

**Course Syllabus**  
**VERSION 1.9****ISEN 463 *Circular Economy***  
**Winter Quarter****Northwestern University**

**Instructor:** [Jenny Carney](#), Vice President, WSP – [jenny.carney@northwestern.edu](mailto:jenny.carney@northwestern.edu)

**Teaching Assistant:** Molly Mollenkamp – [mollymollenkamp2021@u.northwestern.edu](mailto:mollymollenkamp2021@u.northwestern.edu)

**Possible Guest Lecturers:**

[Garry Cooper, Rheaply](#)

[Danielle Decatur, Microsoft](#)

[Anita Kedia Schwartz, WSP](#)

TBD, [AMP Robotics](#)

TBD, [Break Free from Plastic](#)

TBD, [Delta Institute](#)

**Office Hours:** By appointment and pop-up hours prior to major due dates

**Classroom:** TBD

**Class Timing:** Winter 2022 (January 3<sup>rd</sup>, 2022 – March 11<sup>th</sup>, 2022 Tu, Th 6:30-7:50pm); Finals March 14-18

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**Course Synopsis:** This class will cover the core principles of a circular economy. It will use systems thinking to understand the technological, economic and policy implications of circular economy transitions. It will focus on real-world applications, evaluating the feasibility of achieving zero waste and circular outcomes within industries or geographies.

**Course Goals:** Students will develop a solid foundation in:

- **Systems Thinking and Circular Design:** This paradigm underlies much of the development of CEs and is an effective professional tool. Through this course, students will develop the necessary skills to be able to integrate a systems-based perspective in their analyses of situations. Systems Thinking will be cultivated through case studies and analysis projects.
- **Material Flows:** A basic understanding of the current state of waste and materials management systems, and the technological and other constraints that must be transcended to deliver circular outcomes. This course will impart an understanding of topics such as the biological cycle, energy flows and industrial ecology. Through the medium of case studies, it will also explore properties of common materials such as metals, rubber and plastic—focusing on the manner in which these properties can aid the integration into a circular system.
- **Business Models:** A circular economy requires new and changed business models to function. We will analyze models of financing and running a circular system. We will also look at the

bigger picture, exploring how global supply chains can scale up to faster implement and accommodate circular economies.

- **Incentivizing and Measuring the Circular Economy:** Policy considerations are important to the success of a circular economy. This course will consider the practicalities of delivering a circular economy, addressing the key incentives of all stakeholders involved. It will also consider the available tools to measure the impact and circularity of such systems.

**Grading/Assessment:**

Grading will be based on the following rubric:

Component	Weight	Details	Due
Participation	10%	Based on attendance and instructor assessment of preparation and participation in class on a weekly basis	Ongoing
Quizzes	20%	Conventional in-class quizzes based on the content. These will be declared beforehand and will focus on the details of current practices and outcomes of the linear economy, emergent standards and measurement methodologies to drive circular outcomes, and theoretical frameworks explored in class. Questions may include definitions, analyses, etc.	Week #3 (1/20/22)  Week #5 (2/3/22)
Case Study Assignments	30%	There will be two case studies assigned. Students will research circularity approaches and use case study examples and datasets to summarize and evaluate against assigned case questions (usually 2-3 questions) in the style of business writ. Topics will vary but may include quantifying environmental and business implications, or assessing how the case reallocates benefit and burden, meets financial viability criteria, or addresses consumer behavior and social values considerations.	Week #4 (Due 1/28/22 at 5pm)  Week #6 (Due 2/11/22 at 5pm)
Final Presentation & Paper	40%	Groups of 3-4 students will identify a waste-generating practice with potential for circular disruption, design a circular solution concept and consider the aspects of its implementation.  Students will be expected to deliver: <ol style="list-style-type: none"> <li>1. 10-minute Elevator Pitch of Solution (PowerPoint Presentation in Class)</li> <li>2. A written, 5-page paper submitted at 8am on the morning of the last class.</li> </ol> Students will be assessed in the following ways:	Week #10 (Elevator Pitch presentations in class 3/8/22 and 3/10/22; Final papers due 3/11/22 at 8am)



		<ol style="list-style-type: none"> <li>1. <u>In-Class Presentation</u>: The group will receive a team grade based on the clarity of the message and the quality of presentation (10%)</li> <li>2. <u>Written Project</u>: The instructor will provide a grade to the group based on the assessment of the issue/opportunity for a circular solution, the quality of the recommendation/solution and the depth of implementation planning and risk assessment. Further details on expectations for the project will be shared when teams are formed (30%)</li> </ol> <p>Students are expected to contribute meaningfully to group projects based on peer reviews. Failure to contribute could result in a reduction in an individual's grade relative to the overall team grade on the final project.</p> <p>All students will be expected to be involved and engaged in presentations of others. Failure to attend or show respect during the presentation of the others could result in a reduction in the team grade on the final project.</p>	
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**Grading Policy:**

All questions and problems regarding grades must be presented in writing within one week after the test, homework, or project has been returned. The grading scale is fixed, please do not wait until the end of the quarter if you are concerned about the direction of your grade. Grades will be assigned based on all the work you have completed during the semester using the following scale:

<b>A</b>	93.333 to 100	<b>C</b>	73.333 to 76.666
<b>A-</b>	90.000 to 93.333	<b>C-</b>	70.000 to 73.333
<b>B+</b>	86.666 to 90.000	<b>D+</b>	66.666 to 70.000
<b>B</b>	83.333 to 86.666	<b>D</b>	63.333 to 66.666
<b>B-</b>	80.000 to 83.333	<b>D-</b>	60.000 to 63.333
<b>C+</b>	76.666 to 80.000	<b>F</b>	< 60.000

**Course Readings:**

The following texts are required for the class.

1. Webster, K. *Circular Economy: A Wealth of Flows*. Ellen MacArthur Foundation, 2<sup>nd</sup> Edition, 2016.
2. Raworth, K. *Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist*. Random House, 2017. Print.

Other standards, reports, articles and essays will be assigned and distributed in class. Recommended or required additional reading will include but is not limited to:

- UL 2799 Environmental Claim Validation Procedure for Zero Waste to Landfill
- UL 3600 Outline of Investigation for Measuring and Reporting Circular Economy Aspects of Products, Sites and Organizations
- *Circularity Gap Report 2020*. Circle Economy. 2020.
- [\*Achieving Operational Zero Waste: An inside look into Microsoft's operational zero waste journey.\*](#) Microsoft, in partnership with WSP. 2020.
- Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. *What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050*. Urban Development;. Washington, DC: World Bank. 2018 © World Bank. <https://openknowledge.worldbank.org/handle/10986/30317> License: CC BY 3.0 IGO.
- Ellen MacArthur Foundation, "The New Plastics Economy: Rethinking the Future of Plastics"
- [2021 Chicago Waste Strategy](#)

**Websites:**

At points you may be required to watch videos, read blogs, or explore websites outside of class.

**CLASS OUTLINE**

Weekly Topic	Description
<p><b>1:</b> Intro to Circular Economy, Systems Thinking, and Course Logistics</p>	<ul style="list-style-type: none"> <li>● Student intake survey to determine baseline understanding of circularity topics and areas of top interest</li> <li>● Introduction to course, its objectives and expectations of students</li> <li>● When and why did the economy become linear?</li> <li>● Orientation to circular economy and systems thinking principles</li> </ul> <p><b>Required Readings</b>  <i>Circular Economy: A Wealth of Flows</i>. Introduction and Chapter 3  <i>Doughnut Economics</i>. Chapters 2 and 6            Robin Wall Kimmerer, Serviceberry essay</p>
<p><b>2:</b> The State of Waste in the Linear Economy</p>	<ul style="list-style-type: none"> <li>● Waste generation and management flows and characterization</li> <li>● The environmental and social impacts of linear and extractive practices</li> <li>● Economic drivers of current state approaches</li> <li>● Overview of constraints to adopting circular practices</li> </ul> <p><b>Required Readings</b>  <i>What a Waste 2.0: A Global Snapshot of Solid Waste Management to 2050</i>  <i>Circularity Gap Report 2020</i>, Excerpts to be assigned</p>
<p><b>3:</b> Human Behavior and Circularity</p>	<ul style="list-style-type: none"> <li>● Fundamentals of human behavior as consumers, producers, and materials managers</li> <li>● Values and norms in the US &amp; beyond</li> <li>● Nudging behavior change for circular outcomes</li> </ul> <p><b>Required Readings</b>  <i>Circular Economy: A Wealth of Flows</i>. Chapters 5 and 7  <i>Doughnut Economics</i>. Chapter 3</p> <p><b>QUIZ #1 COVERING WEEKS 1-2 (Thursday, January 20<sup>th</sup>)</b></p>
<p><b>4:</b> Infrastructure &amp; Technology Transformation for Material Flows in Circular Systems</p>	<ul style="list-style-type: none"> <li>● Material flows in circular systems</li> <li>● Processing realities of common materials such as cardboard, plastics, cloth, rubber and metals</li> <li>● Reverse logistics infrastructure needs and opportunities</li> <li>● Impacts of flows beyond raw materials such as transportation, energy</li> </ul> <p><b>Required Readings</b>  <i>Circular Economy: A Wealth of Flows</i>. Chapters 6 and 8</p>



	<p><b>CASE STUDY #1 DUE Friday, January 28<sup>th</sup>, 5pm</b></p>
<p><b>5: Material palettes and product design</b></p>	<ul style="list-style-type: none"> <li>● Materials conducive to circularity based on physical properties, including biological materials as feedstocks</li> <li>● Product life cycles</li> <li>● Proprietary versus open-source circular systems and the implications for product design and branding</li> <li>● The right-to-repair movement</li> <li>● Examples of circular and non-circular designs in food, packaging, electronics, and clothing</li> </ul> <p><b>Required Readings</b> Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of Plastics”</p> <p><b>QUIZ #2 COVERING WEEKS 4-5 (In-class Thursday, February 3<sup>rd</sup>)</b></p> <p><b>Establishment of groups for final project, review of final project objectives and output, discussion of potential topics.</b></p>
<p><b>6: Business-scale circularity &amp; measurement</b></p>	<ul style="list-style-type: none"> <li>● GHG accounting, waste-related emissions and voluntary actions by companies</li> <li>● Corporate sustainability, zero waste, co-opetition and global supply chain influence</li> <li>● Measuring zero waste and circular progress in business operations</li> <li>● Leading practices from Fortune 500 companies</li> <li>● New business models and innovative small-scale players</li> </ul> <p><b>Required Readings</b> UL 2799 Environmental Claim Validation Procedure for Zero Waste to Landfill UL 3600 Outline of Investigation <i>Achieving Operational Zero Waste</i></p> <p><b>CASE STUDY #2 DUE Friday, February 12<sup>th</sup>, 5pm</b></p>
<p><b>7: Local/regional-scale circularity &amp; measurement</b></p>	<ul style="list-style-type: none"> <li>● Regulatory approaches and incentives for circularity</li> <li>● Policy success and failure examples</li> <li>● Adapting local infrastructure to meet global supply chains</li> <li>● Measuring circularity within geographic boundaries</li> <li>● Leading practices in the US and internationally</li> <li>● Review of existing state organics waste policies</li> </ul>



	<p><b>Required Readings</b></p> <p><i>Circular Economy: A Wealth of Flows</i>. Chapter 9  <a href="#">2021 Chicago Waste Strategy</a></p> <p><b>FINAL PROJECT OUTLINE DUE Thursday, February 18<sup>th</sup></b></p>
<p><b>8:</b> Equity in the Circular Economy</p>	<ul style="list-style-type: none"> <li>● Upfront premiums for participating in circular systems</li> <li>● The moral economy, economic inclusion and the circular economy workforce</li> <li>● Is the circular economy for economic growth or social and environmental well-being?</li> </ul>
<p><b>9:</b> Implementation, scaling, and deep dives</p>	<ul style="list-style-type: none"> <li>● Striving towards regenerative systems</li> <li>● Detailed review of implementation examples, including the array of changes necessary, quantitative analysis for planning and reporting, stakeholder mapping, and troubleshooting implementation obstacles</li> <li>● Examples covered might include: <ul style="list-style-type: none"> <li>- Eliminating single-use cups</li> <li>- Composting food waste</li> <li>- Eliminating packaging waste</li> </ul> </li> </ul>
<p><b>10:</b> Final Presentations</p>	<ul style="list-style-type: none"> <li>● Groups will present the 10-minute elevator pitches of their final presentations and field questions about their proposals.</li> </ul> <p><b>PRESENTATIONS In-class Tuesday, March 8<sup>TH</sup> and Thursday, March 10<sup>th</sup></b>  <b>FINAL PROJECT PAPER DUE Friday, Marth 11<sup>th</sup>, 8am</b></p>



## OUTLINE OF A CIRCULAR ECONOMY

### PRINCIPLE

# 1

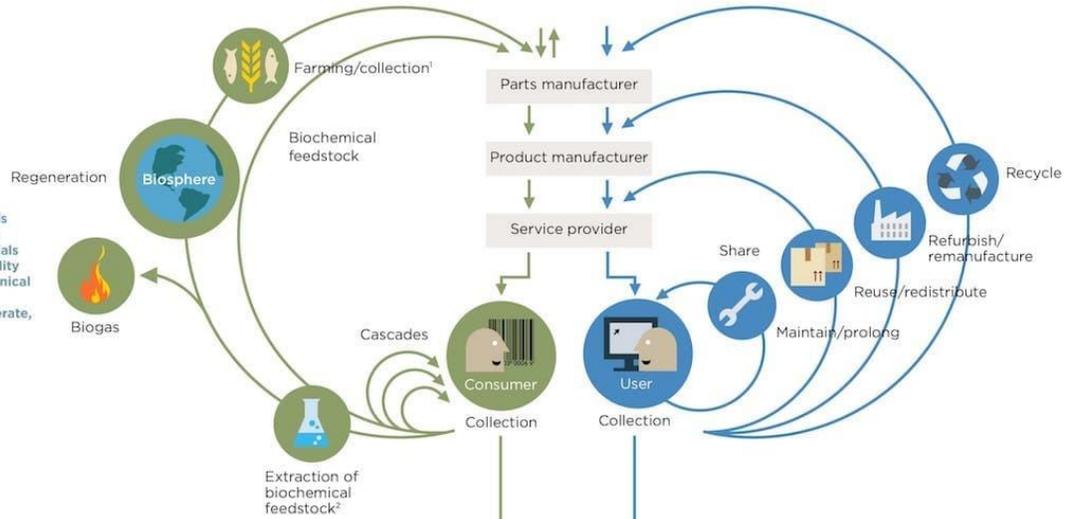
Preserve and enhance natural capital by controlling finite stocks and balancing renewable resource flows  
ReSOLVE levers: regenerate, virtualise, exchange



### PRINCIPLE

# 2

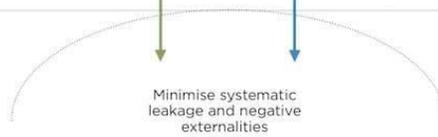
Optimise resource yields by circulating products, components and materials in use at the highest utility at all times in both technical and biological cycles  
ReSOLVE levers: regenerate, share, optimise, loop



### PRINCIPLE

# 3

Foster system effectiveness by revealing and designing out negative externalities  
All ReSOLVE levers



1. Hunting and fishing  
2. Can take both post-harvest and post-consumer waste as an input  
Source: Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle to Cradle (C2C).

Source: Ellen MacArthur Foundation, 2019<sup>1</sup>

## COVID-19 Classroom Expectations Statement

Students, faculty, and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the [COVID-19 Code of Conduct](#). With respect to classroom procedures, this includes:

- Policies regarding masking and social distancing evolve as the public health situation changes. Students are responsible for understanding and complying with current masking, testing, Symptom Tracking, and social distancing requirements.
- In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.
- No food is allowed inside classrooms. Drinks are permitted, but please keep your face covering on and use a straw.

<sup>1</sup> <https://www.ellenmacarthurfoundation.org/circular-economy/concept/infographic>

- Faculty may assign seats in some classes to help facilitate contact tracing in the event that a student tests positive for COVID-19. Students must sit in their assigned seats.

If a student fails to comply with the [COVID-19 Code of Conduct](#) or other University expectations related to COVID-19, the instructor may ask the student to leave the class. The instructor is asked to report the incident to the Office of Community Standards for additional follow-up.

### **Class Recording**

This class or portions of this class will be recorded by the instructor for educational purpose and available to the class during the quarter. Your instructor will communicate how you can access the recordings. Portions of the course that contain images, questions or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact [AccessibleNU](#). Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s [Copyright Policy](#), faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

### **Expectations for Class Participation**

Being prepared for class is about more than just showing up, it’s also about making sure you’ve completed the readings, homework, etc. so that you are able to make thoughtful contributions during class. Sitting silently and/or being unprepared can damage your participation grade. When in a virtual class, we expect students to keep their camera and mute on as much as possible. When in the classroom, we expect students to keep their phones off and put away.

### **Academic Integrity**

Academic integrity is taken very seriously at Northwestern. Students are responsible for reading and understanding Northwestern’s Academic Integrity policies. All suspected violations will be reported to the McCormick College of Engineering’s Dean’s Office. These include cheating, plagiarism, fabrication, unfair advantage, unauthorized collaboration, and aiding and abetting of academic dishonesty. Students found in violation of academic integrity may receive a zero on the assignment or a failing grade for the course and may be suspended or permanently expelled from the University. See [Academic Integrity: A Basic Guide](#) for more information.

### **The Writing Place**

When working on writing assignments for this class, I encourage you to visit the Writing Place, Northwestern’s peer writing center. You will work with juniors and seniors who have been trained to provide you feedback and assistance on any type of writing at any stage in the writing process. They will not edit your work. Rather, they will work with you to brainstorm ideas, organize or outline an essay, clarify your argument, document your sources correctly, or refine grammar and style.

### **Accessibility Statement**



Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university's established accommodation process (e: [accessiblenu@northwestern.edu](mailto:accessiblenu@northwestern.edu); p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

### **Illness and Medical Leave of Absence**

Review the University's [policy](#) on missing academic work due to illness. Your instructor cannot waive an assignment missed due to illness unless the illness can be verified (e.g., by University Health Services or other licensed health professionals).

### **Discrimination and Sexual Harassment**

Northwestern's Policies on Discrimination, Harassment, and Sexual Harassment apply to all members of the University community, including students, staff, faculty, and third parties. Any student, staff, faculty member, or third party who believes that they have been discriminated against or harassed on the basis of their race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, pregnancy, parental status, marital status, age, disability, citizenship, veteran status, genetic information or any other classification protected by law, should contact the Office of Equity at (847) 467- 6571. Additional information about the University's discrimination and harassment policies, including the campus resources available to assist individuals with discrimination or harassment concerns, is available online on the [Office of Equity Website](#). Students, staff, and faculty who report harassment, discrimination, or sexual misconduct are also protected under the [University's Policy on Non-Retaliation](#).

### **Sexual Misconduct and Reporting**

Northwestern University is committed to fostering an environment where students are safe and free from sexual misconduct. [Confidential resources](#) are available to those who have experienced sexual misconduct. Faculty and instructors are not confidential resources and are required to report incidents of sexual misconduct, whether discussed in your assignments or in person, to the Office of Equity, which can provide information about resources and options. We encourage students who have experienced sexual misconduct to talk with someone to get support. For more information, including how to request interim protective measures and academic accommodations or file a complaint, see the [Get Help page](#).

### **Other Resources**

Students can find useful resources for safety and security, academic support, and mental and physical health and well-being at the [NUhelp website](#).