

DIM-GITI-213 Thermodynamics

SEMESTER: Fall
CREDITS: 7.5 ECTS (5 hrs. per week)
LANGUAGE: Spanish
DEGREES: GITI

Course overview

This course gives to the student the tools to analyze any energy system, allowing him to deep on energy topics on forthcoming courses. After explaining the thermophysical properties determination the energy, entropy and exergy balances are presented, focusing on the control volumes formulation. Typical applications are also covered: power cycles (Rankine and Brayton for power stations and Otto and Diesel for internal reciprocating combustion engines), reciprocating compressors and psychrometry.

Prerequisites

Basic knowledges about mechanics are recommended.

Course contents

1. Methodology. Thermodynamic systems. Energy. Equilibrium. Properties. Processes. State functions and variables.
2. Properties. Pure substances. Approximations for liquids. Models: incompressible fluids and ideal gases.
3. First Law. Heat and work. Energy balance in closed systems. Mass balance. Energy balance in control volumes. Industrial devices.
4. Second Law. Carnot machines and engines. Second Law formulations. Carnot Theorems. Entropy balance in closed and control volumes. Isentropic efficiencies. Exergy analysis. Exergy efficiency.
5. Power cycles in power stations. Basic Rankine cycle. Efficiency enhancement procedures. Introduction to actual steam power plants: coal and nuclear. Basic Brayton cycle. Combined cycle.
6. Reciprocating machines. Reciprocating internal combustion engines: Charge renovation processes, spark and compressed ignition engines, performance parameters, thermodynamic cycles. Reciprocating compressors: components, thermodynamic model, multi-stage compression. Indicated diagram in reciprocating machines.

7. Gas mixtures and psychrometry. State equation, energy and entropy balance in a gas mixture. Air-water mixtures: composition description, energy balance and basic psychrometric processes.

Textbook

- Teaching resources (slides, texts, tables and diagrams, videos, solved problems, solved former exams) on Moodle.
- Y.A. Çengel, M.A. Boles. Termodinámica. McGraw-Hill, 2011

Grading

The overall grade is obtained as follows:

- Mid-term exam 20%.
- Two short exams 10%.
- Final exam 70%.