COLUMBIA UNIVERSITY
School of Professional Studies

Master of Science in Sustainability Management

SUMA PS5260 Digital Product Development for Sustainability
Scheduled Meeting Times: TBD
Number of Credits (3)
Elective

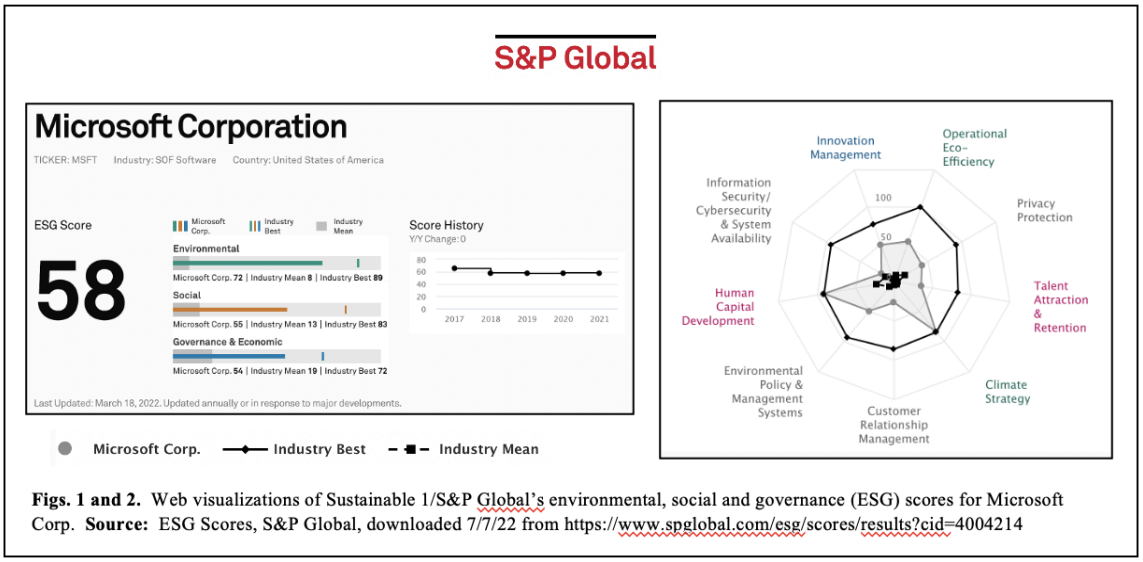
Instructor: Teri Mendelsohn, Lecturer, TM137@columbia.edu
Office Hours: TBD
Response Policy: Email inquiries during the workweek are preferred. I will respond within 24 hours.

Facilitator/Teaching Assistant: TBD
Office Hours: TBD
Response Policy: TBD

Course Overview

In April 2022, the Intergovernmental Panel on Climate Change (IPCC) reported that global efforts are unlikely to reduce carbon emissions in line with COP21 targets of 1.5° C above pre-industrial levels. This finding underscores the urgency around decarbonizing the economy and sustainably managing natural resources. A so-called "big, hairy, audacious goal," it requires that similarly ambitious solutions be implemented across countries and industries.

It is only by measuring resources that stakeholders can manage them and ensure that they are available in sufficient quantities for future generations. Web tools provide up-to-date analyses of aggregated data; distill complex issues into accessible visualizations; enable users to drill down to answer questions; offer insights into complicated and interdependent issues; and display changes in performance over time. For example, Sustainable 1/S&P Global's ESG Scores are valuable because they expose patterns in data related to environmental, social and governance risks and opportunities:



Figs. 1 and 2. Web visualizations of Sustainable 1/S&P Global's environmental, social and governance (ESG) scores for Microsoft Corp. **Source:** ESG Scores, S&P Global, downloaded 7/7/22 from https://www.spglobal.com/esg/scores/results?cid=4004214

Fig. 1 displays Microsoft's total weighted ESG score; the breakdown of each component score compared to the software industry's best and median scores; and the company's ESG performance over time. **Fig. 2** summarizes underlying ESG factors on which Microsoft was scored and benchmarks factor scores against those of the best performers in the industry and the industry mean. Together, these visualizations alert Microsoft to its overall standing and investors to the benefits and risks of investing in Microsoft.

Efforts are underway -- locally, regionally, nationally and internationally -- to address climate and ESG issues and many more need to appear on drawing boards. Examples include:

- In the northeastern U.S., 30 gigawatts of offshore wind, enough to provide electricity to 10 million homes, are slated to be installed by 2030.
- Globally, companies need to evaluate opportunities to deploy renewable energy and energy efficiency measures in their facilities in order to reduce carbon emissions and costs.
- Coastal cities are studying their exposure to sea-level rise so they can harden electricity infrastructure and avoid blackouts caused by more frequent storms.
- Indigenous populations and local governments in the Amazon wish to protect the jungles that act as global carbon sinks and generate revenue opportunities from carbon credits.
- Investors want to understand the exposure of their portfolios to ESG risk.

This elective course will introduce students to the digital product management role in the context of sustainability. Students will get a strong understanding of what it means to be a product manager and its role in the organization. The course will demonstrate how to define a product vision; identify a product strategy; create product roadmaps; design a customer experience; enable data-driven decisions; understand the development process; manage for results; and, by "leading through influence," coordinate cross-functional teams of business analysts, developers, data providers, marketing, users, customers, senior management and other stakeholders. The course is about product strategy and how to innovate and launch new products and features. Students will be prepared for product management roles in companies; though many of those skills are applicable to entrepreneurship, the course is not geared toward start-ups or new ventures.

Students will be introduced to issues and information needs for governance, solar and wind energy, water, sustainable finance, wildlife, and diversity, equity and inclusion (DEI). Industry experts will deliver guest lectures. In-class exercises will provide hands-on experience with product management methods.

The on-campus, full-semester course is intended for 24 second-year students with previous grounding in climate and environmental issues. Instructor permission is required to enroll in the course.

Learning Objectives

The objectives of this course are to:

- **L1:** Use tools and techniques to conceive, build, and manage sustainability-related products and services over their life cycle
- **L2:** Define and communicate the product strategy and business case
- **L3:** Understand how to develop and execute a go-to-market strategy for digital products
- **L4:** Apply agile methods and key business metrics to build an effective product portfolio
- **L5:** Understand the requirements to lead cross-functional teams and manage with influence.

Readings

Required Reading (available on Canvas except where otherwise indicated):

Bakker, Karen. *Gaia's Web: How Digital Environmentalism Can Combat Climate Change, Restore Biodiversity, Cultivate Empathy, and Regenerate the Earth*. MIT Press, 2024.

Bose, Satyajit, Guo Dong and Anne Simpson, *The Financial Ecosystem: The Role of Finance in Advancing Sustainability.* Palgrave Macmillan, 2019, pp. 1-18 and 83-110 (44 pp.)

Brennan, Kevin J., Sallie Godwin and Filip Hendrickx, *Digital Product Management.* BCS, 2022, pp. 1-173 (172 pp.)

Daigger, Glenn T., Nikolay Voutchkov, Upmanu Lall, and Will Sarni. "The Future of Water." *Inter-American Development Bank Water and Sanitation Division,* Spring 2020, pp. 54-84 (30 pp.)

Wyllie de Echeverria, Victoria Rawn, and Thomas F. Thornton. "Using traditional ecological knowledge to understand and adapt to climate and biodiversity change on the Pacific coast of North America." *Ambio* 48, no. 12 (2019): 1447-1469.

Drucker, Peter F. "The discipline of innovation." *Harvard business review* 80, no. 8 (2002): 95-102 (7 pp.)

Hawken, Paul, ed. *Drawdown: The most comprehensive plan ever proposed to reverse global warming*. Penguin, 2017, 6 pp. of your choosing

McGrath, Rita, "The New Disrupters," Harvard Business Publishing, Feb. 2020, pp. 1-9 (8 pp.)

McKinsey & Co. and LeanIn.org, *Women in the Workplace 2023, https://www.mckinsey.com/featured-insights/diversity-and-inclusion/women-in-the-workplace#/*, pp. 4-41 (37 pp.)

Muller, Jerry Z., *The tyranny of metrics.* Princeton University Press, 2015, pp. 1-28 (27 pp.)

Smith, Edward and Steven C. Wheelwright, "The New Product Development Imperative," Harvard Business School Publishing Corp., 1999, pp. 1-21 (20 pp.)

Trelstad, B. et al., "Just Arrived: Integrating Refugees in Sweden," Harvard Business Publishing, 2021 (22 pp.)

Tufte, Edward R. *The visual display of quantitative information.* Graphics Press, 1983, pp. 13-52 (39 pp.)

Usher, Bruce, *Renewable Energy*, Columbia University Press, 2019, pp. 29-54 (25 pp.)

Recommended Videos:

"Renewable Energy Storage," Energy & Environment Women's Circle, Columbia Business School Alumni Affairs, 2020.

Recommended Reading:

Antonelli, Paola. *The Neri Oxman materials ecology catalogue.* Museum of Modern Art, 2020 (181 pp.).

Barry, Roger G., and Eileen A. Hall-McKim. *Essentials of the Earth's climate system*. Cambridge University Press, 2014 (272 pp).

Chambers, Becky, *A psalm for the wild built.* Tordotcom, 2021(160 pp.).

Cohen, Allan R., and David L. Bradford. *Influence without authority, 3e*. John Wiley & Sons, 2017 (320 pp.).

Daly, Herman. *Steady state economy*. W.H. Freeman & Co., 1973, Introduction, pp. 47-52 (5 pp.)

Elkington, John. *Green swans: The coming boom in regenerative capitalism.* Fast Company Press, 2020 (284 pp.).

Godin, Seth. *The carbon almanac.* Penguin, 2022, pp. 263-311 (48 pp.).

Gregory, R., L. Failing, M. Harstone, G. Long, T. McDaniels, and D. Ohlson, *Structured decision making: A practical guide to environmental management choices.* Wiley-Blackwell, 2012 (299 pp.)

Henderson, Rebecca. *Reimagining capitalism in a world on fire.* Public Affairs, 2020, pp. 31-50 (29 pp.)

Heal, Geoffrey. *Endangered economies: How the neglect of nature threatens our prosperity.* Columbia University Press, 2017 (240 pp).

Hendriks, Martin R., *Introduction to physical hydrology.* Oxford University Press, 2010 (352 pp.).

Kelley, Tom and Jonathan Littman, *The ten faces of innovation: IDEO's strategies for beating the devil's advocate & driving creativity throughout your organization.* Profile Books, 2016, pp. 1-14 (13 pp.)

Knight, S. "Designing the Apocalypse," *New Yorker,* Sept. 25, 2023, pp. 22-28 (6 pp.)

McGrath, RG & IC Macmillan, "Driving Corporate Growth with the Right Disciplines: A Discovery-Driven Approach," Harvard Business School Publishing, 2009 (28 pp.)

Mitchel, Andy. *The Esri guide to GIS analysis: volume 1, Geographic patterns & relationships*. ESRI Press, 1999 (312 pp.).

Pearce, Fred. *When the rivers run dry, fully revised and updated edition: water-the defining crisis of the twenty-first century*. Beacon Press, 2018 (328 pp.).

Roberts, Callum M., Colin J. McClean, John E.N. Veron, Julie P. Hawkins, Gerald R. Allen, Don E. McAllister, Cristina G. Mittermeier et al. "Marine biodiversity hotspots and conservation priorities for tropical reefs." *Science* 295, no. 5558 (2002): 1280-1284 (4 pp.).

Sachs, Jeffrey D. *The age of sustainable development*. Columbia University Press, 2015 (544 pp.).

Smil, Vaclav. *Energy myths and realities*. Washington, DC: AEI Press, 2010 (232 pp.).

Wainwright, John and Mark Mulligan, *Environmental modelling: Finding simplicity in complexity, 2e.* Wiley-Blackwell, 2013, ch. 11: Modelling Catchment and Fluvial Processes and their Interactions, pp. 3-26 (25 pp.)

Yunus, M. (1999). The Grameen Bank. *Scientific American*, *281*(5), 114-119 (5 pp.).

Assignments and Assessments

Comments and a grade and will be returned to students two weeks after submission of assignments and assessments:

1. **Assignment 1:** Critique a web-based decision-support tool -- Identify an existing web-based decision support tool and prepare a 500-word, double-spaced critique of it that addresses these questions: What is effective about the site (design, data)? What doesn't work? What would you change in future releases? For whom would the site be valuable in its current version? If the changes you recommend were made, how would the site be improved from the user's perspective? The assignment will instruct students how to think critically about the user experience of existing digital solutions. Grading criteria: 1) select relevant web tool with substantial content, features and functions; 2) answer discussion questions thoughtfully; 3) consider solution's shortcomings from user's perspective and respond with product manager's ability to discern opportunities to improve or expand product's look-and-feel and functionality. [L1, L2; 10% of final grade]

2. **Assignment 2: Case –** With your team, discuss the case provided and prepare case questions, also provided, for class discussion. Grading criteria: 1) grasp of conflicting demands presented in the case; 2) ability to communicate clearly your team's assessment of and recommendations for the situation. **[L2, L5; 10% of final grade]**

3. **Midterm exam –** The take-home midterm exam will assess the students' grasp of material covered in the course and enable them to synthesize that understanding. Grading criteria: 1) grasp of product management responsibilities; 2) ability to identify which product management tools to use when. **[L1, L2, L3; 20% of final grade]**

4. **Assignment 3: Critique a web-based decision support tool --** Without looking at the work you did on assignment 1, go back to the web site your reviewed and critique it again. Prepare a 500-word, double-spaced critique of it that addresses these questions: What is effective about the site (design, data)? What doesn't work? What would you change in future releases? For whom would the site be valuable in its current version? If the changes you recommend were made, how would the site be improved from the user's perspective? The assignment will instruct students how to think critically about the user experience of existing digital solutions. **[L1, L2; 10% of final grade]**

5. **Assignment 4: Final project proposal, presentation and report –**
    a. **Project Proposal --** Prepare a project proposal outlining the product idea and its business case.
    b. **Presentation --** Prepare a 10-minute PowerPoint presentation that you will present to the class during the last week of the course. The presentation will summarize the product opportunity, the mock-up of the product and the business case for the product.
    c. **Business Plan --** Prepare a 5–7-page business plan outlining the product opportunity, assessing Porter's Five Forces or Osterwalder's Mission Model Canvas and displaying a mock-up (PowerPoint) or interactive demo (e.g., wpdemo.com, duda.co) of your web site.

    The final project will be an opportunity to identify an issue in sustainability, develop a digital product related to it and assess the market opportunity for the product. Grading criteria: ability to 1) identify a viable product opportunity; 2) convey how the product will satisfy user needs; and 3) present a compelling business case for the solution. **[L1, L2, L3, L4, L5; 25% of final grade]**

6. **Quizzes and Homework Presentation –** There will be two in-class quizzes and one homework presentation that will assess the students' grasp of the homework and class material. Quiz grading criteria: 1) firm grasp of the material; 2) ability to explain material succinctly and clearly. Homework grading criteria: 1) thorough synthesis of article's key points; 2) Valid critique or links to other readings. **[L1, L2, L3, L4, L5; 15% of final grade]**

Grading

The final grade will be calculated as described below:

FINAL GRADING SCALE

Grade	Percentage
A+	98–100 %
A	93–97.9 %
A-	90–92.9 %
B+	87–89.9 %
B	83–86.9 %
B-	80–82.9 %
C+	77–79.9 %
C	73–76.9 %
C-	70–72.9 %
D	60–69.9 %
F	59.9% and below

Assignment/Assessment	% Weight	Individual or Group/Team Grade
Assignment 1: Critique a web-based decision support tool	10%	Individual
Assignment 2: Case preparation and discussion	10%	Team
Midterm exam	20%	Individual
Assignment 3: Critique a web-based decision support tool	10%	Individual
Assignment 4: Final project presentation and report	25%	Team
Participation	10%	Individual
Quizzes/Homework presentation	15%	Individual

Course Schedule/Course Calendar

Date	Topics and Activities	Readings (due on this date)	Assignments (due on this date)
TBD per term	**Week 1:** Course introduction; what is product management?	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 1, pp. 3-20 (17 pp.) ● Brennan, Kevin J., Sallie Godwin and Filip Hendrickx, *Digital Product Management.* BCS, 2022, ch. 1, pp. 1-17 (17 pp.) ● Hawken, Paul, ed. *Drawdown: The most comprehensive plan ever proposed to reverse global warming*. Penguin, 2017 (6 pp.)	Pre-work: Using your phone, take a photograph of the contents of your refrigerator and bring it to class. Pre-work: Read about three solutions proposed by Hawken that seem promising to you and explain why (1 page).
TBD per term	**Week 2:** Product vision: Enabling customer value	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 2, pp. 21-46 (25 pp.) ● Brennan et al., *Digital Product Management.* ch. 2, pp. 18-39 (21 pp.) ● Drucker, Peter F. "The discipline of innovation." *Harvard business review* 80, no. 8 (2002): 95-102 (7 pp.).	Assignment 1: Critique a web-based decision support solution, due by 5 PM, 9/9/24.
TBD per term	**Week 3:** Product Strategy: Creating business value	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 3, pp. 47-66 (19 pp.) ● Brennan et al., *Digital Product Management.* ch. 3, pp. 41-71 (30 pp.) ● Trelstad, B. et al., "Just Arrived: Integrating Refugees in Sweden," Harvard Business Publishing, 2021 (22 pp.)	Assignment 2: With your team, prepare Trelstad case discussion questions for and be ready to discuss in class

Date	Topics and Activities	Readings (due on this date)	Assignments (due on this date)
TBD per term	**Week 4:** Product Roadmaps	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 4, pp. 67-86 (19 pp.) ● Brennan et al., *Digital Product Management.* ch. 4, pp. 72-86 (14 pp.) ● Muller, Jerry Z., *The tyranny of metrics.* Princeton University Press. 2015, Intro.-ch. 2, pp. 1-28 (27 pp.)	Teams complete and discuss accountability check-in
TBD per term	**Week 5:** Discovering and designing a valuable customer experience; Governance	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 5, pp. 87-112 (25 pp.) ● Brennan et al., *Digital Product Management.* ch. 5, pp. 88-115 (27 pp.)	
TBD per term	**Week 6:** Data-driven decisions; Wildlife	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 6, pp. 113-136 (23 pp.) ● Brennan et al., *Digital Product Management.* ch. 6, pp. 117-139 (22 pp.) ● Read an Environmental Impact Statement for a company of your choosing	Take-home midterm exam due by 5 PM, 10/7/24
TBD per term	**Week 7:** Development; Renewable Energy: Wind and Solar	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 7, pp. 137-156 (19 pp.) ● Brennan et al., *Digital Product Management.* ch. 7, pp. 140-148 (18 pp.) ● Usher, Bruce, *Renewable Energy*, Columbia University Press, 2019, Ch. 4-5, pp. 29-54 (25 pp.)	

Date	Topics and Activities	Readings (due on this date)	Assignments (due on this date)
TBD per term	**Week 8:** Managing for results; Water ***Guest lecture: Physical risk***	● Bakker, Karen, *Gaia's Web,* MIT Press, 2024. ch. 8, pp. 157-182 (25 pp.) ● Brennan et al., *Digital Product Management.* ch. 8, pp. 159-173 (14 pp.) ● Daigger, Glenn T., Nikolay Voutchkov, Upmanu Lall, and Will Sarni. "The Future of Water." *Inter-American Development Bank Water and Sanitation Division,* Spring 2020, pp. 54-84 (30 pp.)	Assignment 3 – Critique a web-based decision-support tool. Due by 5 PM on 10/21/24.
TBD per term	**Week 9:** Go-to-market planning; Diversity, equity & inclusion ***Guest lecture: Social justice***	● McKinsey & Co. and LeanIn.org, *Women in the Workplace 2023,* *https://www.mckinsey.com/featured-insights/diversity-and-inclusion/women-in-the-workplace#/*, pp. 4-41 (37 pp.) ● Wyllie de Echeverria, Victoria Rawn, and Thomas F. Thornton. "Using traditional ecological knowledge to understand and adapt to climate and biodiversity change on the Pacific coast of North America." *Ambio* 48, no. 12 (2019): 1447-1469. (22 pp.)	Project proposal -- Describe the web solution your team will present in your final presentation. In 2-3 PowerPoint slides, prepare: 1) Product positioning statement; AND 2) Porter's Five Forces analysis: OR 3) Osterwalder's Mission Model Canvas. Due by 5 PM, 10/28/24.

Date	Topics and Activities	Readings (due on this date)	Assignments (due on this date)
TBD per term	**Week 10:** Managing teams; Sustainable finance ***Guest lecture: Sustainable finance***	● Bose, Satyajit, Guo Dong and Anne Simpson, *The Financial Ecosystem: The Role of Finance in Advancing Sustainability*. Palgrave Macmillan, 2019, ch. 4, pp. 83-110 (27 pp.) ● Smith, Edward and Steven C. Wheelwright, "The New Product Development Imperative," Harvard Business School Publishing Corp., 1999 (20 pp.)	
TBD per term	**Week 11:** User interface and experience (UI/UX) ***Guest lecture: UI/UX***	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 9, pp. 183-210 (27 pp.) ● Tufte, Edward R. *The visual display of quantitative information.* Graphics Press, 1983, ch. 1, pp. 13-52 (39 pp.)	Work on final project
TBD per term	**Week 12:** Product Management Tools ***Guest lecture: Portfolio management***	● Bakker, Karen. *Gaia's Web*. MIT Press, 2024, ch. 10, pp. 211-232 (21 pp.) ● McGrath, Rita, "The New Disrupters," Harvard Business Publishing, Feb. 2020, pp. 1-9 (8 pp.)	Work on final project
TBD per term	**Week 13:**	Present final projects in class	

Course Policies

Participation and Attendance
I expect you to come to class on time and thoroughly prepared. 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. More than one absence will affect your grade.

Late work
Work that is not submitted on the due date noted in the course syllabus without advance notice and permission from the instructor will be graded down 1/3 of a grade for every day it is late (e.g., from a B+ to a B).]

Citation & Submission
All written assignments must use standard citation format (e.g., MLA, APA, Chicago), cite sources, and be submitted to the course website (not via email).

School and University Policies and Resources

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 https://sps.columbia.edu/students/student-support/academic-integrity-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.

Diversity Statement
It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

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: https://health.columbia.edu/content/disability-services.

Class Recordings
All or portions of the class may be recorded at the discretion of the Instructor to support your learning. At any point, the Instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process.

If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources
The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: https://sps.columbia.edu/students/student-support/student-support-resources.

Columbia University Information Technology
Columbia University Information Technology (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access University-provided and discounted software downloads.

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.

The Writing Center
The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit http://www.college.columbia.edu/core/uwp/writing-center.

Career Design Lab
The Career Design Lab supports current students and alumni with individualized career coaching including career assessment, resume & cover letter writing, agile internship job search strategy, personal branding, interview skills, career transitions, salary negotiations, and much more. Wherever you are in your career journey, the Career Design Lab team is here to support you. Link to https://careerdesignlab.sps.columbia.edu/