Course Syllabus: JEE 673 Waste and Climate Change

Semester: 2/2025 (Academic Year)

Time: Friday 9:00 - 12:00

Start Date: January 30, 2026

Exams: Scheduled outside of regular class hours

Course Learning Outcomes (CLO) - Semester 2/2025

1. Understanding (Interpreting & Explaining Principles)

Interpret the comprehensive relationship between the entire waste sector (solid waste and wastewater) and global climate change. **Explain** how modern waste management aligns with the Bio-Circular-Green (BCG) Economy and Sustainable Development Goals (SDGs).

2. Applying (Executing Technical Tools)

Execute greenhouse gas (GHG) inventory calculations for both solid waste facilities and wastewater treatment plants using **IPCC Guidelines** and **Carbon Footprint for Organization (CFO)** standards.

3. Analyzing (Differentiating Technologies & Contexts)

Analyze the operational efficiency and suitability of diverse technologies—ranging from MBT, Thermal, and Sanitary Landfills to Aerobic/Anaerobic wastewater systems. **Differentiate** the management strategies required for normal operations from those for extreme conditions, such as **floods** and pandemics, to identify resilient infrastructure requirements.

4. Evaluating (Critiquing Environmental Impact)

Evaluate the environmental performance of integrated waste management systems using **Life Cycle Assessment (LCA)** methodologies. **Critique** the trade-offs between different treatment options to select the most sustainable mitigation strategies.

5. Creating (Generating Scenarios & Strategies)

Formulate future waste management scenarios by **generating** waste quantity projections

through forecasting models. **Design** strategic pathways for participation in carbon market mechanisms (T-VER, CDM) to maximize economic and environmental benefits.

Structure of Course (Semester 2/2025)

Session 1: Solid Waste Technologies, Future Trends, and Disaster Resilience = 1.5 credits *(Covers Weeks 1–7).* Focuses on comprehensive management of solid waste technologies (MBT, Landfill, Thermal) alongside future trends, such as the BCG Economy. This session specifically covers waste management strategies for extreme conditions, such as **floods** and pandemics.

Session 2: Wastewater Treatment Systems and GHG Assessment = 0.75 credit *(Covers Weeks 8–11).* Focuses on aerobic and anaerobic wastewater treatment technologies. This session emphasizes calculating Greenhouse Gas (GHG) emissions from the wastewater sector and developing adaptation policies.

Session 3: Integrated Carbon Tools, Forecasting, and Market Mechanisms = 0.75 credit *(Covers Weeks 12–15).* Focuses on advanced analysis using Life Cycle Assessment (LCA) and Carbon Footprint for Organization (CFO). It includes waste quantity forecasting, scenario development, and the application of carbon trading mechanisms (T-VER, CDM).

Mode of learning:

Lecture, hands-on workshop (specifically for GHG Calculation, LCA, and CFO), scenario development, and interactive discussion.

The course places strong emphasis on practical application (60% of the **assessment)**. Students are requested to prepare for **calculation workshops** by reviewing technical guidelines (e.g., IPCC, LCA) in advance. Active participation is required to analyze waste trends, design disaster-resilience strategies, and present carbon-reduction scenarios during class sessions.

15-Week Teaching Schedule

Week	Date	Topic	Content Details	Instructor
Session I		**Solid Waste Technologies (Weeks 1-7)**		
1	Jan 30	**Impact of Climate Change & Future Trends**	- Overview of Climate Change and waste	Sirintornthep

Week	Date	Topic	Content Details	Instructor
			management. - **BCG Economy** (Bio-Circular-Green) and future trends.	
2	Feb 6	**Global to Local Waste Management Outlook**	- SDGs and the direction of global waste to local practice. - Policy and macro-level planning.	Komsilp
3	Feb 13	**MBT: Separation, Composting & AD**	- Mechanical separation technologies and composting. - Anaerobic Digestion (AD) for solid waste.	Komsilp
4	Feb 20	**Final Disposal Engineering**	- Sanitary Landfill engineering. - Leachate management and landfill gas control.	Komsilp
5	Feb 27	**Thermal Treatment**	- Thermal technologies: Incineration, Gasification. - Air pollution management (Flue Gas	Awassada

Week	Date	Topic	Content Details	Instructor
			Cleaning).	
6	Mar 6	**Waste Management under Extreme Conditions**	- Waste management during disasters (floods) and pandemics. - Resilience Planning.	Komsilp
7	Mar 13	**GHG Calculation from Solid Waste**	- **Workshop:** GHG calculation from the waste sector (Landfill & Composting). - Using the IPCC Waste Model with local data.	Komsilp
-	**TBA**	**Midterm Exam (Outside Schedule)**	**Midterm Examination**	-
Session II		**Wastewater Management (Weeks 8-11)**		
8	Mar 20	**(WW 1) Aerobic Wastewater Treatment**	- Aerobic treatment systems (Activated Sludge, etc.). - Energy Intensity and Indirect Emissions.	Warinthorn
9	Mar 27	**(WW 2) Anaerobic Wastewater Treatment**	- Anaerobic treatment systems (UASB,	Warinthorn

Week	Date	Topic	Content Details	Instructor
			etc.). - Energy recovery (Methane Recovery).	
10	Apr 3	**(WW 3) GHG Calculation for Wastewater**	- **Workshop:** Calculating GHG from wastewater per IPCC Guidelines. - Assessment of Emission Factors.	Warinthorn
11	Apr 10	**(WW 4) Adaptation & Global Policy**	- Adaptation of treatment systems to floods and saltwater intrusion. - Global policy (Global Wastewater Initiative).	Warinthorn
-	Apr 17	*Songkran Festival Break*		-
Session III		**Advanced Tools & Integration (Weeks 12-15)**		
12	Apr 24	**LCA of Waste Management**	- Life Cycle Assessment (LCA). - In-depth environmental impact comparison.	Ukrit

Week	Date	Topic	Content Details	Instructor
-	May 1	*Labor Day Break*		-
13	May 8	**Waste Forecasting & Scenario Development**	- Waste quantity forecasting techniques (Forecasting Models). - Scenario development for GHG reduction.	Awassada
14	May 15	**City Planning & CFO**	- Urban waste management planning (City Planning). - Carbon Footprint for Organization (CFO) for waste entities.	Komsilp
15	May 22	**Carbon Trading Mechanisms**	- Carbon market mechanisms (T-VER, CDM). - Project registration procedures.	Paweena
-	**TBA**	**Final Exam (Outside Schedule)**	**Final Examination**	-

Grading System

- **Exams (2 - Midterm & 1 - Final):** 30% (Assessment of comprehensive understanding)
- **Assignments & Workshops:** 60% (Focus on practical calculation and analysis)
- **Class Participation:** 10% (Attendance and engagement)