Western University
Department of Mechanical & Materials Engineering

MME 4459a – Advanced CAE: Manufacturing Technologies

COURSE OUTLINE - 2017-2018

CALENDAR DESCRIPTION: This course is an introduction to modern computer aided manufacturing technologies. Topics include subtractive technologies, such as computer-numerically controlled (CNC) machining, as well as additive technologies used for rapid prototyping purposes.

COURSE INFORMATION:

Instructor:	Professor R. Tutunea-Fatan Office: SEB 2063A; Phone 519-661-2111, ext. 88289 E-mail: rtutunea@eng.uwo.ca
Lectures:	M 12:30 – 1:30 (HSB 9) F 1:30 – 2:30 (SEB 3109)
Labs:	M 9:30 – 11:30 (SEB 37) M 2:30 – 4:30 (SEB 37) Tu 10:30 – 12:30 (SEB 37) Tu 12:30 – 2:30 (SEB 37) W 9:30 – 11:30 (SEB 37) W 1:30 – 3:30 (SEB 37)

PREREQUISITES: MME 3379A/B or MSE 3301A/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.

CONSULTATION HOURS: By advance notice via email or drop in.

ACCREDITATION UNITS: Engineering Science = 100%

TOPICS:

1. Introduction to computer-assisted manufacturing technologies
   - Generalities on computer-assisted manufacturing
   - Subtractive and additive manufacturing processes

2. Subtractive manufacturing: computer numerically-controlled (CNC) machining
   - Historical notes on CNC machining
   - Conventional vs. NC vs. CNC machining
   - Word address programming (G-code)
   - Milling operations
   - CNC position and motion control systems
   - Shop activities
   - CNC machining centers
   - Computer-aided part programming (CAM)

3. Additive manufacturing (AM)
   - Historical notes on AM
   - Generic AM process
   - Types of AM processes
   - Software issues for AM
   - Practical applications of AM
   - CNC machining vs. AM

LEARNING OUTCOMES

Upon the successful completion of the course, students will:

- Understand, assess and apply the advantages and limitations of the subtractive and additive manufacturing processes
- Design mechanical components that address the limitations of the manufacturing process used to produce them in terms of: dimensional precision, surface quality, and cost constraints
- Evaluate and implement setups and workholding methods that allow a fast, accurate and safe generation of the intended geometry
- Select cutting tools and process parameters that are in agreement with machine tool available and surfaces/material being cut
- Use computer-aided manufacturing (CAM) software to generate tool paths to be followed by the CNC machine and/or 3D printer
- Read and troubleshoot NC programs written in standard G-code format
- Observe the principles of a safe working environment

CONTACT HOURS: 2 lecture hours/week, 2 laboratory hours/week, 0.5 course

RECOMMENDED TEXTBOOKS:

Valentino J.V., Goldenberg J., *Introduction to Computer Numerical Control (CNC)*, 5th Edition, Prentice Hall, 2013

Gibson I., Rosen D.W., Stucker B., Additive Manufacturing Technologies, Springer-Verlag, 2009

Groover M.P., Fundamentals of Modern Manufacturing, 5th Edition, Wiley, 2012

EVALUATION:

The final course grade will be determined according to the following weighting scheme:

Assignments	15%
Projects	35%
Final examination (closed book)	50%

Please note that:

- Lab session attendance is mandatory.
- Only non-programmable calculators will be allowed during the final examination.
- If a minimum of 50% is not obtained on the final examination, the student cannot receive a final mark greater than 48%.

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

Evaluation Format	Weight	Effort Type	Assigned	Due
Assignment 1	5%	Individual	Week of Sep. 25th	Week of Oct. 9th
Assignment 2	5%	Individual	Week of Oct. 30th	Week of Nov. 13th
Assignment 3	5%	Individual	Week of Nov. 20th	Week of Dec. 4th
Project 1	10%	Team	Week of Sep. 11th	Week of Sep. 25th
Project 2	15%	Team	Week of Oct. 2nd	Week of Nov. 13th
Project 3	10%	Team	Week of Nov. 20th	Week of Dec. 4th

Term coursework topics:

- Assignment 1: Manual part programming
- Assignment 2: Machining process parameters
- Assignment 3: Motion control systems
- Project 1: Manual part programming
- Project 2: CAM software-assisted part programming
- Project 3: CNC machining vs. AM of complex surfaces

UNITS: Metric and US customary.

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.