UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2017/2018		
MASTER'S DEGREE (MSC)	BUILDING ENGINEERING		
INTEGRATED COURSE	BUILDING THERMOPHYSICS AND PLANT DESIGN - INTEGRATED COURSE		
CODE	17525		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	ING-IND/11		
HEAD PROFESSOR(S)	RIZZO GIANFRANCO	Professore Ordinario	Univ. di PALERMO
OTHER PROFESSOR(S)	SCACCIANOCE GIANLUCA	Professore Associato	Univ. di PALERMO
	RIZZO GIANFRANCO	Professore Ordinario	Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**RIZZO GIANFRANCO** Tuesday 09:00 11:00 Deaim - Stanza T218 **SCACCIANOCE GIANLUCA** Monday 12:00 14:00 Stanza docente, 2° piano dell'edificio 9 (lato Fisica Tecnica), Dipartimento di Ingegneria		

DOCENTE: Prof. GIANFRANCO RIZZO

PREREQUISITES	Basic knowledge of thermodynamics; Basic knowledge of heat transfer; Basic knowledge of psychometry; Basic knowledge of hydraulics
LEARNING OUTCOMES	Knowledge and understanding The course will provide all the knowledge and methods needed to address the issues related to the analysis and evaluation of the energy performance of building-plant system, from point of view both of energy efficiency and of environmental sustainability. The knowledge will concern: - energy balance of building-plant system; - mathematical models of new building components; - methodologies for the assessment of indoor performances; - methodologies for the evaluation of environmental performance; - legislation on the energy performance certificates of buildings; - legislation on the environmental performance of building. Applying knowledge and understanding The students will be able to: - perform a full energy analysis of the building-plant system; - identify the best equipment options; - choose the most appropriate materials to sustainable building management. All this is seen in the context of wide legislation that was recently enacted at European level and Italian national concerning the reduction of energy consumption in buildings. Judgement Autonomy At the end of the course, students will have acquired the ability to single out the most appropriate solutions for each specific question in the field of the energy and environmental performance of the building-plant system, evaluating the effectiveness of different solutions (passive or active). In detail, students will be able to: - Estimate the effectiveness of different solutions for improving energy efficiency of components and systems through a proper identification and computation of involved heat exchanges; - make independently decision to address problems associated with the use of energy in buildings, including the correct use of energy sources, thanks to the knowledge of integrated methods of analysis. Communication abilities The student will have acquire the ability to: - communicate and express issues concerning the themes of the course; - support conversations on heat an mass transfer in building, innovative components for buildings, RES, plants for buildings; - identify practical solutions. The delivery modes of the course and the final test of evaluation are strongly aimed at enhancing the communication capacity of the student towards external consumer, both institutional and private. Learning abilities Thanks to the acquired knowledge, the student will be able to deepen his own knowledge through a literature search or by university courses. The learning of new methods of analysis to address energy and environmental issues will allow the student continuing his engineering studies with greater autonomy and discernment.
ASSESSMENT METHODS	The assessment of learning will be carried out through an oral examination and a discussion on script developed by student. Evaluation criteria of learning Evaluation criteria include an assessment of knowledge and skills of the individual student. The final evaluation aims at appraising whether the student possesses a good knowledge and comprehension of the topics acquired during the course, and whether he/she has acquired the ability to apply theoretical concepts to practical situations. Both the oral examination and the discussion on the script are aimed to evaluate the student's ability to use the acquired knowledge for solving problems as well as to express in a technical correct language. The oral examination will be aimed at verifying the level of acquired knowledge concerning the evaluation of the energy balance of a building, also by means of mathematical models included in the Italian country and international technical standards; the method of assessing the indoor performances; the environmental pressure exerted by buildings on the natural environment also in the framework of LCA methods. The evaluation of the final writing report will check the ability of the student of copying and solving real problems regarding the energy balance and the environmental evaluation (inddor as well outdoor) of buildings, along

	with the capability of singling out optimal solutions for the service equipment of buildings. The vote is expressed in thirtieths with possible praise, according to the scheme reported at the bottom of the degree program homepage, i.e. "Metodi di valutazione". At the end of the first module, a mid-term evaluation will be performed to improve the learning of knowledge and the skills of students, especially with reference to practical applications. Such mid term evaluation will be realized by means an oral enquiry and will not be part of the final appraisal.
TEACHING METHODS	Teaching is organised in theoretical lectures, exercises and the project work, aimed at applying the learned knowledge through numerical exercises. The exercises and the project work will cover applications of the theoretical knowledge to the solution of real problems, with particular attention to energy/ environmental implications of the solutions developed.

MODULE
MODULE 1 - INTEGRATED COURSE BUILDING THERMAL PHYSICS AND BUILDING PLANT DESIGN

Prof. GIANFRANCO RIZZO

SUGGESTED BIBLIOGRAPHY

• Dispense didattiche inserite in rete ed a disposizione degli studenti.
• M. Filippi, G. Rizzo, G. Scaccianoce. Edilizia Sostenibile (Titolo provvisorio-on press), Dario Flaccovio Editore, Palermo, 2013.
• M. Filippi, G. Rizzo. La certificazione energetica e la verifica ambientale degli edifici, Dario Flaccovio Editore, Palermo, 2007.
• A. Giaccone, G. Rizzo. La progettazione termica degli edifici con il personal computer. Franco Angeli Editore, Milano, 1987.

AMBIT	20562-A scelta dello studente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

This module is aimed at providing fundamentals of energy building analysis, with a particular focus on the use of renewable energy sources, on the interventions for energy saving and energy efficiency, on the use of the new components and plant for sustainable buildings.
All these issues take into account the physical and technical conditions for achieving the indoor comfort, as well the current legislation on energy performance and the environmental impacts of buildings.

SYLLABUS

Hrs	Frontal teaching
1	Course overview
4	Knowledge of the energy and environmental behaviour of buildings: energy balance of buildings in heating and cooling season.
7	New technologies for sustainable buildings and their mathematical models: innovative glazed surfaces, green-roofs, natural materials and renewable energy sources (RES).
4	Indoor performace of buildings: thermo-hygrometry and air quality.
4	Environmental performance of buildings: Eco-profile of a building; ecological footprint.
8	Standards and laws related to the energy performance certificate, and to environmental performance of buildings (Ecolabel, etc).

Hrs	Practice
8	Environmental performance of buildings.
8	Indoor performance of buildings.
8	Evaluation of the energy consumption of buildings.

MODULE
MODULE 2 - INTEGRATED COURSE BUILDING THERMAL PHYSICS AND BUILDING PLANT DESIGN

Prof. GIANLUCA SCACCIANOCE

SUGGESTED BIBLIOGRAPHY

- G.Alfano, M.Filippi, E.Sacchi, Impianti di Climatizzazione per l'edilizia - Dal progetto al collaudo, Ed. MASSON;
- C.Pizzetti, Condizionamento dell'aria e refrigerazione - Teoria e calcolo degli impianti, Ed. Tamburini;
- L.Rocco, G.Cellai, Guida agli impianti tecnici - Fondamenti degli impianti di climatizzazione, Ed. PEG;
- Gallizio, Impianti sanitari, Hoepli;
- Altre monografie indicate durante il corso, specificatamente per i singoli temi progettuali da svolgere.

AMBIT	20562-A scelta dello studente
INDIVIDUAL STUDY (Hrs)	98
COURSE ACTIVITY (Hrs)	52

EDUCATIONAL OBJECTIVES OF THE MODULE

The aim of the course is to improve and expand the knowledge about air conditioning and sanitary systems, as well as provide knowledge and understanding concerning to the design of "fire equipment" and "lighting systems", and to the methods for evaluating passive acoustic requirements of buildings.
Moreover, the course aims to complete the transfer to the students of the "know-how" related to:
a) make choices concerning the building equipment consistent with the best practice;
b) design of building systems;
c) converse technically with installers of plants.

SYLLABUS

Hrs	Frontal teaching
1	Course overview
5	Fire prevention system: passive and active fire protection
6	Fire safety engineering
8	Lighting design (photometric quantities, artificial light sources, methods of design, natural lighting)
8	Acoustics (fundamental parameters, indoor acoustic, building passive acoustic requirements)

Hrs	Practice
4	Exercises on fire protection
8	Exercises on HVAC system, and water and sanitary system
8	Exercises on lighting design
4	Exercises on buildings acoustics