**BREVE DESCRIZIONE DEL CORSO**

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 Control...
Lectures: practical experiences in laboratories; homework (design project).

**Laboratory**

Engine performance Lab, Engine Monitoring Lab.
https://sites.google.com/site/greenenginelab2/home

**Homework (design 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.
http://www.aircraftenginedesign.com/index.html (free software)
http://www.aircraftenginedesign.com/custom3.html
http://www.grc.nasa.gov/WWW/K-12/freesoftware_page.htm

**Exam procedures**

The exam consists in the preparation of a Homework (design 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 production.

**OTHER REFERENCES**

- An Introduction to Combustion, McGrawHill.
- PPSG Volume 1 - Piston Engines & Supercharging, http://shop.pilotwarehouse.co.uk/product222023catno0.html.

**INTERNET RESOURCES**

http://www.aircraftenginedesign.com/index.html
TOPIC: AIRWORTHINESS AND ENVIRONMENTAL CERTIFICATION, Aircraft Certification and Production Standards, Type Certificates, Rules for Initial Airworthiness, Certification Specification (CS); COURSE BOOK: ; LECTURE NOTES: .


TOPIC: Constraint Analysis, Mission Analysis; COURSE BOOK: Aircraft Engine Design, chap. 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: propCONSTRAINTR01, propMISSIONR02, propEXAMPLE-CONSTRAINTR00, for in-depth analysis: constraintSTRALCIO2, constraintEXAMPLESTRALCIO, missionSTRALCIO, missionEXAMPLESTRALCIO.


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: Material Properties. SUPERALLOYS FOR TURBINES and MANUFACTURING METHODS; COURSE BOOK: Aircraft Engine Design, cap. 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, chap. 9; 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: propTMDfeceairfoilsR01, propTMDturbinebladevR00, for in-depth analysis: Turbomachinery_DynamicsCh06, propTMDimpellerbdR00, Turbomachinery_DynamicsCh08.

TOPIC: Engine Component Design: Combustion Systems. Concept, Main Burner, Afterburners; COURSE BOOK: Aircraft Engine Design, chap. 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: propCOMBUSTIONEXAMPLER02.

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: propAESenginecontrolr00.

TOPIC: Engine Controls.; COURSE BOOK: Aircraft Engine Design, chap. 10; LECTURE NOTES: propCONTROLR00.

TOPIC: Aircraft Engine Controls - Engine Modeling and Simulation; COURSE BOOK: Aircraft Engine Controls, chap. 2; LECTURE NOTES: propAECmodelingR03, for in-depth analysis: AIRCRAFT ENGINE CONTROLSch02, AIRCRAFT ENGINE CONTROLSapp.

TOPIC: Design of Set-Point Controllers. Design of Transient and Limit Controllers; COURSE BOOK: Aircraft Engine Controls, chap. 4; LECTURE NOTES: propAECdesignspcR02, propAECtransientR01, 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: propAECmonitoringR01.

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, 5, 6, 7; LECTURE NOTES: propAFuelfuelsystemR00, propAFuelfuelstorageR01, propAFuelfuelfunctionsR01, propAFuelfuelsystemR00.

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: propAHydraulicR00, propAPneumaticR00, propAEnvironmentalR00, propAelectricalR00.

TOPIC: Advanced Systems; COURSE BOOK: Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration, Chap. 10; LECTURE NOTES: propAsystemR00.

TOPIC: System Design and Development; COURSE BOOK: Aircraft Systems: Mechanical, Electrical
COURSE BOOKS


