

### COURSE OUTLINE DETAILS

**1. Course: Water quality analysis (Kỹ thuật phân tích chất lượng nước)**

- **Code number:** AQ218

- **Credits:** 3

- **Hours:** 30 theory hours, 30 practice hours, and 60 self-study hours

**2. Management Unit:**

- **Department:** Applied Hydrobiology

- **Faculty:** College of Aquaculture and Fisheries

**3. Requisites:**

- **Prerequisites:** No

- **Corequisites:** No

**4. Course objectives:**

Objectives	Descriptions	Program Outcomes
4.1	Providing the knowledge on principles in chemical reactions, principles in preparations of chemical solutions, and the standard methods for water quality analyses for aquatic life.	2.1.2.a 2.1.2.b
4.2	Training students in the skills of collecting samples, preserving and analyzing water quality parameters to serve the implementation of the graduation thesis and scientific research after graduation.	2.2.1.a
4.3	Training the skills to work independently or/and in a group.	2.2.2
4.4	Training on self-study skills, and lifelong learning skills in order to gain professional knowledge experiences in practical works in the aquaculture field.	2.3

**5. Course learning outcomes:**

COs	Descriptions	Objectives	POs
	<b>Knowledge</b>		
CO1	Summarize the principles of quantitative chemistry, sampling and quantitative chemical analysis of water quality factors in aquaculture environments.	4.1	2.1.2.a
CO2	Describe the steps of analysis and quality control procedures for aquaculture pond environmental factors	4.1	2.1.2.b
	<b>Skills</b>		

COs	Descriptions	Objectives	POs
CO3	Prepare reagents for analysis of water quality parameters in aquaculture ponds	4.2	2.2.1.a
CO4	Perform analysis and quality control procedures for environmental factors in aquaculture ponds	4.2	2.2.1.a
CO5	Develop skills to work independently and in groups	4.3	2.2.2
	<b>Attitudes/Autonomy/Responsibilities</b>		
CO6	Develop self-studying ability, scientific style in learning and research, lifelong learning skills.	4.4	2.3

Note: "COs" means Course Outcomes; "POs" means Program Outcomes

## 6. Brief description of the course:

The course "Water quality analysis" provides the aquaculture bachelor students the knowledge about the standard methods for wastewater and water examination, and the methods for chemical solution preparation for water quality analysis. The methods for water sampling and preservation as well as the physical and chemical principles in water quality analyses in surface water, coastal water bodies and aquaculture ponds. In addition, the students have capacities in data analysis, the errors in analysis, quality control and quality assurance in measurements.

## 7. Course structure:

### 7.1. Theory

	Contents	Hours	COs
<b>Chapter 1.</b>	<b>Concepts and requirements on water quality for aquaculture</b>	<b>3</b>	CO1, CO3, CO6
1.1.	Concepts		
1.2.	Requirement on water quality for aquaculture		
1.3.	Concentration of solutions and reagent preparation method		
<b>Chapter 2.</b>	<b>Sampling and preservation methods</b>	<b>3</b>	CO1, CO6
3.1.	Type of sample		
3.2.	Sample characteristics		
3.3.	Number and volume of samples		
3.4.	Sample collection devices		
3.5.	Preparing for the sampling process		
3.6.	Sampling methods		
3.7.	Sample preservation		
<b>Chapter 3.</b>	<b>Physical factors analysis</b>	<b>6</b>	CO2, CO4, CO6
3.1.	Temperature		
3.2.	pH		



	Contents	Hours	COs
3.3.	Electric conductivity (EC)		
3.4.	Salinity		
3.5.	Transparency		
3.6.	Turbidity		
3.7.	Total solids (TS)		
3.8.	Total volatile solids (TVS) and total fixed solids (TFS)		
3.9.	Total dissolved solids (TDS)		
3.10.	Total volatile dissolved solids (TVDS) and total fixed dissolved solids (TFDS)		
3.11.	Total suspended solids (TSS)		
3.12.	Total volatile suspended solids (TVSS) and total fixed suspended solids (TFSS)		
<b>Chapter 4.</b>	<b>Chemical factors analysis</b>	12	CO <sub>2</sub> , CO <sub>3</sub> , CO <sub>4</sub> , CO <sub>6</sub>
4.1.	Free CO <sub>2</sub>		
4.2.	Dissolved oxygen (DO)		
4.3.	Alkalinity		
4.4.	Hardness		
4.5.	Ca <sup>2+</sup> ion		
4.6.	Mg <sup>2+</sup> ion		
4.7.	K <sup>+</sup> ion		
4.8.	Biochemical oxygen demand (BOD)		
4.9.	Chemical oxygen demand (COD)		
4.10	SiO <sub>2</sub>		
4.11	Free Chlorine		
4.12	Total sulfide		
4.13	Sulfate		
4.14	Total ammonia nitrogen TAN		
4.15	Nitrite		
4.16	Nitrate		
4.17	Phosphate		
4.18	Total iron		
4.19	Chlorophyll-a		
4.20	Total kjeldahl nitrogen (TKN)		
4.21	Total nitrogen (TN)		
4.22	Total phosphorus (TP)		
<b>Chapter 5.</b>	<b>Quality control and quality assurance</b>	6	CO <sub>2</sub> , CO <sub>4</sub> , CO <sub>6</sub>
5.1.	Errors		
5.2.	Some statistical values		
5.3.	Internal quality control		

	Contents	Hours	COs
5.4.	External quality control		

## 7.2. Practice

	Content	Hours	COs
<b>Practice 1</b>	<b>Laboratory safety</b>	<b>5</b>	CO1, CO5
	Personal protection during work in the laboratory		
	Use and storage of chemicals in the laboratory		
	Hazard pictogram and hazard symbols		
<b>Practice 2</b>	<b>Electrometric method</b>	<b>1</b>	CO2, CO4, CO5
	pH		
	Electric conductivity (EC)		
<b>Practice 3</b>	<b>Gravimetric method</b>	<b>4</b>	CO2, CO4, CO5
	Total suspended solids		
<b>Practice 4</b>	<b>Titrimetric method (volumetric method)</b>	<b>10</b>	CO2, CO3, CO4, CO5
	Free CO <sub>2</sub> measurement		
	Dissolved oxygen measurement		
	Alkalinity measurement		
	Hardness measurement		
<b>Practice 5</b>	<b>Spectrophotometric method</b>	<b>10</b>	CO2, CO3, CO4, CO5
	TAN and unionized ammonia measurement		
	Phosphate measurement		
	Total sulfide and hydrogen sulfide measurement		
	Nitrite measurement		

## 8. Teaching methods:

- For theory, active teaching and learning offer opportunities for interaction between lecturers and students, among the students themselves, as well as between students and the materials, the topic itself or the academic discipline.
- For the practice, each group of students (4-5 students) will study the theory for labworks then participate in the practice in the lab. The lecturer will demonstrate the experiments, the students follow the instructor, then each student will perform the experiment in themselves. After obtaining the data, the group discussion about the data, the errors, the process noting, the experience etc will be conducted.

## 9. Duties of student:

Students have to do the following duties:

- Academics participating in at least 80% of the total number of theory periods.
- Preparing and participating 100% hours in the lab
- Participating the discussion in the lab
- Participating in the mid-term exam.
- Physical participation in the final exam.
- Independent study activities



## 10. Assessment of course learning outcomes:

### 10.1. Assessment

No.	Point components	Rules and Requirements	Weights	COs
1	Lab work score	Participating 100% hours for water quality analysis practice	30%	CO3, CO4, CO5
2	Mild-term	Physical attending the test	20%	CO1, CO2, CO3, CO4, CO6
3	Final test	Physical attending the test	50%	CO1; CO2; CO3;CO4;

### 10.2. Grading

- Grading components and final test scores will be marked on a scale of 10 (0 to 10), rounded to one decimal place.
- Course score is the sum of all the components of the evaluation multiplied by the corresponding weight. The course score is marked on a scale of 10 and rounded to one decimal place, then it is converted to A-B-C-D score and score on a scale of 4 under the academic regulations of the University.

### 11. Learning materials:

Learning materials information	Barcode number
[1] Huynh Truong Giang, Truong Quoc Phu. 2021. Coursebook: Water quality analysis for aquaculture. Can Tho University Publishing House (in Vietnamese).	TS005915 639.8/Gi106
[2] Boyd, C.E and Tucker C.S. 1992. Water quality and pond soil analyses for aquaculture. Alabama Agricultural Experiment Station. Auburn University.	MT.002448 639.31 B789
[3] Rice E.W., Baird R.B., Eaton A.D. and Cleceri L.S. 2012. Standard methods for the examination of water and wastewater, 22 <sup>nd</sup> edition. American Public Health Association 800 I Street, NW Washington, DC 20001-3710.	TS.005554 579 A512

### 12. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Student's tasks
	<b>Theory</b>			
1	<b>Chapter 1: Concepts and requirements on water quality for aquaculture</b> Concepts Requirement on water quality for aquaculture Concentration of solutions and reagent preparation method	3	0	Required reading before class attending: - Document [1]: pages 1-8. - Document [2]: pages 21-57

Week	Content	Theory (hours)	Practice (hours)	Student's tasks
2	<b>Chapter 2: Sampling and preservation methods</b> Type of sample Sample characteristics Number and volume of samples Sample collection devices Preparing for the sampling process Sampling methods Sample preservation	3	0	Required reading before class attending: - Document [1]: pages 9-19 - Document [2]: pages 59-70
3	<b>Chapter 3: Physical factors analysis</b> Temperature pH Electric conductivity (EC) Salinity Transparency Turbidity Total solids (TS) Total volatile solids (TVS) and total fixed solids (TFS) Total dissolved solids (TDS) Total volatile dissolved solids (TVDS) and total fixed dissolved solids (TFDS) Total suspended solids (TSS) Total volatile suspended solids (TVSS) and total fixed suspended solids (TFSS)	3	0	Required reading before class attending: - Document [1]: pages 20-33 - Document [2]: pages 99-101, 121-122, 123-125 and 133-134
4	<b>Chapter 4: Chemical factors analysis</b> Free CO <sub>2</sub> DO BOD COD	3	0	Required reading before class attending: - Document [1]: pages 34-39 and 53-61 - Document [2]: pages 85-86, 87-92 and 107-115

Week	Content	Theory (hours)	Practice (hours)	Student's tasks
5	<b>Chapter 4: Chemical factors analysis (cont.)</b> Alkalinity Hardness Calcium hardness ( $\text{Ca}^{2+}$ ) Magnesium hardness $\text{Mg}^{2+}$ Potassium ( $\text{K}^{+}$ )	3	0	Required reading before class attending: - Document [1]: pages 40-52 - Document [2]: pages 73-77, 83-84 and 97-98
6	<b>Chapter 4: Chemical factors analysis (cont.)</b> $\text{SiO}_2$ Free chlorine Total sulfide ( $\text{S}^{2-}$ ) Sulfate ( $\text{SO}_4^{2-}$ )	3	0	Required reading before class attending: - Document [1]: pages 62-77 - Document [2]: pages 95-96 and 126-128
7	<b>Chapter 4: Chemical factors analysis (cont.)</b> Total ammonia nitrogen (TAN) Nitrite ( $\text{NO}_2^{-}$ ) Nitrate ( $\text{NO}_3^{-}$ ) Phosphate ( $\text{PO}_4^{3-}$ )	3	0	Required reading before class attending: - Document [1]: pages 78-93 - Document [2]: pages 78-82, 102-106 and 116-120
8	<b>Chapter 4: Chemical factors analysis (cont.)</b> Total iron (Fe) Chlorophyll-a Total kjeldahl nitrogen (TKN) Total nitrogen (TN) Total phosphorus (TP)	3	0	Required reading before class attending: - Document [1]: pages 94-105
9	<b>Chapter 5: Quality control and quality assurance</b> Errors Some statistical values Internal quality control External quality control	3	0	Required reading before class attending: - Document [1]: pages 106-121 - Document [2]: pages 3-16
	<b>Practice</b>			

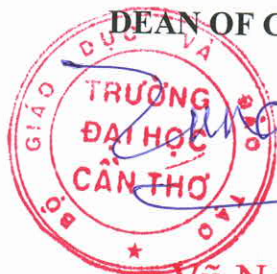


Week	Content	Theory (hours)	Practice (hours)	Student's tasks
10	Laboratory safety	0	5	- Read the document [3] pages 1-49 to 1-66
11	Electrometric and gravimetric methods pH Electric conductivity (EC) Total suspended solids (TSS)	0	5	- Read the document [1]: pages 20-21, pages 22 and pages 31-32 - Read the document [2]: pages 99-102, pages 122 and pages 126 - Read the document [3] pages 2-52 to 2-54, pages 2-66
12	Titrimetric method Free CO <sub>2</sub> Dissolved Oxygen (DO)	0	5	- Read the document [1]: pages 34-39 - Read the document [2]: pages 85-86 and pages 107-115 - Read the document [3]: pages 4-30 to 4-36 và 4-137 to 4-144
13	Titrimetric method Độ kiềm Độ cứng	0	5	- Read the document [1]: pages 40-42 - Read the document [2]: pages 73-77 and pages 97-98 - Read the document [3]: pages 2-34 to 2-36 và 2-44 to 2-46
14	Spectrophotometric method Total ammonia nitrogen (TAN) Phosphate (PO <sub>4</sub> <sup>3-</sup> )	0	5	- Read the document [1]: pages 78-81 and 90-93 - Read the document [2]: pages 78-82 and pages 116-120 - Read the document [3]: pages 4-110 to 4-119 và 4-148 to 4-163



Week	Content	Theory (hours)	Practice (hours)	Student's tasks
15	<b>Spectrophotometric method</b> Tổng sulfide ( $S^{2-}$ ) Nitrite ( $NO_2^-$ )	0	5	<ul style="list-style-type: none"> <li>- Read the document [1]: pages 69-75 and 82-84</li> <li>- Read the document [2]: pages 106 and pages 126-128</li> <li>- Read the document [3]: pages 4-137 to 4-144</li> </ul>

ON BEHALF OF RECTOR  
DEAN OF COLLEGE



Vũ Ngọc Út

Can Tho, 30/.../8.../2022  
HEAD OF DEPARTMENT

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