**BREVE DESCRIZIONE DEL CORSO**

Conventional and advanced propulsion systems for aircraft

**PREREQUISITI**

Sufficiency in flight mechanics and aerospace propulsion. Knowledge of working principles and thermo-fluidodynamic processes of Fluid Machinery and Energy Systems

**OBIETTIVI FORMATIVI**

Overview

The objectives of the course is to present a unified modeling approach for conventional and advanced aircraft powertrains that takes into account the specifications and the performance of their main components (energy converters, energy storage systems, energy transforms) and the flight mechanic of the aircraft.

Learning Outcomes; after the course the student should be able to:

* Describe the working principle of propellers and internal combustion engines;
* Compare performance and fuel consumption of piston, Wankel and turbine engines in flight and at part load;
* Describe and compare conventional and advanced supercharging systems;
* Describe the advantages and disadvantages of more electric aircraft, more electric engines, hybrid electric aircraft;
* Describe the working principle and compare different technologies of electric machines and electric storage systems;

**MODALITA’ D’ESAME**

written, project work

The exam consists of two parts:

the first part is a written test; the student is asked to illustrate one theoretical topic; it is aimed to verify to what extent the student has gained knowledge and understanding of the selected topic of the course and is able to communicate about his/her understanding;

the second part: a project works regarding the simulation and/or optimization of an advanced powertrain; it is aimed to determine to what extent the student has problem solving abilities and
Conventional and advanced propulsion systems for aircraft:
- Turboprop and piston-prop systems. Propeller theory and modeling. More Electric Aircraft. Hybrid electric aircraft. Electric flight: fuel cell systems versus battery-based powertrains (6 hours);
- Engines for aircraft:
- Electric machines:
  - Classifications, performance maps, simplified models. (6 hours)
- Secondary storage systems:
  - Battery and supercapacitor. Energy and power densities, nominal capacity, life cycles. Simplified models. Other storage systems. (6 hours)
- Energy management strategies:
  - Charge depleting and charge sustaining. Supervisory controllers for series and parallel hybrid electric power systems. (6 hours)
- Modeling and optimization of advanced powetrains
- Backward and forward paradigms. Optimization methods and tools. Evolutionary algorithms for

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**TESTI DI RIFERIMENTO**