29913 - Technical Thermodynamics and Heat Transfer Basics

Información del Plan Docente

Academic Year	2016/17
Academic center	110 - Escuela de Ingeniería y Arquitectura
Degree	435 - Bachelor's Degree in Chemical Engineering
ECTS	6.0
Course	2
Period	First semester
Subject Type	Compulsory
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 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 point of view more applied and solve more complex with the help of appropriate resources. Finally, tutored work will complement the above.

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5.2.Learning activities

The learning process is based on the following:

1.- Lectures to the entire group, in which the teacher will explain the basic principles of the subject and resolve some representative problems of implementing the content of the future realistic cases. The participation of students in this activity will be sought. In parallel, the student must perform homework for better utilization of classes.

2.- Computer simulation and laboratory practices are distributed throughout the semester and whose assessment will form part of the final grade for the course. groups of two or three students, thereby learning and group work is encouraged be formed.

3.- Tutored work in small groups (ideally couples): Using a software tool students analyze and solve a problem of the subject. independent learning and group work is enhanced.

4.- Exercise approach, issues and additional problems solved in class: This self-employment is encouraged to study the matter and applying it to the resolution of the exercises. This led, but autonomous execution, activity is essential in the process of student learning and overcoming evaluation activities.

5.- Academic tutoring: The teacher will provide the student certain procedures for approach and resolving doubts. the use of these tutorials is recommended to ensure adequate progress in learning.

5.3.Program

Course syllabus

Item 1: Introduction to Technical Thermodynamics. Introduction and Definitions. Systems and processes.
Item 2: Empirical behavior of matter. Isobaric heating of a liquid. Phase change. T-v diagrams, P-v, P-T phase mixtures. Subcooled liquid. incompressible substance. Real gases. Calculating thermophysical properties.
Item 3: First Principle. mathematical formulations. Material and energy balances for open systems. Application equipment industrial interest.
Item 4: Second Principle. Introduction. reversible and irreversible processes. Carnot cycle. Definition and calculation of entropy. T-s diagrams and h-s. Entropy balance in open systems. isentropic processes. isentropic efficiency of equipment. Heat and work for polytropic processes.
Item 5: Gas turbine cycles. Carnot cycles and Joule-Brayton. Processes and flowcharts. Energy balances. Returns. Gas turbine in open circuit: processes, balances, income .Examples.
Item 6: Steam Cycles. Introduction. Average thermodynamic temperature. Steam cycles: Carnot, Rankine Normal. superheated steam. Reheat intermediate .Irreversibilidades and losses. regenerative cycle. Real cycle.
Item 7: Refrigeration cycles. Applications. thermophysical properties of refrigerants. Vapor compression cycles. P-h diagram. Heat pump. Irreversibility. Real refrigeration cycle. Gas compression cycle.
Item 8: Introduction to heat transfer. Conduction: Equation of conductive heat transfer. Thermal properties of matter.

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Initial and boundary conditions. stationary one-dimensional conduction. Multidimensional stationary conduction.
Item 9: Convection: Introduction. Mass transfer equations, momentum and energy. Dimensional analysis and experimental correlations. forced convection. natural convection
Item 10: Heat Exchangers: Types and general description. Exchangers a current one. Exchangers two streams. overall coefficient of heat transfer. Method e - NUT.
Item 11: Radiation: Fundamentals. Radiation intensity. black body. Stefan-Boltmann. Properties of real bodies. KCL. gray body. environmental radiation.

Practices may cover any of the following contents:

Calculating properties of substances
Modeling power cycle steam turbine
Modeling power cycle gas turbine
Modeling refrigeration cycles
Modeling cycles
Energy balance in an electromagnetic brake
Experimental characterization of operation of a refrigeration cycle
Experimental characterization of operating an evaporative cooler
Modeling heat exchangers
Dimensioning optimal insulation
Experimental characterization of heat transfer in a tube bank

5.4.Planning and scheduling

Lectures and solving problems classes are held according to schedule established by the EINA. The practical sessions in the laboratory are given in the schedule and the groups are set depending on the number of students and will be announced at time. The tutored projects are proposed along the course as the issues involved are. In addition, each teacher will report its hours of tutoring.

5.5.Bibliography and recomended resources

Resources and References

Resources

Communication between the student and the teacher will be managed through the platform of Digital Teaching Ring (ADD) of the University of Zaragoza. Here the teacher can distribute course materials (notes, questions, problems, exams, tables, etc.), make announcements and notifications to students, send and receive emails and make available to students the tools for realization in sending reports of learning activities.

References

BB	engel, Yunus A.. Termodinámica / Yunus A. Çengel, Michael A. Boles ; revisión técnica, Abraham Laurencio Martínez Bautista ... [et al.] . 8ª ed. Mexico [etc.] : McGraw-Hill Interamericana, D.L. 2015

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BB	engel, Yunus A.. Transferencia de calor y masa : un enfoque práctico / Yunus A. Çengel ; revisor técnico Sofía Faddeva . - 3ª ed. México D. F. : McGraw-Hill Interamericana, cop. 2007
BC	engel, Yunus A.. Fundamentals of thermal-fluid sciences / Yunus A. Çengel, Robert H. Turner . Boston, Massachusetts [etc.] : McGraw-Hill, cop. 2001
BC	Incropera, Frank P.. Fundamentos de transferencia de calor / Frank P. Incropera, David P. DeWitt . 4a ed. México : Prentice Hall, 1999
BC	Moran, Michael J.. Fundamentos de termodinámica técnica / Michael J. Moran, Howard N. Shapiro . - 2ª ed. en español, reimp. Barcelona [etc.] : Reverté, D. L. 2012

LISTADO DE URLs:

Libro recomendado
[http://www.mheducation.es/9786071512819-spain-termodinamica]