UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2019/2020
MASTER'S DEGREE (MSC)	ENERGETIC AND NUCLEAR ENGINEERING
SUBJECT	THERMOTECHNICS
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50367-Ingegneria energetica e nucleare
CODE	07545
SCIENTIFIC SECTOR(S)	ING-IND/10
HEAD PROFESSOR(S)	LA ROCCA VINCENZO Cultore della Materia Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**LA ROCCA VINCENZO** Thursday 10:00 11:00 Stanza T128

DOCENTE: Prof. VINCENZO LA ROCCA

PREREQUISITES	For a good understanding of the topics discussed during the lectures, a good knowledge of Mathematics and Applied Physics is required.
LEARNING OUTCOMES	Knowledge and understanding. The student, at the end of the course, will have extensive knowledge of Heat Engineering applied to energy processes and design methodologies for the characterization of the heat exchange equipment, boilers and industrial furnaces. To achieve this objective the course provides: lectures, analysis and discussion of case studies. An oral examination at the end of the module aims to assess if the student has a sufficient knowledge of the topics. Applying knowledge and understanding. The student will be able to actually implement the real issues, is verification that project, the concepts learned during the course. To achieve this objective, the course includes lectures and guided practical lessons. Part of the final oral examination will include the resolution of simple exercises. Making judgments. The student will be able to recognize and classify the physical phenomena studied the Course for a correct management of the same in working practices. To achieve this objective, the course includes lectures and guided practical lessons. Part of the final oral examination will include the resolution of simple exercises. Communication skills. The student will acquire the ability to communicate and express the concepts inherent in the discipline. It will be able to hold conversations and prepare basic documents regarding the material covered during the course. To achieve this objective, the course includes lectures and guided practical lessons. Part of the final oral examination will include the resolution of simple exercises. Learning ability. The student at the end of the course will be able to design heat exchangers, boilers, furnaces and to study the operating characteristics with appropriate simulation models, to design the components of complex energy systems and to deal with the study of components related to complex processes for technological innovation of systems and energy plants. To achieve this objective, the course includes lectures and guided practical lessons. Part of the final oral examination will include the resolution of simple exercises.
ASSESSMENT METHODS	The candidate will have to answer at least four oral questions regarding any of the topics covered by the program which can be found in the recommended textbooks. Final assessment aims to evaluate whether the student has knowledge and understanding of the topics, has acquired a critical thinking and is able of taking decisions independently. A successful outcome can be achieved if the student shows a good knowledge and understanding of the topics at least in general terms and reaches a good level of problem solving; good presentation and communication skills are also important to show the examiner confidence on the topics. If these requirements are not met, the outcome of the examination will be negative. The more, however, the examinee with its argumentative and presentation skills can interact with the examiner and the more his knowledge and application capabilities go into detail on the subject of the discipline, the more the assessment is positive. The assessment is carried out of thirty according to the following schedule. Outcome Rating Rating Excellent30-30 laude The candidate shows an excellent knowledge of the topics, excellent communication skills, good analytical ability. The student is able to apply the knowledge to solve problems proposed. Very good 26-29 The candidate has a good knowledge of the subject, good communications skills. The student is able to apply knowledge to solve problems proposed. Good 24-25 The candidate has a basic knowledge of the main topics, discrete properties language, with limited ability to independently apply the knowledge to solve the proposed problems. Satisfactory21-23The candidate does not fully know the main topics but patly know them, satisfactory property language, poor ability to independently apply the knowledge gained. Sufficient18-20 The candidate has a very basic understanding of the main topics and of the technical language, very little or no ability to independently apply the knowledge gained. InsufficientThe candidate does not show an acceptable knowledge of the topics covered during the module.
EDUCATIONAL OBJECTIVES	Objective of the module is to deepen the study of Heat Engineering applied to energy processes and design methodologies for the characterization of the heat exchange equipment operation, boilers and industrial furnaces. Purpose of the course, in addition to the study of the theory, is the acquisition of a certain

	familiarity with the various computational techniques. To achieve that it is recommended to attend exercise classes and to carry on with self-study using the suggested textbooks.
TEACHING METHODS	Lectures and exercise classes.
SUGGESTED BIBLIOGRAPHY	Dispense, appunti e copie di articoli e manuali distribuiti durante il corso. D.Annaratone, Generatori di vapore, CLUP. S.S.Kutateladze, A councise encyclopedia of heat transfer. W.Trinks, M.H.Mawhinney; Industrial furnaces, J.Wiley. A.Bejan, G.Tsatsaronis, Michael Moran, Thermal design and optimization , J.Wiley.

SYLLABUS

Hrs	Frontal teaching
25	Heat exchangers: types of exchangers, shell and tube, rod cover, mantle, head cover, the tube bundle, baffles, other components of the heat exchanger, plate heat exchangers, finned tubular exchangers, logarithmic mean temperature difference, the project calculation and verification of an exchanger , calculation of the load losses, plant regulating valves; two-way valves, three-and four-way, calculation of the regulating valves.
20	Boilers: construction characteristics of the boilers, various types of boilers: fire tube, water tube, to cast iron elements, boilers for the production of saturated steam and overheated, sizing from boilers, combustion chambers, adiabatic flame temperature, calculation of the combustion chamber, yields of boilers, calculation for directly and indirectly.
15	Industrial furnaces: construction characteristics of industrial furnaces, types of industrial furnaces, thermal load, heat transfer in furnaces, calculation and verification of the ovens.

Hrs	Practice
21	Various exercises on the arguments developed during the lectures.