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

Course Overview

The sections shown on this interface are based on the templates UG OBTL+ or PG OBTL+
If you are revising/duplicating an existing course and do not see the pre-filled contents you expect in the subsequent sections e.g. Course Aims, Intended Learning Outcomes etc. please refer to Data Transformation Status for more information.

Expected Implementation in Academic Year	AY2018-2019
Semester/Trimester/Others (specify approx. Start/End date)	Semester 1
Course Author * Faculty proposing/revising the course	Lee-Chua Lee Hong
Course Author Email	clhlee@ntu.edu.sg
Course Title	Wastewater Engineering
Course Code	EN3002
Academic Units	3
Contact Hours	39
Research Experience Components	Not Applicable

Course Requisites (if applicable)

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

Course Aims

This course aims to provide you with a basic understanding of the wastewater analysis/characterization, the preliminary design and operation of unit processes in wastewater treatment. You will acquire a deeper knowledge of the physical, chemical, and biological principles in wastewater assessment and treatment, with a particular emphasis on water recycle and resources recovery.

Course's Intended Learning Outcomes (ILOs)

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

ILO 1	Analyse physical, chemical and biological characteristics of wastewater.
ILO 2	Determine the design and operation of unit processes in wastewater treatment.
ILO 3	Explore and develop sustainable wastewater treatment technologies.
ILO 4	Conduct the system analysis toward optimal operations.

Course Content

Characterization of wastewater. Analysis of wastewater flowrate and loading; Wastewater treatment: physical, chemical, and biological unit processes. Advanced wastewater treatment. Sludge treatment and disposal.

S/N	Topic	Lecture Hrs	Tutorial Hrs
1.	Physical, chemical and biological characteristics of wastewater	4	2
2.	Analysis and selection of wastewater flowrates and constituent loadings for process design	3	1
3.	Physical unit operations: Screening, grit chamber, sedimentation and air flotation	3	2
4.	Chemical unit operations: coagulation, precipitation, chemical oxidation and scale control.	3	1
5.	Biological treatment introduction, biomass growth kinetics	3	2
6.	Advanced wastewater treatment: nutrient removal – Nitrogen and phosphorus removal, activated sludge processes and attached growth processes	4	2
7.	Anaerobic treatment processes, sludge treatment and disposal: sources, characteristics and quantities of sludge. Treatment processes, gravity and flotation thickening, sludge digestion, vacuum and pressure filtration. Ultimate sludge disposal.	6	3

Reading and References (if applicable)

Metcalf and Eddy, “Wastewater Engineering”, 4th edition, McGraw-Hill, 2003. Viessman and Hammer, “Water Pollution and Control”, 7th edition, Pearson Prentice Hall, 2004.

Planned Schedule

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
1	Physical, chemical and biological characteristics of wastewater	1		In-person	Lectures and Q/A session
2	Physical, chemical and biological characteristics of wastewater	1		In-person	Lectures and Q/A session
3	Analysis and selection of wastewater flowrates and constituent loadings for process design	2		In-person	Lectures and Q/A session
4	Analysis and selection of wastewater flowrates and constituent loadings for process design, Physical unit operations: Screening, grit chamber, sedimentation and air flotation	2		In-person	Lectures and Q/A session
5	Physical unit operations: Screening, grit chamber, sedimentation and air flotation	2		In-person	Lectures and Q/A session

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
6	Chemical unit operations: coagulation, precipitation, chemical oxidation and scale control. Quiz	2		In-person	Lectures and Q/A session
7	Chemical unit operations: coagulation, precipitation, chemical oxidation and scale control. Biological treatment introduction.	2		In-person	Lectures and Q/A session
8	Biomass growth kinetics	2, 4		In-person	Lectures and Q/A session
9	Advanced wastewater treatment: nutrient removal – Nitrogen and phosphorus removal	1, 2, 3		In-person	Lectures and Q/A session
10	Activated sludge processes and attached growth processes	2, 4		In-person	Lectures and Q/A session
11	Anaerobic treatment processes	2, 3		In-person	Lectures and Q/A session

Week or Session	Topics or Themes	ILO	Readings	Delivery Mode	Activities
12	Sludge treatment and disposal: sources, characteristics and quantities of sludge. Treatment processes, gravity and flotation thickening, sludge digestion, vacuum and pressure filtration. Ultimate sludge disposal.	2, 3		In-person	Lectures and Q/A session
13	Revision and quiz	1, 2, 3, 4		In-person	Lectures and Q/A session

Learning and Teaching Approach

Approach	How does this approach support you in achieving the learning outcomes?
Lecture	Formal lectures on topics with in-class discussions
Tutorial	This helps you to understand the concept taught during lectures as well as apply the concept and theories to solve engineering problems.

Assessment Structure

Assessment Components (includes both continuous and summative assessment)

No.	Component	ILO	Related PLO or Accreditation	Weightage	Team/Individual	Rubrics	Level of Understanding
1	Summative Assessment (EXAM): Final exam(Final Examination)	1,2,3,4	EAB SLO* a, b, c, g	60	Individual	Holistic	Relational
2	Continuous Assessment (CA): Test/Quiz(Quiz)	1,2	EAB SLO* a, b, c	20	Individual	Analytic	Multistructural
3	Continuous Assessment (CA): Test/Quiz(Quiz)	1,2,3,4	EAB SLO* a, b, c	20	Individual	Analytic	Multistructural

Description of Assessment Components (if applicable)

Part A - Continual Assessment (40%) consists of,

Quiz (twice), will be conducted during the Teaching Week to evaluate learning outcomes. Questions are designed to test your understanding of basic concepts and design principles as well as your ability in applying them in real application scenarios.

Part B - Examination (60%)

- A final Examination covers topics taught in all 13 Teaching Weeks. Questions are designed to test your ability in understanding the basic concepts and treatment technologies as well as being able to carry out design of wastewater treatment units.

- It will be a 2.5 hours closed book written examination.

SLO = EAB Student learning Outcomes
SLO a, Engineering knowledge: Apply the knowledge of mathematics, natural science, engineering fundamentals and an engineering specialisation to the solution of complex engineering problems.
SLO b, Problem analysis: identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
SLO c, Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
SLO g, Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for the sustainable development.

Formative Feedback

The instructor of quiz 1 will send the quiz marks to you individually, and you can meet the instructor for results discussion upon request.
The quiz 2 questions and the answers will be discussed right after the quiz, and you will be able to estimate quiz results individually.

NTU Graduate Attributes/Competency Mapping

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

Attributes/Competency	Level
Adaptability	Intermediate
Care for Environment	Advanced
Collaboration	Basic
Curiosity	Advanced
Learning Agility	Intermediate

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)

Students are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. Students are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. Students are expected to participate in all seminar discussions and activities.

Policy (Absenteeism)

In-class activities make up a significant portion of your course grade. Absence from class without a valid reason will affect your overall course grade. 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.

Policy (Others, if applicable)

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