MINISTRY OF EDUCATION AND TRAINING
CAN THO UNIVERSITY

SOCIALIST REPUBLIC OF VIETNAM
Independence - Freedom - Happiness

COURSE OUTLINE DETAILS

1. Course: Aquatic Animal Physiology (Sinh lý động vật thủy sản)
- **Code number:** AQ211
- **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	To provide the knowledge on hematological physiology of fish and crustacean; respiratory physiology; activity of digestive enzymes of fish and shrimps and the metabolism of proteins, lipids… in the body of aquatic animals. The importance of exuviation, exoskeleton structure and mechanism of molting of crustaceans. In addition, the knowledge on the important function of hormones secreted by the pituitary gland and reproductive physiology of fish, shrimps also provide. Based on this knowledge the students apply to aquaculture and seed production of fish and crustacea.	2.1.2.a 2.1.2.b 2.1.3.a
4.2	To train students how to obtain the blood of fishes, count the number of blood cells and to determine oxygen consumption and the toxicity testing of chemicals effect on fish and shrimp.	2.2.1.a
4.3	To train students how to process the data and to be confident on present the knowledge of fish physiology and actively group working.	2.2.2
4.4	To train students to study for gathering the knowledge by themselves	2.3

5. Course learning outcomes:

COs	Descriptions	Objectives	POs
	Knowledge		
CO1	Understand characteristics of basic physiology of hematology of fish, crustacea and respiration concepts. Mater activity of digestive enzymes in the stomach, and intestine of fish and shrimps and the importance of exuviation, exoskeleton structure and mechanism of molting of crustaceans. Knowledge on the method of fish physiology research.	4.1	2.1.2 a
CO2	Apply and explain the knowledge of respiratory physiology, the activity of digestive enzymes, functions of hormone of fish and crustacea on aquaculture and on seed production of fish and crustacea.	4.1	2.1.2.b 2.1.3. a
	Skills		
CO3	To skill at obtaining the blood of fish, shrimp and count the number of red blood cells, white blood cells of fish. To determine oxygen consumption and the toxicity testing of chemicals effect on fish and crustacean	4.2	2.2.1a
CO4	To be confident on presentation the knowledge of fish physiology and describe the physiological phenomenon and work in groups.	4.3	2.2.2
	Attitudes/Autonomy/Responsibilities		
CO5	To develop ability of learning to a higher degree and complete the study program on time.	4.4	2.3

6. Brief description of the course:

This course will give students with the knowledge of understanding on the characteristics of living, structure and function of organs of aquatic animals and relationship to the environment. (i) The knowledge of hematological physiology of fish and shrimp, the function of red blood cells, white blood cells and thrombocyte related to respiration, health and blood clotting. (ii) The course will cover the concepts of respiratory physiology related to the metabolism and environmental factors, the effects of toxin (as pesticide, chemical.. in the water) on respiration of fish and shrimp. (iii) The activity of the digestive enzymes in the stomach and intestines of fish, the absorption and metabolism of nutrients in the body of fish, and crustaceans are presented. (iv) The knowledge of the function of hormones related to growth and reproduction of fish, crustaceans are also presented in this course. (v) Structure of exoskeleton and the mechanism of molting, and other factors affecting the molting of crustaceans are also in this discipline. At the same time, the practice lessons and project experiments in this

course will help students familiar with some methods for research on hematological physiology and the influence of environmental factors and toxins on the respiratory activity and body organs in shrimp and fish. Knowledge of the theory and practice of the course will help students in learning following subjects, applications for study on physiology, toxicology and health management of aquatic animals and aquaculture very well.

7. Course structure:

7.1. Theory:

	Content	Hours	COs
Chapter 1.	**General introduction of Aquatic Animal Physiology**	2	CO1
1.1.	The definition of physiology and the relationship of the subject to other fields		
1.2.	Characteristics of living organisms, the differences between terrestrial and aquatic animals		
Chapter 2.	**Hematological physiology of fish and crustacean**	5	CO1, CO2, CO4, CO5
2.1.	Overview of body fluid, internal environment and blood a. The concept of intracellular and extracellular fluids b. The general concepts of blood c. The main functions of blood d. Quantity of blood in the fish, crustacean		
2.2.	The chemical composition, and physical and chemical characteristics of blood. a. Chemical composition b. Chemical and physical characteristics of blood		
2.3.	Blood cells a. Red blood cells (Erythrocyte) b. White blood cells (Leukocyte) c. Blood plaque (Thrombocyte)		
Chapter 3.	**Respiratory physiology of fish and Crustaceans**	5	CO1, CO2, CO4, CO5
3.1.	Respiratory environment and concepts a. Respiratory environment b. Concepts of respiratory physiology		

	Content	Hours	COs
3.2.	Respiratory mechanism a. The mechanical movement of the gills and flushing phenomenon b. The gas exchange between the water and the blood c. Respiratory frequency d. The oxygen consumptions		
3.3.	Factors of water environments affecting fish respiration. a. Temperature b. O_2 and CO_2 c. Effects of swimming d. Effects of chemical and toxic		
3.4.	Air breathing organs a. Intestines b. skin c. Suprabranchial organs d. Swim bladder		
Chapter 4	**Digestive physiology**	4	CO1, CO2, CO4
A	Digestion		
4.1.	The digestion in the mouth and esophagus		
4.2.	Digestion in the stomach a. Mechanical digestion b. The process of chemical digestion		
4.3	The digestion in the gut a. Mechanical process of intestinal digestion b. The process of chemical digestion		
B	Absorption		
4.4.	The absorption ways a. Lymphatic way b. Blood ways		
4.5.	Place of absorption a. Gastric mucous membrane b. Intestinal mucous membrane		
4.6.	The absorption of nutritional components a. Amino acid uptake b. Glucose uptake c. Lipid uptake		

	Content	Hours	COs
4.7	Factors affecting to the digestion of fish a. Weight of feed b. Quality of feed c. Temperatures d. Ages		
Chapter 5	**Kidneys and Urinary Physiology**	3	CO1, CO2, CO5
5.1.	Kidneys and osmotic regulation in fish a. Cartilaginous class b. Teleost class		
5.2.	Osmotic and ionic regulation in crustaceans a. Osmotic and ionic regulation in marine crustaceans Osmotic regulation of euryhaline and stenohaline crustacean		
Chapter 6	**Metabolism and Nutrition**	3	CO1, CO2, CO5
6.1.	Metabolism a. Protein metabolism b. Lipid metabolism a. Carbohydrate metabolism c. Water exchange d. Mineral exchange e. Vitamin exchange		
6.3.	Environmental factors affecting to metabolism of fish and crustacea		
Chapter 7	**Endocrine gland**	3	CO1, CO2, CO5
7.1.	Concepts		
7.2.	Hormone a. Effects of hormone b. Mechanism of hormone		
7.3.	Fish pituitary a. Structure b. Hormones and functions		
7.4.	Thyroid gland a. Structure b. Hormones and functions		
7.5.	Adrenal gland a. Structure b. Hormones and functions		

	Content	Hours	COs
7.6.	Endocrine pancreas gland a. Structure b. Hormones and functions		
7.7.	Reproductive endocrine gland		
7.8.	The hypothalamus		
Chapter	**Reproductive Physiology**	3	CO1, CO2, CO5
8.1	Sexual and maturation, reproductive cycle a. Sexual and maturation b. Reproductive cycle		
8.2	The process of oocyte development		
8.3	The biochemical changes of cells during maturation		
8.4	Mechanism of ovulation and ovarian degradation a. Mechanism of ovulation b. Ovarian degradation		
8.5	Mechanism of hatching		
8.6	Some factors affecting reproductive process a. Nutrition b. Temperature c. Water flow		
Chapter 9	**Crustacean molting**	2	CO1, CO2, CO5
9.1	Concepts		
9.2	Structure of crustacean shell		
9.3	Crustacean molting stages		
9.4	New shell development		
9.5	Molting cycle		

7.2. Practice

	Content	Hours	COs
Unit 1.	**Study method of fish and shrimp hematological physiology**	5	CO1, CO3, CO4
1.1.	Brief introduction about equipments		
1.2.	Shrimp hemolymph sampling method		
1.3.	Fish blood sampling		
Unit 2.	**Determine blood cell quantity (red blood cells and white blood cells)**	5	CO1, CO3, CO4
2.1.	Red blood cells counting method		
2.2.	White blood cells counting method		
Unit 3.	**Oxygen consumption and oxygen threshold**	5	

3.1.	Introduction of implementation tools		CO1, CO3, CO4
3.2.	Method of determining oxygen consumption of fish and shrimps		
3.3.	Method of determining oxygen threshold of fish and shrimps		
Unit 4.	**Identify LC $_{50}$ values of the chemicals used in aquaculture**	5	CO1, CO3, CO4
4.1.	Introduction of devices		
4.2.	Method of setting up LC_{50} experiment		
4.3	Method of LC_{50} data analysis		
Unit 5.	**Temperature and salinity tolerance of fish and shrimps**	5	CO1, CO3, CO4
5.1.	Introduction of tools		
5.2.	Determine fish and shrimps tolerance		
Unit 6.	**Digestive system observation of fish and shrimp**	5	CO1, CO3, CO4
6.1.	Introduction of tools		
6.2.	Observe and identify the differences among the digestive system of fish, shrimps and crabs and analysis some digestive enzyme		

8. Teaching methods:

- The theory will be presented in class upon each chapter mentioned above
- The practical in labs for each article mentioned above, each group of 10-15 students

9. Duties of student:

Students have to do the following duties:

- Attend at least 80% of the theoretical lessons.
- Join 100% full hours of practice and presentation (summary of the practical work and project reports) and attend the practice test.
- Attend the final test.

10. Assessment of course learning outcomes:

10.1. Assessment

No.	Point components	Rules and Requirements	Weights	COs
1	Attendance	Prepare the lesson by himself, Exercises done, discussion in group on the theoretical lessons in class.	10%	CO4, CO5
2	Practical/ practice	Multiple choices or perform tasks required in the practical exercise	30%	CO3, CO4, CO5
3	Final test	Writing test (multiple choices and writing test)	60%	CO1, CO2, 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] Do Thi Thanh Huong and Nguyen Van Tu. 2010. Introduction to Physiology of Fish and Crustacean. Published by Agricultural Publishing House, Ho Chi Minh City. (in Vietnamese) 152 p.	TS.005655
[2] Rankin, J.C., Pitcher, T.J. and Roger Duggan (1983). Control Processes in Fish Physiology. 298 p	TS.005648
[3] David H. Evans and James B. Claiborne (2006). The Physiology of Fishes. Third Edition. Taylor and Francis. Boca Raton, London and New york. 601 p	TS 003781
[4] Graham, J. B. (1997). Air-Breathing Fishes. Printed in the United States of America. [4] Graham, J. B. (1997). Air-Breathing Fishes. Printed in the United States of America.	TS.005680
[5] Chester A. Glomski and Alessandra Pica (2006). Erythrocytes of the poikilotherms: a phylogenetic odyssey. 423p	TS.005685
[6] Hoar, W. S. and D. J. Randall (Eds.) (1969). Fish Physiology. Volume I: Excretion, Ion regulation, and Metabolism	TS 001345
[7] Perry, S. F. and Tufts B. L. (Eds). 1998. Fish Respiration. In Fish Physiology (volume 17)	TS 001352
[8] SINH LÝ CÁ: Nguyên ý và ứng dụng (Fish Physiology: Principles and Application) (2020). Đỗ Thị Thanh Hương, chủ biên. Nhà xuất bản Đại học Cần thơ. 181 trang	TS 005833

12. Self-study Guide:

Week	Content	Theory (hours)	Practice (hours)	Student's Tasks
1	**Chapter 1: General introduction of Aquatic Animal Physiology**	4	0	- Study before class: +Reference [1]: Chapter 1 and 2 (page 1-12)

	1.1.Study the body characteristics of aquatic animal 1.2. The differences between terrestrial and aquatic animals			
2-3	**Chapter 2: Hematological physiology of fish and shrimps** 2.1. Functions of blood 2.2 Functions of red blood cells, white blood cells and thrombocyte	10	10	- Study before class: + Reference [1]: Chapter 3 (page 13-49) + Reference [6] (page 185-219) + Reference [5] (page 65-88) + Read the practical lesson 1 and 2, and study practical lesson 1 & 2 (practical lesson reference will be given by the teacher)
4-6	**Chapter 3: Respiratory Physiology** 3.1.Concepts of respiratory environment and physiology 3.2. Factors affecting respiratory physiology 3.3. Air breathing organs	8	10	- Study before class: + Reference [1]: Chapter 4 (page 50-69) + Reference [4] (page 65-90) and 7 (page 141-174) + Learn the practical lesson 3 and 4 and study practical lesson 3 & 4 (practical lesson reference will be given by the teacher)
7-8	**Chapter 4: Digestive physiology** 4.1. Concept of digestive system 4.2. Digestion in stomach 4.3. Digestion in intestines 4.4 . Factors affecting digestion of fish and shrimp	8	5	- Study before class: + Reference [1]: Chapter 5 (page 70-89) + Reference [2] (page 23-41) and [3] (page 47-74) - Learn the practical lesson 6. (practical lesson reference will be given by the teacher)

9-10	**Chapter 5: kidney and urinary physiology** 5.1. Concept of fish kidneys 5.2. Regulation of osmotic pressure of Cartilaginous class 5.3. Regulation of osmotic pressure of freshwater teleost. 5.4. Regulation of osmotic pressure of marine teleost 5.5. Regulation of osmotic pressure of crustaceans	6	5	- Study before class: + Reference [1]: Chapter 6 (page 90-112) and Ref. [8] (page 149-175) + Study of osmotic pressure regulation in material [6] (page 293-309) + Learn the practical lesson (5). (practical lesson reference will be given by the teacher)
11	**Chapter 6. Metabolism** 6.1 Protein metabolism 6.2 Lipid metabolism 6.3 Glucose metabolism 6.4 Water exchange 6.5 Minerals exchange 6.6 Vitamin exchange 6.7 Factors affecting metabolism, what is the standard metabolism	6	0	- Study before class: + Reference [2] (page 89-102). +Reference [8] Page 49-52
12	**Chapter 7. Endocrine gland** 7.1 General concepts 7.2 Study of fish pituitary and	6	0	- Study before class: + Reference [3] (page 207-307). + Presentation on using the pituitary for fish propagation.

	application of seed reproduction.			
13	**Chapter 8: reproductive Physiology** 8.1. Sexual and maturation, reproductive cycle 8.2. The process of oocyte development 8.3. The biochemical changes of cells during sexual maturation 8.4. Mechanism of ovulation and ovarian degradation 8.5. Some factors affecting reproductive process	6	0	- Study before class: + Reference [3] (page 343-372)
14-15	**Chapter 9: Crustacean molting** Concept Structure of crustacean shell Molting stages New shell development Molting cycle	6	0	- Study before class: + Reference [1] (Page 113-130)

Can Tho, 30/8/2022

ON BEHALF OF RECTOR
DEAN OF COLLEGE

BỘ GIÁO DỤC VÀ ĐÀO TẠO TRƯỜNG ĐẠI HỌC CẦN THƠ

Vũ Ngọc Út

HEAD OF DEPARTMENT

Huỳnh Trường Giang