Universitat de Lleida

DEGREE CURRICULUM

INDUSTRIAL CHEMISTRY PROCESSES

Coordination: MARTÍ BERNADAS, JOAN FRANCESC

Academic year 2019-20

INDUSTRIAL CHEMISTRY PROCESSES 2019-20

Subject's general information

Subject name	INDUSTRIAL CHEMISTRY PROCESSES
Code	102348
Semester	2nd Q(SEMESTER) CONTINUED EVALUATION
Typology	

Degree	Course	Character	Modality
Not informed	3	COMPULSORY	Attendance-based

Course number of credits (ECTS)	6
Type of activity, credits, and groups	

Activity type	PRALAB	PRAULA	TEORIA
Number of credits	0.4	2.6	3
Number of groups	1	1	1

Coordination	MARTÍ BERNADAS, JOAN FRANCESC
Department	ENVIRONMENT AND SOIL SCIENCES
Teaching load distribution between lectures and independent student work	Attendance time: 60 h. Home work: 90 h.
Important information on data processing	Consult this link for more information.
Distribution of credits	3 Teoria, 2,6 praula, 0,4 pralab

INDUSTRIAL CHEMISTRY PROCESSES 2019-20

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
BARTOLÍ SOLER, ESTHER	esther.bartoli@udl.cat	4	
COMBALIA CENDRA, FELIP	felip.combalia@udl.cat	2	

Learning objectives

At the end of the course the student must be able to:

- Interpret the different processes in industrial chemistry.

- Explain the differences between small and large scale processes (type of reagents, temperature control, ..).

- Analyze the different methods of catalysis at the industrial level.

- Make a critical study of an industrial process.

- Obtain a global vision of the problems of the chemical industry, the available resources and the replacement routes in case of exhaustion.

- Compare the different raw materials, analyze the methods of obtaining products from these.

- Formulate the diagram and balance (raw materials, energy, water and waste) of any process.

- Delve deeper into powerful products such as polymers.

- Recognize and evaluate the impact of these industries and their products on the environment

Competences

Basics

B03 That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include a reflection on relevant social, scientific or ethical issues.

B04 That students can transmit information, ideas, problems and solutions to a specialized and non-specialized public.

B05 That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy.

Generals

CG3. To synthesize basic and technological subjects, which enable them to learn new methods and theories, and provide them with versatility to adapt to new situations.

CG4. To solve problems with initiative, make decisions, creativity, critical reasoning and to communicate and transmit knowledge, skills and abilities in the field of Industrial Chemical Engineering.

CG7. To analyze and assess the social and environmental impact of technical solutions.

CG10. To work in a multilingual and multidisciplinary environment.

Specific

CE20. To analyze, design, simulate and optimize processes and products.

CE22. To design, manage and operate simulation, control and instrumentation procedures of chemical processes.

Transversal

CT1. To develop a proper understanding and oral and written expression of Catalan and Spanish.

CT3. To iImplement new technologies and technologies of information and communication.

CT5. To apply essential notions of scientific thinking.

Subject contents

Fundamental contents of the subject

Introduction to industrial chemistry

- Industrial chemical and chemical industry
- Classification and characteristics of the chemical industry
- Raw materials
- Energy
- Waste
- Industrial ecology

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Electrolysis, Chlorine, Soda, Sodium.

- Fundamentals of electrolysis: Voltage, energy and performance
- Electrolysis of melted sodium chloride- Brine electrolysis:
    - Diaphragm cells
    - Mercury cathode cells
    - Selective membrane cells

Sulfur and sulfuric acid, heterogeneous catalysis.

- Raw materials
    - Sulfur and pyrite
    - Roasting furnaces
- Manufacture of sulfuric by contact
    - Gas purification
    - Catalysis
    - Absorption
- Double contact

Fertilizers

- Introduction to fertilizers
- Nitrogen fertilizers
    - Synthesis of ammonia
    - Nitric acid
    - Ammonium nitrate
    - Urea
- Phosphates
    - Raw materials
    - Phosphorus and derivatives by thermal route
    - Phosphates and phosphoric acid by wet route
    - Ammonium phosphates
- Potash
    - Raw materials
    - Separation by differential solubility
    - Other methods of separation
    - Potassium nitrate

Petroleum and petrochemicals

- Characterization of oil.
- Petroleum products and properties: Gases, gasoline and kerosene, gas oils, lubricants, heavy products.
- Refining processes
    - Distillation
    - Thermal cracking.
    - Catalytic cracking.
    - Catalytic reformed
    - Hydrogen cracking
    - Debugging with hydrogen
    - Isomerization
    - Alkylation

- Petrochemicals, production and separation of raw materials

    Aromatic

    Alkin and alquine

    Black smoke

    Synthesis gas.

Polymers

- Monomers and functionality
- Types of polymers, classification
- polycondensation
- Poladdicions
- Properties of the polymers linked to the structure.
- Polymeric materials

Carbochemistry, agricultural resources and biotechnologies

- Obtaining raw materials from resources other than oil

    Carbochemistry

    Agricultural resources

    Biotechnologies

Methodology

Methodology

- Theory in classes of large groups: Expositive classes by the teacher, with the explanation of concepts, materials and the work plan.
- For each module, exercises will be proposed individually and autonomously, which will be evaluated by the teacher.
- Preparation of a topic, with presentation and oral and written communication.

Students also have the responsibility to reinforce their knowledge independently, based on the didactic material facilitated and / or recommended by the teacher.

Development plan

Week	Methodology	Temary	On-site hours	Hours of autonomous work
1-8	Master class / exercises	Lessons1 a 4	32	43
9	Written test (E1))	Lessons 1 a 4	2	
10-15	Master class / exercises	Lessons 5 -6	20	35
10-15	Preparation of topic 7	Lesson 7	4	12
16	Written test (E2)	Lessons 5 a 7	2	

Evaluation

In the middle of the semester there will be an eliminatory partial test (E1) that corresponds to the matter taught during this first part. At the end of the semester there will be another test (E2) also eliminatory with the rest of the contents. In addition there will be a note of exercises and presentations (P), and a note of assessment of the teacher (A).

The final grade will be:

$$FG = 0.65\ ((E1 + E2) / 2) + 0.30\ P + 0.05A$$

In order to be able to apply, a minimum of 3 is needed in the eliminatory partial exams.

Those who have not passed the subject at the first opportunity may take a final recovery exam (ER) that will include the exams not passed. The final grade of the subject will be calculated using the same formula,

Tests E1, E2, and ER will be carried out on the dates set by the Studies Departement

Bibliography

- Subject notes
- Vian, A. *Introducción a la química industrial.* 2ª ed. Barcelona: Reverté, 1999. ISBN 84-291-7933-X
- Perrin, R; Scharff, J.P. C*himie industrielle.* 2e éd. Paris: Masson, 2002. ISBN 2-10-006747-8
- Mujlionov, I.P. et al; *Tecnologia Quimica Industrial vol 2,* Moscu ed.Mir, 1979
- Austin, G.T. *Manual de procesos químicos en la industria.* México D.F.: McGraw-Hill, 1992. ISBN 970-10-0388-8
- Gary, J.H.; Handwerk, G.E. (1980). *Refino de petróleo : tecnología y economía.* Barcelona: Reverté. ISBN
- Proskuriakov, V.A.; Drabkin, A.E. Q*uímica del petróleo y del gas.* Moscú: Mir, 1984
- Ramos Carpio, M.A. *Refino del petroleo, Gas natural, y Petroquímica;* Madrid Fundacion fomento innovación industrial 1997 ISBA 84-605-6755-9
- Wittcoff, H.A.; Reuben, B.G. *Productos químicos orgánicos industriales.* Mexico: Limusa, 1987. ISBN 968-18-1882-2. 2 vols.
- Weissermel, K.; Arpe, H-J. Química orgánica industrial : productos de partida e intermedios más importantes. 2ªed. Barcelona: Reverté, 1981. ISBN 84-291-7989-5
- Revistes vàries de Química Industrial i d'Enginyeria Química

Adaptations to the methodology due to COVID-19

Course content will be develop due to presentation pof 2 projects carried out in groups o 2 or 3 students.

Projects must content :

M1: Report first project : Monitoring of the project till presentation date. Once validated and evaluated for the professors, document will be shared with the rest of the groups.

M2: Report second project : Monitoring of the project till presentation date. Once validated and evaluated for the professors, document will be shared with the rest of the groups.

P1: Presentation 1: Online report presentation. Once validated and evaluated for the professors, document will be shared with the rest of the groups.

P2: Presentation 2: Online report presentation. Once validated and evaluated for the professors, document will be shared with the rest of the groups.

Adaptations to the development plan due to COVID-19

ACTIVITY	PRESENTATION DATE	PRESENTATION DATE	PRESENTATION DATE final
REPORT 1 (M1)			26/02/2020
REPORT 2 (M2)	27/03/2020 (seguiment)	10/04/2020(seguiment)	4/05/2020
PRESENTATION 1 (P1)			11/03/2020
PRESENTATION 2 (P2)			11/05/2020
EXAM 1 (E1)			20/04/2020
EXAM 2 (E2)			2/06/2020

Adaptations to the evaluation due to COVID-19

Evaluation will be carried out due to evaluation of the projects presented and the theory related with each unit of the course content.

P1: Presentation 1 (0,15 %)

P2: Presentation 2 (0,15 %)

M1: Report first project (0,20 %)

M2: Report second project (0,20 %)

E1: Exam 1 (0,125 %)

E2: Exam 2 (0,125 %)

A: Profesor evaluation (0,05 %)

Fional Mark

FM= (P1+P2)*0,30 + (M1+M2)*0,40 + (E1+E2)*0,25 + (A)*0,05