Course guide
310184 - 310184 - Energy Rehabilitation

Last modified: 28/06/2023

Unit in charge: Barcelona School of Building Construction
Teaching unit: 753 - TA - Department of Architectural Technology.
748 - FIS - Department of Physics.
758 - EPC - Department of Project and Construction Engineering.

Degree: MASTER'S DEGREE IN DIAGNOSIS AND INTERVENTION TECHNIQUES IN BUILDING CONSTRUCTION (Syllabus 2020). (Compulsory subject).

Academic year: 2023 **ECTS Credits:** 5.0 **Languages:** Spanish

LECTURER

Coordinating lecturer: Rodriguez Cantalapiedra, Inmaculada

Others: Martí Muñoz, Jordi
Dolcet Butsems, David
Olona Casas, Joan

REQUIREMENTS

During the master the student will visit different building sites. Therefore, it is mandatory that the students have hired the compulsory and automatic insurance at the time of the enrollment. Those over 28 years of age do not have this university insurance and they must have their own insurance.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE5MUDITIE. To describe the aspects of heat exchange, thermic perception, indoor air quality, ventilation, lighting conditions and noise control and propagation.
CE6MUDITIE. To acquire knowledge about the thermal behaviour and the energy efficiency of the existing buildings.
CE12MUDITI. To make decisions based on the analysis of the results.
CE15MUDITI. To carry out an original exercise individually to be presented and defended before a University tribunal. It should consist of work in the field of diagnosis and intervention techniques in the building of a professional nature. The fact is, to synthesize and integrate the skills acquires into the teaching.

Generical:
CG1MUDITIE. To apply the knowledge acquired in the complex problem’s resolution in any sector of the existing building.
CG2MUDITIE. To use the tools for the research activities, as can be the data analysis and processing, as well as research techniques and methodology.
CG5MUDITIE. To obtain results transferable to the construction industry, by means of the applied investigation, the technological development and the innovation.

Transversal:
CT2MUDITIE. (ENG) Sostenibilitat i compromís social. Conèixer i comprendre la complexitat dels fenòmens econòmics i socials típics de la societat del benestar; tenir capacitat per relacionar el benestar amb la globalització i la sostenibilitat; aconseguir habilitats per utilitzar de forma equilibrada i compatible la tècnica, la tecnologia, l’economia i la sostenibilitat.
CT3MUDITIE. (ENG) Treball en equip. Ser capaç de treballar com a membre d’un equip interdisciplinar, ja sigui com un membre més o realitzant tasques de direcció, amb la finalitat de contribuir a desenvolupar projectes amb pragmatisme i sentit de la responsabilitat, assumint compromisos, tenint en compte els recursos disponibles.
CT4MUDITIE. (ENG) Ús solvent dels recursos de la informació. Gestionar l’adquisició, l’estructuració, l’anàlisi i la visualització de dades i informació en l’àmbit de la seva especialitat i valorar de forma crítica els resultats d’aquesta gestió.

Basic:
CB6MUDITIE. To possess and comprehend the knowledge that provides a basis or opportunity of being original on the development and/or implementation of ideas, often in an investigation context.
CB7MUDITIE. For the students to know how to apply the knowledge acquired and their problem-solving capacity in new environments or slightly familiar, within wider contexts (or multidisciplinary) related to their area of study.
CB8MUDITIE. For the students to be able to integrate knowledge and face the complexity of making judgements based on some information which, being incomplete or limited, includes considerations about the social and ethical responsibilities linked to the application of their knowledge and judgement.
CB9MUDITIE. For the students to know how to communicate their conclusions and the knowledge and underlying reasons to a specialised and a non-specialised public on a clear and concise way.
CB10MUDITI. For the students to obtain learning skills that allows them to continue studying on a mainly autonomous and self-taught way.

TEACHING METHODOLOGY

Training in energy rehabilitation strategies applied to buildings is carried out by integrating 2 knowledge groups into the project conception:
Passive systems (bioclimatic design)
Active systems (energy efficient facilities and with active use of renewable energy)
The course is developed using different methodology:

Theoretical classes, taught by the teachers responsible for each module and the invited speakers.
Software classes to learn how to use design and calculation software programs related to sustainable architecture.
Practical exercises for the application of the theoretical teachings.
Visits to buildings and facilities built using sustainability strategies

LEARNING OBJECTIVES OF THE SUBJECT

From the diagnosis, it proceeds to the evaluation of the building, and to the identification of the lines of improvement that can be related to the use and the management, the limitation of the demand from the improvement of the envelopes or systems efficiency, improved performance, and the incorporation of renewable energy.

This course provides students with an introduction to the energy performance issues of a building, including building thermodynamics, natural lighting, and solar control.

The course presents the scientific foundations of construction and provides the basis for an analysis of buildings following a methodology from which to obtain performance information of the different construction elements that make up the building envelope, as well as services and facilities that affect current requirements for limiting demand and energy efficiency.

Finally, the evolutionary nature of construction technologies, energy efficiency, ecology and responsible design is recognized.

STUDY LOAD

Type	Hours	Percentage
Hours large group	15,0	12.00
Self study	90,0	72.00
Hours small group	5,0	4.00
Guided activities	10,0	8.00
Hours medium group	5,0	4.00

Total learning time: 125 h

CONTENTS

Modul 1 Energy diagnosis and intervention techniques

Description:
In this module, a building energy diagnosis methodology will be presented based on the systematic and necessary collection of data related to architecture, construction, energy systems, environmental conditions and the dynamics of use and management in buildings, both residential and public.
Within the module itself, intervention techniques will be proposed to improve the behavior of the existing building, from the point of view of limiting the demand for the building envelopes

Related competencies :
CE12MUDITI. To make decisions based on the analysis of the results.
CE6MUDITIE. To acquire knowledge about the thermal behaviour and the energy efficiency of the existing buildings.
CT3MUDITIE. (ENG) Treball en equip. Ser capaç de treballar com a membre d'un equip interdisciplinar, ja sigui com un membre més o realitzant tasques de direcció, amb la finalitat de contribuir a desenvolupar projectes amb pragmatisme i sentit de la responsabilitat, assumint compromisos, tenint en compte els recursos disponibles.
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Full-or-part-time: 66h
Theory classes: 6h
Practical classes: 6h
Self study : 54h

Modul 2 Energy analysis and evaluation

Description:
This module lays the foundations for the evaluation of buildings from the point of energy analysis. Concepts will be remembered and knowledge regarding fluid dynamics and physical concepts related to energy will be consolidated. Likewise, abilities and skills will be acquired in the use of small equipment, tools, measurement equipment and simulation software for a correct evaluation and energy certification. You will be informed of the regulations related to energy rehabilitation and aid programs.

Related competencies :
CG1MUDITIE. To apply the knowledge acquired in the complex problem's resolution in any sector of the existing building.
CG5MUDITIE. To obtain results transferable to the construction industry, by means of the applied investigation, the technological development and the innovation.
CG2MUDITIE. To use the tools for the research activities, as can be the data analysis and processing, as well as research techniques and methodology.
CE12MUDITI. To make decisions based on the analysis of the results.
CE5MUDITIE. To describe the aspects of heat exchange, thermic perception, indoor air quality, ventilation, lighting conditions and noise control and propagation.
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CT4MUDITIE. (ENG) Ús solvent dels recursos de la informació. Gestionar l'adquisició, l'estructuració, l'anàlisi i la visualització de dades i informació en l'àmbit de la seva especialitat i valorar de forma crítica els resultats d'aquesta gestió.

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CB7MUDITIE. For the students to know how to apply the knowledge acquired and their problem-solving capacity in new environments or slightly familiar, within wider contexts (or multidisciplinary) related to their area of study.
CB8MUDITIE. For the students to be able to integrate knowledge and face the complexity of making judgements based on some information which, being incomplete or limited, includes considerations about the social and ethical responsibilities linked to the application of their knowledge and judgement.

Full-or-part-time: 37h 30m
Theory classes: 6h
Practical classes: 9h
Self study : 22h 30m

Modul 3 Systems Efficiency

Description:
In this module, emphasis is placed on energy rehabilitation based on the evaluation of existing installations and equipment, the identification of energy needs and proposals for intervention based on the efficiency of the systems: air conditioning, ventilation and lighting. The basic and necessary concepts are also introduced to undertake a comprehensive rehabilitation with the NzEB objective, the incorporation of renewable energies, the optimization of resources, and economic feasibility studies.

Related competencies :
CG1MUDITIE. To apply the knowledge acquired in the complex problem's resolution in any sector of the existing building.
CG5MUDITIE. To obtain results transferable to the construction industry, by means of the applied investigation, the technological development and the innovation.
CG2MUDITIE. To use the tools for the research activities, as can be the data analysis and processing, as well as research techniques and methodology.
CE12MUDITI. To make decisions based on the analysis of the results.
CE5MUDITIE. To describe the aspects of heat exchange, thermic perception, indoor air quality, ventilation, lighting conditions and noise control and propagation.
CE15MUDITI. To carry out an original exercise individually to be presented and defended before a University tribunal. It should consist of work in the field of diagnosis and intervention techniques in the building of a professional nature. The fact is, to synthesize and integrate the skills acquires into the teaching.
CE6MUDITIE. To acquire knowledge about the thermal behaviour and the energy efficiency of the existing buildings.
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CT2MUDITIE. (ENG) Sostenibilitat i compromís social. Conèixer i comprendre la complexitat dels fenòmens econòmics i socials típics de la societat del benestar; tenir capacitat per relacionar el benestar amb la globalització i la sostenibilitat; aconseguir habilitats per utilitzar de forma equilibrada i compatible la tècnica, la tecnologia, l'economia i la sostenibilitat.
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Full-or-part-time: 15h
Theory classes: 3h
Practical classes: 3h
Self study : 9h

Energetic Refurbishment

Description:
This module will serve to describe the different ways to improve a building energetically and there will be a practical application workshop to our model building.

Related competencies :
CG1MUDITIE. To apply the knowledge acquired in the complex problem's resolution in any sector of the existing building.
CE12MUDITI. To make decisions based on the analysis of the results.
CT3MUDITIE. (ENG) Treball en equip. Ser capaç de treballar com a membre d'un equip interdisciplinar, ja sigui com un membre més o realitzant tasques de direcció, amb la finalitat de contribuir a desenvolupar projectes amb pragmatisme i sentit de la responsabilitat, assumint compromisos, tenint en compte els recursos disponibles.
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CB9MUDITIE. For the students to know how to communicate their conclusions and the knowledge and underlying reasons to a specialised and a non-specialised public on a clear and concise way.
CB7MUDITIE. For the students to know how to apply the knowledge acquired and their problem-solving capacity in new environments or slightly familiar, within wider contexts (or multidisciplinary) related to their area of study.
CB8MUDITIE. For the students to be able to integrate knowledge and face the complexity of making judgements based on some information which, being incomplete or limited, includes considerations about the social and ethical responsibilities linked to the application of their knowledge and judgement.

Full-or-part-time: 21h
Theory classes: 3h
Practical classes: 9h
Guided activities: 9h

GRADING SYSTEM

Continuous assessment.
Each Module will have its related activities.
Activities Module 1: 30% of the Final Grade
Module 2 Activities: 30% of the Final Grade

Activities Module 3: 15% of the Final Grade
Semester Compendium Work: 25% of the Final Grade

EXAMINATION RULES.

The tests will be of an individual nature. Assessable assignments or exercises can be in pairs or in groups, to be determined

BIBLIOGRAPHY

Basic:
- Dirección General de Arquitectura, Vivienda y Suelo. Código técnico de la edificación [on line]. Madrid: Ministerio de Fomento. Dirección General de Arquitectura, Vivienda y Suelo, 2006 [Consultation: 08/07/2020]. Available on: https://www.codigotecnico.org/index.php/menu-documentoscte.html.
- Bosch González, Montse; Ruiz Martorell, Galdric; López Plazas, Fabián; Rodríguez Cantalapiedra, Inma. Avaluació energètica d'edificis: l'experiència de la UPC, una metodologia d'anàlisi [on line]. Barcelona: Edicions UPC, 2006 [Consultation: 06/07/2020]. Available on: https://upcommons.upc.edu/handle/2099.3/36741. ISBN 9788498800234.
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- Dirección General de Arquitectura, Vivienda y Suelo. Documento básico HE : ahorro de energía [on line]. Madrid: Ministerio de Fomento. Dirección General de Arquitectura, Vivienda y Suelo, 2019 [Consultation: 08/07/2020]. Available on: https://www.codigotecnico.org/images/stories/pdf/ahorroEnergia/DccHE.pdf.

RESOURCES

Hyperlink:
- Código Técnico de la Edificación. www.codigotecnico.org