CV3017 Urban Water Circularity

Academic Year	2023-24	Semester	1
Course Coordinator	A/P Zhou Yan		
Course Type	Core		
Pre-requisites	CV1012 Fluid Mechanics		
AU	2		
Grading	Letter Grading		
Contact Hours	26 (13 hours of Lecture; 13 hours of Tutorial)		
Proposal Date	8 September 2022		

Course Aims

This course aims to provide you with an in-depth water and wastewater treatment and resource recovery principles, which integrate science and engineering principles to improve the availability of water resource and water environment, to provide healthy water, for other organisms, and to remediate water pollution and recover resource in more sustainable ways. Urban Water Circularity is vital for our future as we need to protect the earth for those who live here tomorrow.

Intended Learning Outcomes (ILO)

By the end of this course, student will be able to:

1. Calculate the water use and wastewater generation.
2. Explain basic water quality parameters and wastewater characteristics.
3. Discuss the working principle and design of unit processes for water treatment.
4. Discuss the working principle and design of unit processes for wastewater treatment.

Course Content

No	Topic	Hours
1	Water Use	2
2	Water Quality and Standard	2
3	Water Treatment Processes	8
4	Wastewater Generation and Characteristics	2
5	Wastewater Treatment Processes	12
	Total	26

Assessment (Includes both continuous and summative assessment)

Component	ILO Tested	EAB Graduate Attributes	Weightage	Team / Individual	Rubrics
1. CA1: Quiz 1	1, 2, 3	a, b, g	20%	Individual	-
2. CA2: Group Project	4, 5	a, b, c, g, i, j	20%	Team	Appendix 1

3. Final Examination	1, 2, 3, 4	a, b, g	60%	Individual	-
Total			**100%**		

EAB Graduate Attributes	
a)	**Engineering Knowledge** Apply the knowledge of mathematics, natural science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.
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.
c)	**Design / Development of Solutions** Design solutions for complex engineering problems and design systems, components or processes that meet the specified needs 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 research 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 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 demonstrate the knowledge of, and need for the sustainable development.
h)	**Ethics** Apply ethical principles and commit to professional ethics and responsibilities and norms of the 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 engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k)	**Project Management and Finance** Demonstrate knowledge and understanding of the engineering management principles and economic decision-making, and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
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 change.

Formative Feedback

For CA1, the questions and solutions will be discussed with you after the quiz. You will be informed of the median grade and individual grade will be uploaded in NTULearn.
For CA2, the group project will focus on water treatment and wastewater treatment process unit design. You are required to present the design to the class, and the instructor will comment and feedback on the design during the class.

Learning & Teaching Approach

Approach	How does this approach support students in achieving the learning outcomes?
Lecture	Faculty will elaborate on complex content for deeper learning. You will be able to ask questions when in doubt.
Tutorial	Tutor will guide you in analysing and solving problems.

Readings & References

Hammer and Hammer, 'Water and Wastewater Technology', Pearson Prentice Hall, 7th Ed. 2012.

Metcalf and Eddy, 'Wastewater Engineering - Treatment and Reuse', McGraw Hill, 4th Edition, 2004.

Course Policy & Student Responsibility

(1) General
You are expected to complete all assigned pre-class readings and activities, attend all lectures and tutorials punctually and take all quizzes. You are expected to take responsibility to follow up with course notes and course related announcements for lectures and tutorials you have missed. You are expected to participate in all lectures and tutorials discussions and activities.

(2) Absenteeism
CAs make up a significant portion of your course grade. Absence from quizzes 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 quizzes.

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 recognise 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 about the definitions of any of these terms, you should refer to the Academic Integrity Handbook 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	Phone	Email
Assoc. Prof. Zhou Yan	N1-01c-90	6790 6103	zhouyan@ntu.edu.sg

Planned Weekly Schedule

Week	Topic	Course ILO	Readings / Activities
Week 1	Topic 1: Water Use	1	Lecture: 1 hour Tutorial: 1 hour
Week 2	Topic 2: Water Quality and Standard	2	Lecture: 1 hour Tutorial: 1 hour
Week 3	Topic 3: Water Treatment Processes	3	Lecture: 1 hour Tutorial: 1 hour
Week 4	Topic 3: Water Treatment Processes	3	Lecture: 1 hour Tutorial: 1 hour
Week 5	Topic 3: Water Treatment Processes	3	Lecture: 1 hour Tutorial: 1 hour
Week 6	Topic 3: Water Treatment Processes	3	Lecture: 1 hour Tutorial: 1 hour
Week 7	Topic 4: Wastewater Generation and Characteristics	1, 2	Lecture: 1 hour Tutorial: 1 hour
Week 8	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour
Week 9	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour
Week 10	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour
Week 11	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour
Week 12	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour
Week 13	Topic 5: Wastewater Treatment Processes	4	Lecture: 1 hour Tutorial: 1 hour

Appendix 1: Assessment Criteria for CA2 Group Project

Performance criteria	Performance Level			
	Outstanding: 4	Good: 3	Average: 2	Poor: 1
Calculate the water use and wastewater generation.	Excellent knowledge of water use and wastewater generation	Good knowledge of water use and wastewater generation	General understanding of water use and wastewater generation	Little understanding of water use and wastewater generation
Explain basic water quality parameters and wastewater characteristics.	Excellent ability to analyse basic water quality parameters and wastewater characteristics.	Good ability to analyse basic water quality parameters and wastewater characteristics.	Able to analyse basic water quality parameters and wastewater characteristics.	Unable to analyse basic water quality parameters and wastewater characteristics.
Discuss the working principle and design of unit processes for water treatment.	Excellent ability to explain the working principle and design of the unit processes for water treatment.	Good ability to explain the working principle and design of the unit processes for water treatment.	Able to explain the working principle and design of the unit processes for water treatment.	Unable explain the working principle and design of the unit processes for water treatment.
Discuss the working principle and design of unit processes for wastewater treatment.	Excellent ability to explain the working principle and design of the unit processes for wastewater treatment.	Good ability to explain the working principle and design of the unit processes for wastewater treatment.	Able to explain the working principle and design of the unit processes for wastewater treatment.	Unable explain the working principle and design of the unit processes for wastewater treatment.
Propose and discuss novel sustainable water and wastewater treatment and resource recovery processes	Excellent understanding of novel sustainable treatment processes based on literature study.	Good understanding of novel sustainable treatment processes based on literature study.	General understanding of novel sustainable treatment processes based on literature study.	Little understanding of novel sustainable treatment processes based on literature study.

Instructor may change the individual score should there be unequal contribution from students.