SUBJECT GUIDE Academic year 2019-2020

FUNDAMENTALS OF FOOD ENGINEERING

MODULE	CONTENT	YEAR	TERM	CREDITS	TYPE
Food Technology	Fundamentals of Food Technology	1º	2º	6	Compulsory

LECTURER(S)	Postal address, telephone nº, e-mail address
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	TUTORING SCHEDULE
	http://sl.ugr.es/bailonm
DEGREE WITHIN WHICH THE SUBJECT IS TAUGHT	
Degree in Food Science and Technology	

PREREQUISITES and/or RECOMMENDATIONS (if necessary)

Students should have passed the following basic subjects: Physics, Chemistry and Mathematics

BRIEF ACCOUNT OF THE SUBJECT PROGRAMME

Introduction to Chemical and Food Engineering. Balances of matter without chemical reaction in steady state. Balances of matter with chemical reaction in steady state. Energy balances at steady state. Balance of matter and energy in unsteady state. Momentum transfer. Heat transfer. Matter transfer. Elements of Chemical Reaction Engineering.

GENERAL AND PARTICULAR ABILITIES

CE2, CE4, CE5, CE6, CE15

OBJECTIVES (EXPRESSED IN TERMS OF EXPECTED RESULTS OF THE TEACHING PROGRAMME)

At the end of the subject the student should know / understand:

- Know the basic concepts related to food engineering.
- Solve balances of matter in single units and systems, without chemical reaction and with chemical reaction, in steady and non-steady states.

- Solve balances of energy in single units and systems, without chemical reaction and with chemical reaction in steady, and non-steady states.
- Jointly solve balances of matter and energy.
- Know the laws that govern the transport phenomena of momentum, heat and matter.
- Know the different types of chemical reactors and their modes of operation and calculate the dimensions a single reactor.

DETAILED SUBJECT SYLLABUS

THEORETICAL TOPICS:

- **Theme 1. Introduction to Chemical Engineering and Food.** Concept of Chemical Engineering and Food Engineering. Development of processes and products in the food industry. Access to information techno-scientific and evaluation. Extensive and intensive variables. Technical System of Units. Types of operation and contact. Block and flow diagrams. Classification and brief description of the main basic operations of the food industry.
- **Theme 2. Balances of matter without chemical reaction in steady state.** Principles of conservation of matter and energy. Balances of matter for single units. Balances of matter in systems of units in series, with shunt currents and recycle streams without purge and purge.
- **Theme 3. Balances of matter with chemical reaction in steady state.** Balances of matter for single units and systems in series, with shunt currents and recycle streams without purge and purge.
- **Theme 4. Balances of energy at steady state.** General expression of a macroscopic balance of energy. Enthalpy balances without chemical reaction and with chemical reaction. Thermodynamic cycles and performance. Water and steam as heat exchange agents. Izard and Mollière diagrams. Steam tables. Matter and energy balances simultaneously.
- **Theme 5. Balances of matter and energy in unsteady state**. Nonstationary operations in the food industry. Simultaneous matter and energy balances.
- **Theme 6. Fluid mechanics.** Internal flow of incompressible fluids: Equation of continuity, Bernoulli's equation, energy losses due to friction, Fanning equation and Moody chart, impulsion power. External flow: Movement of particles within a fluid. Terminal speed.
- **Theme 7. Heat transfer.** Heat transfer by conduction. Models for heat transfer in foods. Heat transfer by convection. Heat exchangers. Heat transfer by radiation.
- **Theme 8. Separation operations.** Transfer of matter. Single stage contact. Cascade of stages. Distillation. Extraction. Evaporation. Crystallization.
- **Theme 9. Elements of Chemical Reaction Engineering.** Ideal reactor types and modes of operation. Reactor volume and residence time. Heterogeneous reactors. Association reactors.

PRACTICAL SYLLABUS:

Practices class / computer

Practice 1. Triangular diagrams.
Practice 2. Graphical solution of a balance of matter.
Practice 3. Solving nonlinear equations by numerical methods.
Practice 4. Numerical integration
Practice 5. Derivation of empirical models from experimental data.

READING

FUNDAMENTAL BIBLIOGRAPHY:

- Alberto Ibarz Ribas. Operaciones unitarias en la ingeniería de alimentos. Mundi-Prensa (2005)

- Antonio Valiente, Antonio Valiente Barderas. Problemas de balance de materia y energía en la industria alimentaria. Limusa (2006)
- J. R. Hermida Bun. Fundamentos de ingeniería de procesos agroalimentarios. Mundi-Prensa Libros (2000)
- Guillermo Calleja Pardo. Introducción a la Ingeniería Química. Editorial Síntesis (1999)
- José Costa López. Curso de ingeniería química. Reverte (1998)
- David M. Himmelblau. Principios básicos y cálculos en ingeniería química. Pearson Educación (1997)
- V. Bravo Rodríguez, G. Blázquez García y A. Gálvez Borrego. Fundamentos de la Ingeniería Química. V. Bravo (1997)

SUPPLEMENTARY BIBLIOGRAPHY::

- Antonio Huerta Cerezuela y Antonio Rodríguez-Ferrán. Métodos numéricos: introducción, aplicaciones y programación. Ediciones UPC (2009).
- Vv.aa. Excel 2007: tablas simples y gráficos. Ediciones ENI (2007)
- Pedro Alberto Quintana Hernández. Métodos numéricos: con aplicaciones en Excel. Reverte (2005)
- Ana Casp Vanaclocha. Diseño de industrias agroalimentarias. Mundi-Prensa Libros (2004)
- Antonio Herranz, Antonio Herranz García y Albino Arenas, Albino Arenas Gómez. Análisis dimensional y sus aplicaciones. Editum (1989)

RECOMMENDED INTERNET LINKS

- Oficina Española de Patentes y Marcas. http://www.oepm.es
- Google Patents. http://www.google.com/patents
- Scopus. http://www.scopus.com/