

Academic Year/course: 2022/23

60569 - Systems and processes of food industries

Syllabus Information

Academic Year: 2022/23

Subject: 60569 - Systems and processes of food industries

Faculty / School: 201 - Escuela Politécnica Superior

Degree: 546 - Master in Agricultural Engineering

ECTS: 6.0

Year: 1

Semester: Second semester

Subject Type: Compulsory

Module:

1. General information

2. Learning goals

3. Assessment (1st and 2nd call)

4. Methodology, learning tasks, syllabus and resources

4.1. Methodological overview

The methodology followed in this course is oriented towards achievement of the learning objectives. It is based on theoretical classes to study the basic concepts of the course, trying to encourage student participation through short questions. On the other hand, problems and practical cases related to the theoretical concepts will be solved in the classroom and in the computer room. Course contents are supplemented with visits to food processing industries.

4.2. Learning tasks

The course includes the following learning tasks:

- Theory sessions and problems where the teacher explains the course contents.
- Seminars (10 sessions). The students develop and apply practical cases under the teacher's supervision (see the practice syllabus).
- Visits to different food processing industries.

In relation to the Sustainable Development Goals and in particular to target 9.4, proposed learning activities include these targets since they are focused on the importance of developing production systems in which the design and choice of suitable operating conditions allow the development of the desired product and the maximum optimization of the process, using the Best Available Techniques developed for each type of industry, also being energy-optimized and environmentally friendly processes.

4.3. Syllabus

The course will address the following topics:

Theory

SECTION I. PROCESSES OF FOOD INDUSTRY

Topic 1. DAIRY INDUSTRY: Previous treatments (filtration, elimination of air and clarification). Centrifugal separation. Homogenization. Pasteurization. Sterilization and UHT treatment.

Topic 2. BEER INDUSTRY. Mashing. Filtration. Cooking. Whirlpool tank. Wort cooling. Fermentation. Maturation. Beer filtration. Pasteurization. Packing.

Topic 3. PRODUCTION OF JUICES: Treatment of fruit (washing, brushing and inspection). Extraction of juice and essential oils. Treatment of the juice (clarification, mixing and correction, elimination of air and pasteurization). Preparation of concentrated juice (evaporation, freezing and membrane separation).

Topic 4. FLOUR INDUSTRY. Milling and storage. Trituration. Extraction. Purification. Compression.

SECTION II. DESIGN OF FOOD INDUSTRY

Topic 1. Design of the minimum requirements of the food system: Production capacity, raw materials, product specifications

Topic 2. Preliminary design: Flowchart, basic operations, biochemical processes, mass and energy balances

Topic 3. Simulation and optimization of the plant:

- Dimensioning and selection of main equipments (reactors, heat exchangers, separation equipment, etc.).
- Auxiliary equipments (pumps and compressors, cold production, etc.).
- Choice and design of control systems and automation.
- Energy integration (pinch analysis and network optimization exchangers).

Practice (design of one of these production processes)

1. **Design of a production system of pasteurized milk.** Mass and energy balances. Design and choice of the equipment needed for the different stages: storage tanks, elimination of air, centrifugal separation, standardization and homogenization equipments, heat exchangers, process controllers, cleaning systems.
2. **Design of a juice production system.** Mass and energy balances. Design and choice of equipments needed for the different stages of the process: Handling of fruit and juice extraction (reception, unloading and storage of fruit, juice extraction, juice preparation, recovery of essential oil, recovery of pulp and/or juice, pasteurization and cooling of the juice).
3. **Design of a system of beer production.** Mashing boiler and wort production, fermentation, clarification, heat exchangers, storage.

4.4. Course planning and calendar

Course planning

Activity / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
<i>Classroom activity</i>																				63
Theory	2	4	4	4	2	2	2	2	2			2			2					28
Practical sessions		2	2	2	2	2		2	2		2	2	2		2					22
Visits							5							5						10
Evaluation																			3	3
<i>Personal work</i>																				87
Individual work	6	3	2	2	4	4	2	4	4	8	6	4	6	4	4	8	8	8		87
TOTAL	8	9	8	8	8	8	9	8	8	8	8	8	8	9	8	8	8	8	3	150

4.5. Bibliography and recommended resources

BB Bylund, Gösta. Manual de industrias lácteas / texto : Gösta Bylund ; traducción de la versión inglesa a la española por : Antonio López Gómez López [y] Antonio Madrid Vicente. Madrid : A. Madrid Vicente : Mundi-Prensa, D.L. 2003

BB Callejo González, María Jesús. Industrias de cereales y derivados / M^a Jesús Callejo González ; colaboran,

Guillermo Rodríguez Badiola, Manuel Gil González. Madrid : AMV : Mundi-Prensa, 2002

- BB** Madrid Vicente, Antonio. Nuevo manual de industrias alimentarias / autores, Antonio Madrid Vicente, Javier Madrid Cenzano. [3ª] ed. amp. y corr. Madrid : A. Madrid Vicente : Mundi-Prensa, 2001
- BB** Producción y envasado de zumos y bebidas de frutas sin gas / editado por P. R. Ashurst ; traducción ... Concepción Llaguno Marchena. Zaragoza : Acribia, 1999
- BC** Coulson, John Metcalfe. Ingeniería química : unidades SI / J.M. Coulson, y J.F. Richardson. T. II, Operaciones básicas / con la colaboración de J.R. Backhurst y J.H. Harker; versión española de la 3a. ed. original por Joaquín Casal Fábrega. [1ª ed. reimp.]. Barcelona [etc] : Reverté, cop. 1988
- BC** Ingeniería bioquímica / Francesc Gòdia Casablanques y Josep López Santín (Editores) ; Carles Casas Alvero ... [et al.]. Madrid : Síntesis, D.L. 1998
- BC** McCabe, Warren L. Operaciones unitarias en ingeniería química / Warren L. McCabe, Julian C. Smith, Peter Harriott ; revisor técnico, René Huerta Cevallos ; [traductor, Alejandro Carlos Piombo Herrera]. 7ª ed. México D.F. : McGraw-Hill Interamericana, cop. 2007
- BC** Singh, R. Paul. Introducción a la ingeniería de los alimentos / R. Paul Singh, Dennis R. Heldman. [1ª ed. en español de la 2ª en inglés]. Zaragoza : Acribia, D.L. 1997
- BC** SMITH, J. C.; MCCABE, W. L. Operaciones básicas de ingeniería química. Vol. 1. Barcelona: Reverté, 1986
- BC** SMITH, J. C.; MCCABE, W. L. Operaciones básicas de ingeniería química. Vol. 2. Barcelona: Reverté, 1986

The updated recommended bibliography can be consulted in:<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=60569>