CARLETON UNIVERSITY
School of Industrial Design

IDES 4101 – Advanced Manufacturing - Winter 2019

Instructors
Paul Durocher (first half) Gerry Kanter (second half)

Office
Sessional Instructor Office
Email: gerardo.kanter@carleton.ca
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Office Hours
Office hours are by appointments, please send an email to schedule

Teaching Assistants
TBD

Time and Location
Lectures             Friday    06:00 - 7:00pm   3101 Canal Building
Lab Modules         Friday    07:15 - 9:00pm   3101 Canal Building
Lab Hours            Schedule TBD

Course Description
Directed study in the field of manufacturing, centered on such topics as: cost analysis, new materials and processes, computer aided manufacturing, numerically controlled machining, machining of moulds, etc.. Prerequisite(s): IDES 2101 and IDES 2102.

Learning Outcomes
The focus of this class will be on giving students a glimpse into the theory, tools and applications used in industry to automate and digitize production processes. Lectures will cover fundamental knowledge of advanced manufacturing technology issues and themes. The labs will include more practical and hands on examples used to develop code, programming basics and inspection routines for machine automation.

Course Format
Course materials for this class will be delivered to students through lectures and lab sessions. Typically, during the lecture portion of this class, materials will be presented to students via exercises or slide decks, followed by live demonstrations. For the lab portion of the class, students may be required to work in groups to complete the in-class assignment. Additional homework assignments will be assigned on specific weeks and must be completed at specified dates.

Assignments:

LAB 1 Manual programming (CNC) In this Lab students will learn the proper format and syntax to write a g-code program based on a technical drawing to cut a simple part.

LAB 2 2.5D CAM (CAM programming) The second module introduce students to 2.5D programming with the aid of computer software. They will learn how to create various type of toolpaths and output a useable CNC program.

LAB 3 3D CAM (CNC) The third lab will introduce full 3D CAM programming, allowing students to create toolpaths for contoured surfaces. Students will design a simple part and program it from stock to finished model, the part will later be machined.
LAB 4 Digital Modeling (Rapid Prototyping) the third module will introduce the concept of digital prototypes. Students will learn about digitizing technology use and applications along with the workflows needed to convert 3D scan data into usable solid models.

LAB 5: Digital Measurement (Inspection & Quality) In this las module student will learn about the field of metrology (the science of measurement). They will also be introduced to how industry uses sensors and software to automate quality control and part inspection.

CASE STUDY Students will use a set of case studies to apply what they learn in class though readings, videos, discussions and labs to develop a written recommendation report from the point of view of an analyst, highlighting opportunities, risks and challenges faced by a business looking to implement advanced manufacturing into their production systems.

Course Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Theme</th>
<th>Notes</th>
<th>Assigned</th>
<th>Due</th>
<th>Lecturer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1</td>
<td>Jan 11</td>
<td>G Code</td>
<td>Introduction</td>
<td>Lab 1</td>
<td></td>
<td>Paul</td>
</tr>
<tr>
<td>Week 2</td>
<td>Jan 18</td>
<td>2.5D CAM</td>
<td>File creation</td>
<td>Lab 2</td>
<td>Lab 1</td>
<td>Paul</td>
</tr>
<tr>
<td>Week 3</td>
<td>Jan 25</td>
<td>3D CAM</td>
<td>Machine Setup</td>
<td>Lab 2</td>
<td></td>
<td>Paul</td>
</tr>
<tr>
<td>Week 4</td>
<td>Feb 1</td>
<td>3D CAM</td>
<td>Design Workflow</td>
<td>Lab 3</td>
<td></td>
<td>Paul</td>
</tr>
<tr>
<td>Week 5</td>
<td>Feb 8</td>
<td>3D CAM</td>
<td>Cutting Parts</td>
<td></td>
<td></td>
<td>Paul</td>
</tr>
<tr>
<td>Week 6</td>
<td>Feb 15</td>
<td>3D CAM</td>
<td>Class Transition</td>
<td></td>
<td></td>
<td>Paul</td>
</tr>
<tr>
<td>Week 7</td>
<td>Feb 18-22</td>
<td>READING BREAK</td>
<td></td>
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<tr>
<td>Week 8</td>
<td>Mar 1</td>
<td>Rapid Prototyping</td>
<td>Mesh Editing</td>
<td>Lab 4</td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 9</td>
<td>Mar 8</td>
<td>Rapid Prototyping</td>
<td>Modeling Tools</td>
<td></td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 10</td>
<td>Mar 15</td>
<td>Digital Inspection</td>
<td>Intro to Metrology</td>
<td></td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 11</td>
<td>Mar 22</td>
<td>Digital Inspection</td>
<td>Setting up parts</td>
<td>Lab 5</td>
<td>Lab 4</td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 12</td>
<td>Mar 29</td>
<td>Statutory Holiday.</td>
<td>University closed.</td>
<td></td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 13</td>
<td>Apr 5</td>
<td>Digital Inspection</td>
<td>Best Practices</td>
<td>Lab 5</td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 14</td>
<td>Apr 9</td>
<td>Digital Inspection</td>
<td>Make up class moved to Wednesday</td>
<td></td>
<td></td>
<td>Gerry</td>
</tr>
<tr>
<td>Week 15</td>
<td>Apr. 27</td>
<td></td>
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<td></td>
<td>Case Study</td>
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Course Requirements

We will be using advanced commercial software which requires a computer system with lots of memory and a good video card. Most of the applications for this course are windows based, which means students should use a PC to ensure optimal performance.

Students with a Mac system can try using bootcamp to install and run the software; however, they should be aware of potential installation or instability issues related to using their systems in this mode.

This is an advanced course, which means students should have a basic knowledge of circuits and electronics. Students will also need a three-button mouse with a wheel as the middle button. We cannot guarantee proper operation of the software by use of a touch-pad alone. We also recommend students share a pair of calipers since we will be using them for precision measurements.

Course Evaluation

<table>
<thead>
<tr>
<th>Lab</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>LAB 1 - G-Code</td>
<td>10% (Lab 1)</td>
</tr>
<tr>
<td>LAB 2 - 2.5D CAM</td>
<td>15% (Lab 2)</td>
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<tr>
<td>LAB 3 - 3D CAM</td>
<td>25% (Lab 2)</td>
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<tr>
<td>LAB 4 - Rapid Prototyping</td>
<td>10% (Lab 3)</td>
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<tr>
<td>LAB 5 - Quality Inspection</td>
<td>10% (Lab 4)</td>
</tr>
<tr>
<td>Case Study- Report</td>
<td>30% (Individual)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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Individual/Group Work

Courses may include various combinations of individual and group work. Students must demonstrate individual aptitude. It is important where collaborative work is undertaken that students be able to clearly demonstrate that individual contribution has been made. Where the evaluation for individual work is below a passing grade, that grade will be awarded for the course.

Exam Attendance

Attendance to scheduled exams is mandatory. **Failure to attend will result in a grade of F.** If you are not able to attend an exam, you are required to call the General Office (613-520-5672) and/or send an email to id@carleton.ca to leave a message in advance. A comprehensive medical certificate or other documentation to substantiate the absence must be submitted as soon as possible after the review. The documentation must state the date of illness onset, the expected date of recovery, and the extent to which the student is incapacitated. The student is also required to set up a meeting with the instructor as soon as he or she is well enough to discuss and schedule an alternative date.

Instructional Offenses / Plagiarism

The regulations of the university require that we bring to your attention to Regulations on Instructional Offenses, descriptions of which can be found in the current Carleton University Undergraduate Calendar. At the same time, it seems that students do not always understand the meaning of plagiarism and how to avoid it. In industrial design, true and unique originality is difficult. Ideas and concepts come from a multitude of sources to be modified and utilized in the design and development process. A mature designer understands the need to seek out and acknowledges other successful solutions. The challenge for the student of industrial design is to learn how to develop this understanding.
Late Submission of Deliverables

Course Deliverables for reviews and other due dates
All deliverables submitted late will accrue a 10% per day deduction from the determined grade, to a maximum of 3 days, from the original deadline time and date. Failure to submit within 3 days, without approval from the instructor, will result in a grade of F.

Participation and Professionalism
Active participation and professional conduct are particularly important in studio courses and will be evaluated. At the same time, when the student’s work is reviewed at the end of the course, an evaluation will be made based on one or more of the following: in class discussion; consultations with instructors; and work ethic. However, none of these evaluations will be used to raise an overall failing grade, to a passing one, based on the quality of the work.

Student Access to Quiz, Test, and Exam Papers
Examinations are for evaluation purposes only and will not be returned to the student.

Student Considerations & Responsibilities

Requests for Academic Accommodation
You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Pregnancy obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: https://carleton.ca/equity/accommodation/

Religious obligation
Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website: https://carleton.ca/equity/accommodation/

Academic Accommodations for Students with Disabilities
If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made.

Survivors of Sexual Violence
As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities
Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom
experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf For more information on academic accommodation, please contact the departmental administrator or visit: students.carleton.ca/course-outline

**Student Responsibility**
The student is responsible for knowing the content of this course outline, the schedule of classes, assignments, and examinations; and material covered during any absence from scheduled classes. Students are also required to attend all lectures and labs as scheduled, and submit their finished work as required.

**Class Schedule**
Unless otherwise arranged, the class will meet during regularly scheduled studio hours. These meetings are mandatory; important issues and questions will be raised, and announcements might be made. Everyone is expected to be based in studio and to work during scheduled hours. The studio should be considered a professional design studio environment. Because of the special involvement of external professionals, scheduling changes for guest lectures, presentations, and reviews may occur at short notice; students should stay informed regularly.

**Changes to the Course Outline**
The course outline may be subject to change in the event of extenuating circumstances.