Week of Nov. 18th	Week of Dec. 2nd

Evaluation Format	Weight	Handed Out	Deadline
Project 1	10%	Week of Sep. 9th	Week of Sep. 23rd
Project 2	10%	Week of Sep. 30th	Week of Oct. 28th
Project 3	15%	Week of Nov. 4th	Week of Dec. 2nd

Please note that:
- Lab session attendance is **mandatory**.
- Final examination carries a weight of 50% in the final course grade.
- Only non-programmable calculators will be allowed during final examination (closed book).
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

ENGLISH: In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

CLASSROOM DEMEANOR: The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion. This includes arriving at lectures on time, and acting in a professional manner during class.

ATTENDANCE: Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

CHEATING: University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning. (see Scholastic Offence Policy in the Western Calendar.

SSD: Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.

NOTE: Students who have failed an Engineering course (i.e. < 50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.