MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

SUBJECT OUTLINE DETAILS

1. Subject: Limnology (Ao hồ học)

- Code: AQ209

- Credits: 4

- Hours: 45 theory hours, 30 practice hours

2. Management Unit:

- Department:

- Faculty: College of Aquaculture and Fisheries

3. Prerequisites: No

4. Subject objectives: Upon completing this course, students will be able to:

4.1. Knowledge:

4.1.1. Understand and master knowledge on physical, chemical, biological and ecological characteristics and their dynamics in lakes and ponds

4.1.2. Understand and master all ecological processes of interaction and relationships between biotic and abiotic factors in lake and ponds

4.1.3. Broaden understanding on common aquatic groups in lakes and ponds and freshwater ecosystems

4.2. Skill:

4.2.1. Practice and develop thinking skills

4.2.2. Learn how to read and interpret scientific literature and paper

4.2.3. Evaluate and analyze water parameters freshwater ecosystems

4.2.4. Identify and evaluate plankton groups present in the freshwater ecosystems

4.3. Attitude:

4.3.1. Aware of freshwater and environmental reservation and protection

4.3.2. Display attitude of life-long study

5. Brief description of subject content:

The course will provide students knowledge on chemical, physical, geological, biological, and ecological processes that influence the structure and function of aquatic communities; common aquatic plants, animals found in the ecosystems; the ecological relations among organisms in the ecosystems.

6. Subject content structure:

6.1. Theory

Content	Hours	Objectives

Chapter 1.	**Introduction on limnology**	**3**	
1.1.	Definitions of limnology		4.1.1, 4.2.1, 4.2.2, 4.3.2
1.2.	Importance of limnology study		4.1.1, 4.2.1, 4.2.2, 4.3.2
1.3.	Approaches in limnology study		4.1.1, 4.2.1, 4.2.2, 4.3.2
1.4.	History of limnology study		4.1.1, 4.2.1, 4.2.2, 4.3.2
1.5.	Formation of lakes		4.1.1, 4.2.1, 4.2.2, 4.3.2
Chapter 2.	**Characteristics of water**	**6**	
2.1.	Structure		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
2.2.	Solubility		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
2.3.	Salinity of water		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
2.4.	Buffer system		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
2.5.	Viscosity		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
2.6.	Lake wave and seich		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
Chapter 3.	**Water physical characteristics**	**6**	
3.1.	Light and its effects on organisms		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
3.2.	Heat and water stratification		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
3.3.	Lake mixing patterns		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
3.4.	Oxygen cycle		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
3.5.	Carbodioxide cycle		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
Chapter 4.	**Water quality in ponds**	**6**	

4.1.	Physical characters		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
4.2.	Chemical charaters		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
4.3.	Water quality management		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
Chapter 5.	**Nutrients**	**3**	
5.1.	Resource limitation		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
5.2.	Phosphorus cycle		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
5.3.	Nitrogen cycle		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
5.4.	Ecological Stoichiometry		4.1.1, 4.1.2 4.2.1, 4.2.2, 4.3.2
Chapter 6.	**Biotic profile of lakes and ponds**	**9**	
6.1.	Biological diversity of lakes and ponds		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
6.2.	Aquatic invertebrates (protozoa, rotifers, cladocerans, copepods…)		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
6.3.	Aquatic vertebrates (fish, birds, reptiles…)		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
6.4.	Macrophytes		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
6.5.	Importance of aquatic organisms in lakes and ponds		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
Chapter 7.	**Population dynamics**	**4**	
7.1.	Phytoplankton		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
7.2.	Zooplankton		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
7.3.	Loss and gain		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2

Chapter 8.	**Ecological relationships**	**4**	
8.1.	Competition		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
8.2.	Predation		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
Chapter 9.	**Trophic cascade and regulation**	**4**	
9.1.	Biomanipulation		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
9.2.	Seasonal succession		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2
9.3.	Bottom-up and top-down regulation		4.1.1, 4.1.2, 4.1.3, 4.2.1, 4.2.2, 4.3.2

6.2. Practice

	Content	Hours	Objectives
Unit 1.	**Prepartion of instruments**	5	
1.1.	Sechi disk design		
1.2.	Experimental equipment preparation		
Unit 2.	**Determination of chlorophyll-a in different fertilization regimes**	**5**	
2.1.	Experiment design (Fertilizer (NPK) supplied at 1, 2, 3 and 4 g/m^3 (in 20 L buckets)		
2.2.	Sampling and monitor temperature, pH, DO, EC and TDS		
2.3.	Analyzing chlorophyll-a		
2.4.	Results presentation		
Unit 3.	**Determination of water quality parameter in ponds**	**5**	
3.1.	Measurement and analysis of temperature and pH		
3.2.	Measurement and analysis of transparency		
3.3.	Measurement and analysis of DO		
Unit 4.	**Identification of phytoplankton**	**5**	
4.1.	Field sampling (in ponds)		
4.2.	Qualitative and quantitative analysis		
4.3.	Results presentation		
Unit 5.	**Identification of zooplankton**	**5**	
5.1.	Field sampling (in ponds)		
5.2.	Qualitative and quantitative analysis		
5.3.	Results presentation		
Unit 6.	**Identification of zoobenthos**	**5**	
6.1.	Field sampling (in ponds)		
6.2.	Qualitative and quantitative analysis		
6.3.	Results presentation		

7. Teaching method:

- Class lectures
- Group disscusion, presentation

8. Duties of student:

Students have to do the following duties:

- Attending at least 80% of theoretical session
- Attending 100% hours of practical and reporting results
- Participating in group discussions and presentation
- Taking quizzes
- Taking final test

9. Assessment of student learning outcomes:

9.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Attendance	Number of attendance hour/total class hours	5%	4.3.2
2	Work assignment	Seminar/presentation Participation confirmed by team	15%	4.1.1 to 4.3.2
3	Lab work	100% participating in lab work	15%	4.1.1 to 4.3.2
	Mid term exam	Multiple choice exam Not absent	15%	4.1.1 to 4.3.2
	Final exam	Multiple choice combined with written exam Attending at least 80% theoretical hours and 100% practical hour of lab work Compulsory exam	50%	4.1.1 to 4.3.2

9.2. Grading

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

10. Materials:

Materials information	Code number

[1] Dodson, S. 2005. Introduction to limnology. McGraw Hill Companies. 400pp.

[2] Wetzel, R.G. 2001. Limnology, Lake and river ecosystems. Academic Press. 1006pp.

[3] Fee, E. J., Hecky, R. E. , Kasian, S. E. M. and Cruikshank, D. R. 1996. Effects of lake size, water clarity, and climatic variability on mixing depths in Canadian

Shield lakes. Limnol. Oceanogr., 41(5):912-920.

[4] Verburg, p., Hecky, R.E., Kling, H. 2003. Ecological Consequences of a Century of Warming in Lake Tanganyika. SCIENCE VOL 301:505-507.

[5] Boyd, C.E. 1990. Water quality in Ponds for Aquaculture. Ala. Agr. Exp. Sta., Auburn Univer., Al. 462 pp.

[6] Carpenter, S.R., Kitchell, J.F., Hodgson, J. R. 1985. Cascading tropic interactions and lake productivity. Bioscience 5: 634-639.

11. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Students' duties
1	**Chapter 1: Introduction on limnology** 1.1. Definitions of limnology 1.2. Importance of limnology study 1.3. Approaches in limnology study 1.4. History of limnology study 1.5. Formation of lakes	3	2	Students read [1] from p3-23; 265-290; [2] p4-5; and whole paper [3]
2&3	**Chapter 2: Characteristics of water** 2.1. Structure 2.2. Solubility 2.3. Salinity of water and buffer system 2.4. Viscosity 2.5. Wave and seich			Read [1] pp. 29-38, 50-56; [2] pp. 9-14
4&5	**Chapter 3: Water physical characteristics** 3.1. Light and its effects on organisms 3.2. Heat and water stratification 3.3. Lake mixing patterns 3.4. Oxygen and carbon dioxide cycle			Read [1] pp. 40-47, 231-239; [2] pp.151-164; read whole [4]
6&7	**Chapter 4: Water**			Read [5] pp.

	quality in ponds 4.1. Physical characters 4.2. Chemical characters 4.3. Water quality management			
8	**Chapter 5: Nutrients** 5.1. Resource limitation 5.2. Phosphorus cycle 5.3. Nitrogen cycle 5.4. Ecological Stoichiometry			Read [1] pp. 65-80; [2] p187-193; p205-230; p239-258.
9,10 &11	**Chapter 6: Biotic profile of lakes and ponds** 6.1. Biological diversity of lakes and ponds 6.2. Aquatic invertebrates (protozoa, rotifers, cladocerans, copepods…) 6.3. Aquatic vertebrates (fish, birds, reptiles…) 6.4. Macrophytes 6.5. Importance of aquatic organisms in lakes and ponds			Read [1] pp. 239-251, 85-157; [2] p332-338; p619-621; p396-482
12& 13	**Chapter 7: Population dynamics** 7.1. Phytoplankton 7.2. Zooplankton 7.3. Loss and gain			Read: [1] 85-157; [2]p134-142 ; Porter, 1977
14	**Chapter 8: Ecological Relationships** 8.1. Competition 8.2. Predation			Read: [1] pp. 161-179;
15	**Chapter 9: Trophic cascade and regulation**			Read [1] pp. 180-205; whole [6]
	9.1. Biomanipulation			
	9.2. Seasonal succession			
	9.3. Bottom-up and top-down regulation			

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DEAN/ DIRECTOR

HEAD OF DEPARTMENT

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