

**COURSE OUTLINE IDES 2102A • DESIGN FOR MANUFACTURING B • Winter (2023)**

---

---

**Instructor: Rob Watters**

RobertWatters@cunet.carleton.ca

Office: **446 Azrieli Pavilion**

Office Hours: During Lecture, Lab times or by appointment.

**Teaching Assistant: Kimia Tajmirriahi**

KimiaTajmirriahi@cmail.carleton.ca

Office Hours: by appointment.

**Course Time and Location:** Please refer to Carleton Central under Student Services – Registration or Search Schedule: [https://central.carleton.ca/prod/bwysched.p\\_select\\_term?wsea\\_code=EXT](https://central.carleton.ca/prod/bwysched.p_select_term?wsea_code=EXT)

LECTURE: Meeting Date: Jan 09 to Apr 12, 2023 Days: Thu. Time: 18:05 - 20:55 Building: Mackenzie, Room: 4494

LABORATORY: Meeting Date: Jan 09 to Apr 12, 2023 Days: Thu, Time: 11:35 - 14:25 Building: Mackenzie, Room: 4494

**Course Description**

Continuation of IDES 2101. Transformation techniques applied to manufacturing materials. Part-design requirements and cost factors for manufacturing processes. The influences and role of assembly, finishing, production tooling, costing are addressed. Includes: Experiential Learning Activity.

Prerequisite(s): IDES 2101 or permission of the School of Industrial Design. Lecture and tutorials three hours a week, laboratory three hours a week.

## **Learning Outcomes**

By the end of this course, students will be able to:

1. Demonstrate a process for comparing and contrasting different types of common plastic materials in terms of performance characteristics particular to their intended use (UV, temperature, impact, creep, cost, etc.)
2. Be familiar with plastic raw materials including rod, tubing, and sheet stock as well as pellet forms.
3. Describe the main manufacturing processes for thermoset and thermoplastic materials in terms of tooling and raw material requirements.
4. Compare and contrast various plastic manufacturing processes in terms of production quantity, quality, and cost as a function of mass production volumes.
5. Be aware of important life cycle issues in regards to regrind, material identification, and degradable plastics.
6. Describe the fundamental requirements for plastic part design as it relates to various plastic manufacturing processes.
7. Be aware of Digital Additive Manufacturing processes including powder, liquid, and solid extruded technologies.
8. Be familiar with the primary difference between prototyping and manufacturing.
9. Be able to design simple jigs and fixtures for plastic fabrication from sheet materials.
10. Work as a team and use each other's resources effectively.
11. Write a technical report.
12. Work safely in the lab under supervision by professional staff.

## **Course Deliverables**

These are the deliverables for this course. Please see 'Appendix A Course Schedule' for more detailed information.

## Course Deliverables and Grading (\*is a potential for adjustments)

The course mark will be based on the term work as follows:

LECTURE: <b>Testing/Quizzes</b>		LABORATORY: <b>Lab assignments</b>	
Mid-term	<b>15%</b>	Lab 1 - Thermoformed	<b>20%</b>
Final	<b>15%</b>	Lab 2 - Analysis Report	<b>20%</b>
Quizzes	<b>20%</b>		
Participation/Engagement	<b><u>5%</u></b>	Participation/Engagement	<b><u>5%</u></b>
	<b>55%</b>	<b>+</b>	<b>45% = 100%</b>

- A passing grade must be attained in each of the LECTURE and LABORATORY sections of the course in order to receive a passing grade on the course. Understanding of lecture knowledge will be partially assessed in the lab fundamentals.

### Student Access to Quiz, Test and Exam Papers

Examinations are for evaluation purposes only and will not be returned to the student.

### Required Materials

Materials required for the course are listed below. You may be asked by your instructor to refer to Brightspace for a more comprehensive list of required materials.

#### Text Books /Papers (required)

de Leeuw, M., Series and Mass Production Technology for Product Design. You are advised to make your own notes alongside this text during class. (Note: Text book is the same as used for IDES2101). Available at Haven Bookstore at the corner of Sunnyside Ave and Seneca Street.

#### Materials suggested and not limited to:

Utilize the tools that you have purchased for previous years studios. Ensure their availability for Labs and Lectures as required.

- Vernier Calipers with digital display for dimensional measurement (inexpensive versions available for <\$15 - \$40 at Amazon, BusyBee, Canadian Tire, etc.
- One pack of HP Bright White Ink Jet paper or Similar 8 ½ x 11"
- Tape (roll): masking, and duct or packing. (to secure work, or help with mock ups)
- Drawing: Pens, Pencils, Erasers
- Designer Markers - eg. Pilot felt tip red, blue green, black) – ensure a range of colours (to help denote different materials and assembly elements in your assignments, tests and quizzes)
- Segmented Knife – Olfa like, and replacement blades required (a pack of 50 is recommended)
- Cork back steel ruler - 14" minimum or longer preferred.
- Clear Straight Edge for drawing lines (ruler to or triangle).
- Cutting Board – Small 30cm x 45cm
- Engineer Square or equivalent
- 100 and 220 Grit Wet Dry Sand Paper with a Sanding Block
- One set of Safety Goggles/Glasses,
- Dust masks, they can be purchased at SID shops.
- Other lab/project specific materials as determined.

### **Computer Requirements**

Please refer to the computer requirements on the School of Industrial Design Website. You may be asked by your instructor to refer to Brightspace for other information or requirements related to computer work.

<http://www.id.carleton.ca/undergraduate/about-the-bid-program/computer-requirements>

### **Individual/Group Work**

Courses may include individual and group work. It is important in collaborative work that students clearly demonstrate their individual contribution.

### **Review/Presentation Attendance**

Attendance at scheduled SID Reviews/Presentations is mandatory. These are equivalent to exams when indicated in the course outline. Failure to attend the Review/Presentation without reasonable cause, will result in a grade of F. Students arriving late for the Review/Presentation or not remaining for the complete session without approval from the instructor, will be addressed on a case-by-case basis at the discretion of the instructor.

If you are not able to attend a Review/Presentation, foresee arriving late or need to leave before it is complete, please email your instructor in advance explaining the reason for the situation. It is important that you provide a reasonable rationale for your absence, late arrival or early departure. In the event of an illness or death in the family, you will be required to sign a form verifying your claim and this form is available through the SID administration office.

### **Late Submission of Lecture & Studio Deliverables**

Students who do not hand in deliverables on time will have their earned grade reduced by 10% per day up to a maximum of 3 days.

### **Participation and Professionalism**

Active participation and professional conduct (e.g. class discussion, consultations with instructors, work ethic, etc.) are important in lecture and studio courses and may be formally evaluated by a grade. Professionalism also includes Carleton's Policy on Academic Integrity described in more detail below with links to content which you are required to review.

### **Academic Integrity**

*Carleton's Policy on Academic Integrity* is available at: <https://carleton.ca/registrar/academic-integrity/> and covers the following topics:

*Plagiarism* (e.g. submitting work in whole or in part by someone else, failing to acknowledge sources through the use of proper citations when using another's work).

*Test and Exam Rules* (e.g. attempting to read another student's exam paper, speaking to another student even if the subject matter is irrelevant to the text, using material not authorized by the examiner).

*Other Violations* (e.g. improper access to confidential information, disruption in classroom activities, misrepresentation of facts for any academic purpose).

This policy governs the academic behavior of students. In industrial design, ideas and concepts come from a multitude of sources and may be modified and utilized in the design and development process. The student should reference such sources appropriately and it is strongly advised that you read Carleton's Policy on Academic Integrity prior to conducting any work at the University.

## Requests for Academic Accommodation

You may require special arrangements to meet your academic obligations during the term. For an accommodation request for any of the following topics below, refer to the link provided for more information: <https://students.carleton.ca/course-outline/>

- **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, please review the [Student Guide to Academic Accommodation \(PDF, 2.1 MB\)](#) For accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form ([click here](#)).
- **Religious/Spiritual 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, please review the [Student Guide to Academic Accommodation \(PDF, 2.1 MB\)](#)
- **Academic Accommodations for Students with Disabilities:** The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. 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](mailto: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. For more details, visit the [Paul Menton Centre website](#).
- **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 where 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 the [Equity and Inclusive Communities website](#).

- **Accommodations 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. For more details, see the [Senate Policy on Accommodation for Student Activities \(PDF, 25KB\)](#).
- **The Use of Self-Declaration Forms:** In place of a doctor's note or medical certificate, students may complete the [self-declaration form](#) available on the Registrar's Office website to request academic accommodation for missed course work including tests and assignments. Students are also encouraged to connect directly with their instructors to discuss required accommodations arising from the COVID-19 situation.

## Statement on Student Mental Health

As a university student, you may experience a range of mental health challenges that significantly impact your academic success and overall well-being. If you need help, please speak to someone. There are numerous resources available both on- and off-campus to support you. Here is a list that may be helpful:

**Emergency Resources (on and off campus):** <https://carleton.ca/health/emergencies-and-crisis/emergency-numbers/>

### Carleton Resources:

- Mental Health and well-being: <https://carleton.ca/wellness/>
- Health & Counselling Services: <https://carleton.ca/health/>
- Paul Menton Centre: <https://carleton.ca/pmc/>
- Academic Advising Centre (AAC): <https://carleton.ca/academicadvising/>
- Centre for Student Academic Support (CSAS): <https://carleton.ca/csas/>
- Equity & Inclusivity Communities: <https://carleton.ca/equity/>

### Off-Campus Resources:

- Distress Centre of Ottawa and Region: (613) 238-3311 or TEXT: 343-306-5550, <https://www.dcottawa.on.ca/>

- Mental Health Crisis Service: (613) 722-6914, 1-866-996-0991, <http://www.crisisline.ca/>
- Empower Me: 1-844-741-6389, <https://students.carleton.ca/services/empower-me-counselling-services/>
- Good2Talk: 1-866-925-5454, <https://good2talk.ca/>
- The Walk-In Counselling Clinic: <https://walkincounselling.com>

## Statement on Pandemic Measures

It is important to remember that COVID is still present in Ottawa. The situation can change at any time and the risks of new variants and outbreaks are very real. There are [several actions you can take](#) to lower your risk and the risk you pose to those around you including being vaccinated, wearing a mask, staying home when you're sick, washing your hands and maintaining proper respiratory and cough etiquette.

**Feeling sick?** Remaining vigilant and not attending work or school when sick or with symptoms is critically important. If you feel ill or exhibit COVID-19 symptoms do not come to class or campus. If you feel ill or exhibit symptoms while on campus or in class, please leave campus immediately. In all situations, you should follow Carleton's [symptom-reporting protocols](#).

**Masks:** Masks are no longer mandatory in university buildings and facilities. However, we continue to recommend masking when indoors, particularly if physical distancing cannot be maintained. We are aware that personal preferences regarding optional mask use will vary greatly, and we ask that we all show consideration and care for each other during this transition.

**Vaccines:** While proof of vaccination is no longer required to access campus or participate in in-person Carleton activities, it may become necessary for the University to bring back proof of vaccination requirements on short notice if the situation and public health advice changes. Students are strongly encouraged to get a full course of vaccination, including booster doses as soon as they are eligible and submit their booster dose information in [cuScreen](#) as soon as possible. Please note that Carleton cannot guarantee that it will be able to offer virtual or hybrid learning options for those who are unable to attend the campus.

All members of the Carleton community are required to follow requirements and guidelines regarding health and safety which may change from time to time. For the most recent information about Carleton's COVID-19 response and health and safety requirements please see the [University's COVID-19 website](#) and review the [Frequently Asked Questions \(FAQs\)](#). Should you have additional questions after reviewing, please contact [covidinfo@carleton.ca](mailto:covidinfo@carleton.ca).

## Student Responsibility

The student is responsible for knowing the content of this course outline; the schedule of classes, assignments, and/or Reviews; and the material that was covered when absent. The studio is a professional environment and students should be working during the scheduled hours.

Unless otherwise arranged, the class will meet during scheduled class hours. Please note that attendance is important since issues and questions may be raised in class, and announcements made, along with information disseminated through Brightspace. As external professionals are often involved in our work, scheduling changes for guest lectures, presentations, and Reviews may occur at short notice, requiring students to stay informed.

### Changes to the Course Outline

The course outline may be subject to change in the event of extenuating circumstances.

### Appendix A - Course Schedule

Course Schedule. Version 1.0

Class 1 Jan. 12	Lecture	<ul style="list-style-type: none"> <li>● <b>Introduction to Course</b></li> <li>● Polymer Families and Fabrication</li> <li>● Assignment of Lab 1</li> </ul>
	Lab	No Lab this week (read the text / homework)
	Homework	de Leeuw Chapter 1 (pgs 1-38) Materials of Manufacture de Leeuw Chapter 5 (pgs 1-11) Fabricating: machining, bending, bonding.
Class 2 Jan. 19	Lecture	<ul style="list-style-type: none"> <li>● <b>Thermoforming</b></li> <li>● Creating fixtures and jigs</li> <li>● Material Spotlight - PMMA, PC, PSO</li> </ul>
	Lab	Meet and work on Lab 1
	Homework	de Leeuw Chapter 6 (pgs 1-21) Thermoforming: vac, pressure, twin
Class 3 Jan. 26	Lecture	<ul style="list-style-type: none"> <li>● <b>Injection Molding Part 1</b></li> <li>● Material Spotlight - ABS, PP, POM</li> </ul>
	Lab	Meet and work on Lab 1

	Homework	de Leeuw Chapter 2 (pgs 1-35) Injection Mold: over, gas, 2/co-injection de Leeuw Chapter 3 (pgs 1-19) Structural Foam
Class 4 Feb. 02	Lecture	<ul style="list-style-type: none"> <li>• <b>Quiz 1:</b> on preceding Chapters (1, 5, 6, 2[light])</li> <li>• <b>Injection Molding Part 2 including Structural Foam, RIM Molding</b></li> <li>• Material Spotlight – CAs, TPEs. PAs</li> </ul>
	Lab	Lab 1 Progress Check AND Work on Lab 1.
	Homework	de Leeuw Chapter 4 (pgs 1-11) Extrusion.
Class 5 Feb. 09	Lecture	<ul style="list-style-type: none"> <li>• <b>Extrusions</b></li> </ul>
	Lab	<b>Deliverable:</b> Hand-In Lab 1 jigs, fixtures and part(s) to Lab 1
	Homework	de Leeuw Chapter 7 (pgs 1-14) Blowmolding,
Class 6 Feb. 16	Lecture	<ul style="list-style-type: none"> <li>• <b>Blow molding</b></li> <li>• Material Spotlight – PUR, PFs, EVA</li> </ul>
	Lab	<b>Deliverable:</b> Hand in of Lab 1 Report
	Homework	de Leeuw Chapter 8 (pgs 1-20) Rotational Molding
Feb. 20-24	Break	Winter Break
Class 7 Mar. 02	Lecture	<ul style="list-style-type: none"> <li>• <b>Roto molding</b></li> <li>• <b>Material Spotlight</b> – PVC, Fiberglass, UP</li> </ul>
	Lab	<b>Midterm Test:</b> Based on: deLeeuw, Chapters 1,2,3,5,6 and Prezi, materials spotlights covered to date.
	Homework	de Leeuw Chapter 10 (pgs 1-38) Composites
Class 8 Mar. 09	Lecture	<ul style="list-style-type: none"> <li>• <b>Composites + Alloys, Compression Molding</b></li> <li>• Material Spotlight – Fiber reinforced materials, EP</li> </ul>
	Lab	<b>Meet and work on Lab 2 – Product / Process / Feature Types</b>
	Homework	tbd
Class 9 Mar. 16	Lecture	<ul style="list-style-type: none"> <li>• tbd</li> </ul>
	Lab	<b>Deliver Draft of Lab 2 (80% complete) – Upload in Brightspace</b> <b>Meet and work on Lab 2 – Product / Process / Feature Types</b>
	Homework	de Leeuw Chapter (tbd)

<b>Class 10</b> Mar. 23	Lecture	<ul style="list-style-type: none"> <li>• <b>Quiz 2: Chapters 7,8,9,10. (deLeeuw)</b></li> <li>• <b>Aspects of environmental sustainability in product design</b></li> </ul>
	Lab	<b>Meet and work on Lab 2 – Product / Process / Feature Types</b>
	Homework	(tbd)
<b>Class 11</b> Mar. 30	Lecture	<ul style="list-style-type: none"> <li>• <b>Rapid Prototyping Technologies</b></li> <li>• <b>Discuss next week's Final Presentations</b></li> </ul>
	Lab	<b>Deliverable: Upload:</b> Hand in of Lab 2 Report by 11:50pm
	Homework	de Leeuw Chapter 11 (pgs 1-14) Rapid Prototyping, Rapid Tooling and Rapid Manufacturing.
<b>Class 12</b> Apr. 06	Lecture	• <b>Final Presentations-(Lab Project 2 – Product or Process)</b>
	Lab	• <b>Final Presentations (Lab Project 2 – Product or Process)</b>
	Homework	
<b>Final Test/Exam</b>		<b>// Take home Exam //</b> – Due on last day of Exam period

Filename: IDES 2102A DESIGN FOR MANUFACTURING B W23 1.0 - Rob Watters