UNIVERSITÀ
DEL SALENTO

CORSO DI LAUREA LM52 –

CdLM Aerospace Engineering

SCHEDE INSEGNAMENTI DIDATTICA EROGATA
a.a. 2020/2021

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

AERODYNAMICS (MOD.1) C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/06
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Basic knowledge of Calculus (derivatives and integrals), Applied Thermodynamics and Fluid Dynamics
Contenuti	The course provides the fundamentals for the study of gas dynamics and aerodynamics. Starting from the formulation of the fundamental equations of gas dynamics in vector notation, the one-dimensional and quasi-one-dimensional gas dynamics is studied, analyzing the isentropic conditions and the normal shocks, in order to characterize the flow through nozzles. Two-dimensional supersonic flows are then studied taking into account oblique shocks and Prandtl-Meyer expansion waves and finally the flow past airfoils. After recalling the concepts of classical aerodynamics, the approximate solution to several important aerodynamic problems is addressed employing the potential flow assumption. Finally, the study of finite wing theory is carried out.
Obiettivi formativi	At the end of the course the student must: - Know the fundamental equations of gas dynamics in vector notation and their simplification in the simplified case of: one-dimensional flow; quasi-one-dimensional flow; multi-dimensional irrotational flow; - Know how to characterize and calculate the properties of the flow through a normal shock, an oblique shock, an expansion wave - Know how to evaluate the force coefficients in the case of airfoils in a supersonic flow - Know the fundamental aspects of the flow past an airfoil and past a finite wing, along with the evaluation of the force coefficients.
Metodi didattici	Lectures supported by the use of a computer and a projector
Modalità d'esame	Written examination for the application part and oral test.

	In the written test (2 hours) the student is requested to solve two/three exercises concerning the arguments of the course; the test aims to verify the capability of the student to select the appropriate solution approach. In the oral test the student has to discuss the theoretical arguments of the course, that the student must demonstrate to know and to be able to explain.
Programma	Basic concepts of fluid dynamics. Fluid properties; flow kinematics; Reynolds transport theorem; conservation equations in integral and differential form; Bernoullis equation; Croccos theorem; boundary layer theory (7 hours). Introduction to the basic concepts of aerodynamics (3 hours). One-dimensional gas dynamics. Quesi one-dimensional flow equations: compressibility; speed of sound; quasi one-dimensional steady flow; isentropic flow; stagnation and critical conditions; area-Mach number relation; mass flow rate; normal shocks; convergent nozzle; convergent-divergent nozzle (13 hours). Two-dimensional gas dynamics. Oblique shocks and Prandtl-Meyer expansion waves; Mach angle; oblique shock equations; β - θ - Mach diagram; shock polar; shock reflection from a solid boundary; pressure-deflection diagrams; intersection of shocks of opposite families and of the same family; detached shock in front of a blunt body; isentropic expansions and compressions; Prandtl-Meyer function; reflection from a free boundary; over-expanded and under-expanded nozzle flows; Shock-Expansion Theory, Thin-Airfoil Theory (13 hours). Linearized potential flow. Equations of the velocity potential; linear equation of the perturbed velocity potential; linearized two-dimensional subsonic flow; compressibility correction; critical Mach number (6 hours). Aerodynamics. Kutta condition; Kelvins and Helmholtzs theorems; two-dimensional potential flows. Flow past airfoils of arbitrary shape and evaluation of the force coefficients; finite wing theory and Prandtls Classical Lifting-Line Theory; applications (13 hours).
Testi di riferimento	John D. Anderson Jr., Modern compressible flow: With historical perspective , Mc-Graw-Hill, Int. Ed. 1990. John D. Anderson Jr., Fundamental of Aerodynamics , Mc-Graw-Hill, 5th Ed. 2010.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

AERONAUTIC PROPULSION MOD. 1 C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING/IND07
Docente	Maria Grazia De Giorgi
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Fluid dynamic and fluid machinery
Contenuti	This course presents aerospace propulsive devices with particular focus on air-breathing engine, with focus on: analysis of operating characteristics of turbojet, turbofan, turboshaft, afterburning, and ramjet propulsion systems. Analysis and design of inlet, diffuser, combustor, compressor, turbine, nozzle. Component matching and off-design performance for steady-state and transient operating lines. Piston Engine.
Obiettivi formativi	1 Gain knowledge of different types of aero-engines (turbojets, turbofans, ramjets) and to understand the aerodynamic and thermodynamic characteristics of major engine components. 2 Develop the knowledge and skills to analytically and numerically solve problems related to aerospace propulsion systems. 3 Develop skills in working independently. 4 Develop skills in critical evaluation of scientific literature. 5 Develop skills in planning and presentation of scientific talks and reports.
Metodi didattici	Theory and practical activities (Tutorials devoted to discussion and problem solving referred to the aeroengine.)
Modalità d'esame	The final exam consist of two part: 1)Written examination covering all material covered in course 2) individual project
Programma	1)Classifications of Aircrafts and Propulsion System: types of Airbreathing Engines. Aircraft Propulsion Requirements. 2)A Review of Basic Laws for a Compressible Flow. Quasi-One-Dimensional Flow. Area–Mach Number Relationship; Sonic Throat; Waves in Supersonic Flow 3)Performance Parameters of Jet Engines

	4)Elements of Thermodynamics for Aero Propulsion ; thermodynamic of Ideal Cycle and Real Engine Cycle Analysis. Parametric Cycle Analysis. 5) Inlets: Introduction; The Flight Mach Number and Its Impact on Inlet Duct Geometry; Diffusers; Ideal and real Diffuser; Subsonic Diffuser Performance; Supersonic Inlets; 6) Axial Flow Compressors:Introduction; The Geometry; Rotor and Stator; The Euler Equation; Axial-Flow Versus Radial-Flow Machines; Axial-Flow Compressors and Fans; Compressor Performance Map; Compressor Instability – Stall and Surge; Multistage Compressors; Compressor Design Parameters and Principles 8) Axial Flow Turbines: Aerodynamic Performance Analysis of Axial-Flow Turbines; Preliminary Aerodynamic Design of Axial-Flow Turbine Stages 9) Combustors: Introduction; Laws Governing Mixture of Gases; Chemical Reaction and Flame Temperature; Chemical Equilibrium and Chemical Composition; Chemical Kinetics; Combustion Chamber; Combustion-Generated Pollutants; Aviation Fuels 10) Exhaust Nozzle: Gross Thrust; Nozzle Adiabatic Efficiency; Nozzle Total Pressure Ratio; Nozzle geometry; Effect of Flow Angularity on Gross Thrust; Nozzle Gross Thrust Coefficient; Overexpanded Nozzle Flow—Shock Losses; Nozzle Cooling; Thrust Reverser and Thrust Vectoring; Noise 11) Airbreathing Engine System Considerations. 12) Piston Engine: mechanical, thermal, and volumetric efficiencies; operating principles of 2 stroke, 4 stroke, Otto, and diesel; piston displacement and compression ratio.Engine Performance. Principles and purpose of supercharging
Testi di riferimento	Aerothermodynamics of Gas Turbine and Rocket Propulsion Gordon C. Oates eISBN: 978-1-60086-134-5 print ISBN: 978-1-56347-241-1 DOI: 10.2514/4.861345 Hill, P., and Peterson, C., Mechanics and Thermodynamics of Propulsion, Addison-Wesley Publishing Co., 1992, Course notes
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

ATMOSPHERIC AND SPACE FLIGHT DYNAMICS (MOD.2)

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/03
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Basic knowledge of fluid-dynamics and a good knowledge of flight mechanics and analytical dynamics are highly recommentded.
Contenuti	The course is aimed at introducing the student to the methods for modeling the dynamic behavior of an aircraft as a function of its aerodynamic configuration, propulsion system and inertial characteristics. Based on models derived on first principles, the students will learn the tools necessary for the determination of aircraft characteristics in terms of static and dynamic stability and response to controls. The course is focused on the dyanmics of rigid aircraft. Effects of structural deformation on stability and control are introduced at an elementary level. A few notion on rotorcraft dynamics (helicopter trim and rotor blade flapping dynamics) and satellite attitude dynamics and control are also provided. Tutorials will allow the students to apply the notions learned to representative examples and case studies, maturing the capabilitiy of interpreting aircraft and spacecraft motion as a function of controls.
Obiettivi formativi	A the end of the course the student is ecpected to be able to 1) determine trim conditions, aircraft stability and response to controls for conventional configurations; 2) understand, describe and discuss basic features of rotary wing aircraft dynamics and its response to controls; 3) understand, describe and discuss basic features of rigid spacecraft dynamics and how to control it; 4) handle mathematical and numerical tools for simulating aircraft and spacecaft dynamic behavior.
Metodi didattici	The course is delivered with class and laboratory activities, in three different forms:

	- standard class lectures, where the teacher presents methods and models; students are encouraged to participate by discussing validity of the assumptions at the basis of the models and physical meanings of the results derived from the analysis performed; example: derive the expression of aircraft neutral point; - tutorial classes, during which problems are stated, where the students refine their understanding, by numerically evaluating aircraft performance from geometric, propulsion and aerodynamics characteristics; the teacher supports the class by recalling relevant models and highlighting the procedure; some calculations (e.g. for a different set of parameters) can be proposed to the students as homework; example: evaluate the position of aircraft neutra point from aircraft geometric and aerodynamic data; - computer lab. classes, where students are required to write simple computer programs for performing parametric analysis, and/or use or implement Simulink models for simulation; example: evaluate aircraft response in simulation for differnet control inputs. Results from homework and conputer lab classes will be collected in a report to be delivered and discussed during the oral exam.
Modalità d'esame	The exam is oral. The exam starts with a discussion of the projects proposed during the tutorials and lab. classes in order to evaluate the capability of the student in analyzing complex problems, where numerical tools or a large number of calculations are required, using some mathematical programming software and/or simulation tools. The oral exam also includes the discussion of more general aspects regarding aircraft and helicopter dynamics, spacecraft attitude dynamics and control.
Programma	- Equations of motion for rigid aircraft (4 hours). - Equilibrium in the longitudinal plane: longitudinal static stability; longitudinal control and trim; directional stability and dihedral effect; lateral-directional control; non-symmetric flight (6 hours). - Tutorials on trim curves and static stability (4 hours) - Dynamic stability: linearization of aircraft equations of motion; stability derivatives; longitudinal dynamics; lateral-directional dyanmics (16 hours) - Tutorials on dynamic stability and response to controls (4 hours) - Nonlinear phenomena: inertial coupling; autorotation; spin (2 hours). - Rotary-wing aircraft: helicoper commands; swashplate; flap dynamics (4 hours). - Project 1: Laboratory on basic facts in aircraft flight simulation (4 hours) - Rigid spacecraft dynamics: free-spinning motion and passive stabilization (4 hours). - Rigid spacecraft active control: sensor and actuators; control tecniques (4 hours). - Project 2: Laboratory on spacecaft attitude dynamics simulation (4 hours)
Testi di riferimento	Flight Dynamics B. Etkin. Dynamics of Atmospheric Flight. Dover, 2005 (original hardcover edition: , J. Wiley & Sons, 1972)

	B.L. Stevens, and F.L. Lewis. Aircraft Control and Simulation, 2nd edition, , J. Wiley & Sons, 2003 R.F. Stengel. Flight Dynamics, Princeton University Press, 2004 G. Guglieri, and C.E.D. Riboldi. Introduction to Flight Dynamics. CELID, 2014 M. R. Napolitano. Aircraft Dynamics (from modeling to simulation), J. Wiley & Sons, 2012. In Italiano M. Calcara, Elementi di Dinamica del Velivolo, Edizioni CUEN, Napoli, 1988 Suggested readings from… M.J. Abzug and E.E. Larrabee. Airplane Stability and Control: a History of the Technologies that Made Aviation Possible. Cambridge University Press, 1997. Handbooks on spacecraft attitude dynamics and control Bong Wie. Space Vehicle Dynamics and Control, 2nd ed., AIAA Education Series, 2008 P.C. Hughes. Spacecraft Attitude Dynamics, Dover, 2004 (original hardcover edition: , J. Wiley & Sons, 1986)
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

COMPUTER AIDED DESIGN FOR AEROSPACE APPLICATIONS

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/15
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Sufficiency in geometry and linear algebra.
Contenuti	Computer aided design aims at provide to the students the knowledge regarding the design process and 3d modelling from a theoretical and practical point of view. The course includes the teaching of the 3D modelling software Catia V5, with particular attention to the surface modelling in the Generative Shape Design module.
Obiettivi formativi	Overview Computer aided design aims at developing engineering design skills with a particular focus on the proficient use of modern CAD-integrated analysis tools. Learning Outcomes After the course the student should be able to * acquire detailed knowledge and understanding of the most recent advances in 3D computer aided design. * know the fundamental building blocks for creating parametric geometry.
Metodi didattici	Theoretical and practical lessons
Modalità d'esame	The exam consists of two cascaded parts (maximum overall duration: three hours). The first part is closed book (duration: one hour); the student is asked to illustrate some theoretical topics. The second part, that starts when the student has completed the first part (duration: two hours), consists in modelling, using CATIA, a given mechanical/aeronautical component and outputting the detail drawing.
Programma	Introduction: CAD/CAM/CAE systems in the industrial product development cycle.

	Geometric modeling methods and techniques. The representation schemes of solid geometry: CSG, B-rep, finite elements, schemes by enumeration of occupied spaces . CATIA V5: Introduction CATIA V5: The sketching CATIA V5: Part Design CATIA V5: Assembly Design CATIA V5: Generative Shape Design CATIA V5: Drawing
Testi di riferimento	Lee Kunwoo, Principles of CAD/CAM/CAE Systems , Addison Wesley Longman Mortenson M.E., GeometricModelling ,John Wiley and Sons,1997. Ibrahim Zeid, Mastering CAD/CAM , McGrawHill Michel Michaud,CATIA-Core Tools, McGrawHill slides of the lessons
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

SPACE PROPULSION MOD. 2

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING/IND 07
Docente	Maria Grazia De Giorgi
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Fluid dynamic and fluid machinery
Contenuti	This course presents aerospace propulsive devices with particular focus on rocket engine
Obiettivi formativi	1 Gain knowledge of different types of rocket engines and to understand the aerodynamic and thermodynamic characteristics of major rocket components. 2 Develop the knowledge and skills to analytically and numerically solve problems related to aerospace propulsion systems. 3 Develop skills in working independently. 4 Develop skills in critical evaluation of scientific literature. 5 Develop skills in planning and presentation of scientific talks and reports.
Metodi didattici	Theory and practical activities
Modalità d'esame	The final exam consist of two part: 1)Written or oral examination covering all material covered in course
Programma	Rocket Nozzles and Thrust: Performance and nozzle design. Convective Heat Transfer Combustion and Thermochemistry: Perfect gas law and thermodynamics review,equilibrium Thermochemistry, adiabatic flame temperature calculations, non-Equilibrium Flows. Rocket nozzle thermochemistry. Solid Rocket Motors: General description, interior ballistics, component design goals and constraints. Liquid Rocket Motors: General description, engine cycles, power balance calculations, component design fundamentals. Combustion of Liquid

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	Propellants ; Injection and Mixing ; Stability; Pressurization and Pump Cycles; Turbomachinery Performance Trajectory Analysis and staging: The rocket equation, vertical trajectories, multistage rockets. Electric Propulsion: General description and classification of electric propulsion systems, performance analysis. Hybrid rockets: Classification, Challenges, and Advantages of Hybrids
Testi di riferimento	Aerothermodynamics of Gas Turbine and Rocket Propulsion Gordon C. Oates eISBN: 978-1-60086-134-5 print ISBN: 978-1-56347-241-1 DOI: 10.2514/4.861345 Hill, P., and Peterson, C., Mechanics and Thermodynamics of Propulsion, Addison-Wesley Publishing Co., 1992, George P. Sutton, Oscar Biblarz, Rocket Propulsion Elements, 7th Edition John-Wiley & Sons, Ltd. Course note
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

AIRCRAFT POWERPLANT DESIGN AND MANTENANCE C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/09
Docente	Antonio FICARELLA
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	PERCORSO COMUNE

Prerequisiti	Course Requirements Knowledge of the operating principles of fluid machinery and fluid dynamics. Basic elements of design and technology of fluid machines. Knowledge of aircraft propulsion and the basic principles of flight mechanics.
Contenuti	AIRWORTHINESS AND ENVIRONMENTAL CERTIFICATION; The Design Process; Engine Selection: Parametric Cycle Analysis; Engine Selection: Performance Cycle Analysis; Engine Component Design: Rotating Turbomachinery, Concept, Design Tools; Engine Component Design: Combustion Systems, Concept, Main Burner, Afterburners; Aircraft Engine Controls - Engine Modeling and Simulation; Aircraft Systems.
Obiettivi formativi	Aims of the course (knowledge and understanding) - Specialist knowledge of propulsion, advanced elements of mechanical design of aircraft engines. - Knowledge of the internal fluid dynamics. - Insights on design and technological features and performance of different types of engines. - Insights into automatic controls and system design aimed at providing an integrated view of the aerospace product. - Knowledge of advanced propulsion systems. - Knowledge of specific technical terms in English. (applying knowledge and understanding) - Understanding of the main features of a project of the engine. - Ability to perform sketches and preliminary dimensioning of the components of an aircraft engine. - Ability to take action in the main stages the project of an aircraft engine. - Advanced capabilities for the analysis of systems and control techniques.

	- Ability to see the product in the form of system integrated complex. (making judgements) - Ability to analyze the mission requirements of the aircraft and to evaluate the necessary engine performance. - Ability to understand the technological issues and system integration for the engine. - Ability to understand the problems of research and development of an aircraft engine or of an aviation system. (communication skills) - Ability to communicate with experts in other fields of engineering for the integrated design of the engine. (learning skills) - Development of learning skills that enable to continue to study for the most part autonomously. - Availability update the acquired knowledge.
Metodi didattici	Lectures; practical experiences in laboratories; homework (design project). Laboratory Engine performance Lab, Engine Monitoring Lab. https://sites.google.com/site/greenenginelab2/home Homework (desig project) Software applications for the design of aircraft engines and systems. Application examples and design of aircraft engines and systems. Turbofan, turbofans with high bypass ratio, turboprop propeller design. Systems for Civil and military aircraft, helicopters, light aircraft. Fluid-dynamics numerical simulations applied to engines and systems design. <a href="http://www.aircraftenginedesign.com/index.html"> http://www.aircraftenginedesign.com/index.html (free software) <a href="http://www.aircraftenginedesign.com/custom3.html"> http://www.aircraftenginedesign.com/custom3.html <a href="http://www.grc.nasa.gov/WWW/K-12/freesoftware_page.htm"> http://www.grc.nasa.gov/WWW/K-12/freesoftware_page.htm http://www.cfdsupport.com/openfoam-for-windows.html
Modalità d'esame	Exam procedures The exam consists in the preparation of a Homework (desig project) and an oral interview. A design project related to aircraft engines or systems will be conducted. Homework assignments will be due at least one month before the examination. The deliverables are a written report (in digital format, with any files used for calculations and the relevant bibliography) and the discussion of the work. You must acknowledge all references (both literature and people) used; all the deliverables will be sent by email to the instructor at least 10 days before the oral examination. The oral examination consists of the discussion of the work of the year and a series of questions on the matters stated in the course program for the evaluation of acquired knowledge on the principles of operation of engines and aircraft systems, their performance and the principles of design and in general on the technologies of these systems.

Programma	TOPIC: AIRWORTHINESS AND ENVIRONMENTAL CERTIFICATION, Aircraft Certification and Production Standards, Type Certificates, Rules for Initial Airworthiness, Certification Specification (CS); COURSE BOOK: ; LECTURE NOTES: . TOPIC: The Design Process; COURSE BOOK: Aircraft Engine Design, cap. 1.; LECTURE NOTES: propDESIGNPR02. TOPIC: Constraint Analysis, Mission Analysis; COURSE BOOK: Aircraft Engine Design, cap. 2 (no par. 2.2.2, 2.2.3, 2.2.4, 2.2.6, 2.2.7, 2.2.8, 2.2.9, 2.2.10, 2.2.11, 2.2.12), Aircraft Engine Design, cap. 3 (no par. 3.2.1, 3.2.2, 3.2.3, 3.2.6, 3.2.7, 3.2.8, 3.2.9, 3.2.10, 3.2.11); LECTURE NOTES: propCONSTRAINTRA01, propMISSIONR02, propEXAMPLE-CONSTRAINTR00, for in-depth analysis: constraintSTRALCIO2, constraintEXAMPLESTRALCIO, missionSTRALCIO, missionEXAMPLESTRALCIO. TOPIC: Aircraft Engine Efficiency and Thrust Measures; COURSE BOOK: Aircraft Engine Design, app. E.; LECTURE NOTES: propMEASURESR02. TOPIC: Engine Selection: Parametric Cycle Analysis, Engine Selection: Performance Cycle Analysis, Sizing the Engine: Installed Performance; COURSE BOOK: Aircraft Engine Design, cap. 4 (for 4.2.3, 4.2.4, 4.2.7 only concepts, no 4.3.4, 4.4 only concepts), Aircraft Engine Design, cap. 5 (5.2.4, 5.2.5, 5.4 only concepts), Aircraft Engine Design, cap. 6 (6.2.2, 6.3, 6.4 only concepts).; LECTURE NOTES: propPARAMETRICR03, propPERFORMANCER03, propINSTALLEDR03, propEXAMPLE-PARAMETRICR00. TOPIC: Engine Component Design: Global and Interface Quantities. Concept, Design Tools, Engine Systems Design; COURSE BOOK: Aircraft Engine Design, cap. 7; LECTURE NOTES: propENGINEDESIGNR03. TOPIC: Engine Component Design: Rotating Turbomachinery. Concept, Design Tools; COURSE BOOK: Aircraft Engine Design, cap. 8; LECTURE NOTES: propROTATINGR08. TOPIC: Material Properties. SUPERALLOYS FOR TURBINES and MANUFACTURING METHODS; COURSE BOOK: Aircraft Engine Design, app. M, Turbo-Machinery Dynamics, chap. 11, 12; LECTURE NOTES: propMATERIALR01, propTMDsuperalloysR00, propTMDmanufacturingR00, for in-depth analysis: Turbomachinery_DynamicsCh11, Turbomachinery_DynamicsCh12. TOPIC: Turbine Engine Life Management; COURSE BOOK: Aircraft Engine Design, app. N; LECTURE NOTES: propLIFEMANR01. TOPIC: Fan and Compressor Airfoils, Turbine Blade and Vane; COURSE BOOK: Turbo-Machinery Dynamics, chap. 6. (no 6.12, 6.18), Turbo-Machinery Dynamics, chap. 8; LECTURE NOTES: propTMDfecairfoilsR01, propTMDturbinebvR00, for in-depth analysis: Turbomachinery_DynamicsCh06, propTMDimpellerbdR01, Turbomachinery_DynamicsCh08. TOPIC: Engine Component Design: Combustion Systems. Concept, Main Burner, Afterburners; COURSE BOOK: Aircraft Engine Design, cap. 9 (no par. 9.1.4.5, 9.1.5.4, 9.3); LECTURE NOTES: propCOMBUSTIONR05, propCOMBUSTIONEXAMPLER02, THE NEW FRONTIERS FOR THE CONTROL-FICARELLAslidesR31, for in-depth analysis: propCOMBUSTIONEXAMPLESR02.

	TOPIC: Combustion system; COURSE BOOK: Turbo-Machinery Dynamics, chap. 9; LECTURE NOTES: propTMDcombsysR00. TOPIC: Engine Control Systems; COURSE BOOK: Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Chap. 2; LECTURE NOTES: propASEngineControlR00. TOPIC: Engine Controls.; COURSE BOOK: Aircraft Engine Design, app. O; LECTURE NOTES: propCONTROLR00. TOPIC: Aircraft Engine Controls - Engine Modeling and Simulation; COURSE BOOK: Aircraft Engine Controls, chap. 2; LECTURE NOTES: propAECemodelingR03, for in-depth analysis: AIRCRAFT ENGINE CONTROLSch02, AIRCRAFT ENGINE CONTROLSapp. TOPIC: Design of Set-Point Controllers. Design of Transient and Limit Controllers; COURSE BOOK: ; LECTURE NOTES: propAECdesignspcR02, propAECtransientlR01, for in-depth analysis: AIRCRAFT ENGINE CONTROLSch04, AIRCRAFT ENGINE CONTROLSch05. TOPIC: Advanced Control Concepts; COURSE BOOK: Aircraft Engine Controls, chap. 8; LECTURE NOTES: propAECadvancedR00. TOPIC: Engine Monitoring and Health Management, Integrated Control and Health Monitoring; COURSE BOOK: Aircraft Engine Controls, chap. 9; LECTURE NOTES: propAECemonitoringR01. TOPIC: Aircraft Fuel Systems, Fuel System Deign Drivers, Fuel System Functions of Commercial Aircraft; COURSE BOOK: AIRCRAFT FUEL SYSTEMS cap. 2 - 3 (no 3.5) - 4.; LECTURE NOTES: propAFuelSfueldesignR00, propAFuelSfuelstorageR01, propAFuelSfuelfunctionsR01, AFUELSYSTEMSch020304. TOPIC: Hydraulic Systems, Electrical Systems, Pneumatic Systems, Environmental Control Systems; COURSE BOOK: Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Chap. 4, 5, 6, 7; LECTURE NOTES: propAShydraulicR00, propASpneumaticR01, propASenvironmentalR00, propASelectricalR00. TOPIC: Advanced Systems; COURSE BOOK: Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Chap. 10; LECTURE NOTES: propASadvancedR00. TOPIC: System Design and Development; COURSE BOOK: Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Chap. 11; LECTURE NOTES: propASdesignR00.
Testi di riferimento	COURSE BOOKS Aircraft Engine Design, Second Edition - Jack D. Mattingly, William H. Heiser, David T. Pratt, AIAA Education Series, ISBN-10: 1-56347-538-3, ISBN-13: 978-1-56347-538-2, <a href="http://www.aiaa.org/content.cfm?pageid=360id=975">http://www.aiaa.org/content.cfm?pageid=360id=975 , <a href="http://www.amazon.com/">http://www.amazon.com . Turbo-Machinery Dynamics: Design and Operations, A. S. Rangwala, S. Rangwala a., McGraw-Hill Professional Publishing, ISBN: 0071453695, ISBN-13: 9780071453691. Aircraft Engine Controls: Design, System Analysis, and Health Monitoring, Link C. Jaw, Jack D. Mattingly, AIAA Education Series, ISBN-10: 1-60086-705-7, ISBN-13: 978-1-60086-705-7, <a

	href="http://www.aiaa.org/content.cfm?pageid=360id=1759">http://www.aiaa.org/content.cfm?pageid=360id=1759. Aircraft Fuel Systems, Roy Langton, Chuck Clark, Martin Hewitt, Lonnie Richards, AIAA Education Series, ISBN-10: 1-56347-963-X, ISBN-13: 978-1-56347-963-2, <a href="http://www.aiaa.org/content.cfm?pageid=360id=1741">http://www.aiaa.org/content.cfm?pageid=360id=1741. Design and Development of Aircraft Systems, 2nd Edition, Ian Moir, Allan Seabridge, ISBN: 978-1-1184-6914-9, E-book, November 2012, Wiley. Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, 3rd Edition, Ian Moir, Allan Seabridge, ISBN: 978-1-1199-6520-6, E-book, August 2011, Wiley. Contact the instructor (antonio.ficarella@unisalento.it) for more lecture notes.
Altre informazioni utili	OTHER REFERENCES An Introduction to Combustion, McGrawHill. Combustion Physics, Chung K. Law, Publisher: Cambridge University Press; ISBN-10: 0521870526, ISBN-13: 978-0521870528. Performance of Light Aircraft (Aiaa Education Series), ISBN-10: 15634733

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SCHEDA INSEGNAMENTO

AEROSPACE SYSTEM MOD. 2 C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/05
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	General notions of physics, electrotechnics, thermodynamics and chemistry.
Contenuti	The course aims to analyze the functionality of each aerospace system. It also studies the interdependencies of several systems in routine or emergency conditions. The attention will be focused on the functional aspects of its components and less on their construction solutions. According to this setting, the system should be seen as a logical block of functionality.
Obiettivi formativi	Upon completion of the course students will have acquired: - The concept of aircraft intended as a system operating within the air transport system, including, in particular, maintenance. - Basic knowledge of systems engineering: definition of requirements, management of interfaces, verification, and validation of the project. - The ability to identify the main aerospace on-board systems, the functions they perform, the architectures, the performances, the operating principles, with references to the energy sources that allow the operation of each system. - The ability to identify the features and design choices made through retrospective analysis of aircraft systems or existing space modules. - The ability to apply the concepts learned in class with simple sizing calculations of elements of the on-board systems.
Metodi didattici	The structure of the single lesson is articulated through a series of sub-chapters that are repeated - as far as possible - in a standard way: - The mission of the system - Interdependence on other systems - Basic operating principles

	- Key components - Command, control, and warning systems - Description of the real plant - Operational aspects of the operation.
Modalità d'esame	The exam consists of a written test with questions on the various systems and their correlation. An oral test will follow.
Programma	Aircraft board systems: Zones / Rooms / Doors; Engine systems; APU; Pneumatic system; Cabin air conditioning and pressurization system; Oxygen system; Fuel system; Hydraulic system; Flight controls; Landing gear; Anti-ice system and anti-fire system; Internal equipment; Water treatment. Introduction to space systems
Testi di riferimento	All lecture notes shown during lessons will be made available in the digital version. During the lessons, the teacher will refer to the following textbooks: I. Moir, A. Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration , Volume 21 di Aerospace Series, John Wiley Sons, 2008. F. Vagnarelli - impianti aeronautici - IBN editore S. Chiesa, fascicoli tematici su impianti di bordo di vario tipo, Ed. CLUT, Torino.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

CERTIFICATION OF AEROSPACE STRUCTURES

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/04
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

DESIGN AND TESTING OF POWER CONVERTERS AND ELECTRICAL MACHINES

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/32
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

ROBUST CONTROL AND FLIGHT CONTROL MOD. 1 C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-INF/04
Docente	In attesa di assegnazione
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

SYSTEMS AND DEVICES FOR SATELLITES

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-INF/01
Docente	In attesa di assegnazione
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

EMBEDDED AND CERTIFIED SOFTWARE

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-INF/05
Docente	In attesa di assegnazione
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

SPACE ECONOMY

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/35
Docente	In attesa di assegnazione
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE SYSTEMS

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

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SCHEDA INSEGNAMENTO

Electrical Energy Storage For Aeronautics

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	Ing-Ind/21
Docente	Pasquale Daniele Cavaliere
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN / SYSTEMS

Prerequisiti	Conoscenze di Analisi matematica, fisica, chimica e metallurgia
Contenuti	Il corso mostrerà le basi di funzionamento dei sistemi di stoccaggio di energia elettrica. Particolare attenzione verrà rivolta ai sistemi applicati e/o applicabili in campo aerospaziale.
Obiettivi formativi	Conoscenze e comprensione: Lo studente acquisirà le conoscenze per la selezione e scelta dei diversi tipi di batterie in funzione delle diverse densità di energia e Potenza richieste dell'utenza finale. Capacità di applicare conoscenze e comprensione: Lo studente conoscerà i modelli di funzionamento delle celle e delle batterie. Questo consentirà di utilizzare tali modelli per la progettazione di sistemi applicabili in campo aerospaziale. Autonomia di giudizio: Al termine del corso lo studente sarà capace di operare in autonomia all'interno dell'ambito specifico. Abilità di comunicative: Lo studio comune per lo svolgimento di un breve lavoro di gruppo consentirà una migliore è maggiore interazione tra gli studenti consentendo la messa in condivisione dei metodi di approfondimento e dei contenuti acquisiti. Capacità di apprendimento: La capacità di apprendimento sarà favorita dell'interazione continua col docente e tra i vari gruppi di studenti.
Metodi didattici	Erogazione delle lezioni attraverso Microsoft Teams
Modalità d'esame	Prova orale-progetto d'anno
Programma	Sistemi di accumulo Termodinamica chimica Modelli di funzionamento delle batterie Batterie tradizionali Batterie al litio Batterie metallo aria

	Batterie metallo idrogeno Esempi applicativi
Testi di riferimento	Dispense a cura del docente
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

FLIGHT MECHANICS MOD. 2 C. I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/03
Docente	Giulio Avanzini
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN / TECHNOLOGY

Prerequisiti	Good knowledge of physics (mechanics, in particular), analytical mechanics and basic tools of calculus are necessary.
Contenuti	The course is aimed at introducing the student to the methods for estimating aircraft performance as a function of aerodynamic configuration and propulsion system. Based on models derived from first principles, the students will learn how to evaluate fixed-wing aircraft range and endurance, flight envelope, take-off and landing distance, climb and turn performance. The course is mainly focused on rigid fixed-wing aircraft, but a few notion on rotorcraft performance and space flight mechanics (orbits, orbit perturbations and orbital maneuvers) are also provided. Tutorials will allow the students to apply the notions learned to representative examples and case studies, developing the capabilitiy of solving simple problems and write computer programs that allow for a systematic analysis of the relation between aircraft characteristics and its expected behavior.
Obiettivi formativi	At the end of the course the student is expected to 1) understand, analyze and critically discuss the relations between aircraft configuration, mission requirements and expected performance; 2) evaluate performance from the knowledge of aerodynamic and propulsion characteristics; 3) understand, analyze and critically discuss basic features of rotary wing aircraft configurations and evaluate their performance; 4) understand and analyze basic features of orbit mechanics and maneuvers; 5) handle mathematical tools and write simple software programs in order to develop the ability for quantitative analysis of aircraft behavior as a function of design parameters.

Metodi didattici	The course is delivered with class and laboratory activities, in three different forms: - standard class lectures, where the teacher presents methods and models; students are encouraged to participate by discussing validity of the assumptions at the basis of the models and physical meanings of the results derived from the analysis performed; example: derive the expressions for minimum and maximum airspeed of a turbojet aircraft; - tutorial classes, during which problems are stated, where the students refine their understanding, by numerically evaluating aircraft performance from geometric, propulsion and aerodynamics characteristics; the teacher supports the class by recalling relevant models and highlighting the procedure; some calculations (e.g. for a different set of parameters) can be proposed to the students as homework; example: evaluate minimum and maximum airspeed of a turbojet aircraft at a given altitude, knowing maximum thrust-to-weight ratio and aerodynamic coefficients; - computer lab. classes, where students are required to write simple computer programs for performing parametric analysis, in order to assess aircraft performance for a wider range of design variables; example: plot the flight envelope of a turbojet aircraft in the altitude vs airspeed plane. Results from homework and conputer lab classes will be collected in a report to be delivered and discussed during the oral exam.
Modalità d'esame	The written test is divided into 2 parts. Part 1, to be completed in 90 minutes, without using books or lecture notes: - 2 theoretical questions, that require analytic evaluation of some physical facts regarding aircraft performance and/or dynamics; - 2 descriptive questions, where the student is required to demonstrate his understanding of some specific facts of aircraft configuration, systems or features of its dynamic behaviour; Part 2, to be completed in 60 minutes, using books and/or lecture notes: - 2 problems, where the students prove their ability in quantitavely evaluating aircraft performance from its geometrical, inertial and aerodynamic characteristics. The use of programmable devices and/or devices connected to the internet is strictly forbidden. Calculations can be performed by means of a non-programmable scientific calculator. The oral exam starts with the discussion of the results of homeworks and activities performed in the computer lab., collected in a report, in order to assess the capability of the student in solving more complex problems, where numerical tools or a large number of calculations are required, using some mathematical programming software and/or spreadsheet. The oral exam also includes the discussion of more general aspects regarding aircraft configuration or performance, in the large.
Programma	- Fixed wing aircraft: configurations, applied aerodynamics and basic facts (8 hours) - International Standard atmosphere and on-board instruments (4 hours)

	- Performance Analysis: steady state flight; gliding flight; flight envelope; propulsion systems and propellers; cruise; climbing flight; maneuvers and turning flight; take-off and landing (12 hours) - Tutorials on performance evaluation (10 hours) - Project 1: Determination of the balanced field length (2 hours) - Project 2: Optimal climb strategy for supersonic aircraft (2 hours) - Rotary-wing aircraft: configuration and commands; actuator disk theory; required power estimate (4 hours). - Keplerian orbits (3 hours). Space environment and orbit perturbations (2 hours). Orbit maneuvers (3 hours). - Project 3: Laboratory on basic facts on orbit dynamics and orbit transfers (4 hours)
Testi di riferimento	Introduction to Aeronautics Darrol Stinton. The Anatomy of the Aeroplane, 2nd ed., Blackwell science, 1998 E. Torenbeek. Flight Physiscs, Springer, 2009 Holt Ashley. Engineering Analysis of Flight Vehicles, Dover, 1992 Barnes W. McCormick. Aerodynamics, Aeronautics, and Flight Mechanics, J. Wiley & Sons, 1994 Richard Von Mises, Theory of Flight, Dover, 1959 Daniel P. Raymer. Aircraft design: a conceptual approach, 4th ed., AIAA Education Series, 2006 Performance Francis J. Hale. Introduction to Aircraft Performance, Selection and Design. J. Wiley & Sons, 1984 J. D. Anderson jr. Aircraft Performance and design, McGraw Hill, 1999 J.B. Russell. Performance and Stability of Aircraft, Arnold, 1996 Nguyen X. Vinh. Flight Mechanics of High Performance Aircraft, Cambridge University Press, 1995 D.R., Kermode (R.H., Philpott and A.C. Barnard editors). Mechanics of Flight, 11th ed. Prentice Hall, 2006 In Italiano A. Lausetti e F. Filippi. Elementi di Meccanica del Volo. Levrotto e Bella, 1956 M. Calcara, Elementi di Dinamica del Velivolo, Edizioni CUEN, Napoli, 1988 M. Venuti, Aerodinamica Oggi, TOTEM, 2002 G. Guglieri. Introduzione alla Meccanica del Volo. CELID, 2005 Suggested readings from… M.J. Abzug and E.E. Larrabee. Airplane Stability and Control: a History of the Technologies that Made Aviation Possible. Cambridge University Press, 1997.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

FLUID DYNAMICS (MOD. 1) C.I.

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/13
Docente	Michele Scaraggi
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN / TECHNOLOGY

Prerequisiti	Knowledge of calculus (derivatives and integrals), algebra (basic vector and tensor operations), dynamics of a rigid body and thermodynamics.
Contenuti	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.
Obiettivi formativi	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.
Metodi didattici	Every topic will be discussed and all the models derived on the blackboard.
Modalità d'esame	3h written exam.
Programma	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
Testi di riferimento	Any fluid dynamics textbook, such as Irving H. Shames, Mechanics of Fluids; Tannehill, Computational fluid mechanics and heat transfer; Introduction to FEniCS.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

MATHEMATICAL AND NUMERICAL METHODS IN AEROSPACE ENGINEERING, WITH LABORATORY

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	MAT/07
Docente	Raffaele VITOLO
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	I anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN / TECHNOLOGY

Prerequisiti	Calculus of functions of one or more real variables; linear algebra.
Contenuti	Algorithms and methods of approximate solution of algebraic and differential equations, with computer experiments.
Obiettivi formativi	The students will acquire basic knowledge about main numerical methods in engineering applications.
Metodi didattici	Lectures and computer experiments.
Modalità d'esame	Oral exam on the course program (as exposed during the lectures) and proof of knowledge of the Matlab language.
Programma	Matrix computations Principles of numerical mathematics Direct methods for the solution of linear systems Iterative methods for the solution of linear systems Iterative methods for eigenvalues and eigenvectors Solution of non-linear algebraic equations Polynomial interpolation of functions and data Numerical integration Orthogonal polynomials and Fourier transform Numerical solution of ODEs Finite difference methods and finite element methods for PDEs.
Testi di riferimento	Quarteroni, Sacco, Saleri: Numerical Mathematics, 2nd ed., Springer 2006.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

CERTIFICATION OF AEROSPACE STRUCTURES

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/14
Docente	In attesa di assegnazione
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN

Prerequisiti	
Contenuti	
Obiettivi formativi	
Metodi didattici	
Modalità d'esame	
Programma	
Testi di riferimento	
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

FUNDAMENTAL OF HELICOPTER DESIGN PRODUCTION AND MAINTENANCE

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/04
Docente	FRANCESCO NICASSIO
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	II anno
Semestre	I
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN

Prerequisiti	In order to attend the course, students must have a deep knowledge of physics (kinematic, static, dynamic, thermodynamic, electrical, optical, acoustic studies…). Overall, skills on aircraft (configurations and main features) are desirable. The knowledge of aerodynamic, flight mechanics, aeronautic structures and propulsion principles could be an aid for the students.
Contenuti	This course provides basic concepts of helicopter systems, with associated structures and substructures. The course intends to reach the "integrated helicopter view" in which each part is connected to the "helicopter main system". This interdisciplinary approach facilitates the scientific development of the students.
Obiettivi formativi	The course aims at developing the student's skills of helicopter system. In particular, it is expected that the students will know: - the main features of helicopter structures; - the architecture of the main PERCORSO COMUNE helicopters; - the certification specifications about helicopter vehicles; - the helicopter substructures in a correct manner; - the mechanical vibrations; - the fasteners design. The students are encouraged to: - carry out simple planning applications; - estimate order of magnitude of values in case study of a vehicle benchmark; - learn technical terminology (English vocabulary)
Metodi didattici	The course is delivered with class activities, where the teacher presents methods, models and experimental experiences.

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Modalità d'esame	The exam consists of written and oral tests, based on questions, where the student is required to demonstrate his understanding of some specific facts of helicopter configuration.
Programma	- Course introduction - Basic helicopter structures - CS 27 & 29 - Main and Tail Rotor - Flap, Pitch, Lead and Lag Main Rotor DOFs - Swashplate - Main Command Line - Tail Command Line - Drive System - Main Gear Box and Boundary Conditions - Mechanical Vibrations - Fasteners
Testi di riferimento	This course is a summary of several basic helicopter structures concepts: teaching material has been specifically produced for each lesson and it is provided to the students.
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

AIRCRAFT DESIGN

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/03
Docente	Giulio Avanzini
Crediti Formativi Universitari	6
Ore di attività frontale	54
Ore di studio individuale	96
Anno di corso	II anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN

Prerequisiti	Good background in Flight Mechanics and Flight Dynamics, Aerospace Structures, Aerodynamics and Aeronautical Propulsion is strongly recommended.
Contenuti	Aircraft design is on one side a separate discipline in the framework of aeronautical engineering, where specific methods and analysis tools are introduced to size a new aircraft with the objective of developing a vehicle which outperforms existing ones in the same market segment. At the same time, an aircraft designer needs to be well skilled in all the fundamental aeronautical engineering disciplines (aerodynamics, propulsion, structures, systems and – last but not least - flight mechanics), in order to understand and handle all the available options for performing a given set of mission tasks. The course is aimed at introducing the student to this unique mix of specific expertize and multidisciplinary knowledge, challenging him/her with the development of a realistic design for a given set of (possibly competing) mission requirements.
Obiettivi formativi	At the end of the course the student is expected to - understand the relation between aircraft mission and its configuration, in qualitative as well as quantitative terms; - use this knowledge to perform, at a conceptual level, the preliminary sizing of a fixed wing aircraft as a function of a set of mission and regulatory requirements; draw a sketch by means of some Computer Aided Design tool; estimate performance and update the design, if necessary; - autonomously perform choices with respect to possible alternatives (e.g. type of engines, cabin layout, wing planform shape and position, etc.); - present and discuss the resulting design in a report and in oral form, providing adequate motivation for all the choices performed;

	- become aware of sources of information related to aircraft design, airworthiness, certification procedures, etc. deriving useful and reliable information for the design process.
Metodi didattici	The course is delivered with lectures and lab hours. - Standard class lectures: the teacher presents methods and models for fixed wing aircraft conceptual design, spanning a wide range of (mainly civil) missions and configurations; aspects of conceptual design are introduced (preliminary sizing, engine and wing sizing, configuration lofting, performance evaluation, design iterations, cost estimate) at a general level; students are encouraged to participate by discussing design alternatives for each class of aircraft considered, origin of requirements, tradeoffs between competing requirements. - Computer lab. classes: students learn the use of Raymer's Design Software (RDS) for conceptual aircraft design with a "hands on" approach; they are instructed to use the RDS CAD tool and aerodynamic analysis tool. Design contest: each year a design contest is proposed, focused on a particular class of civil aircraft; starting from a set of mission requirements, typical of the considered class, small groups of student (2 or 3) develop throughout the semester their own design, performing aircraft sizing, lofting, performance analysis, thus developing a realistic configuration and solving design tradeoffs between competing mission objective. At the end of the semester each group presents its own design and a comparison among the resulting design is performed. Cooperation between team members is encouraged, but also information sharing between different groups.
Modalità d'esame	The exam is oral. The exam starts with a discussion of the project work carried out during the semester in order to assess the capability of the student in analyzing the considered design example, his/her awareness of the various alternatives available for the considered design and his/her communication skills in discussing and supporting the choices done. The oral exam also includes the discussion of more general aspects regarding aircraft design, when applied to different classes of aircraft, in order to assess the student's ability to apply the same concepts to a different scenario.
Programma	- Introduction to aircraft design and overview of the design process, from conceptual design through preliminary design to final detail design (6 hours) - Review of concepts of applied aerodynamics and aircraft configuration (6 hours) - Sizing from a conceptual sketch with determination of thrustto-weight ratio and wing loading and initial design iterations (6 hours) - Aircraft layout and lofting by RDS CAD tool (10 hours) - Propulsion and fuel system integration (4 hours)

	- Cost analysis and trade studies (4 hours) - Lab classes, with supervision and discussion of the design process (18 hours during the semester)
Testi di riferimento	D. P. Raymer, Aircraft Design: a conceptual approach, AIAA Education Series, 2012 E. Torenbeek, Synthesis of Subsonic Airplane Design: An Introduction to the Preliminary Design of Subsonic General Aviation and Transport Aircraft, with Emphasis on Design, Propulsion and Performance, Springer, 1982 J. Roskam, Airplane Design (Parts 1 to 8), DAR Corporation, 1985
Altre informazioni utili	

UNIVERSITÀ DEL SALENTO

SCHEDA INSEGNAMENTO

PROCESSING AND PROPERTIES OF COMPOSITE MATERIALS FOR AERONAUTICS

Corso di studio di riferimento	LM52 - CdL Magistrale in Aerospace Engineering
Dipartimento di riferimento	Dipartimento di Ingegneria dell'Innovazione
Settore Scientifico Disciplinare	ING-IND/24
Docente	Alfonso Maffezzoli
Crediti Formativi Universitari	9
Ore di attività frontale	81
Ore di studio individuale	144
Anno di corso	II anno
Semestre	II
Lingua di erogazione	Inglese
Percorso	CURRICULUM AEROSPACE DESIGN

Prerequisiti	knowledge of solid mechanics and materials science and technology
Contenuti	This course provides a strong interdisciplinary approach to composite materials in view of their application in aeronautic structure. Competences on polymer matrices and reinforcements, mechanics of anisotropic materials, fabrication technologies of thermoplastic and thermosetting matrix composites are provided.
Obiettivi formativi	Knowledge and understanding: The course provides the basis of knowledge to understand and solve complex new problems in design and processing of composite materials accounting for anisotropy and reactive processing Applying knowledge and understanding The student will be able to apply the basic knowledge on mechanics of anisotropic materials to the design of simple structural elements. A multidisciplinary approach is presented accounting for chemical, materials and mechanical engineering aspects. Making judgements Simplification and synthesis of complex problems is presented in order to promote the judgement and evaluation capabilities of the students Communication The course promotes the development of the following skills of the student: ability to expose in precise and formal terms an abstract model of concrete problems, identifying the salient characteristics of them and discarding the inessential characteristics; ability to describe and analyze an efficient solution for the problem under consideration. A seminar on composite properties is assigned to students Learning skills

	Autonomous learning is promoted thanks to the use of: different books and slides, numerical methods, homework exercise to be solved in groups of two.
Metodi didattici	Lessons, practice with a software implementing micro and macromechanic of composite materials, visit to an industrial plant. Self evaluation tests after each topic by Kahoot
Modalità d'esame	Interview after a seminar on composite properties and a homework .
Programma	Introduction (2 h.) Reinforcement materials (15 h) Thermosetting and thermoplastic matrices and core materials. (10 h.) Micromechanic. (15 h.) Mcromechanic. (20 h.) Properties (4 h.) Fabrication technologies of polymer matrix materials (12 h.) Visit to an industrial plant (3 h.)
Testi di riferimento	P.K. Mallick "Fiber-reinforced composites"CRC Press, R.M. Jones "Mechanics of composite materials" Taylor & Francis Slides of the course provided by the teacher
Altre informazioni utili	For any question write an email to alfonso.maffezzoli@unisalento.it. Link to the team for online interviews: https://teams.microsoft.com/l/team/19%3a458cbee969be476aa9eea632273a6e8b%40thread.tacv2/conversations?groupId=7f7c14aa-bc49-4e0a-83a3-df9179e7e81