AEROSPACE ENGINEERING (LM52)

(Brindisi - Università degli Studi)

Teaching GAS DYNAMICS

GenCod A008253

Owner professor DONATELLA PASSIATORE

Teaching in italian GAS DYNAMICS

Teaching GAS DYNAMICS

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 2024/2025

Taught in 2024/2025

Course year 1

Language ENGLISH

Curriculum SPACE TECHNOLOGY

Location Brindisi

Semester First Semester

Exam type Oral

Assessment Final grade

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

BRIEF COURSE DESCRIPTION

- Recap of basic knowledge: conservation equation for a fluid, fluid properties and defiinition of compressibility and speed of sound (5 hours)
- Steady quasi-one-dimensional flow: general properties of quasi flows, total and critical quantities, area-velocity relation, mass flux, normal shock waves and Rankine–Hugoniot relations, convergent nozzles, convergent-divergent nozzles (11 hours, including exercise session)
- Steady non-isentropic one-dimensional flows: adiabatic flow with friction, flow with friction and heat exchange, Rayleigh's flow (5 hours, including exercise session)
- Two-dimensional gas dynamics: oblique shocks, Prandtl-Meyer expansions, shock polars, interactions between different waves, bow shocks, isentropic compressions and expansions, flow past a convergent-divergent nozzle, shock-expansion theory, thin-airfoil theory (15 hours, including exercise session)
- Unsteady one dimensional flows: unsteady normal shock waves, small perturbations, finite perturbations, expansion waves, shock tube relations (10 hours, including exercise session)
- Boundary layer: scale separations, Prandtl equations, thicknesses definition, Blasius equations, von Karmann equation, Blasius equation extended to compressible flows (8 hours)

REQUIREMENTS

Knowledge of calculus (derivatives and integrals), algebra (basic vector and tensor operations), dynamics of a rigid body, thermodynamics, and fluid dynamics (properties of a fluid, substantial derivative, Reynolds transport theorem, conservation equation of mass, momentum, and energy).

COURSE AIMS

At the end of this course, students in aerospace engineers should have a good knowledge compressible flows and specifically:
- quasi one-dimensional isoentropic and non-isoentropic flows, including normal shocks
- two-dimensional compressible flows, including oblique shocks and Prandtl-Meyer expansions
- one-dimensional unsteady flows (shock tube)
- compressible laminar boundary layer

TEACHING METHODOLOGY	54 hours of lecture, including exercise sessions
ASSESSMENT TYPE	Written exam with numerical exercises and oral exam for theory
REFERENCE TEXT BOOKS	Anderson, John David. **Fundamentals of Aerodynamics.** Fifth edition. McGraw-Hill, 2010. Anderson, John David. **Modern compressible flow: with historical perspective.** Fourth edition. McGraw-Hill, 2020