

## Course guide

### 250591 - ENGPORQUAI - Engineering in Aquaculture Projects

**Last modified:** 22/05/2024

**Unit in charge:** Barcelona School of Civil Engineering

**Teaching unit:** 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

**Degree:** BACHELOR'S DEGREE IN MARINE SCIENCE AND TECHNOLOGY (Syllabus 2018). (Optional subject).

**Academic year:** 2024    **ECTS Credits:** 6.0    **Languages:** Spanish

#### LECTURER

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**Coordinating lecturer:** INGRID MASALO LLORA

**Others:** EDUARDO DE NEIRA ARIAS, INGRID MASALO LLORA

#### DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

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##### Specific:

- 13388. To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
- 13390. Establish a good practice in the integration of common numerical, laboratory and field techniques in the analysis of any problem related to the marine environment.
- 13395. To set, evaluate and propose solutions to the different conflicts of use and exploitation in the marine and coastal environment resources based on scientific and technical criteria.
- 13399. Apply the state-of-the-art numerical and statistical techniques in the coastal and marine fields for a correct interpretation of data. (Specific competence of the Marine Technologies Mention)
- 13402. Use and apply indicators to assess impacts, both natural and anthropogenic, and propose corrective measures with monitoring and surveillance programs. (Specific competence of the Marine Technologies Mention)
- 13403. Develop a conceptual framework to address the sustainability of the marine environment and the related socio-economic activities at different scales, explaining the effects of climate change.
- 13404. Set, plan and execute basic and applied research in the field of Marine Sciences and Technologies.
- 13405. Carry out calculations, assessments, surveys and inspections in coastal and marine environments, as well as the corresponding technical documents.
- 13406. Write technical reports and disseminate knowledge about the different components of the marine system, considering the applicable legal framework.
- 13407. Apply the necessary tools to analyze the economic and legal aspects of human actions and the related impacts on the marine environment, including technical advice and representation of companies and administrations.

##### Generical:

- 13384. Apply knowledge and academic experience to the control and monitoring of the marine environment and its coastal boundary, using the state-of-the-art tools in the Marine Sciences and Technologies.
- 13386. Encompass and teach studies in the different research lines that converge in Marine Sciences and Technologies.
- 13387. Combining preservation with economic activity within the framework of current legislation promoting the development of a social and environmental awareness.

## TEACHING METHODOLOGY

The course consists of 2.3 hours per week of classroom activity (large size group) and 1.2 hours weekly with half the students (medium size group).

The 2.3 hours in the large size groups are devoted to theoretical lectures, in which the teacher presents the basic concepts and topics of the subject, shows examples and solves exercises.

The 1.2 hours in the medium size groups is devoted to solving practical problems with greater interaction with the students. The objective of these practical exercises is to consolidate the general and specific learning objectives.

The rest of weekly hours devoted to laboratory practice.

Support material in the form of a detailed teaching plan is provided using the virtual campus ATENEA: content, program of learning and assessment activities conducted and literature.

Although most of the sessions will be given in the language indicated, sessions supported by other occasional guest experts may be held in other languages.

## LEARNING OBJECTIVES OF THE SUBJECT

In this subject, the basic aspects related to the engineering of aquaculture projects will be addressed. The different types of aquaculture facilities, their characteristics, limitations and main applications (offshore/onshore installations) will be reviewed and analyzed. Emphasis will be placed on the design and implementation aspects of onshore aquaculture infrastructures in open and closed (RAS) circuits. Flow and load capacity calculations will be carried out for open circuits. The facilities for collection, conduction, pumping and water control will be analyzed, as well as water treatments (decanting, filtration, sterilization and disinfection, heating and cooling, aeration and oxygen injection), with particular emphasis on recirculation.

1. Define the parameters of vertebrate nutrition and feeding for a sustainable production.
2. Identify reproductive strategies in vertebrates as well as the management of reproduction in aquaculture.
3. Know and know how to apply the bases of sustainable management in a vertebrate production facility

This subject is oriented to the application of technologies of observation, remote perception and automatic exploration of the marine environment, which is essential for the motorization of the coastal water bodies and the obtaining of the necessary data for the control of practically all the activities human resources in the marine environment related to the exploitation of natural and aquacultural resources of the marine and coastal environment.

In this subject the basic aspects related to the engineering of aquaculture projects will be addressed. The different types of aquaculture facilities, their characteristics, conditions and main applications (open sea facilities, land-based facilities) will be reviewed and analyzed. Design and implementation aspects of open and closed circuit land-based aquaculture infrastructures (RAS) will be emphasized. Flow and load capacity calculations will be carried out in open circuits. Water collection, conduction, pumping and control facilities will be analysed, as well as water treatment (decantation, filtration, sterilization and disinfection, heating and cooling, aeration and oxygen injection), with particular emphasis on recirculation. 1. Define nutrition and feeding parameters for sustainable aquaculture production. 2. Identify reproductive strategies, as well as management of reproduction in aquaculture. 3. Know and know how to apply the bases of sustainable management in an aquaculture production facility. This subject is oriented towards the application of observation technologies, remote sensing and automated exploration of the marine environment, which is essential for the motorization of coastal water bodies and obtaining the necessary data to control practically all activities. in the marine environment related to the exploitation of natural and aquaculture resources of the marine and coastal environment.

## STUDY LOAD

Type	Hours	Percentage
Hours small group	20,0	13.33
Hours large group	40,0	26.67
Self study	90,0	60.00

**Total learning time:** 150 h

## CONTENTS

### Introduction to aquaculture project engineering

**Description:**

Objectives of the course  
Aquaculture engineering

**Full-or-part-time:** 4h 48m

Theory classes: 2h  
Self study : 2h 48m

### Facilities

**Description:**

Types of aquaculture facilities  
Offshore facilities (platforms, cages, long lines, other facilities)  
Land-based facilities (flow-through systems, recirculation systems (RAS))  
Extensive, semi-intensive and intensive systems  
Species-specific engineering  
Work: Aquaculture Facilities

**Full-or-part-time:** 16h 48m

Theory classes: 5h  
Practical classes: 2h  
Self study : 9h 48m

### Species selection

**Description:**

Biological characteristics  
Life cycle, reproduction and growth  
Food. Disease control and general care  
Work on the choice of cultivation species  
Laboratory: Cultivable species

**Full-or-part-time:** 24h

Theory classes: 3h  
Practical classes: 4h  
Laboratory classes: 3h  
Self study : 14h

### Selection of the area

**Description:**

Geographic Location. Topography and soil characteristics  
Water fountains. Quantity and quality of water  
Water quality laboratory

**Full-or-part-time:** 14h 23m

Theory classes: 3h  
Laboratory classes: 3h  
Self study : 8h 23m



### Exam 1

**Full-or-part-time:** 4h 48m

Laboratory classes: 2h

Self study : 2h 48m

### Fluid transport

**Description:**

Hydraulic installations

Bernoulli equation and its applications

Exercises: Bernoulli's equation

Water flows. Pumps. Types of pumps and power. Calculation of flow rates

Dissolution of gases. Solubility equations. Gas transfer

Exercises: Pump power and flow calculation. Solubility and gas transfer.

Laboratory: Hydraulics

**Full-or-part-time:** 36h

Theory classes: 8h

Practical classes: 4h

Laboratory classes: 3h

Self study : 21h

### Water treatment

**Description:**

Solids separation and biological filtration

Ventilation and oxygenation. Disinfection

Visit to water treatment plant

**Full-or-part-time:** 14h 23m

Theory classes: 2h

Practical classes: 4h

Self study : 8h 23m

### Electrical installations

**Description:**

Consumption. Distribution. Lighting

Energy sources

**Full-or-part-time:** 4h 48m

Theory classes: 2h

Self study : 2h 48m

### Design and construction

**Description:**

General considerations. Design. Materials  
Open-air installations  
Indoor installations

**Full-or-part-time:** 12h

Theory classes: 5h  
Self study : 7h

### Cages and tanks

**Description:**

General considerations. Types of cages (location, dimensions, buoyancy, anchoring and maintenance)  
Types of tanks (location, dimensions and maintenance)

**Full-or-part-time:** 4h 48m

Theory classes: 2h  
Self study : 2h 48m

### Exam 2

**Full-or-part-time:** 7h 11m

Laboratory classes: 3h  
Self study : 4h 11m

## GRADING SYSTEM

The mark of the course is obtained from the ratings of continuous assessment and their corresponding laboratories and/or classroom computers.

Continuous assessment consist in several activities, both individually and in group, of additive and training characteristics, carried out during the year (both in and out of the classroom).

The teachings of the laboratory grade is the average in such activities.

The evaluation tests consist of a part with questions about concepts associated with the learning objectives of the course with regard to knowledge or understanding, and a part with a set of application exercises.

## EXAMINATION RULES.

If one or more of the continuous assessment activities or directed activities are not carried out in the scheduled period, it will be considered a zero score. The tests will be carried out individually or in groups, depending on what is requested by the teacher, they can include multiple choice questions that can be theoretical or problem type questions. The exams can include short questions to be developed by the students and exercises to be solved.



## BIBLIOGRAPHY

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### Basic:

- Tidwell, James. Aquaculture Production Systems [on line]. Ames, Iowa: Wiley-Blackwell, 2012 [Consultation: 15/02/2023]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781118250105>. ISBN 9781118250105.
- Lekang, Odd-Ivar. Aquaculture Engineering [on line]. Wiley-Blackwell. Chichester, West Sussex, England: Wiley-Blackwell, 2020 [Consultation: 15/02/2023]. Available on: <https://onlinelibrary-wiley-com.recursos.biblioteca.upc.edu/doi/book/10.1002/9781119489047>. ISBN 1-119-48903-2.

### Complementary:

- Oca, J.; Masaló, I. "Diseño de tanques en acuicultura intensiva". Acuicultura [on line]. [Consultation: 02/10/2023]. Available on: <https://upcommons.upc.edu/handle/2117/114534>.