66226 - Energy Optimization

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	531 - Master's in Chemical Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Optional
Module	---

1.Basic info

1.1.Recommendations to take this course

1.2.Activities and key dates for the course

2.Initiation

2.1.Learning outcomes that define the subject

2.2.Introduction

3.Context and competences

3.1.Goals

3.2.Context and meaning of the subject in the degree

3.3.Competences

3.4.Importance of learning outcomes

4.Evaluation

5.Activities and resources

5.1.General methodological presentation

The learning process that is designed for this subject is based on the following:

The learning process has been proposed to encourage continued student work and participation, and focuses on the theoretical and practical aspects to understand, analyze and apply knowledge to solve real problems. In the lectures the theoretical bases that form the subject will develop, solving some model problems. The practices are effective complement to the lectures, allowing verify compression of matter and in turn help the student to acquire a more applied

point of view and solve more complex and complete problems with the help of appropriate resources. Finally, tutored work will complement the above.

5.2.Learning activities

The program offered to help you achieve the expected results includes the following activities ...
Lectures (30 contact hours, 2 h/week). It taught the theory of the proposed topics and model problems will be solved.
Problem-solving classes and cases (15 contact hours 1 h/week). In these classes, students solve problems supervised by the teacher. Problems or cases will be related to the theoretical part explained in lectures.
Practice (15 contact hours). 5 sessions of 3 hours duration each will be made. The student applies the contents studied in lectures and problem classes. They will be made individually or in groups of 2 students and will be supervised by teachers. The evaluation of the practices will be continuous reporting the student's level of achievement of program objectives.
Tutored work (15 h non-contact). 1 or 2 activities will be proposed during the course, which will be held individually and be supervised by teachers. They consist of the development, expansion, documentation, resolution, ..., proposed by the teacher, based on the concepts seen in the classroom cases. The report will be evaluated.
Personal study (70 h non-contact). Students perform individual study continuously throughout the semester is recommended.
Evaluation tests (5 h). A final exam will be conducted to evaluate the theoretical and practical knowledge gained by the student.

5.3.Program

The program planned for the course is as follows:

* Physical fundamentals. Modeling and simulation of energy systems.
* Exergy analysis. Diagnosis of the operation of equipment and plants.
* Economic fundamentals. Principles and criteria for economic evaluation.
* Mathematical programming. Optimality conditions and their economic significance. Techniques and optimization programs. Optimal design of equipment and plants.
* Synthesis process. Polygeneration systems.
* Energy integration. Heat exchange networks. Cogeneration and optimum heat recovery. Heat pumps and refrigerating machines. Thermal energy storage (heat and cold). Use of renewable energy.
* Introduction to Thermoeconomics. Thermoeconomic and life cycle analysis of energy systems.

5.4.Planning and scheduling

Schedule sessions and presentation of works

Professor inform its hours of tutoring.

Lectures and solving problems classes are held according to schedule established by the EINA.

The practical sessions in the laboratory will be planned depending on the number of students and will be previously announced. In principle 5 sessions focused on solving practical cases will be developed:

* Modeling and simulation with Engineering Equation Solver (EES)
* Refrigeration cycles: selection of refrigerant an comparison of cycles

66226 - Energy Optimization

* Performance analysis of a gas turbine combined cycle
* Process optimization with linear and nonlinear programming
* Optimization and synthesis of processes with mixed integer programming

The report of practices must be delivered the following day practice, except the last one before Christmas.

The students perform practical work at the end of the course by applying the acquired knowledge and having teacher mentoring. Three examples of practical work are:

* Exergy analysis of a cogeneration system
* Optimum design of a network of heat exchangers
* Optimal operation of a plant for energy services

5.5.Bibliography and recomended resources

BB	Biegler, L.T.. Systematic methods of chemical process design / L.T. Biegler, I. E. Grossmann, and A.W. Westerberg Upper Saddle River : Prentice Hall, cop. 1997
BB	Knopf, F.C. Modeling, analysis and optimization of process and energy systems / Knopf, FC Wiley, 2012
BB	Kotas, T.J.. The exergy method of thermal plant analysis / T.J. Kotas . - 1st ed. London [etc.] : Butterworths, 1985
BB	Putman, Richard E.. Industrial energy systems : analysis, optimization and control / Richard E. Putman New York : American Society of Mechanical Engineers, cop. 2004
BC	Analysis, synthesis, and design of chemical processes / Richard Turton ... [et al.] . - 2nd ed., repr. with revisions Upper Saddle River, New Jersey : Prentice Hall, 2003
BC	Diwekar, Urmila M.. Introduction to applied optimization / Urmila M. Diwekar Norwell, Mass : Kluwer Academic Publishers, cop. 2003
BC	Edgar, Thomas F.. Optimization of chemical processes / Thomas F. Edgar, David M. Himmelblau, Leon S. Lasdon . - 2nd ed. Boston [etc.] : McGraw-Hill, 2001
BC	Floudas, Christodoulos A.. Nonlinear and mixed-integer optimization : fundamentals and applications / Christodoulos A. Floudas New York [etc.] : Oxford University Press, 1995
BC	Product and process design principles : synthesis, analysis, and evaluation / Warren D. Seider ... [et al.] . - 3rd ed. Hoboken [New Jersey] : John Wiley and Sons, cop. 2010

66226 - Energy Optimization

BC	Sieniutycz, Stanislaw. Energy optimization in process systems [recurso electrónico] / Stanislaw Sieniutycz, Jacek Jeżowski . - 1st ed. 1st ed.
BC	Smith, R.. Chemical process design and integration / Robin Smith Chichester [etc.] : John Wiley & Sons, cop. 2005
BC	Stoecker, Wilbert F.. Design of thermal systems / W.F. Stoecker . - 3rd. ed. New York : McGraw-Hill, cop. 1989