

Outline JEE 673 Waste and Climate Change

Semester 2/2024

Friday 13.30-16.30

Course Learning Outcome (CLO):

Understanding principles of climate change and their broad implications in relation to contemporary waste trends and management. Ability to clearly perceive and articulate the link between waste management and its contributions to climate change, circular economy, and sustainable development. Capable of discussing, in full dimension, the various waste treatment technologies and their future projections concerning climate change mitigation. Enhancing skills in presentation, brainstorming, and interactive engagement among students and instructors. Improving the ability to conduct field experiments and analyze waste-to-energy projects on both national and global scales as mitigation options to address climate change scenarios. Understanding current knowledge and trends related to waste management issues under extreme conditions such as floods and pandemics, including plastic waste trends.

Structure of Course:

Part 1: Foundations of Climate Change and Waste Management = 0.5 credit

- **Session 1:** Introduction to Climate Change and Waste Management

Part 2: Circular Economy and Sustainable Waste Management = 0.5 credit

- **Session 2:** Circular Economy and Sustainable Waste Management

Part 3: Waste Characterization and Analysis = 1 credit

- **Session 3:** Waste Characterization and Properties Analysis
- **Session 4:** Life Cycle Assessment (LCA) of Waste Management

Part 4: Waste Treatment Technologies = 1 credit

- **Session 5:** Waste Treatment Technologies I (Final Disposal Engineering)
- **Session 6:** Waste Treatment Technologies II (Waste-to-Energy)
- **Session 7:** Waste Treatment Technologies III (Composting and Anaerobic Digestion)
- **Session 8:** Waste Treatment Technologies IV (Mechanical Biological Treatment Process and Waste Pretreatment)

Part 5: Impact and Policy Frameworks = 1 credit

- **Session 9:** Plastic Waste Management
- **Session 10:** Waste Management under Extreme Conditions
- **Session 11:** Greenhouse Gas (GHG) Mitigation and Carbon Accounting

- **Session 12:** Waste Forecasting
- **Session 13:** GHG Mitigation Scenarios
- **Session 14:** Waste Management Policies and Regulations
- **Session 15:** Monitoring, Reporting, and Verification (MRV) for Carbon Projects

Mode of learning:

Self-study, discussion , paper, excursion(if possible), exercise ,hand-on workshop and lecture . Students are requested to read and study pre-class documents including finish assignment before participate in class with an ability to explain details of assignment findings.

Detailed Course Plan

Date	Session	Contents and Activities	Expected Output/Outcomes	Assignment
24/01/2025 (Sirintornthep)	Session 1: Introduction to Climate Change and Waste Management	Climate change principles and relevance to waste management; global and local waste management challenges. Activities: Lecture, discussion, self-study on IPCC report.	Understand climate change principles and their connection to waste management; awareness of global and local challenges.	Self-study and a short report on the latest IPCC findings related to waste management. Class discussion on identified challenges.
31/01/2025 (Sirintornthep)	Session 2: Circular Economy and Sustainable Waste Management	Concepts of circular economy and sustainability; role of waste management in SDGs. Activities: Lecture, group discussion, case study analysis.	Understand circular economy and sustainability concepts; relate waste management practices to SDGs.	Individual research and class presentation on a case study illustrating the circular economy in waste management.
7/02/2025 (Awassada)	Session 3: Waste Characterization	Types, generation, and composition of waste; waste	Understand characteristics of municipal solid waste (MSW);	Group work on waste analysis at KMUTT.

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	and Properties Analysis	sorting, characterization, and property analysis. Activities: Lecture, onsite study and waste sorting, group work.	analyze and characterize waste properties.	Presentation of findings.
14/02/2025 (Thapat)	Session 4: Life Cycle Assessment (LCA) of Waste Management	Introduction to LCA and its application in waste management. Activities: Lecture, hands-on workshop on conducting an LCA, group discussion.	Understand LCA principles; apply LCA to assess environmental impacts of waste management options.	Conduct an LCA on a selected waste treatment technology. Prepare a report and presentation on the findings.
21/02/2025	Exam 1	Covers material from Sessions 1-4.	Exam covering content from Sessions 1-4.	Exam
7/03/2025 (Komsilp)	Session 5: Waste Treatment Technologies I (Final Disposal Engineering)	Elements of landfill design, pollution control, methane generation in disposal sites. Activities: Lecture, case study analysis, group discussion.	Understand landfill design and operation; discuss pollution control measures in landfills; analyze methane generation in disposal sites.	Individual research on landfill design and pollution control. Class presentation on findings.
28/02/2025 (Awassada)	Session 6: Waste Treatment Technologies II (Waste-to-Energy)	Thermal treatments: combustion, gasification, pyrolysis; Activities: Lecture, site visit, discussion.	Understand fundamentals of thermal treatment technologies; awareness of RDF characteristics and quality improvement methods; explain	Shared homework on thermal treatment calculations. Group presentation on site visit observations.

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			advantages and disadvantages of thermal treatments.	
14/03/2025 (Komsilp)	Session 7: Waste Treatment Technologies III (Composting and Anaerobic Digestion)	Fundamentals of composting technology; processes and benefits of anaerobic digestion. Activities: Lecture, hands-on workshop, group discussion.	Understand principles of composting and anaerobic digestion; perform basic operations; evaluate benefits.	Individual research on composting or anaerobic digestion project. Class presentation on findings.
21/03/2025 (Komsilp)	Session 8: Waste Treatment Technologies IV (Mechanical Biological Treatment Process and Waste Pretreatment)	Fundamentals of mechanical biological treatment (MBT); waste pretreatment processes and technologies. Activities: Lecture, hands-on workshop, group discussion.	Understand MBT process; discuss different waste pretreatment technologies; apply MBT and pretreatment knowledge.	Group project on designing a waste pretreatment process. Presentation of the project.
28/03/2025	Exam 2	Covers material from Sessions 5-8.	Exam covering content from Sessions 5-8.	Exam preparation.
4/04/2025 (Awassada)	Session 9: Plastic Waste Management	Plastic pollution, microplastics, new plastic materials; policies and technologies for plastic waste management. Activities: Lecture, self-study with video	Understand origins and effects of plastic and microplastic pollution; awareness of new materials; discuss policies and technologies.	Individual research on a selected aspect of plastic waste management. Class presentation on findings.

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		lectures, discussion.		
11/04/2025 (Komsilp)	Session 10: Waste Management under Extreme Conditions	Impact of natural disasters and pandemics on waste management; strategies for managing waste during extreme events. Activities: Lecture, case study analysis, discussion.	Understand impact of extreme events on waste management; identify suitable strategies for managing waste during extreme conditions.	Case study analysis on waste management during a specific extreme event. Class presentation on strategies.
18/04/2025 (Komsilp)	Session 11: Greenhouse Gas (GHG) Mitigation and Carbon Accounting	GHG emissions from the waste sector; IPCC waste model. Activities: Lecture, hands-on workshop on carbon accounting, discussion.	Understand GHG emissions related to waste management; use IPCC waste model for carbon accounting; propose GHG mitigation strategies.	Individual research on GHG emissions from a specific waste management practice. Class presentation on findings.
25/04/2025 (Awassada)	Session 12: Waste Forecasting	Principles of forecasting; developing waste forecasting models. Activities: Lecture, hands-on workshop on model development, discussion.	Understand basics of forecasting; develop waste forecasting models; apply forecasting to real-world scenarios.	Individual case study on waste forecasting using collected data. Report and presentation on the forecasting model.
2/05/2025 (Komsilp)	Session 13: GHG Mitigation Scenarios	Developing GHG mitigation scenarios; techniques for projecting emission	Understand GHG mitigation scenario development; use techniques for projecting emission	Group project on developing a GHG mitigation scenario.

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		reductions. Activities: Lecture, hands-on workshop on projection techniques, discussion.	reductions; apply techniques to waste management practices.	Presentation of the scenario.
9/05/2025 (Komsilp)	Session 14: Waste Management Policies and Regulations	International and national policies on waste management and climate change; analysis of policy frameworks and their effectiveness. Activities: Lecture, case study analysis, discussion.	Understand waste management policies and regulations; analyze effectiveness of policy frameworks; propose improvements.	Individual research on a specific policy or regulation. Class presentation on findings.
16/05/2025 (Paweena/Komsilp)	Session 15: Monitoring, Reporting, and Verification (MRV) for Carbon Projects	Introduction to CDM and T-VER projects; methodologies for calculating project-based GHG reduction. Activities: Lecture, hands-on workshop on GHG reduction calculations, discussion.	Understand principles of MRV for carbon projects; calculate GHG reductions; apply MRV methodologies.	Individual research on a CDM or T-VER project. Class presentation on findings.
23/05/2025	Final Exam	Covers material from Sessions 9-15.	Final exam covering content from Sessions 9-15.	Exam

Grading System:

- Active participation in class and online discussions: 20%

- Individual assignments and reports: 40%
- Mid-term exam: 20%
- Final exam: 20%

Main Instructors and Guest Lecturers:

Main Instructors: Dr. Sirintornthep Towprayoon, Dr. Komsilp Wangyao, Dr. Awassada Phongphiphat.

Guest Lecturers: Dr. Thapat Silalertruksa and Dr. Paweena Panichayapichet