NANYANG TECHNOLOGICAL UNIVERSITY

Teaching, Learning and Pedagogy Division

Reg. No. 200604393R

PROPOSED COURSE OUTLINE TEMPLATE FOR STUDENTS AT NTU

Academic Year	AY2018/19	**Semester**	1
Course Coordinator	Asst. Prof. Zhou Yan		
Course Code	EN3002		
Course Title	Wastewater Engineering		
Pre-requisites	Year 3 standing		
No of AUs	3		
Contact Hours	Lecture: 26 hours,; Tutorial: 13 hours; Lab: 0 hour		
Proposal Date	*30 Sep 2018*		

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.

Intended Learning Outcomes (ILO)

By the end of the course, you would be able to:

1. Analyse physical, chemical and biological characteristics of wastewater.
2. Determine the design and operation of unit processes in wastewater treatment.
3. Explore and develop sustainable wastewater treatment technologies.
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

Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Related Programme LO or Graduate Attributes	Weighting	Team/Individual	Assessment rubrics
1. Final Examination	1, 2, 3, 4	EAB SLO* a, b, c, g	60%	Individual	NA
2. Continuous Assessment 1 (CA1): quiz	1, 2	EAB SLO* a, b, c	20%	Individual	NA
3. CA2: quiz	1, 2, 3, 4	EAB SLO* a, b, c	20%	Individual	NA
Total			100%		

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.

Learning and Teaching approach

Approach	**How does this approach support students 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.

Reading and References

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

Course Policies and Student Responsibilities

(1) 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.

(2) 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.

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
Liu Yu	N1-01c-93	67905254	cyliu@ntu.edu.sg
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Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Physical, chemical and biological characteristics of wastewater	1	Lectures and Q/A session
2	Physical, chemical and biological characteristics of wastewater	1	Lectures and Q/A session
3	Analysis and selection of wastewater flowrates and constituent loadings for process design	2	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	Lectures and Q/A session
5	Physical unit operations: Screening, grit chamber, sedimentation and air flotation	2	Lectures and Q/A session
6	Chemical unit operations: coagulation, precipitation, chemical oxidation and scale control. Quiz	2	Lectures and Q/A session
7	Chemical unit operations: coagulation, precipitation, chemical oxidation and scale control. Biological treatment introduction.	2	Lectures and Q/A session
8	Biomass growth kinetics	2, 4	Lectures and Q/A session

9	Advanced wastewater treatment: nutrient removal – Nitrogen and phosphorus removal	1, 2, 3	Lectures and Q/A session
10	Activated sludge processes and attached growth processes	2, 4	Lectures and Q/A session
11	Anaerobic treatment processes	2, 3	Lectures and Q/A session
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	Lectures and Q/A session
13	Revision and quiz	1,2,3,4	Lectures and Q/A session

Appendix 1: Assessment Criteria for Final Exam and CA 1 and CA2

Performance criteria	Performance Level			
	Outstanding: 4	Good: 3	Average: 2	Poor: 1
Analyse physical, chemical and biological characteristics of wastewater.	Excellent knowledge of wastewater characteristics, and ability to link their negative impact on the environment and calculate the various pollutant fractions	Good knowledge of wastewater characteristics, and ability to calculate the various pollutant fractions	General understanding of wastewater characteristics, and ability to calculate the various pollutant fractions	Little understanding of wastewater characteristics, and ability to calculate the various pollutant fractions
Determine the design and operation of unit processes in wastewater treatment.	Excellent ability to apply basic principles of wastewater treatment process and design the process according to the treatment requirement	Good ability to apply basic principles of wastewater treatment process and design the process according to the treatment requirement	Able to design the process according to the treatment requirement	Unable to design the process according to the treatment requirement
Explore and develop sustainable wastewater treatment technologies.	Excellent ability to understand and analyse the energy efficient processes and identify the sustainable resource recovery technologies.	Good ability to understand and analyse the energy efficient processes and identify the sustainable resource recovery technologies.	Able to understand and analyse the energy efficient processes.	Unable to determine the sustainable wastewater treatment technologies.
Conduct the system analysis toward optimal operations.	Excellent understanding of process designs and appreciation of advantages and limitations of given designs, able to modify the process towards better performance.	Good understanding of process designs and appreciation of advantages and limitations of given designs, able to modify the process towards better performance.	General understanding of process designs and advantages and limitations of given designs,	Unable to understand membrane layout designs