UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria		
ACADEMIC YEAR	2020/2021		
MASTER'S DEGREE (MSC)	BUILDING ENGINEERING		
INTEGRATED COURSE	ENERGY AND INDOOR PERFORMANCE OF THE BUILDING - INTEGRATED COURSE		
CODE	21097		
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)	RIZZO GIANFRANCO LA GENNUSA MARIA	Professore Ordinario Professore Associato	Univ. di PALERMO Univ. di PALERMO
CREDITS	12		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	2		
TERM (SEMESTER)	2° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**LA GENNUSA MARIA** Thursday 12:00 14:00 Dipartimento di Ingegneria, Edificio 9, Studio 2009, secondo piano. Friday 10:00 12:00 Dipartimento di Ingegneria, Edificio 9, Studio 2009, secondo piano. **RIZZO GIANFRANCO** Tuesday 09:00 11:00 Deaim - Stanza T218		

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 and indoor comfort 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; - 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, indoor comfort 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, lighting and acoustics aspects; - 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, paying more attention on lighting and acoustics aspects; 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 (indoor as well outdoor) of buildings, along with the

	capability of singling out optimal solutions for improving indoor and energy performances 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 as well as the effect on lighting and acoustics performance of enclosure.

MODULE
BUILDINGS THERMOPHYSICS

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)	86
COURSE ACTIVITY (Hrs)	64

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.
3	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.
5	Standards and laws related to the energy performance certificate, and to environmental performance of buildings (Ecolabel, etc).

Hrs	Practice
4	Environmental performance of buildings: Eco-profile of a building.
4	Environmental performance of buildings: ecological footprint and Ecolabel.
4	Indoor performance of buildings: thermo-hygrometry.
4	Indoor performance of buildings: Indoor Air Quality.
4	Evaluation of the energy consumption of buildings: cooling load.
4	Evaluation of the energy consumption of buildings: heating load.

Hrs	Workshops
5	Laboratory referring to the passive solar systems and technologies for the bioclimatic building architecture: glazing surfaces.
5	Laboratory referring to the passive solar systems and technologies for the bioclimatic building architecture: greenhouses and Trombe wall.
5	Laboratory referring to the passive systems and technologies for the bioclimatic building architecture: flat-plate collectors.
5	Laboratory referring to the passive systems and technologies for the bioclimatic building architecture: advanced building envelope components.

MODULE
INDOOR PERFORMANCE

Prof.ssa MARIA LA GENNUSA

SUGGESTED BIBLIOGRAPHY

- Dispense del docente (lecture notes)
- Everest, Manuale di acustica. Concetti fondamentali, acustica degli interni, Hoepli
- Arianna Astolfi, Vincenzo Corrado, Applicazioni di illuminazione e acustica, CELID

AMBIT	20562-A scelta dello studente
INDIVIDUAL STUDY (Hrs)	86
COURSE ACTIVITY (Hrs)	64

EDUCATIONAL OBJECTIVES OF THE MODULE

The aim of the course is to provide the student with the knowledge and skills for the lighting design and for the suitable acoustic design of building environments and for understanding of some current regulations.
All this will be provided in the light of energy saving and indoor performances, also in order to reduce the environmental impact of buildings maintaining the same indoor comfort level.

SYLLABUS

Hrs	Frontal teaching
1	Course overview
3	The light and the vision; photometric quantities and their measurement
4	Lighting design and light sources
3	Daylighting and Circadian rhythm
4	Acoustics: parameters and sound propagation in free field
3	Architectural Acoustics
3	Environmental acoustics

Hrs	Practice
4	Exercises of lighting
4	Training on using of lighting software
4	Design of a lighting system by means of a software
4	Exercises of acoustics
4	An example of acoustic correction of a conference/meeting room
4	Training on the using of instruments for measuring acoustic parameters

Hrs	Workshops
5	Design of lighting system: sizing of lighting sources by means the software
5	Design of lighting system: writing elaborate graphics and reports
5	Acoustic correction of a conference/meeting room: choosing and sizing of acoustic material
5	Acoustic correction of a conference/meeting room: writing elaborate graphics and reports