



# Faculté des sciences appliquées

**FSA**

MECA2780 **Turbomachines motrices**

[30h+15h exercices] 4 credits

This course is taught in the 2nd semester

**Teacher(s):** Tony Arts  
**Language:** french  
**Level:** 2nd cycle course

## Aims

Explain the fundamental principles of design and operation of axial and radial turbomachines (turbines)

## Main themes

The main focus of these lectures is directed towards axial steam and gas turbines. The description of radial gas turbines, as well as their operation, is of less importance. A short description of hydraulic machines ends the lectures.

## Content and teaching methods

- Energetical study of the operation of a turbine stage. Flow field in stationary nozzles. Expansion in a converging-diverging nozzle. Flow field in rotating blade rows. Degree of reaction. Operation of action and reaction machines.
- Characteristic coefficients of the operation of a turbine stage. Velocity triangles. Determination of the aerodynamic angles of stationary and rotating blade rows. Various operation principles of a turbine stage. Efficiency of a turbine stage. Typical action and reaction stages. Curtis turbine.
- Flow field in a cascade : various blade design methods. Evaluation of the aerodynamic performance of a blade row.
- Determination of losses by experimental correlations. Secondary flows. Total-to-total efficiency of a turbine stage.
- Radial equilibrium principles in turbines. Equations and general solutions. Description of particular solutions (free vortex, #)
- General design principles of large power steam turbines. Exit stage.
- Industrial exploitation of steam turbines. Analysis of pressure and mass flow regimes. Heat and power production by steam turbines
- General description and manufacturing particularities of axial gas turbines.
- General description of radial turbines. Geometrical particularities. Characteristic coefficients. Loss analysis and efficiency.
- General description of hydraulic turbines. Overall operation characteristics.

## Other information (prerequisite, evaluation (assessment methods), course materials recommended readings, ...)

- Background  
Fundamental background in fluid dynamics (including gas dynamics) and thermodynamics (including the analysis of direct thermal cycles)
- Reference books  
See the french version
- Evaluation  
Oral open book exam, allowing an in depth evaluation of the skills of the student
- Organization  
Three visits to turbomachines companies are organized
- Lecture Notes  
Available from the SICI and CD given by the lecturer

**Other credits in programs**

<b>ELME22/E</b>	Deuxième année du programme conduisant au grade d'ingénieur civil électro-mécanicien (énergie)	(4 credits)	Mandatory
<b>MECA21</b>	Première année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)	
<b>MECA22</b>	Deuxième année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)	
<b>MECA23</b>	Troisième année du programme conduisant au grade d'ingénieur civil mécanicien	(4 credits)	