

DETAILED COURSE OUTLINE

1. Course Name: Wastewater Engineering

Course code: WWTR434410

2. Number of Credits: 3 credits (3: 0: 6) (3 theoretical credits, 0 practical/experimental credits)

Total time: 45 periods (3 theoretical periods + 0 practical period + 6 self-study periods per week)

3. Course lecturers:

1 / Major responsibility: PhD. Nguyen Thai Anh

2 / List of another lecturers:

2.1 / PhD. Tran Thi Kim Anh

2.2 / PhD. Nguyen My Linh

4. Prerequisites:

Prerequisite subjects: None

Previous subjects: None

5. Course description:

The basic principles of wastewater treatment technique, the design of domestic and industrial wastewater treatment system are presented. Moreover, the necessary expertise in the field of the wastewater treatment is also presented via the knowledge of the operation of the reactors, the reaction kinetics of the biological, chemical and physical treatment of pollutants in wastewater.

Course goals

Goals	Goal description <i>(Course's contributions to student)</i>	Expected learning outcome
G1	Necessary expertise in the field of domestic and industrial wastewater treatment.	ELO15, ELO16

G2	Ability to analyze, explain and solve problems concern to the wastewater treatment plants, then choose the appropriate technology for the design.	ELO3, ELO6
G3	The skills of teamwork, communication, reading and understanding the document of environmental chemical analysis written in English.	ELO11
G4	The ability to apply the knowledge from courses in the field of environmental remediation.	ELO15, ELO16

6. Course learning outcomes

Course expected learning outcome		Description (After accomplishing this course, students are able to:)	Expected learning outcome
G1	CELO1	The ability to present the wastewater treatment methods, capable of offering technology solutions to design the domestic and industrial wastewater treatment systems.	ELO12, ELO15, ELO16
	CELO2	Mastering the steps in the engineering designing process for specific wastewater treatment systems.	ELO3, ELO16
G2	CELO3	Understanding the process of aerobic, anaerobic, combined processes (chemical, biological, physical), applied in wastewater treatment plants to degrade pollutants.	ELO3, ELO16
	CELO4	The ability to present the function and operation steps of the reactors in the wastewater treatment system.	ELO16
	CELO5	The ability to search for documents, self-research and presentation of specialized content.	ELO3, ELO11,
G3	CELO6	The ability to work in groups for the discussion and solution of the problem which related to wastewater treatment.	ELO6, ELO12, ELO16
	CELO7	Understand the English terms used for wastewater treatment	ELO3,

		techniques.	ELO11,
G4	CELO8	The ability to apply wastewater treatment techniques for specific effluents such as domestic, pharmaceutical, textile or dyeing effluent.	ELO15, ELO16
	CELO9	Mastering the steps in the measurement of pollution such as COD, N, DO, alkalinity, acidity and heavy metals tests.	ELO15, ELO16
	CELO10	Capable of improving methods and making more appropriate solution to achieve the best effectiveness of wastewater treatment.	ELO3, ELO16

7. Learning Materials

- Books, essential textbook:

[1]. WEF & ASCE (1992) Design of Municipal Wastewater Treatment Plants, Vol.1, WEF

[2]. Raymond D. Letterman (1999) Water quality and Treatment, American water work association, McGraw-Hill, Inc.

[3]. Ronald L.Droste, Theory and Practice of Water and Wastewater Treatment, John Wiley and Sons, 1997

- References:

[4]. Assoc. Prof. Nguyen Van Suc, Wastewater engineering Textbook, HCMC National University Publisher, 2013.

[5]. Lam Minh Triet, Domestic and industrial wastewater treatment, Construction Publishing House, Hanoi, 2002.

[6]. Stanley E. Manahan, (2000) Environmental Chemistry, Lewis Publisher, London. New York Washington, D.C.

8. Student assessment:

- Grade scale: 10

- Assessment plan:

Assessment	Contents	Schedule of progress	Assessment methods	Expected Learning Outcome	Grading weight (%)
Subtest					30

Exercise #1	Review the characteristics and effect of wastewater to people and the environment.	1 st Week	Subtest	ELO12	5
Exercise #2	Review the physical methods in wastewater treatment, do the computational analysis and design of screening, preliminary sedimentation, primary clarifier and equalization tank.	5 th Week	Subtest	ELO16	5
Exercise #3	Review the operation of BR, FMT, FPRT.	6 th Week	Subtest	ELO16	5
Exercise #4	Review the biological wastewater treatment method, do the computational analysis and design of aerobic and anaerobic reactors, calculate the oxygen uptake for the degradation of BOD and nitrification.	10 th Week	Subtest	ELO3, ELO16	5
Exercise #5	Do the computational analysis and design of UASB.	11 th Week	Subtest	ELO3	5
Exercise #6	Do the computational analysis and design of Chlorine's dose in the disinfection. Do the calculation for the design of disinfection system.	13 th Week	Subtest	ELO3, ELO16	5
Assignments					10
Assignment#1	Do the teamwork to discuss about the treatment of industrial wastewater.	5 th Week	Result evaluation	ELO6, ELO12	5
Assignment#2	Do the teamwork to discuss	7 th Week	Result	ELO6,	5

	about the treatment of pharmaceutical and dyeing wastewater.		evaluation	ELO12	
Essay - Report					10
	<p>Students can choose specific topic after each class. In class room, a group of students will report the materials which they found for their topic. The contents of topic are :</p> <ol style="list-style-type: none"> 1. The necessary of wastewater treatment. 2. Wastewater treatment methods. 3. Finding out the wastewater treatment technologies. 4. Do the computational analysis and design of the preliminary treatment including screening, preliminary sedimentation, equalization tank and primary clarifier 1. 5. Finding out how to operate each part of the preliminary treatment particularly. 6. Finding out the activities and relationships of the reactors in the wastewater treatment system, anaerobic and aerobic 	2 - 7 th Week	Presentation	ELO3, ELO6, ELO16	

	<p>biological techniques, design methods and biochemical reactions occurring in the reactors.</p> <p>7. Finding out the N, P removal processes.</p> <p>8. Finding out the dyeing, pharmaceutical wastewater treatment technologies. The advanced oxidation methods should be studied more deeply.</p>				
Final exam					50
	<ul style="list-style-type: none"> - The content covers all of course outcomes. - 70 minutes duration. 		Writing test	ELO3	

9. Detailed contents of course:

Week	Contents	Expected Learning Course outcome
1	Chapter 1: Sources, characteristics of wastewater and Wastewater collection system	
	<p>A/ Teaching content in classroom (3)</p> <ul style="list-style-type: none"> + Sources of wastewater + Wastewater characteristics + The effect of untreated wastewater + Wastewater collection system 	CELO1

	<ul style="list-style-type: none"> + Objectives of wastewater treatment + Classification of wastewater treatment <p>Summary of teaching methodology:</p> <ul style="list-style-type: none"> + Speech + Group discussion + Slide presentation (Powerpoint) 	
	<p>B/ The contents of home self-study (6)</p> <p>All the contents of Chapter 1</p>	
2-3	Chapter 2: Preliminary treatment	
	<p>A/ Teaching contents in classroom (6)</p> <ul style="list-style-type: none"> + Function of preliminary treatment units + Screening + Primary settling tank + Oil and grease removal tank + Equalization and neutralization tank <p>Summary of teaching methodology:</p> <ul style="list-style-type: none"> + Speech + Slide presentation (Powerpoint) + Group discussion 	CELO1, CELO2
	<p>B/ Self-study contents (12)</p> <p>Items 2.2, 2.3, 2.4 and 2.5.</p>	
4	Chapter 3: Primary treatment	
	<p>A/ Teaching contents in classroom (3)</p> <ul style="list-style-type: none"> + Function of primary treatment units + Coagulation and flocculation process + Primary Sedimentation <ul style="list-style-type: none"> -Settling Theory -Types of Settling Tanks -Design considerations of primary sedimentation tank + Flotation tank 	CELO1, CELO2, CELO3, CELO4

	-Flotation Theory -Design considerations of flotation tank Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	
	B/ Self-study contents (6) All the contents of Chapter 3	
5	Chapter 4: Secondary treatment	
	A/ Teaching contents in classroom (3) + Function of secondary treatment units + Activated sludge process + Lagoons and oxidation ponds + Trickling filtration Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO1, CELO2, CELO3, CELO4
	B/ Self-study contents (6) All the contents of Chapter 4	
6-7	Chapter 5: Activated sludge process in wastewater treatment	
	A/ Teaching contents in classroom (6) + Modelling of Activated sludge processes + Return Activated Sludge Capacity Requirements + Comparison of Activated sludge processes + Secondary clarifier + Diffused Aeration system Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10

	B/ Self-study contents (12) All the contents of Chapter 5	
8-9	Chapter 6: Biofilm process	
	A/ Teaching contents in classroom (6) + Biofilm process considerations + Trickling filtration + Rotating biological contactor + Hybrid biofilm / suspended-growth process Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study content (12) Items 6.2, 6.3 and 6.4	
10-11	Chapter 7: Anaerobic process in wastewater treatment	
	A/ Teaching contents in classroom (6) + Anaerobic process considerations + Anaerobic process configurations + Anaerobic processes - Suspended growth > Complete mix digester > Anaerobic contact - Supported growth > Fixed bed processes > Expanded / Fluidized bed processes - Hybrid system > Upflow anaerobic sludge blanket > Upflow sludge blanket / fixed bed reactor Summary of teaching methodology: + Speech + Slide presentation (Powerpoint)	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10

	+ Group discussion	
	B/ Các nội dung cần tự học ở nhà: (12) All the contents of Chapter 7	
	Chapter 8: N, P removal methods	
12	A/ Teaching contents in classroom (3) + Eutrophication + Nitrification + Denitrification + Phosphorus removal Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Các nội dung cần tự học ở nhà: (6) Items 8.2, 8.3 and 8.4	
	Chapter 9: Sludge treatment in wastewater treatment plants	
13	A/ Teaching contents in classroom (3) + Objectives of sludge treatment + Classification of sludges + Sludge thickening, dewatering, and drying + Sludge stabilization Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Teaching contents in classroom (6) All the contents of Chapter 9	
14	Chapter 10: Physical-Chemical methods in wastewater treatment	

	A/ Teaching contents in classroom (3) + Chemical treatment + Adsorption + Filtration + Membrane Processes + Advanced oxidation Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Các nội dung cần tự học ở nhà: (6) All the contents of Chapter 10	
15	Chapter 11: Disinfection	
	A/ Teaching contents in classroom (3) + Objectives, methods, and Mechanism of Disinfection + Ozonation + Chlor disinfection + Chlorine disinfection + Ultraviolet disinfection Summary of teaching methodology: + Speech + Slide presentation (Powerpoint) + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Các nội dung cần tự học ở nhà: (6) All the contents of Chapter 11	

10. Scientific ethics:

The homework and projects must be implemented by the students themselves. If the copy is detected, the students will be evaluated with the zero of the processing grade and final exam.

11. Date of first approval:

12. Approval by

Dean of the faculty

Head of department

Editorial Group

13. The process of updating course outline

<p>1st update content: Date</p>	<p><Who updating needs a sign and write full name></p> <p>Head of Department:</p>
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