Module Description, available in: EN

Advanced aircraft system design

General Information

Number of ECTS Credits

3

Module code

TN2

Valid for academic year

2020-21 DRAFT

Last modification

2019-08-31

Responsible of module

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Explanations regarding the language definitions for each location:

- Instruction is given in the language defined below for each location/each time the module is held.
- Documentation is available in the languages defined below. Where documents are in several languages, the percentage distribution is shown (100% = all the documentation).
- The examination is available 100% in the languages shown for each location/each time it is held.

	Winterthur			
Instruction	**X** E 100%			
Documentation	**X** E 100%			
Examination	**X** E 100%			

Module Category

TSM Technical scientific module

Lessons

2 lecture periods and 1 tutorial period per week

Entry level competences

Prerequisites, previous knowledge

The students are expected to have knowledge of the basics of Fluid Dynamics / Aerodynamics, Structural Mechanics, Thermodynamics (Gas Turbines), and Systems Engineering.

An interest in Aircraft Systems is important.

The knowledge of simulation tools (Matlab, Simulink, Modelica, Comsol, etc.) and performance calculations or optimization calculations is an advantage.

Brief course description of module objectives and content

The course will focus on the design of advanced aircraft systems, aiming towards more electric types of aircraft for a new generation beyond the Airbus A380 and Boeing 787.

Today, aircraft design is more than just aerodynamics, flight dynamics, propulsion, and structures. The new technologies require a systems engineering approach, which guides the way towards a sustainable aircraft.

The whole design process will be discussed and the students will learn to do a preliminary design concept.

in this module, the whole design process of a complex system such as an aircraft will be discussed and the students will learn how to do a preliminary design concept. The course is structured in lectures as well as a conceptual aircraft design case study, which will be done in groups.

Aims, content, methods

Learning objectives and acquired competencies

The students will learn how the design process of a complex system such as an aircraft is done, with a focus on the early stages between concept and the preliminary design stage.

All important disciplines, which play a key role in aircraft design, will be addressed: weight, performance, reliability, operation and maintenance costs.

The students will be able to understand the architecture of modern aircraft, focussing on the advancing system integration with the trend towards electric and more environmentally sustainable aircraft.

The students can apply the current design standards and analyze the design of new aircraft for the efficiency and performance of the operation.

Learning experience working in a design team to define an aircraft concept.

Contents of module with emphasis on teaching content

The course will start with an introduction to aircraft conceptual design.

The aerodynamics for wing design, propulsion technology, and engine integration and the electrical, hydraulic and pneumatic systems will be discussed to provide an aircraft architecture from the system point of view.

The available methods of aircraft design optimization will be discussed in the light of perfect design or an illusion of the existence of such.

The concept of increasingly electrical aircraft will be introduced and the concept of hybrid propulsion with new aircraft layouts will be discussed.

The course will close with the outlook to new aircraft generations to meet the reduction of CO2 and noise footprint.

Teaching and learning methods

- Lectures with focus on practical cases for commercial airplanes
- Self study and perfomance of literature research
- Performace of a case study for an aircraft design working together with teams which cover different design aspects
- Final presentation of aircraft design as team effort

Literature

- Aircraft Design: A Conceptual Approach, Daniel P. Raymer, AIAA Education Series
- Aircraft Design, A Systems Engineering Approach, Mohammad H. Sadraey, Wiley Aerospace Series
- Fundamental of Aerodynamics, John D. Anderson Jr., McGraw-Hill Series in Aeronautical and Aerospace Engineering
- Airframe Structural Design, Practical Design Information and Data on Aircraft Structures, Michael C. Y. Niu, Hong Kong Conmilit Pres Ltd.

Assessment

Certification requirements

Module does not use certification requirements

Basic principle for exams

As a rule, all the standard final exams for modules and also all repetition exams are to be in written form

Standard final exam for a module and written repetition exam

Kind of exam

written

Duration of exam

120 minutes

Permissible aids

Aids permitted as specified below:

Permissible electronic aids

- Closed book
- Written summary of 4 pages (A4 size, hand written, single sided)
- No programable calculator

Other permissible aids

none

Special case: Repetition exam as oral exam

Kind of exam

oral

Duration of exam

30 minutes

Permissible aids

No aids permitted