Universidad Zaragoza

Year : 2020/21

28937 - Unit operations II

Syllabus Information

Academic Year: 2020/21
Subject: 28937 - Unit operations II
Faculty / School: 201 - Escuela Politécnica Superior
Degree: 583 - Degree in Rural and Agri-Food Engineering
437 - Degree in Rural and Agri-Food Engineering
ECTS: 6.0
Year: 3
Semester: Second semester
Subject Type: 583 - Optional
437 - Compulsory
Module: ---

1.General information

1.1.Aims of the course

1.2.Context and importance of this course in the degree

1.3.Recommendations to take this course

This subject is offered in the English Friendly form

2.Learning goals

2.1.Competences

2.2.Learning goals

2.3.Importance of learning goals

3.Assessment (1st and 2nd call)

3.1.Assessment tasks (description of tasks, marking system and assessment criteria)

4.Methodology, learning tasks, syllabus and resources

4.1.Methodological overview

The learning process is based on:

1) The participatory lecture technique (PLT) will be applied during the course of the theoretical sessions. Students will be encouraged to actively participate in the lectures by asking/answering questions and/or solve short exercises.

2) Group work and collaborative learning will be used during the course of the practical sessions, which will be focused on solving a number of problems (practical problem-solving sessions) and performing a number of laboratory experiments (practical laboratory sessions).

3) The technical visits to two agri-food industries will provide students with demonstrable knowledge on the topics covered during the course.

4) A collaborative project integrating concepts and techniques will be performed by the students (in groups of 2 or 3 members; the same groups as those established during the practical sessions).

4.2.Learning tasks

The course includes the following learning tasks:

- Lectures in the classroom (30 h).

- Practical sessions in the computer classroom (18 h).
- Practical sessions in the laboratory (8 h).
- Technical visits (2 visits).
- Cooperative learning: during the practical sessions (in class) and the collaborative project (out of class).
- Autonomous learning (out of class): students will be encouraged to resolve several exercises and questionnaires related to the subjects covered in the classroom. They will post the solution on the Moodle site and interact with each other.
- Individual or small-group tutoring, which can be face-to-face (in the desk of lecturers) or virtual (using the Moodle platform).

4.3.Syllabus

The course will address the following topics:

Theoretical Program

Block I: Unit operations based on simultaneous heat and mass transfer.

Topic 1: FUNDAMENTALS OF PYSCHOMETRICS. Properties of wet air and characteristic temperatures (dew point, adiabatic saturation and wet-bulb). Use of psychometric diagram. Heating and humidification of air.
Topic 2: DRYING OF SOLIDS WITH WARM AIR. Drying curve. Descriptions of the most commonly used drying equipment within the agrifood industry. Calculations of drying times in discontinuous dryers (during stages of constant or decreasing drying rate). Design equation in continuous dryers (rotary dryer or belt dryers). Applications.

Block II: Unit operations based on momentum transfer.

Topic 3: FLUIDISATION AND PNEUMATIC TRANSPORT. Characterization of solid particles. Grinding and sifting. Fluidization: minimum fluidization and drag velocity. Pneumatic transport.

Topic 4: SEDIMENTATION and CENTRIFUGATION. Sedimentation by gravity. Calculation of a section of a continuous sedimentation system. Centrifugation: fundamentals and the most commonly used equipment for separation of immiscible liquids and separation of insoluble solids in liquid products.

Topic 5: FILTRATION AND SEPARATION BY MEMBRANES. Filtration: theoretical foundations, constant pressure drop filtration, filtration by constant medium flow; equipment. Separation using membranes: ultrafiltration, inverse osmosis, materials and membrane configuration, applications.

Block III: PROCESSES WITHIN THE AGRI-FOOD INDUSTRY

Topic 6: MILK INDUSTRIES. Preliminary treatments (filtering, deaeration, and clarification). Creaming. Homogenization. Pasteurization. Sterilization and UHT treatment.

Topic 7: JUICE PRODUCTION. Fruit treatments (washing, brushing, and inspection). Extraction of juice and essentials oils. Treatment of juice (pulp removal and clarification, blending and corrective actions, deaeration, and pasteurization). Production of concentrated juice (evaporation, freezing, and separation by membranes).

Topic 8. FLOUR INDUSTRY. Milling, silage and dispatch. Grinding. Extraction. Purification. Compression. Introduction to bread-making technology.

Topic 9. BEER PRODUCTION. Maceration. Filtration. Brewing. Separation of solids from the warm liquid using whirlpooling. Cooling of the must. Fermentation. Ageing. Beer filtration. Pasteurization. Packaging.

Practical Program

Practical problem-solving sessions

8 two-hour problem-solving sessions focused on solving several case studies and problems.

Practical laboratory sessions

Practical 1: DRYING OF SOLIDS WITH HOT AIR. For this practical a tunnel tray dryer is available for academic purposes. It is possible to feed different airflows at different temperatures and continuously measure the weight of the solid material (such as carrot, barley or maize) in the trays. The temperature and relative moisture in the air, before and after the trays, are also measured continuously. Students must experiment in order to calculate drying times in a discontinuous dryer and compare them with data obtained from theoretical expressions.

Practical 2: GRINDING AND FLUIDISATION. The aim of this practical is to analyze the distribution of different grain sizes attained in a coffee grinding operation through the use of vibrating sieves. In the second part of the practical, a fluidization operation using silica sand is carried out in order to quantify minimum fluidization velocity and particle density.

Practical 3. FILTRATION AND SEDIMENTATION BY GRAVITY. Here, a filter press device is used for the filtration of a watery solution of calcium carbonate, which operates using constant pressure drop. Using data gained from experiments highlighting filter volume in terms of time, the parameters of the system can be estimated: specific resistance of the filter cake and specific volume. During the second part of the session, experimental data is recorded from the discontinuous sedimentation process of the water-CaCO3, using different concentrations. This data can be used to determine the minimum area required for a continuous sedimentation system operating in fixed conditions.

Practical 4. CENTRIFUGATION OF IMMISCIBLE LIQUIDS. For this practical, whole milk is separated into two phases (skimmed milk and cream) by using a laboratory centrifuge. The influence on separation yield is analyzed using three variables: working temperature, rotational speed and partition separation. The separation yield of each test is determined in terms of the results obtained relating to the fat content present in the heavy phase.

4.4.Course planning and calendar

Schedule

Week	Theoretical sessions	Practice sessions	Visits
1	4 h		
2	2 h	Problem-solving session 1 (2 h)	
3	2 h	Problem-solving session 2 (2 h)	
4	2 h	Problem-solving session 3 (2 h)	
5	2 h	Problem-solving session 4 (2 h)	
6	2 h	Problem-solving session 5 (2 h)	
7	2 h	Problem-solving session 6 (2 h)	
8	2 h	Laboratory session 1 (2 h)	
9	2 h	Laboratory session 2 (2 h)	
10	2 h	Laboratory session 3 (2 h)	
11	2 h	Laboratory session 4 (2 h)	
12	2 h	Problem-solving session 7 (2 h)	Visit(s)
13	2 h	Problem-solving session 8 (2 h)	
14	2 h	Problem-solving session 9(2 h)	
15	Oral presentation of the collaborative projects (20 min per group).	Laboratory exam (2 h)	

Worklo

4.5.Bib and recom resour

BB Rhodes, Martin. Introduction to particle technology / Martin Rhodes Chichester [etc.] : John Wiley and sons, cop. 1998

BB Seader, J. D.. Separation process principles / J. D. Seader, Ernest J. Henley . 2nd ed. Hoboken, NJ : John Wiley & Sons, cop. 2006

BC Earle, R.L.. Ingeniería de los alimentos : (las operaciones básicas del procesado de los alimentos) / R.L. Earle ; traducido por Miguel Calvo Rebollar, Emilia Sevillano Calvo . [2a. ed.; 1ª reimp.] Zaragoza : Acribia, D.L. 1997

BC Ibarz, Albert. Operaciones unitarias en la ingeniería de los alimentos / Albert Ibarz, Gustavo V. Barbosa-Cánovas . Madrid : Mundi-Prensa, 2005

Activity	Classroom or laboratory hours	Factor	Out of class hours
Lectures	30	1,5	45
Practical problem-solving sessions	18	1	18
Practical laboratory sessions	8	1	8
Collaborative work	0.3	-	15.7
Technical visits	3	-	-
Evaluation	4		
Total	63.3		86.7

LISTADO DE URLs:

Documentos de Mejores Técnicas Disponibles (MTD). Ministerio de Agricultura, Alimentación y Medio Ambiente. [http://www.prtr-es.es/documentos/documentos-mejores-tecnicas-disponibles]

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Total workload	**150 h**

can be consultec
in:
http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=28937