30012 - Technical Thermodynamics and Heat Transfer Basics

Información del Plan Docente

Academic Year	2017/18
Faculty / School	110 - Escuela de Ingeniería y Arquitectura
Degree	436 - Bachelor's Degree in Industrial Engineering Technology
ECTS	6.0
Year	2
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

1.2.Recommendations to take this course

1.3.Context and importance of this course in the degree

1.4.Activities and key dates

2.Learning goals

2.1.Learning goals

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

3.2.Competences

4.Assessment (1st and 2nd call)

4.1.Assessment tasks (description of tasks, marking system and assessment criteria)

5.Methodology, learning tasks, syllabus and resources

5.1.Methodological overview

The course Engineering Thermodynamics and Fundamentals of Heat Transfer pertains to the group of compulsory subjects of the Industrial Branch. It is a course of 6 credits of the second year (3 rd semester) of the Degree in Industrial Technology Engineering. The main objective of this course is to equip to the students with the knowledge and the required skills to analyze and improve thermal devices and installations applying the engineering thermodynamics and the fundamentals of heat transfer studied in this course. These skills will be expanded in the course Thermal Engineering (4 th semester, Second year). Both subjects will provide the required foundations on engineering thermodynamics, heat

transfer and thermal engineering to study the elective group of Energy that will be studied in the last year (4 th year).

5.2.Learning tasks

5.3.Syllabus

Chapter 1: Introduction to Engineering Thermodynamics. Introductory concepts. Definitions. System and processes.

Chapter 2: Empirical behaviour of matter and calculation of thermodynamic properties. Phase change. Diagrams T-v, P-v, P-T. Superheated steam. Two phase mistures. Subcooled liquid. Real gas. Ideal gas.

Chapter 3: First Law of Thermodynamics. Mathematical formulations. Mass and energy balances for closed and open systems (control volume). Application to industrial processes and equipment. Transient analysis.

Chapter 4: Second Law of Thermodynamics. Reversible and irreversible processes. Formulations of Second Law of Thermodynamics. Carnot Cycle. Entopy: definition and calculation. T-s and h-s diagrams. Entropy balancea. Isentropic processes. Isentropic efficiency. Heat transfer and work in cuasiestatic (isentropic) processes.

Chapter 5: Gas power cycles. Otto, Diesel and Dual cycles. Joule-Brayton cycle. Air standard analysis. Effect of pressure ratio and irreversibilities on energy efficiency. Regenerative gas turbine. Regenerative gas turbine with reheat and intercooling.

Chapter 6: Steam power cycles. Ideal Rankine cycle.Effect of the boiler and condenser pressures on the energy efficiency. Comparisson with Carnot cycle. Irreversibilities and losses. Superheating and reheating. Regenerative cycles.

Chapter 7: Refrigeration cycles. Applications. Thermophysical properties of refrigerants. Vapor compression refrgeration cycle. Cascade and multi-stage refrigeration cycles. Heat pump. Irreversibilities. Gas refrigeration cycle.

Chapter 8: Psychrometrics and psychrometric processes. Psychrometric principles. Mass and energy conservation in psychrometric processes. Psychrometric diagram. Psychrometric processes.

Chapter 9: Fundamentals of Heat Transfer. Relationship of heat transfer with engineering thermodynamics. Relevance of heat transfer. Physical origins and rate equations: conduction, convection radiation.

Laboratory and computer activities (tentaive program that could be modified)

1. Thermodynamic properties of P-V-T substances
2. Energy balances to different pieces of equipment
3. Gas or Steam power cycle
4. Refrigeration cycle
5. Psychrometric processes

5.4.Course planning and calendar

5.5.Bibliography and recommended resources

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