Course unit title:	**Energy Design of Buildings**		
Course unit code:	CESU 310		
Type of course unit:	Compulsory (for Specialization in Sustainable Construction)		
Level of course unit:	Bachelor (1st Cycle)		
Year of study:	3		
Semester when the unit is delivered:	6 (Spring)		
Number of ECTS credits allocated :	6		
Name of lecturer(s):	Dr Paris Fokaides		
Aim of the Course	The purpose of this course is to present the important aspects of the energy design of buildings that are related to the civil engineering. In terms of this course, issues concerning the energy interaction between the building shell and the environment will be discussed. Buildings shell design towards minimizing energy losses to the environment will also be analyzed. The energy behavior of building elements will be introduced and the entire process of certifying the energy performance of a building will be presented.		
Learning outcomes of the course unit:	○ Understand the basic principles that govern the energy transfer from and to the building envelope ○ Identify the parameters that affect the indoor thermal comfort and calculate the relative indoor comfort indexes. ○ Be aware of the best practices in building's thermal insulation ○ Perform standard calculations for the overall heat transfer coefficient of building elements ○ Quantify the building losses from vulnerable building elements such as the glazed areas and the thermal bridges ○ Be aware of the principles related to the energy performance certification(EPCs) in process and be in position to issue EPCs.		
Mode of delivery:	Face-to-face		
Prerequisites:	None	Co-requisites:	None
Course contents:	**Module 1: Energy transfer principles** ○ Fundamentals of energy transfer mechanisms ○ Parameters affecting energy transfer mechanisms from and to the building envelope ○ Quantification of energy losses – worked examples **Module 2: Indoor thermal comfort** ○ Energy interaction between building user and building envelope ○ The Fanger model – worked examples ○ Quantification of thermal comfort indexes (PMV, PPD) ○ The psychrometric chart – worked examples **Module 3: Building elements thermal behavior** ○ Definition of the overall heat transfer coefficient of building elements ○ Calculation of energy losses from building elements consisting of several layers ○ Definition of thermal bridges and calculation of energy losses ○ Best practices in selection and application of buildings thermal insulation ○ Minimum legislative requirements in buildings thermal insulation **Module 4: Buildings energy performance certification** ○ Fundamentals of calculation buildings heating and cooling loads ○ Building services contribution to buildings energy consumption ○ Definition of the operational and asset rating ○ Energy classification rationale – the reference building		

	○ Definition of buildings energy class – worked examples
Recommended and/or required reading:	
Textbooks:	○ ASHRAE 2013 Handbook of fundamentals, ISBN: 978-1-936504-46-6 (SI) ○ VDI-Wärmeatlas, ISBN: 978-3-540-25504-8
References:	○ 2010/31/EC Directive on the energy performance of buildings (EPBD) ○ CEN/TR 15615 ”Umbrella document” ○ EN 15603 Overall energy use and definition of energy ratings ○ ISO 7730:2005: Ergonomics of the thermal environment -- Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria ○ ISO 6946:2007: Building components and building elements -- Thermal resistance and thermal transmittance -- Calculation method ○ ISO 14683:2007: Thermal bridges in building construction -- Linear thermal transmittance -- Simplified methods and default values ○ ISO 13790:2008: Energy performance of buildings -- Calculation of energy use for space heating and cooling
Planned learning activities and teaching methods:	The course is presented through theoretical lectures in class. The lectures present to the student the course content and allow for questions. The material is presented using visual aids (i.e. PowerPoint presentation slides, documentaries, etc.). The aim is to familiarize the student with the different and faster pace of presentation and also allow the instructor to present related material that would otherwise be very difficult to do. The learning process is enhanced with the requirement from the student to carry in-class discussions and tackling of hypothetical scenarios in small-group exercises. Homework Assignments, which are required as part of the students assessment for the course, allows students the opportunity to carry out independent work, synthesize basic concepts presented in class, as well as hone their writing and presentation skills. Besides from the notes taken by students in class, all of the course material is made available through the class website which is available through the University’s E-learning platform (“Moodle”). The instructor is available to students during office hours or by appointment in order to provide necessary guidance.
Assessment methods and criteria:	• Midterm Exams: 25% • Assignments: 25% • Final Exam 50%
Language of instruction:	English
Work placement(s):	No