COURSE CONTENT

Academic Year	2020/21	**Semester**	1
Course Coordinator	Asst Prof FEI Xunchang		
Course Code	EN3001		
Course Title	Solid and Hazardous Waste Management		
Pre-requisites	Year 3 standing		
No of AUs	3		
Contact Hours	Lecture: 26 hr ; Tutorial: 13 hr ; Lab: 0 hr		
Proposal Date	Feburary 2020		

Course Aims

To provide an understanding of solid and hazardous waste engineering principles and management issues.

- Municipal solid waste properties, generation, collection, management, recycling, treatment, disposal;
- Hazardous waste properties, generation, management, containment, treatment.

Intended Learning Outcomes (ILO)

After successfully completing the course, you will be able to:

1. Explain integrated solid and hazardous waste management;
2. Assess and predict waste sources, characteristics, generation, collection, transfer and transport;
3. Assess and design waste recycling, reuse, recovery, treatment and disposal;
4. Explain industrial waste management issues and productivity;
5. Assess hazardous treatment and disposal.

Course Content

	Topic	Lecture (hours)
1.	Integrated solid waste management	3
2.	Waste characteristics, generation, handling, collection, and transfer	3
3.	Waste minimization and processing	3
4.	Biochemical waste conversion	3
5.	Thermal waste transformation	3
6.	Solid waste disposal	3
7.	Hazardous waste management	3

8.	Hazardous waste treatment	3
9.	Hazardous waste reutilization	2

Assessment (includes both continuous and summative assessment)

Component	Course ILO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/ Individual	Assessment rubrics
1. Team project	1-5	ENE SLO* a b c d e f g h i j	40%	Team	appendix
2. Final exam	1-5	ENE SLO* a b c d f g k	60%	Individual	
Total			100%		

ENE SLOs: Student Learning Outcome for Environmental Engineer Programme

Related Programme LO or Graduate Attributes

a. **Engineering knowledge:** Apply the knowledge of mathematics, natural science, engineering fundamentals, and environmental engineering specialisation to the solution of complex environmental engineering problems.

b. **Problem Analysis:** Identify, formulate, research literature, and analyse complex environmental engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

c. **Design/development of Solutions:** Design solutions for complex environmental engineering problems and design system components or processes with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

d. **Investigation:** Conduct investigations of complex problems using research-based knowledge and methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

e. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex environmental engineering activities with an understanding of the limitations.

f. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

g. **Environment and Sustainability:** Understand the impact of the professional

engineering solutions in societal and environmental contexts, and the need for the sustainable development.

h. **Ethics:** Apply ethical principles and commit to professional and moral responsibilities in the environmental engineering practice.

i. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams and in multidisciplinary settings.

j. **Communication:** Communicate effectively on complex environmental engineering activities with the engineering community and with society at large, be able to comprehend and write effective reports and design documentation, and make effective presentations.

k. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and economic decision-making, and apply these to work, as a member and leader in a multidisciplinary team.

l. **Life-long Learning:** Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological evolution.

Formative feedback

Instructors take questions during and at the end of lectures, and provide on-the-spot clarifications. You can also confer with the instructors via appointed consultations or email.

You are assessed on a final exam and a team project. You will be informed of the feedback and grade of the project.

Learning and Teaching approach

Approach	How does this approach support students in achieving the learning outcomes?
Lectures	Weekly lectures to provide you with the specific knowledge and techniques to achieve the learning outcome stated above.
Tutorials	Weekly tutorials to guide problem solving and provide face-to-face feedback.

Reading and References

Readings are revised year to year to keep up with the latest development in the subject. Other more classic readings are mostly from the following books:

1. Tchobanoglous, G., Theisen, H and Vigil, S., “Integrated Solid Waste Management”, McGraw-Hill, New York, 1993.

2. Vesilind, P.A., Worrell, W., and Reinhart, D., "Solid Waste Engineering", Brooks/Cole, 2002.
3. LaGrega, M, Buckingham, P. and Evants, J.C., “Hazardous Waste Management”. McGraw-Hill, New York, 2001.

Course Policies and Student Responsibilities

(1) General

You are expected to take responsibility to follow up with course notes, assignments and course related announcements. You are also expected to participate in class discussions.

(2) Absenteeism

Valid reasons include falling sick supported by a 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.

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. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Dr FEI Xunchang	N1-01c-70	6790-5249	xcfei@ntu.edu.sg

Appendix: Individual Project with Written Report (40%)

Each team will write a report on the project. This assessment is covered by the following marking scheme. More details of the report length and specific requirements will be briefed by the course instructor.

Criteria	Good (8-10)	Ave (6-7)	Fair (4-5)	Poor (1-3)	Remarks
Report generated by Turnitin	Within acceptable degree of originality? (Yes/No)				Fresh report, in case of too many commonalities.
Background/ objective/ purpose					Accurate contextualisation of background and description. Well defined issues; clear objectives.
Methodology/ information / data Collection					Ability and independence in acquiring relevant and useful information/data for the study.
Findings and discussion					Well-presented results with discussion, showing ability to understand problem, interpret information obtained, and be cognisant of limitations. **Innovative (and well justified) solutions will be favourably evaluated.**
Conclusions and recommendations					Summarise report clearly and show ability to make appropriate and relevant conclusions, with clear and workable recommendations.
References and report format					Report is clear and concise; good grammar and spelling with appropriate tables/ graphs/ figures. Report is presented well with logical sequence.
Progress update and group presentation (individually assessed, 50%)					Each team should consult the instructor before starting the project, and provide oral interim update. The presentation should be divided equally so that all team members can present.