

Master of Science in Sustainability Management

**Circular Economy for Sustainability Professionals (SUMA PS5470)**

**Mondays: 6 - 8PM**

**3 credits**

**Instructor:** Danielle Azoulay, Adjunct Professor

**Response Policy:** Students can expect me to respond to emails within 48 hours during work week and weekends. For urgent questions students may text me and I will respond or call ASAP.

**Course Overview**

Today, we operate in a “linear” (take, make, dispose) economy that is defined by a reliance on large quantities of cheap materials and energy that are typically “finite” in nature. This approach is proving unsustainable and presents problems that include the degradation of natural systems, economic and structural waste, as well as “supply” risks, as our planet reaches its physical limits.

Against a backdrop of population growth, these problems are only set to get worse. Yet at the same time, an unprecedented alignment of technological and societal factors is enabling the transition to a new model possible at scale.

A circular economy is an alternative economic model, that is restorative by design, and rather than relying on a constant throughput of newly extracted resources and non-renewable energy, aims to keep materials, products and components constantly at their highest utility and value.

This elective course will delve into both the theory and practical applications of a circular economy. Achieving perfect circularity (which would theoretically be a state of complete systemic regeneration and restoration, optimized resource utility and zero waste) represents potentially transformative system change and will involve a fundamental re-think of many of our structures, systems and processes in the economy at large. At the same time, its value creation potential for businesses, households and the environment alike, is extremely significant. For example, manufacturers can reclaim substantial value from the products they develop by introducing take-back schemes to reclaim components and materials for re-use or recycling, as opposed to allowing them to go to waste as would typically be the case in a linear system.

We will explore the theoretical underpinnings of a circular economy, including systems thinking (taking relevant learnings from biomimicry and industrial ecology). We will look to circular design principles and explore their use in different industries. We will pose the question of which stakeholders can help to facilitate this transition to circularity, and what enablers, in the form of policy and financing, will need to be in place to allow it to progress.

The exploration of new and emerging business models will form a significant part of this class. From sharing models to “product as a service” models, these new ways of doing business provide inherent opportunities and incentives for businesses to re-think how they can create value while simultaneously optimizing resource use and remaining at the competitive edge.

The course will explore real-life examples of circular economic thinking in specific industries, such as the fashion industry, as well as looking at its application in a geographic context through the lens of cities, and examining standalone infrastructure, such as waste management.

The class will comprise a series of lectures, supported by case-study based assignments that will help to familiarize students

## Master of Science in Sustainability Management

with the challenges that apply to circular economic thinking in different geographical, industry and economic contexts. An important aspect of the course will be learning how to link systems thinking with effective stakeholder engagement to facilitate change.

This class will be ideal for graduate students and young professionals who have a good basic understanding of economic principles and are keen to explore an alternative approach to traditional sustainability, which has increasingly become focused on using less resources, without addressing the more systemic flaws we face in our economy.

Upon completion of this class, students will possess sufficient knowledge to discuss the merits of a circular economy and its applications with potential employers. This course will benefit anyone with an interest in a career in sustainability, particularly (but not exclusively) in the corporate and non-profit sectors, in operations, design, strategy or communications.

## Learning Objectives

While elements of circular economy thinking have been around for some time, as an approach it has recently gained significant momentum. It is a rapidly evolving area, particularly when it comes to implementation. For that reason, the goal is not necessarily to learn about the circular economy as it applies to all industries or to understand every aspect of its successful application. Instead the course aims to provide students with firm knowledge of the underlying principles and approaches, as well as allowing them to practice a systems-focused mindset applied to a number of potential applications. During the course, students will:

- Identify critical aspects of circular economy terminology and vocabulary and learn to speak authoritatively about the merits and challenges of this approach
- Develop the skills to assess and evaluate opportunities for the use of circular economy thinking and approaches
- Apply systems thinking and circular design approaches to a range of real-world challenges
- Evaluate systems in a way that identifies their biological and technical materials/components
- Establish the key enablers and barriers for circular economy implementation in general, and as they relate to financing, policy, stakeholder management, business models and industry/application specifics
- Define ways to begin implementation and measure progress and success in circular economy
- Construct a response to a specific sustainability challenge that employs what they have learned about circular economy

## Master of Science in Sustainability Management

### Readings

#### Required readings

1. Acaroglu, Leyla: Tools for Systems Thinkers: The 6 Fundamental Concepts of Systems Thinking ([Available on medium.com](#)), 2017. Web. (3 pages)
2. Video: Beinhocker, Eric, “The economy as a complex and evolving system”: Lecture from UCL Institute for Innovation and Public Purpose, Feb 2019 (40 mins) ([Available here](#))
3. Benyus, Janine. *Biomimicry*. (Harper Perennial, 2002). Print. Chapter 1, p1-10 (10 pages). Available on Canvas.
4. Circle Economy, Fabric TNO and Gemeente Amsterdam, “Circular Amsterdam: A vision and action agenda for the city and metropolitan area”, 2016. Web. (47 pages) [Available here](#)
5. Ellen MacArthur Foundation, “A New Textiles Economy: Redesigning Fashion’s Future” Ellen MacArthur Foundation. 2017. Web. p36-117 (81 pages). [Available here](#).
6. Congress.gov “Green New Deal” Resolution text. Web. (14 pages). [Available here](#).
7. Despeisse, M., Baumers, M et al. “Unlocking value for a circular economy through 3D printing: A research agenda”, February 2017. Elsevier. Technological Forecasting and Social Change Volume 115, pages 75-84 (10 pages). [Available here](#)
8. Meadows, Donella. *Thinking in Systems: A Primer*. Chelsea Green Publishing, 2008. Print. Chapter 1, Chapter 7 and Appendix up until Model Equations (53 pages in total). Available on Canvas.
9. Ellen MacArthur Foundation, “Circularity in the Built Environment: A compilation of case studies from the CEO100”. April 2016. Web. 72 pages. [Available here](#).
10. Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2015. Web. p39-88 (49 pages). [Available here](#)
11. Ellen MacArthur Foundation, “Intelligent Assets: Unlocking the Circular Economy Potential” Ellen MacArthur Foundation. 2016. Web. p28-63 (35 pages) [Available here](#)
12. Ellen MacArthur Foundation, “Re-use: Rethinking Packaging”, 2019. PDF [Available here](#). (43 pages)
13. Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 1: Economic and Business Rationale for an Accelerated Transition” Ellen MacArthur Foundation. 2013. Web: p6-62 (56 pages) [Available here](#)
14. Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. p16-52 (36 pages) [Available here](#).
15. Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of Plastics”. Ellen MacArthur Foundation. 2016. Web. (92 pages) [Available here](#)
16. Ellen MacArthur Foundation (in cooperation with Granta and LIFE). “Circularity Indicators. An Approach to Measuring Circularity: Project Overview”, May 2015. Web. (12 pages) [Available here](#)
17. Ellen MacArthur Foundation. Video: Amsterdam – Exploring the Sharing City, DIF 2014. [Available here](#). (32min, 30 sec)
18. Ellen MacArthur Foundation & CE100, “Water and Circular Economy: A White Paper, 2018 ([Available here](#)) (18 pages)
19. Franconi, Ellen, Brett Bridgeland et al. *A New Dynamic 2: Effective Systems in a Circular Economy*. Ellen MacArthur Foundation Publishing, 2016. Print. Available on Canvas.
  - a. Chapter 1, Circular Business Opportunities for the Built Environment, p9-27 (18 pages)
  - b. Chapter 5, The Circular Economy of Soil, p87-103 (16 pages)
  - c. Chapter 4, Ecosystems as a Unifying Model for Cities and Industry, p63-85 (22 pages)
  - d. Chapter 6, Remanufacturing and the Circular Economy, p107-127 (20 pages)
  - e. Chapter 11: Circularity Indicators, p195-210 (15 pages)
  - f. Chapter 10: Cities as Flows in a Circular Economy, p177-193 (16 pages)
20. Groothuis, Femke (supported by ACCA), “Tax as a force for good – Headline summary”. ACCA 2018. Web. p1-8 (8 pages). [Available here](#).
21. ING Economics Department. “Rethinking finance in a Circular Economy”, May 2015. Web. Section 4: p 34-52 (18 pages) [Available here](#)
22. Mazzucato, Mariana. “Capitalism’s greatest weakness? It confuses price with value”, 2018 (World Economic Forum Article) ([Available here](#))
23. McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. (North Point, 2002). Print. Available on Canvas.

## Master of Science in Sustainability Management

- a. Chapter 2: p45-67 (22 pages)
- b. Chapter 3, p68-91 (23 pages)
- c. Chapter 4, Waste Equals Food, p92-117 (25 pages)
24. NYC: Zero Waste Design Guidelines, 2017, (authored & supported by multiple participants). p18-37 (20 pages). Web/PDF [Available here](#).
25. Raworth, Kate, Video: “*Why it's time for 'Doughnut Economics'*”, 2014. ([Available here](#))
26. Ross, M. (Producer), & Morgan, A. (Director). (2015). Video documentary: *The True Cost*. United States: Life is My Movie Entertainment; Untold Creative LLC (1h 32 min): <https://truecostmovie.com/>
27. Rutqvist, Jakob and Peter Lacy. *From Waste to Wealth: The Circular Economy Advantage* (Palgrave Macmillan, 2015). Print. Section II, pages 68-114 (46 pages) [Available here](#) (through CLIO)
28. Szaky, Tom, et al. *The Future of Packaging, From Linear to Circular*. (Berrett-Koehler, 2019). Print. Chapters 1-7, p9-119 (110 pages) [Available here](#) (through CLIO)
29. Webster, Ken. *The Circular Economy: A Wealth of Flows*. Ellen MacArthur Foundation Publishing, 2015. Print. Available on Canvas.
  - a. Introduction & Chapter 1-3, p7-61 (54 pages)
  - b. Chapter 4, Through the Macroscopic, p63-87 (24 pages)
  - c. Chapter 5, p89-105 (16 pages)
  - d. Chapter 6, Social Capital, Markets and Money in a Circular Economy, p108-125 (17 pages)
  - e. Chapter 9, The Regenerative Biological Cycle at Scale, p159-173 (14 pages)
  - f. Chapter 10, p175-189 (14 pages)

---

### Recommended/Optional Readings

1. Amendolare, Nicholas. “What is the tragedy of the commons?” TED-Ed Video. 2017. ([Available here](#)) (5 mins)
2. Benyus, Janine. *Biomimicry*. (Harper Perennial, 2002). Print. (297 pages)
3. Benyus, Janine: Video. Biomimicry in action, TED Talk, (2009). [Available here](#). (20 min)
4. Brown, Tim: Design & the circular economy – Circular Design Guide. [Available here](#).
5. BSI. “Executive Briefing: BS 8001 – a Guide”. (BSI, 2017). Web. (6 pages) [Available here](#)
6. Cabrera Research Lab, Video: “*NEW Systems-thinking: A Little Film About a Big Idea*”, 2015. ([Available here](#))
7. Circle-Economy & The City of Amsterdam: “Circular Amsterdam”, 2018. Web. [Multiple Resources Available here](#).
8. Despeisse, M., Baumers, M et al. “Unlocking value for a circular economy through 3D printing: A research agenda”, February 2017. Elsevier. *Technological Forecasting and Social Change* Volume 115, pages 75-84 (10 pages).
9. DG Environment Consortium. “Scoping study to identify potential circular economy actions, priority sectors, material flows & value chains”, August 2014. Web. Chapters 4-7, p15-72 (57 pages) and Annex 4. [Available here](#).
10. Donella Meadows Institute: “*In a World of Systems*”. Video. 2016. ([Available here](#)) (9 min)
11. Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. Chapters 3 & 4, p70-92 (22 pages) and p114-136 (22 pages).
12. Ellen MacArthur Foundation (in cooperation with Granta and LIFE). “Circularity Indicators. An Approach to Measuring Circularity: Methodology”, May 2015. Web. (98 pages) [Available here](#)
13. Ellen MacArthur Foundation, “Circular Consumer Electronics: An Initial Exploration”. 2018. PDF [Available here](#). (17 pages)
14. Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2015. Web. p91-146 - Denmark case study (55 pages) [Available here](#)
15. Ellen MacArthur Foundation Educational Resources: Schools of Thought ([Available here](#))
16. Ellen MacArthur Foundation, “The New Plastics Economy: Catalysing Action” Ellen MacArthur Foundation. 2017. Web. (49 pages) [Available here](#)
17. Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 2: Opportunities for the Consumer Goods Sector” Ellen MacArthur Foundation. 2013. Web. (101 pages) [Available here](#)
18. Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains” Ellen MacArthur Foundation. 2014. Web. Chapters 1, 2, 3 & 4, p11-64 (53 pages) [Available here](#)
19. Ellen MacArthur Foundation, “Urban Biocycles” Ellen MacArthur Foundation. 2017. Web. (36 pages) [Available here](#)

## Master of Science in Sustainability Management

20. Franconi, Ellen, Brett Bridgeland et al. *A New Dynamic 2: Effective Systems in a Circular Economy*. Ellen MacArthur Foundation Publishing, 2016. Print.
  - a. Chapter 3, Towards a Regenerative Food System, p49-61 (12 pages)
  - b. Chapter 8, Broader Lessons from Self-Organising Traffic Lights in City Transport Systems, p143-155 (12 pages)
  - c. Chapter 9, Challenges and Capabilities for Scaling up Circular Economy Business Models – A Change Management Perspective, p157-175 (18 pages)
21. Graedel, T.E. and Allenby, B.R. *Industrial Ecology* (Second Edition). New Jersey: Pearson Education, 2003. Print. p183-227 (43 pages) and p268-283, (23 pages). Available at CU Libraries.
22. Groothuis, Femke (supported by ACCA), “Tax as a force for good”. ACCA 2018. Web. p1-52 (52 pages). [Available here](#).
23. Kim, Daniel. *Introduction to Systems Thinking*, Pegasus Communications, 1999. Print. (21 pages) ([Available here](#))
24. London Waste and Recycling Board (LWRAB), “London’s Circular Economy Route Map”, 2017. Web (60 pages) [Available here](#)
25. Haskel, J & Westlake, S. *Capitalism without Capital*. Princeton University Press, 2018. Print. (242 pages).
26. Lovins, B, Amory, Michael Braungart et al. *A New Dynamic: Effective Business in A Circular Economy*. Ellen MacArthur Foundation Publishing, 2013. Print.
  - a. Chapter 2: A Concise Guide to the Circular Economy, p19-28 (9 pages)
  - b. Chapter 8: Rebuilding Economic Vitality, Rev@ the World, by Sally Goerner and Randolph Voller, p112-128 (16 pages)
  - c. Chapter 9: White Goods/Washing Machines – Business Case Study, p129-142 (13 pages)
  - d. Chapter 10: Implementing a Circular and Performance Economy through Business Model Innovation, p143-156 (13 pages)
27. Mazzucato, Mariana. *The Value of Everything: Making and Taking in the Global Economy*. Penguin Random House, 2018. Print. (280 pages).
28. Mazzucato, M and McPherson, M, “The Green New Deal: A bold mission-oriented approach” IIPP Policy Brief, UCL, December 2018. Web. (7 pages). [Available here](#).
29. McDonough, William, and Michael Braungart. *Cradle to Cradle: Remaking the Way We Make Things*. (North Point, 2002). Print. (193 pages)
30. McDonough, William, and Michael Braungart. *The Upcycle: Beyond Sustainability – Designing for Abundance*. New York: North Point, 2013. Print. (217 pages)
31. NY Times “The Daily Podcast”: What American C.E.O.s are worried about. Aug 2019, [Available here](#) (25 min)
32. NYC: Zero Waste Design Guidelines, 2017, (authored & supported by multiple participants). Web/PDF [Available here](#). (270 pages)
33. Raworth, K. *Doughnut Economics. Seven Ways to Think Like a 21st-Century Economist*. Random House, 2017. Print. (250 pages)
34. Schenck, Rita C. “LCA for Mere Mortals. A Primer on Life Cycle Assessment” (IERE, 2000). Web. (103 pages) [Available here](#)
35. Szaky, Tom, et al. *The Future of Packaging, From Linear to Circular*. (Berrett-Koehler, 2019). Print. (242 pages). [Available here](#) (through CLIO)
36. The Ex’tax Project, “New Era. New Plan. Europe. A Fiscal Strategy for an Inclusive, Circular Economy. The Ex’tax Project Foundation, 2016. Web. (196 pages) – of particular interest are chapters 3,-5, 7 & 8 [Available here](#).
37. The Recycling Partnership. “The 2016 State of Curbside Report”, January 2017. Web. (25 pages) [Available here](#)
38. Trebeck, K and Williams J. *The Economics of Arrival*. Policy Press, 2019. Print. (215 pages)
39. Van Staveren, I. *Economics After the Crisis: An introduction to Economics from a Pluralist and Global Perspective*. Routledge, 2015. Print. (431 pages)
40. Working Group FinanCE. “Money Makes the World Go Round (and will it help to make the economy circular as well?)”, March 2016. Web. Sections 2 & 3, p35-68 (33 pages) [Available here](#).



## Master of Science in Sustainability Management

### Resources

#### *Course Specific Tools*

I recommend exploring the following resources to provide additional information and examples:

<https://kumu.io/ellenmacarthurfoundation/educational-resources#circular-economy-general-resources-map/key-for-general-resources-map>  
<https://www.ellenmacarthurfoundation.org/case-studies>  
<https://www.thinkdif.co/>  
<https://medium.com/circulateneews>  
<https://www.weforum.org/agenda/2016/04/8-videos-that-explain-the-circular-economy/>  
<https://www.circulardesignguide.com/>  
<https://www.systemsfieldbook.org/>  
<https://thesystemsthinker.com/>  
<https://www.greenbiz.com/topics/circular-economy>  
<https://www.sustainablebrands.com/>  
<https://biomimicry.net/>  
<https://www.circle-economy.com/>  
<http://www.closedlooppartners.com/>  
<http://www.symbiosis.dk/en/>  
<https://ubuntoo.com>

#### *Columbia University Library*

Columbia's extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online: <http://library.columbia.edu/>. The Columbia University Libraries offer many services to faculty including direct contact with librarians who will build custom queries and set up custom databases for your course. They also work one on one with students and consult with faculty to build research projects for courses. Many faculty services are available via CUL/IS such as subject guides (<http://library.columbia.edu/subject-guides.html>), the digital collections (<http://library.columbia.edu/find/digital-collections.html>) and how to request an appointment with a librarian to review library, archival, print and electronic resources, including primary sources, to customize resources for their course (<https://library.columbia.edu/find/request/reference/consultation.html>)

#### *SPS Academic Resources*

The Office of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: <http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources>.

### Course Requirements (Assignments)

In total, there are 10 assignments for this class. The deliverables consist of nine individual writing assignments and a group term project. Each assignment is due at the beginning of class on Monday of that week (e.g. Assignment #1 is due at the beginning of class on 9/14 etc.)

**Four assignments are Point-of-View (POV) writing assignments.** POV writing deliverables will be posted to the discussion board on Canvas and should be no longer than 250 words in length. You will be asked to share your point-of-view on specific class topics and/or weekly readings. These assignments are designed to provide you with the opportunity to internalize each week's class topic. Your work will be evaluated individually and each POV writing assignment is worth 5% of your final grade.

**Five assignments are Case Study assignments.** Case study deliverables should be no more than three pages in length. You will be asked to use specific tools and/or reading material to conduct a straightforward analysis of a situation and present your findings and/or suggested solutions to a specific dilemma. These assignments are designed to test your understanding of key concepts. Your work will be evaluated individually. Case studies will include an answer to the dilemma, rationale to support that answer and evidence, calculations, logic and assumptions behind the rationale where relevant. Work will be evaluated individually, and each Case Study assignment is worth 5% of your final grade.

## Master of Science in Sustainability Management

**Group Term Project: During the course of the semester, you will also complete a term project in groups of approximately four**, producing a term project report and delivering a summary oral presentation/pitch. Over the course of the semester, in your group, you will explore the circular economy systems upstream for a common consumer good or product of your choosing:

***Think big: What changes would need to be made for XYZ consumer product to adhere to circular economy principles both in design, execution and end of life management?***

You will demonstrate having achieved the learning goals for the course by including the following in your report, summarized in an engaging way in your presentation:

### **Background research**

- What consumer product are you choosing? (be specific)
- Materials mapping of your product (Packaging, raw materials, end of life, etc)
- What does the current system look like - what are the networks, enablers, active businesses, key stakeholders, communities & supply chains? (supply chain mapping for key raw material ingredients and packaging components: where do they come from? What are the challenges for sourcing?)
- Human rights risks?

### **Business case**

- Why is this product suited for circular disruption?
- What is the market opportunity?
- What are the barriers you face?
- Gap analysis: what solutions are out there? Where are there gaps that you need to imagine/create?

### **Circular approach and implementation i.e. your proposed product, solution or process**

- Present your chosen product, redesigned for circularity
- Draw on best practice/examples to demonstrate feasibility
- Identify key enablers and potential barriers to achieving this
- Work through the economic viability of your proposal vs current reality

### **Implementation, route to market and scalability**

- Suggest a plan for implementation and an approach to measuring the success for your newly imagined application/solution in relation to its circular credentials
- What is your route to market?
- What are your options for scaling?
- What are your immediate next steps?

Master of Science in Sustainability Management

**Evaluation/Grading**

100 Points Total divided as follows:

**Class participation (0 points)**

- Stay current on readings and current events readings, and be prepared in class or through Canvas discussions to raise points of interest and questions you may have. Active participation during class and on Canvas.

**Point-of-View writing assignments (5 points each, for total of 20 points)**

- Present your insights on things you found interesting in the readings

**Case Study assignments (5 points each, for total of 25 points)**

- Answering the dilemma presented
- Use calculations, data and/or cited evidence to support the answer
- Present within the length limits

**Term project (55 points)**

- 35 points for the report content and coverage (in line with criteria provided)
- 15 points for the summary presentation/pitch, including content and style/layout
- 5 points for peer evaluation: your student peers will assign points, from 0-100 based on the following evaluation criteria, and average scores will be used for peer evaluation points:
  - Individual grade (from your group) to reflect your performance during work on the term project (50%)
  - Group grade (from the other students) for presentation content (25%)
  - Group grade (from the other students) for presentation style and layout (25%)

ASSIGNMENT	% Weight
Attendance and class participation	0%
Term project	55%
4 x POV writing assignments	20%
5 x Case study assignments	25%

**FINAL GRADING SCALE**

Grade	Points
A+	98–100
A	93–97
A-	90–92
B+	87–89
B	83–86
B-	80–82
C+	77–79
C	73–76
C-	70–72
D	60–69
F	59 and below



## Master of Science in Sustainability Management

### Course Policies

#### *Participation and Attendance*

I expect you to come to class on time and thoroughly prepared if you are taking the class live. I will keep track of attendance and look forward to an interesting, lively and confidential discussion. If you miss an experience in class, you miss an important learning moment and the class misses your contribution. A chronic lack of engagement will impact your grade.

#### *Late work*

There are 10 deliverables. The nine writing assignments will be due at the beginning of class each Monday via Canvas. It is your responsibility to ensure that I receive your submission. There will be an automatic 1 point reduction in score for deliverables submitted up to a day late. No points will be awarded to any deliverable submitted over 24 hours after the due date/time.

Teams will present their term projects to the class at the end of the semester, and the term project report will be due at the time of the presentations.

### School Policies

#### *Copyright Policy*

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

#### *Academic Integrity*

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at

<http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

#### *Accessibility*

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>.

Master of Science in Sustainability Management

Course Schedule/Course Calendar

Date	Topics and Activities	Readings (due on this day)	Assignments
9/14	<p><b>A Circular Economy: Why?</b> <i>Topics</i></p> <ul style="list-style-type: none"> <li>• Course introduction, requirements and objectives for the class</li> <li>• Overview of the key principles of Circular Economy (background, rationale, basic theory, schools of thought)</li> <li>• Megatrends, imperatives and enablers</li> <li>• Term project intro</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Introductions</li> <li>• Course overview</li> <li>• Lecture</li> <li>• Discussion</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Podcast: <a href="https://www.stitcher.com/podcast/stitcher/science-rules-with-bill-nye/e/76550199">Science Rules! with Bill Nye</a> and William McDonough <a href="https://www.stitcher.com/podcast/stitcher/science-rules-with-bill-nye/e/76550199">https://www.stitcher.com/podcast/stitcher/science-rules-with-bill-nye/e/76550199</a></li> <li>• VIDEO: <a href="https://www.youtube.com/watch?time_continue=228&amp;v=zCRKvDyyHmI&amp;feature=emb_logo">https://www.youtube.com/watch?time_continue=228&amp;v=zCRKvDyyHmI&amp;feature=emb_logo</a></li> <li>• Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 1: Economic and Business Rationale for an Accelerated Transition” Ellen MacArthur Foundation. 2013. Web: p6-34 (28 pages)</li> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2017. Print Introduction &amp; Chapter 1-3, p7-61 (54 pages)</li> <li>• McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. New York: North Point, 2002. Print. Chapter 2: p45-67 (22 pages)</li> </ul> <p><i>Recommended (Optional):</i></p> <ul style="list-style-type: none"> <li>• Ellen MacArthur Foundation Educational Resources: Schools of Thought (<a href="#">Available here</a>)</li> <li>• Ellen MacArthur Foundation, “Towards the Circular Economy Vol. 3: Accelerating the Scale-Up Across Global Supply Chains” Ellen MacArthur Foundation. 2014. Web. Chapters 1 &amp; 2, p11-36 (25 pages)</li> <li>•</li> </ul>	<p>Personal bio (Due 9/14)</p> <p>Assignment #1: Point-of-view. (Due 9/14)</p>
9/21	<p><b>A Circular Economy: What?</b> <i>Topics</i></p> <ul style="list-style-type: none"> <li>• Rethinking existing economic systems and constructs</li> <li>• Education and mindsets</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 4, Through the Macroscope, p63-87 (24 pages)</li> <li>• Video: “Why it’s time for Doughnut Economics”, Kate Raworth, 2014 (<a href="#">Available here</a>) (17 min)</li> </ul>	<p>Assignment #2: Point-of-view. (Due 9/21)</p>

Master of Science in Sustainability Management

		<ul style="list-style-type: none"> <li>• “Capitalism’s greatest weakness? It confuses price with value”, Mariana Mazzucato, 2018. Web. (<a href="#">Available here</a>) (2 pages)</li> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 10, p175-189 (14 pages)</li> </ul>	
9/28	<p><b>Business Models</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Business Models for a circular economy</li> <li>• Servicization</li> <li>• Financial system limitations</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> <li>• <b>Guest Speaker: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 5, p89-105 (16 pages)</li> <li>• Rutqvist, Jakob and Peter Lacy. <i>From Waste to Wealth: The Circular Economy Advantage</i> (Palgrave Macmillan, 2015). Print. Section II, pages 68-114 (46 pages)</li> <li>• ING Economics Department. “Rethinking finance in a Circular Economy”, May 2015. Web. Section 4: p 34-52 (18 pages)</li> </ul>	Assignment #3: Point-of-view. (Due 9/28)
10/5	<p><b>Design</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Schools of thought (recap)</li> <li>• “Design for” – different approaches and their considerations</li> <li>• Material selection</li> <li>• Human-centered design</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Group workshop</li> <li>• <b>Guest Speaker: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• McDonough, William, and Michael Braungart. <i>Cradle to Cradle: Remaking the Way We Make Things</i>. (North Point, 2002). Print. Chapter 3, p68-91 (23 pages)</li> <li>• Benyus, Janine. <i>Biomimicry</i>. (Harper Perennial, 2002). Print. Chapter 1, p1-10 (10 pages)</li> <li>• Video: Janine Benyus. <i>Biomimicry in action</i>, TED Talk, (2009). <a href="#">Available here</a>. (20 min)</li> <li>• Tim Brown: <i>Design &amp; the circular economy – Circular Design Guide</i>. <a href="#">Available here</a>.</li> </ul>	Assignment #4: Case Study. (Due 10/5)
10/19	<p><b>Policy Considerations</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Approaches and interventions</li> <li>• Municipal, regional, national, supranational and international considerations</li> <li>• Fiscal policy as a case study</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussions</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Ellen MacArthur Foundation, “Delivering the Circular Economy: A Toolkit for Policymakers” Ellen MacArthur Foundation. 2015. Web. p39-88 (49 pages)</li> <li>• Groothuis, Femke (supported by ACCA), “Tax as a force for good – Headline summary”. ACCA 2018. Web. p1-8 (8 pages). <a href="#">Available here</a>.</li> <li>• Congress.gov “Green New Deal” Resolution text. Web. (14 pages). <a href="#">Available here</a>.</li> </ul>	Group Project Check In

Master of Science in Sustainability Management

	<ul style="list-style-type: none"> <li>• <b>Guest Speaker: TBD</b></li> </ul>		
10/26	<p><b>Flows (Part I)</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Revisiting systems thinking: stocks and flows</li> <li>• Information flows</li> <li>• The concept of value; the power of capital; money as information</li> <li>• Energy flows</li> <li>• Material flows</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussions</li> <li>• <b>Guest Speaker: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Meadows, Donella. <i>Thinking in Systems: A Primer</i>. Chelsea Green Publishing, 2008. Print. Chapter 1, Chapter 7 and Appendix up until Model Equations (53 pages in total).</li> <li>• Video: Beinhocker, Eric, “The economy as a complex and evolving system”: Lecture from UCL Institute for Innovation and Public Purpose, Feb 2019 (40 mins)</li> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 6, Social Capital, Markets and Money in a Circular Economy, p108-125 (17 pages)</li> <li>• Ellen MacArthur Foundation, “Intelligent Assets: Unlocking the Circular Economy Potential” Ellen MacArthur Foundation. 2016. Web. p28-63 (35 pages)</li> <li>• Video: “<i>In a World of Systems</i>”, Donella Meadows Institute, 2016 (<a href="#">Available here</a>) (9 min)</li> <li>• Video: “<i>NEW Systems-thinking: A Little Film About a Big Idea</i>”, Cabrera Research Lab, 2015. (12 min) (<a href="#">Available here</a>)</li> </ul>	Assignment #5: Case Study. (Due 10/26)
11/2	<p><b>Flows (Part II)</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Biological cycle/nutrients</li> <li>• Organics</li> <li>• Bio-based materials</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>• Lecture</li> <li>• Discussion</li> <li>• <b>Guest Speaker: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Webster, Ken. <i>The Circular Economy: A Wealth of Flows</i>. Ellen MacArthur Foundation Publishing, 2015. Print. Chapter 9, The Regenerative Biological Cycle at Scale, p159-173 (14 pages)</li> <li>• Ellen MacArthur Foundation &amp; CE100, “Water and Circular Economy: A White Paper, 2018(<a href="#">Available here</a>) (18 pages)</li> <li>• Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 5, The Circular Economy of Soil, p87-103 (16 pages)</li> <li>• Szaky, Tom, et al. <i>The Future of Packaging, From Linear to Circular</i>. (Berrett-Koehler, 2019). Print. Chapter 7, p105-119 (14 pages)</li> </ul>	Group Project Check-in
11/9	<p><b>Flows (Part III)</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>• Technical cycle/nutrients</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>• Ellen MacArthur Foundation, “The New Plastics Economy: Rethinking the Future of</li> </ul>	Assignment #6: Case Study. (Due 11/9)

Master of Science in Sustainability Management

	<ul style="list-style-type: none"> <li>Industrial ecology and symbiosis</li> <li>3D printing</li> <li>Plastics</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>Materials – group exercise</li> <li>Lecture</li> <li>Discussion</li> </ul>	<p>Plastics”. Ellen MacArthur Foundation. 2016. Web. (92 pages)</p> <ul style="list-style-type: none"> <li>Szaky, Tom, et al. The Future of Packaging, From Linear to Circular. (Berrett-Koehler, 2019). Print. Chapter 1, p9-23 (14 pages)</li> <li>Despeisse, M., Baumers, M et al. “Unlocking value for a circular economy through 3D printing: A research agenda”, February 2017. Elsevier. Technological Forecasting and Social Change Volume 115, pages 75-84 (10 pages).</li> </ul>	
11/16	<p><b>Flows (Part IV)</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>Reverse logistics, re-use, re-manufacturing</li> <li>Waste and recycling - challenges</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>Class Discussion/Q&amp;A</li> <li>Lecture</li> <li>Guest Lecturer: TBD</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>Ellen MacArthur Foundation, “Re-use: Rethinking Packaging”, 2019. PDF <a href="#">Available here</a>. (43 pages)</li> <li>Szaky, Tom, et al. The Future of Packaging, From Linear to Circular. (Berrett-Koehler, 2019). Print. Chapters 2-6, p23-104 (81 pages)</li> <li>Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 6, Remanufacturing and the Circular Economy, p107-127 (20 pages)</li> </ul>	Assignment #7: Case Study. (Due 11/16)
11/23	<p><b>Implementation &amp; Measurement</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>Approaches to implementation and measurement incl. tools to get started, prioritization, guidance and measurement</li> <li>Life Cycle Assessment</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>Lecture</li> <li>Discussion</li> <li><b>Guest lecture: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>Ellen MacArthur Foundation, “Achieving ‘Growth Within’” Ellen MacArthur Foundation. 2017. Web. p16-52 (36 pages)</li> <li>Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 11: Circularity Indicators, p195-210 (15 pages)</li> <li>Ellen MacArthur Foundation (in cooperation with Granta and LIFE). “Circularity Indicators. An Approach to Measuring Circularity: Project Overview”, May 2015. Web. (12 pages) <a href="#">Available here</a>.</li> </ul>	Assignment #8 Point-of-view. (Due 11/23)
11/30	<p><b>Applications: Organizations &amp; Circular Economy</b></p> <p><i>Topics</i></p>	<p><i>No reading is required for this class, but please use the time to familiarize yourself with all of the term project criteria and any additional pre-read</i></p>	Group Project Check In

Master of Science in Sustainability Management

	<ul style="list-style-type: none"> <li>The roles of key stakeholders in innovation for CE</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li><b>Guest lecture: TBD</b></li> </ul>	<i>material supplied to gain maximum value from this class.</i>	
12/7	<p><b>Applications: Circular Cities and the built environment</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>Cities as environments</li> <li>Urban Metabolism vs Urban Ecosystem approaches</li> <li>Roadmaps for cities</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li><b>Guest lecture: TBD</b></li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. <ul style="list-style-type: none"> <li>Chapter 1, Circular Business Opportunities for the Built Environment, p9-27 (18 pages)</li> <li>Chapter 10, Cities as Flows in a Circular Economy, p177-193 (16 pages)</li> </ul> </li> <li>Franconi, Ellen, Brett Bridgeland et al. <i>A New Dynamic 2: Effective Systems in a Circular Economy</i>. Ellen MacArthur Foundation Publishing, 2016. Print. Chapter 4, Ecosystems as a Unifying Model for Cities and Industry, p63-85 (22 pages)</li> <li>NYC: Zero Waste Design Guidelines, 2017, (authored &amp; supported by multiple participants). p18-37 (20 pages). Web/PDF <a href="#">Available here.</a></li> </ul>	N/A
12/14	<p><b>Applications: Fashion &amp; Textiles</b></p> <p><i>Topics</i></p> <ul style="list-style-type: none"> <li>Industry basics</li> <li>The fashion &amp; textiles system and supply chain</li> <li>Business models and opportunities</li> <li>Active industry project</li> </ul> <p><i>Activities</i></p> <ul style="list-style-type: none"> <li>Lecture</li> <li>Discussion</li> <li>Guest Lecturer: TBD</li> </ul>	<p><i>Required:</i></p> <ul style="list-style-type: none"> <li>Video documentary: Ross, M. (Producer), &amp; Morgan, A. (Director). (2015). <i>The True Cost</i>. United States: Life is My Movie Entertainment; Untold Creative LLC (1h 32 min): <a href="https://truecostmovie.com/">https://truecostmovie.com/</a></li> <li>Ellen MacArthur Foundation, “A New Textiles Economy: Redesigning Fashion’s Future” Ellen MacArthur Foundation. 2017. Web. p36-117 (81 pages). <a href="#">Available here.</a></li> </ul>	Assignment #9: Case Study. (Due 12/14)
12/21	<p><b>Oral presentations/pitches</b> <i>May be an extended class to accommodate all presentations</i></p>	<ul style="list-style-type: none"> <li><i>No required reading for this class</i></li> </ul>	Group Projects Due