

Energy management applied to processes and utilities

1. **Course number and name:** 020GEACS5 Energy management applied to processes and utilities
2. **Credits, contact hours:** 2 ECTS credits, 1x1:15 contact hours
3. **Name of instructor:** Khattar Assaf
4. **Instructional Materials:**
 - Handbook of Energy Engineering, Thumann and Mehta, 7th Ed, 2013.

5. Specific course information

a. Catalog description:

Global energy balances, energy balances on an industrial site, different uses of energy, general presentation of typical utilities and processes, energy efficiency, energy saving potentials; Review of the laws of heat transfer, design method of heat exchangers (thermal calculations and calculations of pressure drops), air coolers and condensers technology; Production of cold in industry, components, (theoretical cycle and real cycle, COP and Carnot efficiency); Industrial combustion, technologies and operation of steam boilers (calculation of energy efficiency, economical production of steam, recovery from smoke, air heater, economizer); Recovery of waste heat (recovery by heat pump, by local production of electricity via an ORC), technical and economic aspect (case study).

b. Prerequisites: 020GTHCS3 Thermal engineering

c. Required/ Selected Elective/Open Elective: Required

6. Educational objectives for the course

a. Specific outcomes of instruction:

- Understand the uses of energy in industrial processes
- Identify sources of energy savings
- Design of complex heat exchangers
- Size utilities for a given duty
- Determine an energy balance of the processes
- Optimize energy management by heat recovery

b. PIs addressed by the course:

PI	1.1	1.2	1.3
Covered	x	x	x
Assessed	x	x	x

7. Brief list of topics to be covered

- Introduction, general information on energy
- Energy efficiency in industry, uses and potentials

- Global heat exchange laws, shell and tube exchangers
- Cross-flow heat exchangers, air coolers and applications
- Condenser technologies and applications
- Pressure drops and sizing of pumps/fans
- Cold production technology in industry
- Study of industrial combustion and applications
- Steam production: boiler technology and efficiency
- Optimization of boilers by economizer and air heater
- Concept of waste heat and techniques for its recovery
- Technical and economic aspect: case study of a recuperator
- Heat pump and local electricity production