

## DIM-SAP-336 Engineering Thermodynamics

**SEMESTER:** Fall / Spring  
**CREDITS:** 6 ECTS (4 hrs. per week)  
**LANGUAGE:** English  
**DEGREES:** SAPIENS program

### Course overview

Engineering Thermodynamics is concerned with energy transformation and utilization. The key of the subject is the analysis of any energy process, determining the variation of the thermophysical properties of the fluids involved and applying energy and entropy balances. Special attention is paid to heat to mechanical/electric power conversion. Real-life examples and general overview of devices designed following Thermodynamic principles (power cycles, combustion engines, compressors, cooling systems, etc.) are shown. Understanding psychrometry is another goal, as the basis to air conditioning and climate control systems.

### Prerequisites

Having passed a first year of Bachelor degree in Engineering

### Course contents

1. Introduction: Basic definitions, Systems, Properties, Specific volume, Pressure, Temperature.
2. Properties of a pure substance: Thermodynamic state, P-v-T surface, Tables of properties, Incompressible substance, Liquids approximation, Ideal gas: equation of state and compressibility factor.
3. The First Law of Thermodynamics: Energy, Energy transfer by work, Energy transfer by heat, Energy balance for closed systems, Energy balance for cycles.
4. The Second Law of Thermodynamics: Heat engines, Refrigerators and Heat pumps, Energy conversion efficiencies, Second Law formulations, Reversible and irreversible processes, The Carnot cycle, Carnot principles.
5. Entropy: Definition, Entropy balance in closed systems, Entropy balance in control volumes, Determination of entropy: pure substances and models, Isentropic efficiencies.
6. Availability: Exergy, Exergy balance for closed systems, Exergy balance for control volumes, Exergy efficiency.
7. Vapor and gas power systems: The Rankine cycle, Improving performance: superheat, reheat, supercritical, regenerative cycles, Internal Combustion

Engines (Otto, Diesel, Dual cycles), Gas turbine power plants, Brayton cycle, Combined-cycle power plants.

8. Refrigeration and heat pump systems: Vapor refrigeration systems, Absorption refrigeration, Heat pump systems.
9. Ideal gas mixtures and psychrometry: Composition and properties of an ideal gas mixture, First and Second Law to ideal gas mixtures, Psychrometric properties, Psychrometric processes.

## Textbook

- M.J. Moran, H.N. Shapiro, et al., Fundamentals of Engineering Thermodynamics, 8th Edition, John Wiley and Sons, 2014

## Grading

The grade will be determined by two midterms (25% each), homework (10%), and a final examination (40%). The exams are all closed notebook and closed textbook. The course will not be graded on a curve, i.e., there is no bound on the numbers of As, Bs, Cs, etc.

A minimum overall grade of at least 5 over 10 must be accomplished to pass the course.

In case of failing, a retake exam will be offered. In this case, the final grade will be determined by the homework (10%), the midterm's average (20%) and the retake exam grade (70%).