

Course guide

330158 - EEQ - Experimentation in Chemical Engineering

Last modified: 25/04/2024

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).
BACHELOR'S DEGREE IN CHEMICAL ENGINEERING (Syllabus 2016). (Compulsory subject).

Academic year: 2024 **ECTS Credits:** 6.0 **Languages:** Catalan

LECTURER

Coordinating lecturer: ANNA BONSFILLS PEDROS

Others: ANTONIO DAVID DORADO CASTAÑO - MARIA DOLORS GRAU VILALTA

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:

1. Raise and test hypotheses. Treat and interpret experimental data correctly. 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 a week, which are dedicated to practical classes in the laboratory, through different pilot plants.

LEARNING OBJECTIVES OF THE SUBJECT

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

- Use knowledge to experimentally study discontinuous and semi-continuous reactors.
- Use knowledge to experimentally study the fluid circulation regime, pressure losses in pipes, and centrifugal pumps.
- Use the knowledge to experimentally study heat exchangers.
- Apply experimentally the balances of matter and energy in basic operations.
- Experimentally analyze separation operations with mass transfer: absorption and biofiltration.
- Experimental study of separation operations with heat and mass transfer: distillation.
- Experimental study of different automatic regulation systems.

STUDY LOAD

Type	Hours	Percentage
Self study	90,0	60.00
Hours small group	60,0	40.00

Total learning time: 150 h



CONTENTS

1. Reactors

Description:

- Experimental determination of the kinetic equation of homogeneous reactions.
- Experimentation in a batch reactor.
- Experimentation in a semi-continuous reactor.

Related activities:

- Activities: 1,2,3,4,5,6.

Full-or-part-time: 40h

Laboratory classes: 16h

Self study : 24h

2. Fluid transport

Description:

- Experimental study of the fluid circulation regime. Reynolds experiment.
- Experimental determination of pressure losses in pipes.
- Experimental study of an industrial centrifugal pump.

Related activities:

- Activities: 1,2,3,4,5,6.

Full-or-part-time: 30h

Laboratory classes: 12h

Self study : 18h

3. Heat transmission

Description:

- Experimental study of a concentric tube heat exchanger.
- Experimental determination of the heat transfer coefficient in a reactor.

Related activities:

- Activities: 1,2,3,4,5,6.

Full-or-part-time: 20h

Laboratory classes: 8h

Self study : 12h

4. Separation operations

Description:

- Separation of binary mixtures by differential distillation.
- Separation of mixtures in a discontinuous distillation column.
- Separation of gaseous mixtures by absorption of gases.
- Separation of gaseous mixtures by biofiltration.
- Discontinuous drying of solids.

Related activities:

- Activities: 1,2,3,4,5,6.

Full-or-part-time: 50h

Laboratory classes: 20h

Self study : 30h

5. Automatic regulation

Description:

- Automatic regulation of the liquid level in a tank.

Related activities:

- Activities: 1,2,4,5,6.

Full-or-part-time: 10h

Laboratory classes: 4h

Self study : 6h

ACTIVITIES

ACTIVITY 1: QUESTIONNAIRE

Description:

Individual tests of previous knowledge.

Specific objectives:

Evaluate the necessary previous knowledge, before carrying out the experimental practices in the pilot plants.

Material:

Atenea Campus.

Delivery:

10% of the final grade.

Full-or-part-time: 17h

Laboratory classes: 2h

Self study: 15h



ACTIVITY 2: LABORATORY EXPERIMENTATION

Description:

Correct laboratory experimentation, treatment and interpretation of experimental data.

Specific objectives:

Experimental study of reactors, fluid transport, heat transmission and separation operations.

- Raise and test hypotheses.
- Treat and correctly interpret the experimental data.
- Develop the capacity for analysis and synthesis.

Material:

Atenea Campus.

Delivery:

25% of the final grade.

Full-or-part-time: 66h

Laboratory classes: 48h

Self study: 18h

ACTIVITY 3: SIMULATION

Description:

Simulation in the computer classroom.

Specific objectives:

- Study for simulation the behavior of variables for different operations, which can be complex to study experimentally.
- Raise and test hypotheses.
- Treat and interpret the data correctly.
- Develop the capacity for analysis and synthesis.

Material:

Atenea Campus.

Delivery:

5% of the final grade.

Full-or-part-time: 13h

Laboratory classes: 6h

Self study: 7h

ACTIVITY 4: INFORMS

Description:

Preparation of practice reports.

Specific objectives:

- Develop the capacity for analysis and synthesis.
- Develop written communication.

Material:

Atenea Campus

Delivery:

15% of the final grade.

Full-or-part-time: 20h

Self study: 20h

ACTIVITY 5: ORAL PRESENTATION

Description:

Oral presentations.

Specific objectives:

- Develop the capacity for analysis and synthesis.
- Develop oral communication.

Material:

Atenea Campus.

Delivery:

20% of the final grade.

Full-or-part-time: 12h

Laboratory classes: 2h

Self study: 10h

ACTIVITY 6: WRITTEN TEST

Description:

Individual written test.

Specific objectives:

Know the student's learning individually.

Material:

Atenea Campus.

Delivery:

25% of the final grade.

Full-or-part-time: 22h

Laboratory classes: 2h

Self study: 20h

GRADING SYSTEM

Final mark: 35% individual written tests + 20% practical reports + 45% oral presentations 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:

- Bonsfills, A.; Dorado, A. D. Experimentació en enginyeria química: guions de pràctiques. Manresa: EPSEM, 2022.

Complementary:

- Levenspiel, O. Ingeniería de las reacciones químicas [on line]. 3ª ed. México: Limusa Wiley, 2004 [Consultation: 27/05/2022]. Available on: <https://ebookcentral-proquest-com.recursos.biblioteca.upc.edu/lib/upcatalunya-ebooks/detail.action?docID=5758266>. ISBN 9681858603.
- Froment, G. F.; Bischoff, K. B. Chemical reactor analysis and design. 2nd ed. New York: John Wiley & Sons, 1990. ISBN

0471510440.

- Ingham, J., i altres. Chemical engineering dynamics: an introduction to modelling and computer simulation. 2nd ed. Weinheim: Wiley-VCH, 2000. ISBN 3527297766.

- McCbe, W. L.; Smith, J. C.; Harriott, P. Operaciones unitarias en ingeniería química [on line]. 7ª ed. Madrid: McGraw-Hill, 2007 Available on :
https://www-ingebook-com.recursos.biblioteca.upc.edu/ib/NPcd/IB_BooksVis?cod_primaria=1000187&codigo_libro=7869. ISBN 9701061748.

- Treybal, R. E. Operaciones de transferencia de masa. 2ª ed. México: McGraw-Hill, 1988. ISBN 9686046348.

- 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-ebshost-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.

RESOURCES

Other resources:

- Bonsfills, A.; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web planta pilot Bomba Centrífuga Industrial. EPSEM 2011. Disponible a:
<http://epsem.upc.edu/bombacentrifuga> />

- Bonsfills, A. ; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web planta pilot Columna Absorció de Gasos. EPSEM 2011. Disponible a:
<http://epsem.upc.edu/absorciogasos> />

- Bonsfills, A. ; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web planta pilot Assecador de Sòlids. EPSEM. 2012. Disponible a:
<http://epsem.upc.edu/assecadordesolids> />

- Bonsfills, A. ; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web Intercanviadors de Calor. EPSEM 2012. Disponible a:
<http://epsem.upc.edu/intercanviadorsdecalor> />

- Bonsfills, A. ; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web planta pilot Transferència de Matèria. EPSEM 2013. Disponible a:
<http://epsem.upc.edu/transferenciademateria> />

- Bonsfills, A. ; Dorado, T.; Gamisans, X.; Lao, C.; Solé, M. Web planta pilot Fermentador. EPSEM 2013. Disponible a:
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