Course guide
330157 - OS - Separation Operations

Last modified: 04/05/2023

Unit in charge: Manresa School of Engineering
Teaching unit: 750 - EMIT - Department of Mining, Industrial and ICT Engineering.

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

Academic year: 2023 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: ANNA BONSFILLS PEDROS

Others: ANTONIO DAVID DORADO CASTAÑO

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
1. Use balances of matter and energy in basic operations. Calculate and design basic separation operations, based on the transfer of matter and heat transmission. Solve problems and apply theoretical knowledge to practice. Develop the capacity for analysis and synthesis

Transversal:
2. EFFICIENT ORAL AND WRITTEN COMMUNICATION - Level 3. Communicating clearly and efficiently in oral and written presentations. Adapting to audiences and communication aims by using suitable strategies and means.
3. TEAMWORK - Level 3. Managing and making work groups effective. Resolving possible conflicts, valuing working with others, assessing the effectiveness of a team and presenting the final results.
4. SELF-DIRECTED LEARNING - Level 3. Applying the knowledge gained in completing a task according to its relevance and importance. Deciding how to carry out a task, the amount of time to be devoted to it and the most suitable information sources.

TEACHING METHODOLOGY

The subject consists of four hours of class per week, which are dedicated to explaining the theoretical foundations and solving problems.

LEARNING OBJECTIVES OF THE SUBJECT

Upon completion of the course, the student must be able to:

- Use mass and energy balances in basic operations.
- Calculate and design basic separation operations, based on the transfer of matter and the transmission of heat.
- Solve problems and apply theoretical knowledge to practice.
- Develop the capacity for analysis and synthesis.
- Efficient oral and written communication.
- Work efficiently as a team.
- Learn autonomously.

STUDY LOAD

Type	Hours	Percentage
Hours medium group	30,0	20.00
Self study	90,0	60.00
Hours large group	30,0	20.00

Total learning time: 150 h

CONTENTS

1. Evaporation

Description:
- Simple evaporator.
- Methods to minimize energy consumption.
- Multiple effect evaporator.

Related activities:
- Theoretical classes.
- Posing and solving problems in class.
- Study and autonomous work of the student.
- Individualized monitoring of the student and evaluation.
- Activities: 1,2,3.

Full-or-part-time: 42h
Theory classes: 9h
Practical classes: 8h
Self study : 25h

2. Distillation

Description:
- Differential distillation.
- Flash distillation.
- Rectification.

Related activities:
- Theoretical classes.
- Posing and solving problems in class.
- Study and autonomous work of the student.
- Individualized monitoring of the student and evaluation.
- Activities: 1,2,3.

Full-or-part-time: 62h
Theory classes: 13h
Practical classes: 11h
Self study : 38h

3. Humidification and dehumidification

Description:
- Methods to humidify and dehumidify.
- Adiabatic columns.

Related activities:
- Theoretical classes.
- Posing and solving problems in class.
- Study and autonomous work of the student.
- Individualized monitoring of the student and evaluation.
- Activities: 1,2,3.

Full-or-part-time: 23h
Theory classes: 4h
Practical classes: 5h
Self study : 14h

4. Drying of solids

Description:
- Discontinuous drying.
- Continuous drying.

Related activities:
- Theoretical classes.
- Posing and solving problems in class.
- Study and autonomous work of the student.
- Individualized monitoring of the student and evaluation.
- Activities: 1,2,3.

Full-or-part-time: 22h
Theory classes: 4h
Practical classes: 5h
Self study : 13h

ACTIVITIES

ACTIVITY 1: AUTONOMOUS PROBLEM RESOLUTION

Description:
The student will be proposed a series of problems that must be solved individually and delivered.

Specific objectives:
Monitor learning in the different separation operations to be studied, with special emphasis on the correct application of mass and energy balances, as well as calculations.

Material:
Atenea Campus

Delivery:
25% of the final grade

Full-or-part-time: 40h
Self study: 40h

ACTIVITY 2: WRITTEN TESTS

Description:
There will be two individual written tests.

Specific objectives:
Know the student's learning individually.

Material:
Atenea Campus.

Delivery:
60% of the final grade.

Full-or-part-time: 46h
Practical classes: 6h
Self study: 40h

ACTIVITY 3: ORAL PRESENTATION

Description:
Oral presentation of an industrial calculation problem and its resolution, where the assimilation of the contents taught in the subject is demonstrated, with subsequent questioning by the rest of the student body.

Specific objectives:
- Solve problems and apply theoretical knowledge to practice.
- Develop the capacity for analysis and synthesis.

Material:
Atenea Campus

Delivery:
15% of the final grade.

Full-or-part-time: 12h
Practical classes: 2h
Self study: 10h

GRADING SYSTEM

Final mark = 60% individual written tests + 25% autonomous problem solving activities + 15% oral presentation and participation.

EXAMINATION RULES.

The activities are part of the continuous evaluation. If the student does not carry out any of the activities, it will be considered not scored.

BIBLIOGRAPHY

Basic:

- Henley, E. J.; Seader, J. D.; Roper, D. K. Separation process principles. 3rd ed. Chichester: John Wiley & Sons, 2011. ISBN 9780470646113.
- McCabe, W. L.; Smith, J. C.; Harriott, P. Operaciones unitarias en ingeniería química. 7ª ed. Madrid: McGraw-Hill, 2007. ISBN 9789701061749.
- Treybal, R. E. Operaciones de transferencia de masa. 2ª ed. México: McGraw-Hill, 1988. ISBN 9686046348.
- Ocón, J.; Tojo, G. Problemas de ingeniería química: operaciones básicas. 3ª ed. Madrid: Aguilar, 1968. ISBN 8403209975.
- Martínez, P. J.; Rus, E. Operaciones de separación en ingeniería química: métodos de cálculo. Madrid: Prentice Hall, 2004. ISBN 8420542504.

Complementary:

- King, C. J. Procesos de separación [on line]. México: Repla, 1988 [Consultation: 10/06/2022]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=2749421&site=ehost-live&ebv=EB&ppid=pp_I. ISBN 9686165061.
- Górak, A.; Sorensen, E., eds. Distillation: fundamentals and principles [on line]. London: Elsevier/Academic Press, 2014 [Consultation: 10/06/2022]. Available on: https://www-sciencedirect-com.recursos.biblioteca.upc.edu/book/9780123865472/distillation. ISBN 9780123865472.
- Coulson, J. M.; Richardson, J. F. Ingeniería química: unidades SI [on line]. Barcelona: Reverté, 1979-1986 [Consultation: 14/09/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=10453. ISBN 8429171347.
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- Backhurst, J. R.; Harker, J. H.; Porter, J. E. Problemas sobre transferencia de calor y masa. México: El Manual Moderno, 1979. ISBN 9684260644.
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- Perry, R. H.; Green, D. W., eds. Manual del ingeniero químico [on line]. 7ª ed. Madrid: McGraw-Hill, 2001 [Consultation: 07/06/2022]. Available on: https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=6572. ISBN 9788448130084.
- Perry, R. H.; Green, D. W., eds. Perry's chemical engineers' handbook [CD-ROM]. New York: McGraw-Hill, 1999. ISBN 0071344128.
- Perry, Robert H.; Green, Don W., eds. Perry's chemical engineers' handbook [on line]. 8th ed. New York: McGraw-Hill, 2008 [Consultation: 10/06/2022]. Available on: https://search-ebscohost-com.recursos.biblioteca.upc.edu/login.aspx?direct=true&AuthType=ip,uid&db=nlebk&AN=219494&site=ehost-live&ebv=EB&ppid=pp_C. ISBN 9780071593137.
- Sinnott, R.; Towler, G. Chemical engineering design [on line]. 5th ed. Oxford: Butterworth-Heinemann, 2009 [Consultation: 31/05/2022]. Available on: https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=5787890. ISBN 9780750685511.

RESOURCES

Other resources:

Bonsfills, A. Operacions de separació: recull de dades. Manresa: EPSEM, 2022.

Bonsfills, A. Operacions de separació: recull de problemes. Manresa: EPSEM, 2022.

Bonsfills, A.; Gamisans, X.; Lao, C.; Solé, M. Web Evaporació. Manresa: EPSEM 2011. Disponible a: http://epsem.upc.edu/evaporacio />
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