UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2019/2020		
BACHELOR'S DEGREE (BSC)	MECHANICAL ENGINEERING		
INTEGRATED COURSE	AEROSPACE CONSTRUCTION AND AEROSPACE CONSTRUCTION LAB - INTEGRATED COURSE		
CODE	20570		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ING-IND/04		
HEAD PROFESSOR(S)	MILAZZO ALBERTO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	BENEDETTI IVANO MILAZZO ALBERTO	Professore Ordinario Professore Ordinario	Univ. di PALERMO Univ. di PALERMO
CREDITS	9		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	3		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**BENEDETTI IVANO** Monday 14:30 16:30 Ufficio Docente Tuesday 14:30 16:30 Ufficio Docente **MILAZZO ALBERTO** Tuesday 12:00 14:00 Ufficio del docente Thursday 12:00 14:00 Ufficio del docente		

DOCENTE: Prof. ALBERTO MILAZZO

PREREQUISITES	Fundamentals of Mathematics, Physics and Strength of Materials.
LEARNING OUTCOMES	Knowledge and ability to understand: In this course, the student will acquire knowledge to face a preliminary design of the airframe structures. He/she will be able to check static robustness and perform analyses for stiffness requirements. Ability to apply knowledge and understanding: The student will acquire knowledge and methodologies to analyze and solve typical problems of airframe preliminary design and stress analysis, also using commercial finite elements codes (PATRAN/NASTRAN). He/she will be able to model the main structures of the airframe and make design choices. Making judgments: The student will acquire a methodology of analysis through which he/she will be able to cope with simple structural problems and make appropriate design decisions. Communicative skills: Ability to communicate by means of technical reports the results of the analyses and chosen solutions. Learning ability: The student will learn the basic principles governing the behaviour of thin-walled structures in airframes. These principles enable the possible study of higher level topics gained through the ability to access to and understanding of specialized publications.
ASSESSMENT METHODS	Oral exam with presentation of technical reports on the exercises. The examination is aimed at the verification of adequate knowledge of the methodological and operational aspects taught during the course. The exam consists of an oral test comprising three or four questions to the candidate, developed through a discussion and takes about therty minutes. The candidate must submit for consideration the written reports of the exercises carried out during the course and a technical report on a FEM modelling problem analogous to those developed during the class. As a rule, one of the exam questions deal with the deep discussion of the topics developed in the exercises; a second questionrelate to the FEM modelling technical report. The marks are out of 30. Sufficiency is achieved if the student demonstrates knowledge and basic understanding of the topics and and he/she is able to present them with appropriate disciplinary lexicon. The assessment, to the honors with distinction, is modulated in relation to the capacity of the student to demonstrate: • confidence and mastery of the subject • ability to make connections between topics and other disciplines • articulation of the subject presentation • mastery of technical language In particular, the final evaluation will be graded as follows: a) excellent: 30 - 30 cum laude. Excellent knowledge of the topics, excellent language properties, the student is able to apply the knowledge to solve proposed problems with characteristics of originality with respect to the classroom exercises; b) very good: 26 –29. Good knowledge of the topics, full ownership of language, the student is able to apply the knowledge to independently solve the proposed problems; c) good: 24 - 25. Basic knowledge of the main topics, fair ownership of language, with limited ability to autonomously apply knowledge to the solution of the proposed problems; d) satisfactory: 21-23. He does not have full mastery of the main topics of the course, but he possesses the knowledge, satisfactory language properties, poor ability to apply the acquired knowledge e) sufficient:18-20: minimum basic knowledge of the main topics of teaching and technical language, poor ability to autonomously apply the knowledge.
TEACHING METHODS	Class lectures, practicals and laboratories.

MODULE
AEROSPACE CONSTRUCTION - MODULE

Prof. ALBERTO MILAZZO

SUGGESTED BIBLIOGRAPHY

- T.H.G. Megson, Aircraft Structures for Engineering Students, Butterworth Heinemann, 2003
- Appunti e Dispense del corso

Per approfondimenti di tipo applicativo

- E.F. Bruhn, Analysis and design of flight vehicle structures, Tristate Offset Company.

AMBIT	10657-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54

EDUCATIONAL OBJECTIVES OF THE MODULE

The course provides the fundamental tools and methodologies fr the static analysis and design of airframes.

SYLLABUS

Hrs	Frontal teaching
4	Aircraft geometry
6	Aircraft loads and structural arrangements
2	Flight envelope
1	Airworthness regulations
5	Thin-walled structures under shear/bending
3	Thin-walled structures under torsion
6	Buckling
6	Wing and fuselage analysis and design

Hrs	Practice
6	Practicals on shear and torsion of thin-walled structures
12	Wing and fuselage analysis and design
3	Exercises on buckling

MODULE
AEROSPACE CONSTRUCTION LAB - MODULE

Prof. IVANO BENEDETTI

SUGGESTED BIBLIOGRAPHY	
Documentazione PATRAN/NASTRAN. PATRAN/NASTRAN documentation.	
AMBIT	10657-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	48
COURSE ACTIVITY (Hrs)	27
EDUCATIONAL OBJECTIVES OF THE MODULE	
The objective of the course is to provide the student with the knowledge and capability to use a finite element commercial package (PATRAN/NASTRAN) for the analysis of aerospace structures.	

SYLLABUS

Hrs	Frontal teaching
3	Introduction to the PATRAN/NASTRAN package. Download of PATRAN/NASTRAN student edition. Introduction to the PATRAN/NASTRAN interface.
3	Introduction to FEM . Principle of Virtual Work. Shape functions for one-dimensional problems. Stiffness matrices.

Hrs	Practice
16	One-dimensional modelling of a cantilever beam. Beam elements. Load and constraint definition. Analysis and post-processing. One-dimensional modelling of a frame; definition of material properties and beam sections; offset of elastic properties. Two-dimensional modelling of a wing spar. Shell elements. Two-dimensional element properties. Analysis and results. Mixed 1D/2D modelling of a stiffened panel. Offset of structural elements. Constraints, symmetry and distributed loads. Two-dimensional modelling of a composite plate. Properties of a orthotropic laminated panel. Analysis and post-processing. Mixed 1D/2D modelling of a fuselage section. Modelling of a semi-monocoque wing box.

Hrs	Workshops
15	Analysis of a aircraft complex structure (either a fuselage section or a wing box) under complex shear/bending/torsion loading. Post-processing and writing of a technical report.