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**Academic Year: ( 2023 / 2024 )****Review date: 29-10-2022**

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**Department assigned to the subject: Aerospace Engineering Department****Coordinating teacher: CAVALLARO , RAUNO****Type: Compulsory ECTS Credits : 6.0****Year : 1 Semester : 2**

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## REQUIREMENTS (SUBJECTS THAT ARE ASSUMED TO BE KNOWN)

Students are expected to have some knowledge of theory of elasticity, aerospace structures and aircraft design.

## OBJECTIVES

Good knowledge of advanced structural analysis, with emphasis on finite element modeling

Good knowledge of aircraft certification process, and in particular the airframe certification test program

## DESCRIPTION OF CONTENTS: PROGRAMME

The course is divided in two different parts: Finite element theory and aircraft certification processes.

### 1. Finite elements

- Introduction to FEA. Review of elasticity.
- The finite element analysis process
- The finite element formulation
- Types of elements and properties
- Numerical integration
- Properties of the solution. Error estimation.
- Modeling for dynamic analysis and vibrations

### 2. Aircraft certification processes

#### 2.1. General Overview

#### 2.2. Airworthiness Authorities and their Regulations: ICAO, Europe, USA, Spain, Military AA

#### 2.3. EASA Part 21

#### 2.4. Certification Specifications.

#### 2.5. Type Certification

- Type Certificate
- Changes to Type Certificate
- Supplemental Type Certificate
- Certification Process
- Qualification vs Certification

#### 2.6. Continuous Airworthiness.

- Modification of In service Aircrafts
- Part M
- Part 145

#### 2.7. Airframe certification.

- Airframe Certification Plan
- Certification Test Program

#### 2.8. Certification Documentation.

## LEARNING ACTIVITIES AND METHODOLOGY

Theory sessions.  
Problem sessions working individually and in groups.  
Lab-sessions with mathematical software.

#### ASSESSMENT SYSTEM

<b>% end-of-term-examination:</b>	60
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	40

End-of-term exam (60%)  
Homeworks, projects with oral presentation, etc (40%)

The two blocks are weighted a 50% of the final grade. The following requirements have to be met in order to pass the subject:

- 1) to have a MINIMUM mark of 4.0/10 in the end-of-term exam (having a minimum of 2.5 in each part);
- 2) to have a minimum overall mark of 5.0/10 (weighing 60% the end-of-term exam mark and 40% the mark of the continuous evaluation).

#### BASIC BIBLIOGRAPHY

- Filippo De Florio Airworthiness. An introduction to Aircraft Certification. , BH, 2006
- K.J. Bathe Finite Element Procedures , Klaus-Jurgen Bathe, 2007
- Logan, D. L. A first course in the finite element method., Cengage Learning., 2011

#### ADDITIONAL BIBLIOGRAPHY

- Cook, RD; Malkus, DS; Plesha, ME; Witt, RJ. Concepts and Applications of Finite Element Analysis, John Wiley & Sons, 2002
- Megson, T.H.G Aircraft Structures for Engineering Students, Elsevier, 2013

#### BASIC ELECTRONIC RESOURCES

- EASA . CS: <https://www.easa.europa.eu/document-library/certification-specifications>