

COURSE OUTLINE DETAILS

1. Course: Aquatic Animal Nutrition (Dinh dưỡng động vật thủy sản)

- **Code number:** AQ212

- **Credits:** 3

- **Hours:** 30 theory hours, 30 practice hours, and 120 self-study hours

2. Management Unit:

- **Department:** Freshwater Aquaculture

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

3. Requisites:

- **Prerequisites:** No

- **Corequisites:** No

4. Course objectives:

Objectives	Descriptions	Program outcomes
4.1	Supply learners with knowledge about chemical composition and methods of analyzing chemical composition of food and ingredients; nutrient requirement of aquatic animals; nutritional experiments.	2.1.2a; 2.1.2b; 2.1.3b
4.2	Supply learners with knowledge about different groups of nutrients and supplying sources; principles of feed formulation; feed processing; effective and appropriate feeding methods for aquatic animals.	2.1.2a; 2.1.2b; 2.1.3b
4.3	Train learners' skills in team working; collecting information; formulating the feed formulation for aquatic animals; analyzing chemical compositions in feed and ingredients; conducting simple nutritional experiments.	2.2.1a; 2.2.2
4.4	Train learners to be aware of health protection; communication skills and professional manners; scientific research skills and lifelong learning; develop a sense of citizenship and professional responsibility.	2.3

5. Course learning outcomes:

CODs	Descriptions	Objectives	POs
	Knowledge		
CO1	Motivate and compare the feed quality and ingredients' characteristics for aquatic animals	4.1 4.2	2.1.2a; 2.1.2b; 2.1.3b
CO2	Apply known knowledge to: analyze the nutrient requirements of aquatic animals; formulate and process diets; suggest the effective and appropriate feeding methods	4.1 4.2	2.1.2a; 2.1.2b; 2.1.3b

CODs	Descriptions	Objectives	POs
	Knowledge		
	Skills		
CO3	Analyze the chemical compositions of ingredients, feed, and aquatic animals	4.3	2.2.1a
CO5	Formulate and process diets for cultured animals, and managing feed intake for aquatic animals appropriately and effectively	4.3	2.2.1a
CO6	Develop to organize group working; searching required information; conducting a study on nutrition requirements for aquatic animals	4.3	2.2.2
	Attitudes/Autonomy/Responsibilities		
CO8	Develop the habits of self-study, self-research; cooperative spirit in teamwork; and an awareness of health protection to serve the community.	4.4	2.3

6. Brief description of the course

The subject “Aquatic Animal Nutrition” provides learners basic knowledge about nutrition and feed in aquaculture, the metabolism and supplied sources of nutrients, nutritional compositions, the anti-nutrition factors and imitative methods of ingredients, effects of processing methods on the nutritional compositions of feed, methods to conduct nutritional experiments, methods to formulate feed for aquatic animals. Moreover, in practical contents, learners will be familiar with the methods to analysis nutritional parameters in the laboratory and make simple feed; learners are able to formulate a feed for a fish at a life stage. Subjective knowledge of the course will help students in scientific research and applications in aquaculture.

7. Course structure:

7.1. Theory:

	Content	Hours	Objectives
Chapter 1.	Introduction to nutrition and fish feed	2	CO1, CO3, CO5, CO6
1.	Concepts about nutrition of feed; chronological development of aquatic animal nutrition; relationship between aquaculture and feed		
2.	Roles of feed for aquaculture; basic nutritional characteristics of aquatic animals		
3.	Using feed in aquaculture		
Chapter 2.	Introduction about nutrition and fish health	1	CO1, CO3, CO5, CO6
1.	Factors affecting fish health		
2.	Dietary components influencing fish health		
3.	Feeding practice affecting fish health		

Chapter 3.	Methods to determine nutritional values of feed	1	CO1, CO2, CO3, CO5, CO6
1.	Analytical methods in laboratory		
2.	Methods to determine digestibility of aquatic animals		
3.	Factors affecting digestibility of aquatic animals		
4.	Experimental design and examined parameters		
Chapter 4.	Energy	3	CO2, CO3, CO5, CO6
1.	Introduction; concepts about biological energy		
2.	Energetic portioning in aquatic animal body		
3.	Energy requirement of aquatic animals		
4.	Factors affecting energy requirement		
Chapter 5.	Protein and amino acid	5	CO2, CO3, CO5, CO6
1.	Introduction		
2.	Roles of protein		
3.	Digestion and metabolism of protein		
4.	Protein requirement of aquatic animals		
5.	Amino acid requirement of aquatic animals		
6.	Factors affecting protein requirement		
7.	Nutritional values of protein		
8.	Methods to determine protein requirement		
Chapter 6.	Lipid and fatty acid	5	CO2, CO3, CO5, CO6
1.	Introduction		
2.	Roles of lipid		
3.	Digestion and metabolism of lipid		
4.	Lipid requirement of aquatic animals		
5.	Fatty acid		
6.	Fatty acid requirement of aquatic animals		
7.	Factors affecting fatty acid compositions		
8.	Phospholipid and requirement		
9.	Cholesterol and requirement		
Chapter 7.	Carbohydrate	2	CO2, CO3, CO5, CO6
1.	Introduction		
2.	Roles of carbohydrate		

3.	Digestion and metabolism of carbohydrate		
4.	Carbohydrate utilization ability of aquatic animals		
5.	Fiber in aquatic feed		
Chapter 8.	Vitamins in aquatic animal feed	1.5	CO2, CO7, CO8, CO9
1.	Introduction		
2.	Factors affecting vitamin utilization		
3.	Vitamin attributes and requirements of aquatic animals		
Chapter 9.	Minerals in aquatic animal feed	1.5	CO2, CO3, CO5, CO6
1.	Introduction		
2.	Roles of minerals		
3.	Macrominerals		
4.	Trace minerals		
Chapter 10.	Ingredients for fish feed	3	CO1, CO2, CO3, CO4, CO5, CO6
1.	Introduction		
2.	Protein sources		
3.	Energy sources		
4.	Additives		
5.	Anti-nutritional and toxic elements in ingredients		
Chapter 11.	Feed formulation and processing	1	CO1, CO2, CO3, CO4, CO5, CO6
1.	Feed ration concepts		
2.	Feed formulation		
3.	Feed processing		
4.	Feed stability		
5.	Feed preservation		
Chapter 12.	Feeding methods	1	CO2, CO4, CO5, CO6
1.	Introduction		
2.	Feeding methodology		
3.	Factors effect on feed intake		
	Midterm and Final exams	3	

7.2. Practice

	Contents	Hours	Objectives
Lesson 1.	Analyzing dry weight, ash, protein, and fat in feed or an ingredient	10	CO3, CO5, CO6
Lesson 2.	Analyzing feed stability	5	CO3, CO5, CO6
Lesson 3.	Feed formulation	5	CO4, CO5, CO6
Lesson 4.	Calculating and statistical analyzing experimental data	5	CO5, CO6
Lesson 5.	Feed processing	5	CO4, CO5, CO6

8. Teaching method

Following the positive, interactive, learner-centred teaching methods:

- Learners must prepare the content of the new lesson, and discuss the given questions for each lesson at the beginning of class time. At the end of the class, the lecturer explains and summarizes the key points of the lesson for take-home message.
- Each group of learners has to prepare the assignments according to the given topic. The lecturer will randomly select one learner from a group to present the group assignment.

9. Duties of learners

Students are requested to follow:

- Attending at least 80% of theoretical sessions.
- Attending 100% hours of practicing and reporting results.
- Doing group assignments.
- Doing the mid-term test.
- Doing the final test.
- Using self-study hours positively.

10. Assessment of student learning outcomes:

10.1. Assessment

No.	Point components	Rules and Requirement	Weights	Objectives
1	Assignments	Individuals/group	20%	CO1, CO2, CO3, CO4, CO5, CO6
3	Mid-term test	Multiple choice test or essay test	30%	CO1, CO2
4	Final test	Multiple choice and essay test	50%	CO1, CO2, CO3, CO4

10.2. Grading

- Grading components (assignments and mid-term test) 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 converted to A-B-C-D score and the scale of 4 under the academic provisions of the University.

11. Materials:

Materials information	Code number
[1] Fish nutrition, 2002. Halver, J.E. Third Edition. Academic Press, USA.	DIG.002326
[2] Crustacean Nutrition, 1997. D'Abramo, L.R., Conklin, D.E., Akiyama, D.M. In Advances in World Aquaculture Volume 6. World Aquaculture Society.	TS.002225
[3] Dinh dưỡng và thức ăn thủy sản, 2009. Trần Thị Thanh Hiền, Nguyễn Anh Tuấn. Nhà xuất bản Nông nghiệp	TS.003966 TS.004343

12. Self-study Guide

Week	Content	Theor y (hours)	Practi ce (hours)	Students' duties
1	Chapter 1. Introduction about nutrition and fish feed 1. Concepts about nutrition of feed; historical development of aquatic animal nutrition; relationship between aquaculture and nutrition 2. Roles of feed for aquaculture; basic nutritional characteristics of aquatic animals 3. Matters in using feed in aquaculture	3	0	+Reading references [1] Chapter 13 (pages 704-753) +Grouping (5 students/group) and discussing about "effective feed"

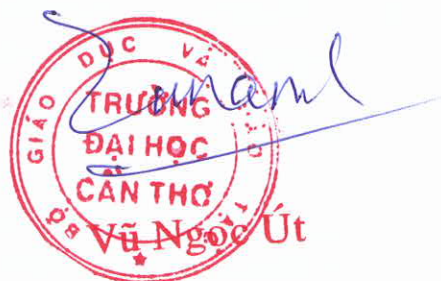
2	Chapter 2. Introduction about nutrition and fish health 1. Factors affecting fish health 2. Dietary components influencing fish health 3. Feeding practice affecting fish health Chapter 3. Methods to determine nutritional values of feed 1. Analytical methods in laboratory 2. Methods to determine digestibility of aquatic animals 3. Factors affecting digestibility of aquatic animals 4. Experimental design and examined parameters	3	0	+Reading references [1] Chapter 12 (pages 672-699) +Understanding “CF, NDF, ADF and ADL”
3	Chapter 4. Energy 1. Introduction; concepts about biological energy 2. Energetic portioning in aquatic animal body 3. Energy requirement of aquatic animals 4. Factors affecting energy requirement	3	0	+Reading references [1] Chapter 1 (pages 2-54) +Reviewing 3 previous chapters +Interpreting data from tables and graphs and giving comments.

4	Chapter 5. Protein and amino acid 4.1. Introduction 4.2. Roles of protein 4.3. Digestion and metabolism of protein 4.4. Protein requirement of aquatic animals 4.5. Amino acid requirement of aquatic animals 4.6. Factors affecting protein requirement 4.7. Nutritional values of protein 4.8. Methods to determine protein requirement	5	0	+Reading references [1] Chapter 3 (pages 144-175), Chapter 6 (pages 333-358), Chapter 14 (pages 763-769) +Reviewing 4 previous chapters +Interpreting data from tables and graphs and giving comments. +Comparing the protein requirements of different species and analyzing the reasons
5	Chapter 6. Lipid and fatty acid 5.1. Introduction 5.2. Roles of lipid 5.3. Digestion and metabolism of lipid 5.4. Lipid requirement of aquatic animals 5.5. Fatty acid 5.6. Fatty acid requirement of aquatic animals 5.7. Factors affecting fatty acid compositions 5.8. Phospholipid and requirement	5	0	+Reading references [1] Chapter 4 (pages 182-246), Chapter 14 (pages 760-762) +Reviewing 5 previous chapters +Interpreting data from tables and graphs and giving comments. +Comparing the lipid requirements of different species and analyzing the reasons +Giving lecithin and cholesterol sources +Categorizing Lipids and supplying sources

	5.9. Cholesterol and requirement Chapter 7. Carbohydrate 6.1. Introduction 6.2. Roles of carbohydrate 6.3. Digestion and metabolism of carbohydrate 6.4. Carbohydrate utilization ability of aquatic animals 6.5. Fiber in aquatic feed			+Reading references [1] Chapter 6 (pages 310-332), Chapter 14 (pages 756-760) +Interpreting data from tables and graphs and giving comments. +Comparing the carbohydrate utilization of different species and analyzing the reasons +Distinguishing phytate and phytase, chitin and chitosan
6	Chapter 8. Vitamins in aquatic animal feed 7.1. Introduction 7.2. Factors effect on vitamin utilization 7.3. Vitamin attributes and requirements of aquatic animals Chapter 9. Minerals in aquatic animal feed 8.1. Introduction 8.2. Roles of minerals 8.3. Macro minerals 8.4. Trace minerals	3	0	+Reading references [1] Chapter 2 (pages 62-132) +Reviewing 7 previous chapters +Interpreting data from tables and graphs and giving comments. +Reading references [1] Chapter 5 (pages 260-301) +Interpreting data from tables and graphs and giving comments.
7	Chapter 10. Ingredients for fish feed 9.1. Introduction 9.2. Protein sources 9.3. Energy sources 9.4. Additives Chapter 11. Feeding methods	4	0	+Reading references [1] Chapter 9 (pages 506-596), Chapter 8 (pages 454-500) +Reviewing 9 previous chapters +Interpreting data from tables and graphs and giving comments +Group discussions about probiotics and prebiotics; soybean

	11.1. Introduction 11.2. Feeding rates 11.3. Factors effect on feed intake			products; different types of fishmeal and processing
8	Chapter 12. Feed formulation and process 10.1. Feed ration concepts 10.2. Feed formulation 10.3. Feed process 10.4. Feed stability 10.5. Feed preservation	2	0	+Reading references [1] Chapter 11 (pages 652-668), Chapter 10 (pages 602-641) +Reviewing 10 previous chapters +Interpreting data from tables and graphs and giving comments +Group discussions
9	Practice lesson 1, 2	0	10	+ Reading handouts: Lessons 1, 2 + Grouping: 5-6 students / group + Assigning tasks + Preparing instruments
10	Practice lesson 3	0	5	+ Reading handouts: Lessons 3 + Formulating 10 diets
11	Practice lesson 4	0	5	+ Reading handouts: Lessons 4 + Recording results
12	Practice lesson 5	0	5	+ Reading handouts: Lessons 5 + Recording results
13	Submit practical reports			
14	Final exam	2	0	

ON BEHALF OF RECTOR
DEAN OF COLLEGE



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

Phạm Thanh Liêm
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