UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2018/2019
MASTER'S DEGREE (MSC)	AEROSPACE ENGINEERING
SUBJECT	AEROSPACE ENGINES
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50350-Ingegneria aerospaziale ed astronautica
CODE	12658
SCIENTIFIC SECTOR(S)	ING-IND/07
HEAD PROFESSOR(S)	LOMBARDO GIUSEPPE Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	12
INDIVIDUAL STUDY (Hrs)	192
COURSE ACTIVITY (Hrs)	108
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**LOMBARDO GIUSEPPE** Tuesday 9:00 13:00 M010

DOCENTE: Prof. GIUSEPPE LOMBARDO

PREREQUISITES	Knowledge of Thermodynamics and Gasdynamics
LEARNING OUTCOMES	Knowledge and understanding: Knowledge and understanding of the technologies used for the preliminary study and the development of aircraft and spacecraft propulsion systems. Knowledge and understanding of the elements influencing the design and the performance of the engine/motor. Knowledge and understanding of aerospace propulsion problems and solutions and elements for a detailed design of the engine/motor. Knowledge and understanding of the space flight maneuvers and the propulsion systems required for their realization. The student will be able to analyse the engine performance with reference to the physical and chemical phenomena that influence the engine behavior. Capacity to apply knowledge and understanding: Capacity to apply performance prediction methods and analysis of aircraft and spacecraft engines/motors and their components. Capacity to analyze transients, automatic controls, capacity to evaluate noise and pollutant emissions. Making judgments: Ability to assess the real behavior and performance of aircraft and spacecraft engines/motors and their components. The student will have the ability to find best solutions in engine/motor design. Communication: Communication ability by means of technical reports of aircraft or spacecraft engines/motor analysis . The student will have the ability to communicate and interact in a multidisciplinary team with other aircraft or spacecraft specialists. Lifelong learning skills: The knowledge acquired will allow the understanding of scientific publications and may allow the admission to courses at doctoral level or the access to research centers in the aerospace propulsion field.
ASSESSMENT METHODS	Written and oral examinations. The written exam consists of two tests to be passed both to access the oral exam. The first test concerns the design of an aeronautical engine or the design of one of its components. The second test concerns the design of a spacecraft or missile engine/motor or the design of one of its components. The oral exam consists of two or three in-depth analysis questions in the areas of the discipline. The final vote is based on the outcome of the written exam and the oral exam.
EDUCATIONAL OBJECTIVES	The student will transfer the principles of thermodynamics and gas dynamics to aerospace propulsion. He will recognise the relevance of jet propulsion in the science, commercial and defence sectors. He will learn the solutions and techniques involved in aerospace propulsion, some architecture details, some specific technologies, the forecasting performance methods involved in the design and analysis of aircraft and spacecraft engines and motors. He will have knowledge and skills that will allow him to analyze the design concepts of aircraft and spacecraft engines and motors.
TEACHING METHODS	Lectures, classroom practice
SUGGESTED BIBLIOGRAPHY	Jack L. Kerrebroch, “Aircraft Engines and Gas Turbines”, The MIT Press, Cambridge Massachusetts. George P. Sutton, Oscar Biblarz, “Rocket Propulsion Elements”, John Wiley & Sons. Ronald D. Flack, "Fundamentals of Jet Propulsion with Applications", Cambridge Aerospace Series

SYLLABUS

Hrs	Frontal teaching
1	Course Introduction
1	Aircraft Engines
2	Space Launch Vehicle and Spacecraft Engines and Motors
1	Missile Engines and Motors
2	The Ramjet
1	The Turbojet
2	The Afterburner Turbojet
3	The Turbofan
3	The Afterburner Turbofan
2	The Turboprop

SYLLABUS

Hrs	Frontal teaching
2	Subsonic and Supersonic Inlets
2	Aircraft Engine Combustors and Afterburners
2	Aircraft Engine Nozzles
4	Aircraft Engine Compressors and Fans
3	Aircraft Engine Turbines
2	Aircraft Engine Controls
4	Elements of Astrodynamics
3	Rocket Motor and Rocket Engine Fundamentals
3	Rocket Nozzles
6	The Solid Propellant Rocket Motor
2	Solid Propellants, Solid Propellant Combustion
2	Combustion Stability in Solid Propellant Rocket Motors
6	The Liquid Propellant Rocket Engine
2	Liquid Propellant Rocket EngineTurbopumps
2	Liquid Propellants, Liquid Propellant Combustion
2	Combustion Stability in Liquid Propellant Rocket Engines
3	Rocket Motor and Rocket Engine Controls

Hrs	Practice
2	The Ramjet
4	The Turbofan
3	The turbofan with afterburner
2	Subsonic and Supersonic Inlets
4	Compressors and Fans
3	Turbines
8	Solid Propellant Rocket Motors
8	Liquid Propellant Rocket Engines
6	Combustion and Combustion Stability in Solid Propellant Rocket Motors and Liquid Propellant Rocket Engines