

## DETAILED COURSE OUTLINE

**1. Course name:** Experiments on Wastewater Treatment      Course code: EOWT326510

**2. Number of Credits:** 2 tín chỉ

Total time: 6 weeks 2(0:2:4)

**3. Course lecturers:**

1 / Major responsibility: PhD. Nguyen My Linh

2 / List of another lecturers:

2.1 / PhD. Tran Thi Kim Anh

2.2 / MSc. Hoang Thi Tuyet Nhung

**4. Prerequisites:**

Prerequisite subjects: None

Previous subjects: Experiments on Environmental Chemical Engineering

**5. Course description:**

The basic knowledge of physical, chemical, biological methods in wastewater treatment is reinforced after course. Students operate the wastewater treatment systems, such as activated sludge, color adsorption, SBR, MBR, sedimentation, ...

### Course goals

<i>Goals</i>	<i>Goal descriptions</i> <i>(Course's contributions to student)</i>	<b>Expected learning outcome</b>
<b>G1</b>	Reinforce, improve the specialized knowledge in the field of wastewater treatment.	ELO3
<b>G2</b>	Practise many skills such as calculation, present, plot, explain the	ELO5, ELO8

	results and the phenomenon in the experiment.	
<b>G3</b>	Practise team-work skill.	ELO9
<b>G4</b>	Deploy the design and operation of wastewater treatment systems in reality.	ELO15

## 6. Course learning outcomes

Course expected learning outcome		Descriptions (After accomplishing this course, students are able to:)	Expected learning outcome
<b>G1</b>	CELO1	State the principles and technical process of chemicals and equipment using in wastewater treatment.	ELO3
	CELO2	Reinforce the theory of wastewater treatment methods learned.	
	CELO3	Analyze the feature of wastewater treatment methods from different sources.	
<b>G2</b>	CELO4	Operate several wastewater treatment models.	ELO5,ELO8
	CELO5	Do the calculation, treatment, plotting experiments's result.	
	CELO6	Make assessment, evaluate, conclusion the experiments's result.	
	CELO7	Perform a precise, meticulous manual in experiments.	
	CELO8	Demonstrate honesty in experiments's reporting as well as in scientific research.	
<b>G3</b>	CELO9	Capable of teamwork	ELO9
<b>G4</b>	CELO10	Deploy the design and operation of wastewater treatment systems in reality.	ELO15

## 7. Learning Materials

- Books, essential textbook:

[1] Textbook of experiments on wastewater treatment, Environmental technology Department, HCMC University of Technology and Education.

- References:

[2] Lam Minh Triet, **Microorganism and wastewater**, Construction Publishing House, 2006

[3] Trinh Xuan Lai, **Industrial wastewater treatment**, Construction Publishing House, 2009

[4] Tomonori Matsuo, **Advances in water and wastewater treatment technology**, Elsevier Science B.V., 2001.

[5] Udo Wiesmann, **Fundamentals of Biological Wastewater Treatment**, WILEY-VCH, 2007.

[6] Ruth E Weiner and Robin A. Matthews, **Environmental Engineering**, Elsevier Butterworth-Heinemann, 2003.

[7] Nicholas P. Cheremisinoff, **Biotechnology for waste and wastewater treatment**, Noyes Publications, 1996.

[8] Simon Judd và Bruce Jefferson, **Membranes for Industrial Wastewater Recovery and Re-use**, Elsevier Ltd, 2003.

**8. Student assessment**

- Grade scale: 10

- Assessment plan:

Assessment	Contents	Schedule of progress	Assesment methods	Expected Learning Outcome	Grading weight (%)
Subtest					<b>15</b>
Exercise#1	Read document of experiments on wastewater treatment before class.	2-5 <sup>th</sup> Weeks	Small questions in class	ELO3	15
Essay - Report					<b>35</b>
Exercise #1	Report process of experiments, results,	7 <sup>th</sup> Week	Report	ELO5,ELO8	35

	all exercises of experiments.				
Final exam					<b>50</b>
	The content covers all of course outcomes.		Writing / practical test	ELO3,ELO5,ELO8 ELO9,ELO15	50

**9. Detailed content of course:**

<b>Week</b>	<b>Contents</b>	<b>Expected Learning Course outcome</b>
1	Chapter 1: <b>PHYSICAL-CHEMICAL METHOD IN WASTEWATER TREATMENT</b> (0/20/40)	
	<p><b>A/ Teaching content in classroom:</b></p> <p><b>1.1. Theory of coagulation and flocculation</b></p> <p><b>1.2. By wastewater flocculation system alum / polymer anion</b></p> <p><i>1.2.1. Determination of the optimal pH</i></p> <p><i>1.2.2. Determination of the optimal coagulant's dosage</i></p> <p><b>1.3. Coagulation of wastewater with FeCl<sub>3</sub> / anionic polymer</b></p> <p><i>1.3.1. Determination of the optimal pH</i></p> <p><i>1.3.2. Determination of the optimal FeCl<sub>3</sub>'s dosage</i></p> <p><b>1.4. Coagulation of wastewater with PAC / anionic polymer</b></p> <p><i>1.4.1. Determination of the optimal pH</i></p> <p><i>1.4.2. Determination of the optimal PAC's dosage</i></p> <p><b>1.5. Coagulation of wastewater with Chitosan / anionic polymer</b></p> <p><i>1.5.1. Determination of the optimal pH</i></p> <p><i>1.5.2. Determination of the optimal Chitosan's dosage</i></p>	CELO4,CELO5 CELO6,CELO7

	<p><b>Summary of teaching methodology</b></p> <ul style="list-style-type: none"> <li>- Speech</li> <li>- Discussion</li> <li>- Guide to how to manual experiments, do the report</li> </ul>	
	<p><b>B/ The contents of home self-study</b></p> <p>The contents of home self-study</p> <ul style="list-style-type: none"> <li>- Compare the optimal pH and the effectiveness of treatment with different coagulants.</li> <li>- Do the report</li> <li>- Prepare the test lesson for the next class.</li> </ul>	CELO6,CELO7,CELO8 CELO9
2	<p>Chapter 2: <b>ADSORPTION METHOD IN WASTEWATER TREATMENT</b> (0/10/20)</p>	
	<p><b>A/ Teaching content in classroom:</b></p> <p><b>Adsorption by the activated carbon</b></p> <p>2.1. Test 1: Determinate the relation of Color and Absorbance</p> <p>2.2. Test 2: Adsorption level 1</p> <p>2.3. Test 3: Adsorption level n</p> <p><b>Summary of teaching methodology</b></p> <ul style="list-style-type: none"> <li>- Speech</li> <li>- Discussion</li> <li>- Guide to how to manual experiments, do the report</li> </ul>	
	<p><b>B/ The contents of home self-study (8)</b></p> <ul style="list-style-type: none"> <li>- Compare the effectiveness of adsorption level 1 and level n</li> <li>- Do the report</li> <li>- Prepare the test lesson for the next class.</li> </ul>	
3	<p>Chapter 3: <b>CHEMICAL METHOD IN WASTEWATER TREATMENT</b> (0/10/20)</p>	
	<p><b>A/ Teaching content in classroom:</b></p> <p><b>3.1. Advanced oxidation by homogeneous Fenton system)</b></p>	CELO4,CELO5 CELO6,CELO7

	<p>3.1.1. Survey the ratio of H<sub>2</sub>O<sub>2</sub> and FeCl<sub>3</sub> used</p> <p>3.1.2. Survey the effectiveness of the reaction with the presence of catalyst - Mn<sup>2+</sup></p> <p><b>3.2. Advanced oxidation by heterogeneous Fenton system</b></p> <p>3.2.1. Survey the ratio of H<sub>2</sub>O<sub>2</sub> and FeOOH used</p> <p>3.2.2. Compare the effectiveness of homogeneous oxidation and heterogeneous oxidation</p> <p><b>Summary of teaching methodology</b></p> <ul style="list-style-type: none"> <li>- Speech</li> <li>- Discussion</li> <li>- Guide to how to manual experiments, do the report</li> </ul>	
	<p><b>B/ The contents of home self-study</b></p> <ul style="list-style-type: none"> <li>- Compare the effectiveness of the treatment by homogeneous and heterogeneous Fenton system</li> <li>- Do the report</li> <li>- Prepare the test lesson for the next class.</li> </ul>	<p>CELO6,CELO7,CELO8 CELO9</p>
4-5	<p>Chapter 4 : <b>BIOLOGICAL METHOD IN WASTEWATER TREATMENT (0/20/40)</b></p>	
	<p><b>A/ Teaching content in classroom:</b></p> <p><b>4.1. wastewater treatment by activated sludge system</b></p> <p>4.1.1. <i>Survey the effectiveness of wastewater treatment with the dosages of sludge</i></p> <p>4.1.2. <i>Survey the effectiveness of wastewater treatment with the time profile</i></p> <p><b>4.2. wastewater treatment by membrane in aerobic condition</b></p> <p>4.2.1. <i>Operate the MBR model with the time profile of diffused aeration</i></p> <p>4.2.2. <i>Survey the effectiveness of wastewater treatment with the time profile</i></p> <p><b>4.3. wastewater treatment by SBR</b></p>	<p>CELO4,CELO5 CELO6,CELO7</p>

	<p>4.3.1. Operate the SBR model with the time profile of diffused aeration</p> <p>4.3.2. Survey the effectiveness of wastewater treatment with the time profile</p> <p><b>Summary of teaching methodology</b></p> <ul style="list-style-type: none"> <li>- Speech</li> <li>- Discussion</li> <li>- Guide to how to manual experiments, do the report</li> </ul>	
	<p><b>B/ The contents of home self-study</b></p> <ul style="list-style-type: none"> <li>- Do the report</li> <li>- Compare the effectiveness of models</li> </ul>	<p>CELO6,CELO7,CELO8 CELO9</p>

**10. Scientific ethics:**

- Students study seriously and follow the instructions of experiments.
- Strictly implement the rules laboratories.
- Students who do not complete the task, banned exam.
- In case of the detection of students who replace the others in the exam, all of them will be suspended or leaved the learning program.

**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>&lt; Who updating needs to sign and</p>
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