AEROSPACE ENGINEERING (LM52)

(Brindisi - Università degli Studi)

Teaching FLUID DYNAMICS (MOD. 1)C.I.

GenCod A005143

Owner professor MICHELE SCARAGGI

Teaching in italian FLUID DYNAMICS (MOD. 1) C.I.

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SSD code ING-IND/06

Reference course AEROSPACE ENGINEERING

Course type Laurea Magistrale

Credits 6.0

Teaching hours Front activity hours: 54.0

For enrolled in 2019/2020

Taught in 2019/2020

Course year 1

Language ENGLISH

Curriculum DESIGN

Location Brindisi

Semester First Semester

Exam type Oral

Assessment

Course timetable https://easyroom.unisalento.it/Orario

BRIEF COURSE DESCRIPTION

The course provides the fundamental understanding of the motion of a fluid. The conservation equations that describe the dynamics of a fluid are analyzed in the case of inviscid and viscous flows. During this process, a description of the main fluid properties is provided as well as the continuum assumption and the definition of Eulerian and Lagrangian frames of reference. The derived equations are used in order to describe the motion of fluid in canonical configurations such as the Poiseuille flow (flow between flat plates), the Couette flow (flow between flat plates in relative motion), and the Hagen-Poiseuille flow (flow inside a pipe). The forces exchanged between the fluid and an immersed body are analyzed by means of the potential flow theory and boundary layer theory. During this course, the Buckingham \pi theorem will be applied to canonical flows in order to derive a dimensionless description of the dynamics of the fluid. An outline about the main phenomena involving turbulence will also be provided.

REQUIREMENTS

Knowledge of calculus (derivatives and integrals), algebra (basic vector and tensor operations), dynamics of a rigid body and thermodynamics

COURSE AIMS

Targeted fluid dynamics fundamentals:

- main properties of a fluid, continuum vs particle description;
- the basic equations that describe the static, kinematics and dynamics of a fluid;
- the principal physical phenomena involved in the motion of a fluid;
- the main interactions between a fluid and an immersed body.

TEACHING METHODOLOGY

Every topic will be discussed and all the models derived on the blackboard.

ASSESSMENT TYPE

3h written exam

FULL SYLLABUS	Hours Topic
	0.5 Introduction, content overview 3.5 General overview on fluids: properties and relevant lenght/time scales 5 Statics of fluids 3 Kinematics of fluids 8 Dynamics of fluids and conservation 4 Bernoulli model 3 Dynamics of vorticity 4 Exact solutions of Navier-Stokes equation 5 Potential flows 4 Boudary layer 4 Turbulence 6 Dimensional analysis and Buckingham theorem 4 Overview of numerical approaches. Overview of FEniCS

REFERENCE TEXT BOOKS	Any fluid dynamics textbook, such as Irving H. Shames, Mechanics of Fluids; Tannehill, Computational fluid mechanics and heat transfer; Introduction to FEniCS.