

Energy Field		Thermo fluids 1	Total of teaching hours : 92 hrs		
EN I3.5	3 ECTS credits		Course	Supervised work	Lab work
			36 hrs		24 hrs
			4 hrs evaluation + 24 hrs individual work		

Objectives

- In fluid mechanics : Understanding the general concepts
- In thermal machinery :
 - Knowledge of basics of thermal machines : principles, cycles, diagrams.
 - Learn how to establish the energy assessment (efficiency, effectiveness, performance) of thermal machines.

(taxonomic level : application and analysis)

Prerequisites and links to other modules

Fluid mechanics

- Knowledge of operators and the basics of the vector analysis - MM 1.1.2
- Control of double and triple integrals, partial differential equations, calculus, matrix operations, definition of the units.
- MM 1.1.1, M 1.2.1, and M 2.3.2

Thermal machines

- Thermodynamics of fluids in permanent discharge regime - PC 2.4.1
- The student must understand how to apply the 1st and the 2nd principle to simple elements (compressor, turbine, pressure reducer) - PC 1.2.1

Thermal machines	<ul style="list-style-type: none"> ◦ Internal combustion engines (fuels and combustion, theoretical and real cycles, overheating). Deformation study (tensor of deformations, Mohr's circles, flat deformation condition) ◦ Gas turbines (Field of application, the improvements to the actual gas turbine) ◦ Steam turbines (Assessment and theoretical cycles, complex cycles)
Fluid mechanics 1	<ul style="list-style-type: none"> ◦ Chap1 : Fluid statics ◦ Chap 2 : Macroscopic assessment, calculation of efforts (Euler's overall theorem) ◦ Chap 3 : Dynamics of non-viscous fluids Bernoulli's theorem ◦ Chap 4 : Dynamics of viscous fluids, load losses by friction, singular load losses ◦ Chap 5 : Calculation of hydraulic networks.

Educational approaches and assessment methods

Lectures with supervised work.

Lab works mechanics of "discovery" fluids : the aim of this session scheduled before the courses in fluid mechanics is to find out about the instrumentation and the vocabulary used in fluid mechanics

One Lab work session covers the dimensioning of the hydraulic networks, researching the economic diameter.

Lab work thermal machines : Assembly and removal of internal combustion engines, measures on test bench.

Bibliography

Fluid mechanics

Course Handouts

R. Comolet. Mécanique expérimentale des fluides. Statique et dynamique des fluides non visqueux. T. 1. Ed. Masson

F. M. White. Fluid Mechanics. McGraw-Hill international editions.

Douglas, Gasiorek & Swaffield. Fluid mechanics. Ed. Longman Scientific & Technical

R.W. Fox. Introduction to Fluid Mechanics. Wiley & Sons Ed

Thermal Machines

Course Handouts

P. Arques. Théories générales des machines. Ed. Masson, 1989

Techniques de l'Ingénieur

R. Gicquel. Systèmes Energétiques, tomes 1 et 2. Les presses de l'Ecole des Mines de Paris, 2001

F. Meunier. Froid Industriel. Série Froid et Génie climatique. Ed. Dunod