

Annexe A: New/Revised Course Content in OBTL+ Format

Course Overview

Expected Implementation in Academic Year (New format)	AY2024-2025
Semester/Trimester/Others (specify approx. Start/End date)	Semester 2
Course Author * Faculty proposing/revising the course	Lee-Chua Lee Hong
Course Author Email	clhlee@ntu.edu.sg
Course Title	Environmental Systems Analysis
Course Code	EN4003
Academic Units	2
Contact Hours	26
Research Experience Components	Not Applicable

Course Requisites (if applicable)

Pre-requisites	Year 3 Standing
Co-requisites	Nil
Pre-requisite to	Nil
Mutually exclusive to	Nil
Replacement course to	Nil
Remarks (if any)	

Course Aims

This course aims at describing the human-environment interactions and environmental repercussions of defined human activities. The course combines qualitative, quantitative, and transdisciplinary analysis of environmental issues including air quality, water quality, and management of waste, energy, and resource. It integrates knowledge from natural, social, and engineering sciences, which is further developed into cost-benefit analysis, environmental risk assessment, and system management strategies. The course covers environmental assessment tools and methods including life cycle assessment (LCA), material flow analysis (MFA), environmental risk assessment (ERA), cost-benefit analysis (CBA), and topics of emerging interest. Students will be instructed to apply these concepts and methods/tools to the various environmental systems. This course covers several fundamental concepts that will reinforce the learning of other environmental engineering and sustainability courses in the aspects of analyzing and solving complex problems.

Course's Intended Learning Outcomes (ILOs)

Upon the successful completion of this course, you (student) would be able to:

ILO 1	Describe how environmental pollutions in the forms of air, water, municipal solid waste, and industrial waste are formed during anthropologic processes.
ILO 2	Conduct material flow analysis (MFA) and life cycle assessment (LCA) for different industrial processes.
ILO 3	Conduct environmental risk assessment (ERA) and cost-benefit analysis (CBA) for different human activities.
ILO 4	Analyze emerging issues of environmental concern and identify potential solutions.
ILO 5	Conduct investigations of complex environmental issues using research-based knowledge and methods.

Course Content

1. Introduction to environmental systems
2. Material flow analysis (MFA)
3. Life cycle assessment (LCA)
4. Cost benefit analysis (CBA)
5. Environmental site assessment (ESA)
6. Environmental risk assessment (ERA)
7. Industry ecology and eco-industrial parks
8. Special topics and case studies

Reading and References (if applicable)

1. Lecture materials provided by individual instructors.
2. Bhavik Bakshi (2019). Sustainable Engineering Principles and Practice. Cambridge University Press.
3. Krishna Reddy, Claudio Cameselle, and Jeffrey Adams (2019). Sustainable Engineering: Drivers, Metrics, Tools, and Applications. Wiley Press.
4. Life Cycle Assessment - Theory and Practice, <https://link.springer.com/book/10.1007/978-3-319-56475-3>
5. Sustainable Engineering: Drivers, Metrics, Tools, and Applications,
<https://www.amazon.com/Sustainable-Engineering-Drivers-Metrics-Applications/dp/1119493935>

NOTE: The above listing comprises the foundational readings for the course and more up-to-date relevant readings will be provided when they become available.

Planned Schedule

Week or Session	Topics or Themes	ILO	Delivery Mode	Activities	Readings
1	Introduction to environmental systems	1	In-person	Lecture & Discussion	Lecture Materials
2	Material flow analysis (MFA)	2	In-person	Lecture & Discussion	Lecture Materials
3	Material flow analysis (MFA)	2	In-person	Lecture & Discussion	Lecture Materials
4	Life cycle assessment (LCA)	2	In-person	Lecture & Discussion	Lecture Materials
5	Life cycle assessment (LCA)	2	In-person	Lecture & Discussion	Lecture Materials
6	Cost benefit analysis (CBA)	3	In-person	Lecture & Discussion	Lecture Materials
7	Cost benefit analysis (CBA)	3	In-person	Lecture & Discussion	Lecture Materials
8	Environmental site assessment (ESA)	3	In-person	Lecture & Discussion	Lecture Materials
9	Environmental risk assessment (ERA)	3	In-person	Lecture & Discussion	Lecture Materials
10	Environmental risk assessment (ERA)	3	In-person	Lecture & Discussion	Lecture Materials
11	Industry ecology and eco-industrial parks	4	In-person	Lecture & Discussion	Lecture Materials
12	Special topics and case studies	4 & 5	In-person	Lecture & Discussion	Lecture Materials
13	Special topics and case studies	4 & 5	In-person	Lecture & Discussion	Lecture Materials

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Conduct 2 hours of normal lectures per week for 13 weeks.
Quizzes	The first quiz will be conducted after 50% of lectures are covered, while the second quiz will be conducted after 100% of lectures are covered.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Description of Assessment Component	Team/Individual	Rubrics	Level of Understanding
1	Continuous Assessment (CA): Test/Quiz(Quiz 1)	1,2,3,4	a - h	20		Individual	Analytic	Multistructural
2	Continuous Assessment (CA): Test/Quiz(Quiz 2)	1,2,3,4	a - h	20		Individual	Analytic	Multistructural
3	Summative Assessment (EXAM): Final exam(Final Exam)	1,2,3,4,5	a - h	60		Individual	Holistic	Relational

Description of Assessment Components (if applicable)

Format grading

Formative Feedback

Discussion will be held after each lecture. Two quizzes will be conducted, and the students will be given the grades. Office hour will be held to discuss the quiz questions and lecture contents.
--

NTU Graduate Attributes/Competency Mapping

This course intends to develop the following graduate attributes and competencies (maximum 5 most relevant)

Attributes/Competency	Level
Care for Environment	Advanced
Care for Society	Intermediate
Global Perspective	Advanced
Transdisciplinarity	Intermediate
Systems Thinking	Advanced

Course Policy

Policy (Academic Integrity)

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values. As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the academic integrity website for more information. On the use of technological tools (such as Generative AI tools), different courses / assignments have different intended learning outcomes. Students should refer to the specific assignment instructions on their use and requirements and/or consult your instructors on how you can use these tools to help your learning. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Policy (General)

You are expected to complete all assigned readings, activities, assignments, attend all classes punctually and complete all scheduled assignments by due dates. You are expected to take responsibility to follow up with assignments and course related announcements. You are expected to participate in all class discussions and activities.

Policy (Absenteeism)

The quizzes will be conducted during regular lecture sessions, which are in-class activities. Absence from the quizzes without a valid reason will result in zero mark. Valid reasons include falling sick supported by a genuine medical certificate and participation in NTU's approved activities supported by an excuse letter from the relevant bodies. There will be no make-up opportunities for in-class activities.

Policy (Others, if applicable)

This course will adopt NTU's policy on the use of AI for take-home assignments and reports, and project reports and presentation slides. More details could be found via the link
[https://entuedu.sharepoint.com/sites/Student/dept/ctlp/SitePages/Exploring-the-Impact-of-Generative-Artificial-Intelligence-\(GAI\)-Tools-on-Education.aspx#1-proper-citations-and-acknowledgements](https://entuedu.sharepoint.com/sites/Student/dept/ctlp/SitePages/Exploring-the-Impact-of-Generative-Artificial-Intelligence-(GAI)-Tools-on-Education.aspx#1-proper-citations-and-acknowledgements)

Last Updated Date: 07-05-2026 16:28:57

Last Updated By: Siti Nur Amirah Binte Suhari