Course guide
390325 - OBIA - Unit Operations in the Food Industry

Last modified: 22/06/2026

Unit in charge: Barcelona School of Agri-Food and Biosystems Engineering
Teaching unit: 745 - DEAB - Department of Agri-Food Engineering and Biotechnology.

Degree: BACHELOR'S DEGREE IN FOOD ENGINEERING (Syllabus 2009). (Compulsory subject).

Academic year: 2026 **ECTS Credits:** 6.0 **Languages:** English

LECTURER

Coordinating lecturer: Achaerandio Puente, Maria Isabel

Others:

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Food engineering and technology: Engineering and basic operations in food industry.
2. Food engineering and technology: Food technology.
3. Food engineering and technology: Processes in food industry.
4. Engineering of agri-food industry: Auxiliary equipments and machinery in agri-food industry.
5. Engineering of agri-food industry: Waste management and uses of wastes.

TEACHING METHODOLOGY

Lectures will consist of the introduction of the necessary concepts to achieve the objectives of the subject by the professor. Active learning will also be used both inside and outside the classroom, fostering the capacity for analysis and synthesis.
Practical sessions, in small student group, consists in working on specific topics, problem solving or/and pilot plant lab activities. In these sessions students will work as a team and the teacher will direct them during the activity. The capacity for teamwork, analysis and resolution of practical cases will be strengthened.
Autonomous learning will focus on actions basically aimed at deepening in specific basic operations, documenting, organizing information and defending it orally, raising systems of operation of the equipment used in the food industry. Discussions allow incentives for criticism and self-criticism.
Some food pilot pant activities are also with the aim of familiarizing the student in the management of the equipment used in the food industry.

LEARNING OBJECTIVES OF THE SUBJECT

With the follow-up of this subject is intended that the student achieves a basic vocabulary and a clear overall vision of the various stages of the processes of the food industry. It is intended to introduce the student to the basic concepts of unit operations applied to food production, taking into account technologies that allow production with quality, savings and efficiency of water and energy among other environmental aspects.

General objectives:
At the end of the basic operations course, the student will be able to:
· Explain the most important historical background of Food Technology
· Characterize the basic aspects of the production and I industrialization of food
· Identify the existing unit operation in the food industry the basic principles that govern them.
· Define, explain and quantify the most important unit operations with special emphasis on quality, safety and environmental aspects.
· Raise and solve balances of matter and energy of a unit operation
· Identify and indicate the main equipment used in the food industry.
· Use books, magazines, specialized catalogs in food processing.

STUDY LOAD

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

Total learning time: 150 h

CONTENTS

FOOD ENGINEERING INTRODUCTION. UNIT OPERATION BASIS

Description:
Food industry information. Background. Fundamental Concepts of Food Engineering. Process. Flowchart. Operating regime. Mass, Energy and Economic Balance. Fundamentals of transport phenomena.
Mass, Energy and quantity of movement transfer. Analogies
Classification of Unit Operations. Dimensional analysis. Main parameters that intervene in Food Engineering.

Related activities:
Activity 1: Lectures
Activity 2: Exams
Activity 3: Problem-solving
Activity 4: Group work

Full-or-part-time: 15h
Theory classes: 4h
Laboratory classes: 2h
Self study : 9h

MASS BALANCES

Description:
Mass Balances. Steady and un-steady state. Chemical reaction mass balances

Related activities:
Activity 1: Lectures
Activity 2: Exams
Activity 3: Problem solving sessions

Full-or-part-time: 47h
Theory classes: 14h
Laboratory classes: 6h
Self study : 27h

ENERGY BALANCES

Description:
Thermal properties of food. Modes of Heat transfer: Conduction, Convection, Radiation. Heat exchangers in Food industry. Un-steady state heat transfer

Related activities:
Activity 1: Lectures
Activity 2: Exams
Activity 3: Problem solving sessions

Full-or-part-time: 47h
Theory classes: 6h
Laboratory classes: 14h
Self study : 27h

FOOD LIQUID TRANSPORT SYSTEMS

Description:
Food Rheology. Types of fluids depending on their rheological behavior. Effect of temperature and pressure. Equipment used in the food industry. Types of pumps. Criteria for selecting a pump in the food industry.

Related activities:
Activity 1: Lectures
Activity 2: Exams
Activity 3: Problem solving sessions

Full-or-part-time: 28h
Theory classes: 6h
Practical classes: 18h
Self study : 4h

UNIT OPERATION REPORT

Description:
Unit operation to study, basic principles, technology used in the process. Schemes of operation. Fields of application. Flow chart showing the reason for this stage in the process. Equipment used. Measuring instruments to be used. Working conditions in the different applications. Specific calculations. Raw material specifications for being processed.

Related activities:
Activity 1: Lectures
Activity 4: Group or individual work

Full-or-part-time: 13h
Theory classes: 2h
Laboratory classes: 2h
Self study : 9h

ACTIVITIES

ACTIVITY 1: LECTURES

Full-or-part-time: 38h
Theory classes: 38h

ACTIVITY 2: EXAMS

Full-or-part-time: 2h
Theory classes: 2h

ACTIVITY 3: PROBLEM SOLVING SESSIONS

Full-or-part-time: 48h
Laboratory classes: 8h
Self study: 40h

ACTIVITY 4: Group work

Full-or-part-time: 54h
Laboratory classes: 8h
Self study: 46h

GRADING SYSTEM

Any academic fraud, plagiarism or use or possession of unauthorised means in an assessment activity leads to a mark of zero (0) for the affected test or assignment. Furthermore, in accordance with the University's regulations, if disciplinary proceedings are initiated the subject is recorded as "Pending Assessment" until a decision is reached. These incidents are managed in accordance with the **Action Framework for Academic Integrity in Assessment at the UPC**.

Grading: One midterm exam, problem sets, written and oral report and final exam.
N1: midterm and final exam
N2: problem sets
N3: written report and oral presentation
N final = 0,7 N1 +0,2 N2 +0,1 N3

BIBLIOGRAPHY

Basic:
- Brennan, J.G. Manual de procesado de los alimentos. Acribia, 2008. ISBN 9788420010991.
- Fellows, Peter. Tecnología del procesado de los alimentos: principios y prácticas. 2a ed. Zaragoza: Acríbia, 2007. ISBN 9788420010939.
- Ibarz, Alberto. Operaciones unitarias en la ingeniería de alimentos [on line]. Madrid: Mundi-Prensa, 2005 [Consultation: 22/12/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3176272. ISBN 8484761630.
- Brennan, J.G. Las operaciones de la ingeniería de los alimentos. 3a ed. Zaragoza: Acribia, 1998. ISBN 8420008524.
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- Casp Vanaclocha, Ana; Abril Requena, José. Procesos de conservación de alimentos [on line]. 2ª ed. corr. Madrid [etc.]: A. Madrid Vicente : Mundi-Prensa, 2003 [Consultation: 27/10/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?pq-origsite=primo&docID=3176331. ISBN 848476169X.
- Raventós Santamaria, Mercè. Tecnologia de fluids alimentaris [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 16/04/2020]. Available on: http://hdl.handle.net/2099.3/36672. ISBN 8483018128.
- Singh, R. Paul; Heldman, Dennis R. Introduction to food engineering. 5th ed. Burlington [etc.]: Elsevier Academic Press, cop. 2014. ISBN 9780123985309.

Complementary:

- Berk, Zeki. Food process engineering and technology [Recurs electrònic] [on line]. London: Academic Press, 2009 [Consultation: 16/07/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780123736604/food-process-engineering-and-technology. ISBN 0123736609.
- Kress-Rogers, E. Instrumentation and sensors for the food industry [on line]. Boca Raton: Woodhead, 2001 [Consultation: 16/12/2021]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9781855735606/instrumentation-and-sensors-for-the-food-industry. ISBN 084931223X.
- Hui, Y.H. Handbook of food science, technology and engineering. Boca Raton: Taylor & Francis, 2006. ISBN 0849398479.
- Raventós, M. Industria alimentaria, tecnologías emergentes. Barcelona: UPC, 2005. ISBN 8483017903.
- Singh, R.P. Introducción a la ingeniería de los alimentos. Zaragoza: Acribia, 2009. ISBN 9788420011240.
- Creus Solé, Antonio. Instrumentación industrial [on line]. 7a ed. Barcelona: Marcombo, 2005 [Consultation: 23/11/2021]. Available on: http://www.ingebook.com/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=9767. ISBN 8426713610.
- Kress-Rogers, Erika; Brimelow, Christopher J.B. Instrumentation and sensors for the food industry. 2nd ed. Boca Raton: CRC, 2001. ISBN 084931223X.
- Singh, R. Paul; Heldman, Dennis R. Introducción a la ingeniería de los alimentos. 2a ed. Zaragoza: Acribia, 2009. ISBN 9788420011240.
- Raventós Santamaria, Mercè. Industria alimentaria, tecnologías emergentes [Recurs electrònic] [on line]. Barcelona: Edicions UPC, 2005 [Consultation: 16/04/2020]. Available on: http://hdl.handle.net/2099.3/36183. ISBN 9788498801521.
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