

Course Syllabus

1. Course Title: Wastewater Engineering

2. Course Code: WWTR434410

3. Credit Units: 3 credits (3/0/6) (3 units of theory/ 0 unit of practice/ 6 units of self-study)

Duration: 15 weeks (3 hours of theory+0 hours of practice, and 6 hours of self-study per week).

4. Course Instructors:

1 / Dr. Nguyen Thai Anh

2 / Dr. Tran Thi Kim Anh

3 / Dr. Nguyen My Linh

5. Course Requirements:

Prerequisite courses: None

Previous courses: None

Parallel courses: None

6. 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.

7. Course goals

Goals	Goal description	Programme ELOs
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	ELO3, ELO6

	wastewater treatment plants, then choose the appropriate technology for the design.	
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

8. Course Learning Outcomes (CLOs)

CLOs		CLO Description	Programme ELOs
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 techniques.	ELO3, 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

9. Learning Resources

- Textbooks:

1. George Tchobanoglous, Franklin L. Burton, H. David Stensel (2004), Wastewater Engineering, Treatment and reuse, Metcalf & Eddy Inc.
2. WEF Press (2006) Biological Nutrient Removal (BNR) Operation in WWTP, McGraw-Hill, Inc.
3. Bruce E. Rittmann, Perry L. McCarty (2001), Environmental Biotechnology_ Principle and Application, McGraw-Hill Inc.

- References:

1. Assoc. Prof. Nguyen Van Suc, Wastewater engineering Textbook, HCMC National University Publisher, 2013.
2. Lam Minh Triet, Domestic and industrial wastewater treatment, Construction Publishing House, Hanoi, 2002.
3. Staney E. Manahan, (2000) Environmental Chemistry, Lewis Publisher, London. New York Wasington, D.C.

10. Student assessment:

- Grading scale: **10**

- Assessment plan:

Type	Content	Timeline	Assessment method	CLOs	Rate (%)
Subtest					30
Exercise #1	Review the characteristics and effect of wastewater to people and the environment.	Week 3	Group-working Presentation	ELO12	5
Exercise #2	Review the physical methods in wastewater treatment, do the computational analysis and design of screening, preliminary sedimentation,	Week 5	Group-working Presentation	ELO16	5

	primary clarifier and equalization tank.				
Exercise #3	Review the operation of BR, FMT, FPRT.	Week 6	Group-working Presentation	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.	Week 10	Group-working Presentation	ELO3, ELO16	5
Exercise #5	Do the computational analysis and design of UASB.	Week 11	Group-working Presentation	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.	Week 13	Group-working Presentation	ELO3, ELO16	5
Assignments					10
Assignment#1	Do the teamwork to discuss about the treatment of industrial wastewater.	Week 5	Group-working Presentation	ELO6, ELO12	5
Assignment#2	Do the teamwork to discuss about the treatment of pharmaceutical and dyeing wastewater.	Week 7	Group-working Presentation	ELO6, ELO12	5
Essay					10
	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 : 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	Week 2-7	Group-working Presentation	ELO3, ELO6, ELO16	

	<p>each part of the preliminary treatment particularly.</p> <p>6. Finding out the activities and relationships of the reactors in the wastewater treatment system, anaerobic and aerobic 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	

11. Course Content:

Week	Contents	CLOs
1	Chapter 1: Sources, characteristics of wastewater and Wastewater collection system	
	A/ Content and pedagogical methods in class (3) Content <ul style="list-style-type: none"> 1.1 Sources of wastewater 1.2 Wastewater characteristics 1.3 The effect of untreated wastewater 1.4 Wastewater collection system 1.5 Objectives of wastewater treatment 1.6 Classification of wastewater treatment Pedagogical methods: <ul style="list-style-type: none"> + Presentation of lecture + Group discussion 	CELO1
	B/ Self-study content (6) All the contents of Chapter 1	
2-3	Chapter 2: Preliminary treatment	

	A/ Content and pedagogical methods in class (6) Content 2.1 Function of preliminary treatment units 2.2 Screening 2.3 Primary settling tank 2.4 Oil and grease removal tank 2.5 Equalization and neutralization tank Pedagogical methods: + Presentation of lecture + Group discussion	CELO1, CELO2
	B/ Self-study contents (12) Items 2.2, 2.3, 2.4 and 2.5.	
	Chapter 3: Primary treatment	
4	A/ Content and pedagogical methods in class (3) Content 3.1 Function of primary treatment units 3.2 Coagulation and flocculation process 3.3 Primary Sedimentation 3.4 Flotation tank Pedagogical methods: + Presentation of lecture + Group discussion	CELO1, CELO2, CELO3, CELO4
	B/ Self-study contents (6) All the contents of Chapter 3	
	Chapter 4: Secondary treatment	
5	A/ Content and pedagogical methods in class (3) Content 4.1 Function of secondary treatment units 4.2 Activated sludge process 4.3 Lagoons and oxidation ponds 4.4 Trickling filtration Pedagogical methods: + Presentation of lecture + Group discussion	CELO1, CELO2, CELO3, CELO4
	B/ Self-study contents (6) All the contents of Chapter 4	
	Chapter 5: Activated sludge process in wastewater treatment	
6-7	A/ Content and pedagogical methods in class (6) Content 5.1 Modelling of Activated sludge processes 5.2 Return Activated Sludge Capacity Requirements 5.3 Comparison of Activated sludge processes 5.4 Secondary clarifier 5.5 Diffused Aeration system Pedagogical methods: + Presentation of lecture + 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/ Content and pedagogical methods in class (6) Content 6.1 Biofilm process considerations 6.2 Trickling filtration 6.3 Rotating biological contactor 6.4 Hybrid biofilm / suspended-growth process Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study contents (12) Items 6.2, 6.3 and 6.4	
10-11	Chapter 7: Anaerobic process in wastewater treatment	
	A/ Content and pedagogical methods in class (6) Content 7.1 Anaerobic process considerations 7.2 Anaerobic process configurations 7.3 Anaerobic processes Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study contents (12) All the contents of Chapter 7	
12	Chapter 8: N, P removal methods	
	A/ Content and pedagogical methods in class (3) Content 8.1 Eutrophication 8.2 Nitrification 8.3 Denitrification 8.4 Phosphorus removal Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study contents (6) Items 8.2, 8.3 and 8.4	
13	Chapter 9: Sludge treatment in wastewater treatment plants	
	A/ Content and pedagogical methods in class (3) Content 9.1 Objectives of sludge treatment 9.2 Classification of sludges 9.3 Sludge thickening, dewatering, and drying 9.4 Sludge stabilization Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10

	B/ Self-study contents (6) All the contents of Chapter 9	
14	Chapter 10: Physical-Chemical methods in wastewater treatment	
	A/ Content and pedagogical methods in class (3) Content 10.1 Chemical treatment 10.2 Adsorption 10.3 Filtration 10.4 Membrane Processes 10.5 Advanced oxidation Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study contents (6) All the contents of Chapter 10	
15	Chapter 11: Disinfection	
	A/ Content and pedagogical methods in class (3) Content 11.1 Objectives, methods, and Mechanism of Disinfection 11.2 Ozonation 11.3 Chlor disinfection 11.4 Chlorine disinfection 11.5 Ultraviolet disinfection Pedagogical methods: + Presentation of lecture + Group discussion	CELO5, CELO6, CELO7, CELO8, CELO9, CELO10
	B/ Self-study contents (6) All the contents of Chapter 11	

12. Learning 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.

13. Date of first approval:

14. Approval by

Dean of the faculty

Head of department

Instructor

15. Date and Up-to-date content

<p>1st time: Date: January 1st, 2017 - Update content and structure of the programme adjusted in 2015</p>	<p>Instructor:</p> <p>Head of Department:</p>
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