Universitat Autònoma de Barcelona

2022/2023

Heat Science

Code: 102441
ECTS Credits: 3

Degree	Type	Year	Semester
2500897 Chemical Engineering	OB	3	1

Contact

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Use of Languages

Principal working language: catalan (cat)
Some groups entirely in English: No
Some groups entirely in Catalan: Yes
Some groups entirely in Spanish: No

Prerequisites

Applied Thermodynamics

Heat Transmission

Objectives and Contextualisation

Analyze, evaluate and design some of the industrial applications of the production of cold and heat, incorporating criteria of energy saving and energy efficiency

Competences

- Analyse, evaluate, design and operate the systems or processes, equipment and installations used in chemical engineering in accordance with certain requirements, standards and specifications following the principles of sustainable development.
- Communication
- Develop personal attitude.
- Develop personal work habits.
- Develop thinking habits.
- Objectively compare and select different technical options for chemical processes.
- Show an understanding of the role of chemical engineering in the prevention and resolution of environmental and energy problems, in accordance with the principles of sustainable development.
- Understand and apply the basic principles on which chemical engineering is founded, and more precisely: balances of matter, energy and thermodynamic momentum, phase equilibrium and kinetic chemical equilibrium of the physical processes of matter, energy and momentum transfer, and kinetics of chemical reactions

Learning Outcomes

1. Analyse, evaluate and design energy and heat transmission systems, in accordance with the principles of sustainable development.
2. Apply matter and energy balance to energy systems.

3. Apply the scientific and technological basics of thermodynamics, phase equilibrium and chemical equilibrium and the kinetics of physical energy transfer processes.
4. Communicate efficiently, orally and in writing, knowledge, results and skills, both professionally and to non-expert audiences.
5. Develop critical thinking and reasoning
6. Develop curiosity and creativity.
7. Develop independent learning strategies.
8. Enumerate, describe and compare the different options for applications used in energy systems.
9. Evaluate the energy consumption of systems.
10. Identify and evaluate energy systems and their energetic efficiency.
11. Manage available time and resources. Work in an organised manner.
12. Work autonomously.

Content

1.- Refrigeration

Refrigerants. Diagram of refrigerants

Refrigeration cycle. Components Refrigerating

Refrigeration Power, Heat, Power, Consumption

Compressor performance. Energy Efficiency

2.- Air conditioning installations

Diagram Psychometric

Cycles

Sensitive heat and latent heat. Sensitive heat factor

Thermal loads. Air conditioning

3.- Combustion

Stoichiometric combustion. Minimum air volume. Dry smoke volume. Wet smoke volume

Combustion with excess air. Fuel PCS and PCI. Combustion performance

4.- Thermal machines and engines. Energy applications. Energy saving

Engines and Turbines

Cogeneration

Trigeneration

Heat pump

Methodology

Master classes i applied classes of problem solvin

The studients have to do a work on a topic related to the subjetc

The proposed teaching and assessment methodology that appear in the guide may be subject to changes as a result of the restrictions to face-to-face class attendance imposed by the health authorities

Annotation: Within the schedule set by the centre or degree programme, 15 minutes of one class will be reserved for students to evaluate their lecturers and their courses or modules through questionnaires.

Activities

Title	Hours	ECTS	Learning Outcomes
Type: Directed			
Problem classes	15	0.6	1, 2, 3, 9, 5, 8, 10
Theoretical classes	15	0.6	1, 2, 3, 9, 5, 8, 10
Type: Supervised			
Tutorials	5	0.2	4, 5, 11
Type: Autonomous			
Personal study	10	0.4	1, 2, 3, 9, 4, 7, 5, 8, 11, 10, 12
Problem solving	10	0.4	1, 2, 3, 9, 4, 7, 5, 8, 11, 10, 12
Team working	15	0.6	4, 7, 5, 8, 11, 10, 12

Assessment

a) Process and scheduled evaluation activities

The course consists of the following evaluation activities:
- Activity A. Written test on the content of topics 1 and 2. The weight will be 45% of the final grade.
- Activity B. Written test on the content of topics 3 and 4. The weight will be 35% of the final grade.
- Activity C. Work. Students must submit a written work that will have a weight of 20% on the final grade. This activity is not recoverable.

To pass the course, through continuous assessment, a minimum grade of 4 will be required in activities A and B.
The note will result from the following expression:
Final grade (continuous assessment) = Activity grade A ($\geq$4) * 0.45 + Activity grade B ($\geq$4) * 0.35 + Activity grade C * 0.2
b) Scheduling of evaluation activities
The schedule of the evaluation activities will be communicated at the beginning of the course.
c) Recovery process
Students who have not passed the subject will be able to present themselves to the recovery of activity A and / or B, provided they have been presented to a set of activities that represent a minimum of two thirds of the total mark for the subject and have a average mark of all the activities of the subject higher than 3.
According to the coordination of the Degree and the management of the School of Engineering, Activity C (work) is not recoverable.
The recovery note will result from the following expression:
Final grade = Activity grade A ($\geq$4) * 0.45 + Activity grade B ($\geq$4) * 0.35 + Activity grade C * 0.2
Those students suspended for not having reached the minimum grade (in any of the activities) will have a maximum final grade of 4.
d) Qualification review procedure
For each assessment activity, there will be a review place, date and time where the student can review the

activitywith the teacher. In this context, it will be possible to make claims about the grade of the activity, which will be evaluated by the teacher responsible for the subject. If the student does not appear for the review, this activity will not be reviewed later.
e) Qualifications
With honors. Up to 5% MH of the total number of students enrolled can be awarded. It can only be awarded to students with a final grade equal to or greater than 9.5.
A student will be considered non-assessable if he / she has not submitted to any evaluation activity of the subject
f) Irregularities on the part of the student, copying and plagiarism
Without prejudice to other disciplinary measures deemed appropriate, the irregularities committed by the student that may lead to a change in the grade of an act of evaluation will be rated with zero. Therefore, copying, plagiarism, cheating, letting yourself be copied, etc. in any of the evaluation activities it will involve suspending it with a zero.
g) Evaluation of repeating students
Students who do not enroll for the first time in the course will have the option of taking the assessment activities during the course or the recovery activities at the end of the course.
Regarding activity C (work), the student may keep the grade from the previous year's work or do a new job. The note of this activity will be kept for one year.
The grade of the subject will correspond to the following result:
Final grade = Activity grade A ($\geq$4) * 0.45 + Activity grade B ($\geq$4) * 0.35 + Activity grade C * 0.2

Assessment Activities

Title	Weighting	Hours	ECTS	Learning Outcomes
Activity A	45	2	0.08	1, 2, 3, 9, 4, 8, 10
Activity B	35	2	0.08	1, 2, 3, 9, 4, 8, 10
Activity C	20	1	0.04	1, 2, 3, 9, 4, 7, 6, 5, 8, 11, 10, 12

Bibliography

Ramírez, Juan Antonio. Nueva enciclopedia de la Climatización: Refrigeración. Ceac, 2007

Rapin, P. J. Instalaciones frigoríficas. Tomo I y II. Marcombo, 1997

Miranda, Ángel Luis. Aire Acondicionado: Nueva Enciclopedia de la Climatización. Ceac, 2005

Giacosa, Dante. Motores endotérmicos. Omega, 1989

Sala Lizarraga, Jose Mª. Cogeneración. Universidad del país vasco, 1995

Software
