UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	AEROSPACE ENGINEERING
SUBJECT	COMPUTATIONAL FLUID DYNAMICS
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	20907-Attività formative affini o integrative
CODE	22905
SCIENTIFIC SECTOR(S)	ING-IND/06
HEAD PROFESSOR(S)	MARRETTA ROSARIO Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MARRETTA ROSARIO** Monday 15:00 17:00 Proprio Ufficio Wednesday 15:00 17:00 Proprio Ufficio

DOCENTE: Prof. ROSARIO MARRETTA

PREREQUISITES	Aerodynamics, Gasdynamics, Computer-aided design
LEARNING OUTCOMES	Knowledge and understanding Acquisition of the concepts of continuum mechanics in aerodynamic fields. General theories of the diffusion of fluidodynic species. Numerical vorticity theory. Theory and design of airfoils and aerodynamic forces. CFD preprocessing: Boolean design of study mock-ups and optimized computational meshes Processing: Turbulence models applied to RANS Post-processing: critical evaluation of fields and fluid dynamics variables obtained from CFD Ability to apply knowledge and understanding Ability to recognize, organize and apply the contents of the discipline to the concepts of aerodynamic foredesign of the main elements a complex and complete aerodynamic body. Making judgements. Be able to evaluate external variables and design specifications to fit the post-design phase of a complex aerodynamic body Communication skills Ability to compare one's cognitive background in the context of both scientific research and aerospace industrial applications as well as in those in which aeronautical issues are widely and fundamentally applied. Learning Skills Ability to criticize and discern the reference literature. Intellectual ability to apply the acquired methodologies typical of fluid dynamics to higher level research and/or application sectors.
ASSESSMENT METHODS	Speeching test about the final CFD design: a) tempus: 30 minutes b) quantum: test of 3-multiple answered questionnaire c) quomodo: minimum score (18/30) when fundamentals are basically learned and exposed but without a deeper integration of math and physics; a light improvement of the above mentioned goal shall be considered for scoring step (21/30); as soon as "light improvement" is considerably "deeper" the scoring step is enhanced (24/30); if and when the previous criterion paves the way to the link with flow and fluid continuum physics, a (relative) considerable improvement in score is obtained (27/30); up to the utmost score (30/30) if the topics are critically analysed and clearly exposed; or 30/30 cum Laude: idem as before but with a deeper insight into theoretical/numerical development and connection with basic disciplines;
EDUCATIONAL OBJECTIVES	The objectives will be to deepen and correlate the mathematical-physical aspects of fluid dynamics in CFD key considering the actions exerted by subsound flows on aerodynamic bodies both in the field of 2D and 3D motion. Basic numerical methods for basic CFD aerodynamic calculation for the main elements of a complete aircraft will be provided. Through preprocessing, processing and numerical postprocessing, the basic and extensive notions for the industrial design of complex aerodynamic bodies and fields will be provided.
TEACHING METHODS	1) Division of students into working groups 2) Assigning a complete fluid dynamics design 3) On desk lessons
SUGGESTED BIBLIOGRAPHY	Manuali e tutorials forniti dalla software house Ansys USA.

SYLLABUS

Hrs	Frontal teaching
3	Turbulence modeling, scale factors, numerical/experimental approach
3	CFD Ansys Fluent solver: features, packages handling, range of applicability
6	Processing: CFD solver set-up, turbulence modeling options, boundary conditions, time-dependent set-up variables
6	Postprocessing: calibration of the CFD solver, analysis of the results in terms of reliability and phenomenological robustness
2	Assignment of the complete fluid dynamics design
2	Collection of numerical/experimental data and drafting of the professional design engineering report

Hrs	Practice
9	Preprocessing: boolean mock-up phase and relative problems

Hrs	Workshops
23	Development of the assigned complete project with CFD analysis in the field of motion and time-variant fluid dynamics variables