Engineering in Aquaculture Projects (250591)

General Information

School	ETSECCPB
Departments	Departament d'Enginyeria Agroalimentària i Biotecnologia (DEAB)
Credits	6.0 ECTS
Programs	GRAU EN CIÈNCIES I TECNOLOGIES DEL MAR (pla 2018)
Course	2024/25

Main teaching language at each group

- Group 10ES2 Spanish (Q2)

Faculty

Responsible Faculty: Ingrid Masalo Llora
Faculty: Eduardo De Neira Arias, Ingrid Masalo Llora

Objectives of Education

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.

Competencies

Especific

To know and apply the lexicon and concepts of the Marine Sciences and Technologies and other related fields.
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.
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.
Apply the state-of-the-art numerical and statisticat techniques in the coastal and marine fields for a correctly interpretation of data. (Specific competence of the Marine Technologies Mention)
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)
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.
Set, plan and execute basic and applied research in the field of Marine Sciences and Technologies.
Carry out calculations, assessments, surveys and inspections in coastal and marine environments, as well as the corresponding technical documents.
Write technical reports and disseminate knowledge about the different components of the marine system, considering the applicable legal framework.
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.

Generic

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.
Encompass and teach studies in the different research lines that converge in Marine Sciences and Technologies.
Combining preservation with economic activity within the framework of current legislation promoting the development of a social and environmental awareness.

Total hours of student work

		Hours	Percentage
Supervised Learning	Large group	40.02 h	66.70 %
	Medium group	0.0 h	0.00 %
	Laboratory classes	19.98 h	33.30 %
	Guided Activities	0.0 h	0.00 %
Self Study		90.0 h	

Contents

Introduction to aquaculture project engineering

Objectives of the course
Aquaculture engineering

Facilities

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

Species selection

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

Selection of the area

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

Exam 1

Fluid transport

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

Water treatment

Solids separation and biological filtration
Ventilation and oxygenation. Disinfection
Visit to water treatment plant

Electrical installations

Consumption. Distribution. Lighting
Energy sources

Design and construction

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

Cages and tanks

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

Exam 2

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.

Grading Rules

(*) The evaluation calendar and grading rules will be approved before the start of the course.

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.

Test 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

Basic

- Tidwell, James. Aquaculture Production Systems. Ames, Iowa: Wiley-Blackwell, 2012. ISBN 9781118250105.
- Lekang, Odd-Ivar. Aquaculture Engineering. Wiley-Blackwell. Chichester, West Sussex, England: Wiley-Blackwell, 2020. ISBN 1-119-48903-2.

Complementary

- Acuicultura. Universitat Politècnica de Catalunya, 2011.