COURSE DESCRIPTION CARD - SYLLABUS

Course name

Energy Protection Building

Course

Field of study	Year/Semester
Environmental Engineering Second-cycle Studies	2/3
Area of study (specialization)	Profile of study
Heating, Air Conditioning and Air Protection	general academic
Level of study	Course offered in
Second-cycle studies	polish
Form of study	Requirements
part-time	compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
20	8	
Tutorials	Projects/seminars	

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

dr inz. Andrzej Górka

Prerequisites

1.Knowledge: Knowledge of thermodynamics, heat transfer and fluid mechanics, heating, ventilation, air conditioning and refrigeration, and general construction.

2.Skills :The ability to perform mathematical transformations, derivation of mathematical formulas and solving classic linear equations and differential equations in the field of heat transfer.

The ability to perform hydraulic calculations in the field od ventilation, air conditioning and refrigeration and perform engineering drawings in AutoCAD in the range discussed in the first cycle of study.

3.Social competencies:

The student should be aware of the consequences of decisions.

The student understands of the need to constantly update and supplement knowledge and skills.

Course objective

-Acquiring the knowledge and skills of the new generation of buildings, environmentally friendly and energy-efficient technical solutions saving energy during operation.

Course-related learning outcomes

Knowledge

1. Student has ordered and theoretically founded knowledge of methods for assessing energy consumption in a building, development trends in the area related to heating systems and the possibilities of using low-temperature heat sources

2. Student knows how to use thermography to assess building quality and understands the impact of building air leaks on its energy balance

3. Student understands the requirements for energy-saving buildings: construction and in the field of technical equipment

4. Student understands the requirements for passive and almost zero-energy buildings and understands the principles of design and implementation of partitions in an energy-efficient building

5. The student understands the basic calculation programs for simulation, design, and evaluation of energy-efficient buildings

Skills

1. Can determine the calculation parameters of an energy-efficient building

2. Is able to perform thermal calculations of building and installation details and components for an energy-efficient building

3. Can use the Blower Door device together with specialized software for measuring the air tightness of a building

Social competences

1. Is aware of the impact of building quality on human health and well-being

2. Understands the need for teamwork in solving theoretical and practical problems

3. sees the need for systematic deepening and extension of their competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture:

Written test - multiple choice and open questions, the threshold is 50% of the maximum number of points.

Laboratories

The report on completed tasks will be evaluated.

The report assesses: the completeness of the tasks performed, the analyses described, references to literature about the results obtained (minimum 2-3 scientific articles), the diligence of report (charts, tables, descriptions), presented completeness, clarity, and transparency of the conclusions regarding the results.

Performing four tasks - grade 3.0; performance of 5 tasks - grade 4.0; performance of 6 tasks - 5.0.

Programme content

Buildings and their energy demand. Building energy standards and their evolution. Passive buildings, Directive on the energy performance of buildings, nearly zero-energy buildings, Polish standards NF15 and NF40. Methods of environmental assessment of buildings and energy standards of buildings? on the example of LCA, LEED, BREEAM, DGNB, Active House.

Requirements for opaque and transparent partitions and building components in energy-efficient buildings. Sample solutions of partitions and components for energy-efficient buildings. The effect of moisture on building partitions and climate comfort in a building. Moisture movement in building partitions. Correct construction of partitions in terms of moisture flow. Detailed calculation of the psi and fRsi values and optimization of building components using the Therm program.

Airtightness of energy-efficient buildings? Basics, essential elements, indicators, requirements, examples. Acceptance tests of thermal quality of energy-saving buildings. Thermography and measurement of airtightness and heat transfer coefficients and climatic comfort. Basics, methods, requirements, measuring equipment.

Systems of technical equipment and energy sources for energy-saving buildings. Electricity demand and lighting in energy-saving buildings. Examples of energy-efficient buildings solutions. Modernization of existing buildings to the energy-saving standard. Operating rules for energy-efficient buildings. Software supporting the simulation and design of energy-efficient buildings.

Subjects of laboratories is an analysis of the impact of input data on building energy consumption and consolidation of the principles of designing energy-efficient buildings. The given building should be drawn in 3D in the Sketch-up program, model the external partitions, locations, and orientation. After the analysis of useful, final, and primary energy for heating, ventilation, and cooling purposes for the base building, a sensitivity analysis to various input data will be carried out. There are seven specific tasks to complete.

Teaching methods

Lecture: lecture with multimedia presentation, problem lecture, case studies.

Laboratories: calculations in the programs: designPH, PHPP, Excel, presentation of results, discussion.

Bibliography

Basic

1. Strony internetowe: www.passivehouse.com, www.pibp.pl, www.cbp.put.poznan.pl

2. Feist W.: Podstawy budownictwa pasywnego. PIBP Gdańsk 2007

3. Wnuk R.: Instalacje w domu pasywnym i energooszczędnym. Przewodnik Budowlany 2007

4. Górzyński J.: Podstawy analizy środowiskowej wyrobów i obiektów. WNT Warszawa 2007

5. Laskowski L.: Ochrona cieplna i charakterystyka energetyczna budynku. Oficyna Wydawnicza Politechniki Warszawskiej. Warszawa 2005

6. Haas K.H. Der Weg zum Nullenergiehaus; VDE GmbH; Berlin; 2013

7. Energooszczędny dom i mieszkanie; Fundacja Instytut na rzecz Ekorozwoju & KAPE, Warszawa 2011, ISBN: 978-83-89495-12-9

8. Nowak H.: Zastosowanie badań termowizyjnych w budownictwie Oficyna Wydawnicza Politechniki Wrocławskiej Wrocław 2012

9. Grabarczyk S. Fizyka Budowli - Komputerowe wspomaganie projektowania budownictwa energooszczędnego; Warszawa 2005; ISBN 83-7207-548-4

10. Paul Appleby: Integrated Sustainable Design of Buildings. Wyd. Earthscan Publ. 2010

11. Nick V. Baker: The Handbook of Sustainable Refurbishment. Wyd. Earthscan Publ. 2010..

Additional

1. Harvey Danny L.D.: A Handbook on Low-Energy Buildings and District-Energy Systems. Earthscan London 2007

2. Tymkow P. i inni: Building Services Design for Energy Efficient Buildings. Earthscan London and New York 2013

3. Dylla A.; Fizyka cieplna budowli w praktyce. Obliczenia cieplno-wilgotnościowe; PWN , 2015

Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,0
Classes requiring direct contact with the teacher	28	1,0
Student's own work (literature studies, preparation for laboratory classes, preparation for tests, report preparation) [1]	47	2,0

[1] delete or add other activities as appropriate