COURSE DESCRIPTION CARD - SYLLABUS

Course name
Fundamentals of intagrated building design [S1BZ1E>PZPB]

Course

Field of study
Sustainable Building Engineering

Year/Semester
3/5

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
English

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
15

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student should have knowledge of: basics of architectural design, building physics, sustainable construction, information technology, numerical methods as well as skills in using Microsoft Excel computer programs, Trimble SketchUp and using the VBA programming language. The student should have the following social competences: responsibility for decisions, ability to work in a group, fulfilling the assigned tasks.

Course objective

Acquiring by the student knowledge and basic skills in the field of integrated design of comfortable buildings, environmentally friendly, energy-efficient and economically optimal. Acquiring by the student knowledge and basic skills in the field of energy simulation of buildings.

Course-related learning outcomes

Knowledge:
1. Students have basic knowledge of the methods for shaping building components with respect of heat, moisture, leakproofness, foundation in soil of heat andsanitary networks.
2. Student know the rules of constructing and analysing civil engineering, low-energy, passive and

sustainable, industrial, road, bridge, and railroad units.
3. Students have basic knowledge of operation algorithms of selected software (including the usage of BIM technology), supporting the calculation and design of constructions, construction work organisation, cost estimation, technical fitting of buildings; basic knowledge of operation algorithms of software dedicated for evaluation and design of energy-saving buildings.
4. Students have know basic methods, techniques, tools and materials applied to solve simple engineering tasks in the field of environmental engineering.

Skills:
1. Students are able to use advanced information and communication technologies (ICT) appropriate to perform typical engineering tasks.
2. Students when formulating and solving problems in sustainable building engineering, they can notice their systemic and non-technical aspects.
3. Students are able to correctly utilise numerical, analytical, simulation, and experimental methods, to identify and solve problems in sustainable building engineering; to obtain and verify the results.
4. Students are able to carry out both chemical and biological experiments, including measurements and computer simulation, in the field of: quality assessment of building and installation materials, simple engineering constructions, systems of technical fitting of buildings, external infrastructure, elements and systems applied in the built environment engineering, thermal comfort and air quality; can clearly present and interpret the obtained results and draw conclusions.
5. Students can utilize selected software supporting design decisions in sustainable building engineering, including programs based on the BIM technology; are able to critically evaluate the obtained results of numerical analysis of building unit.

Social competences:
1. Students are able to adapt to new and changing circumstances, can define priorities for performing tasks defined by themselves and other people, acting in the public interest and with regard to the purposes of sustainable development.
2. Students take responsibility for the accuracy and reliability of working results and their interpretation.
3. Students are ready to autonomously complete and broaden knowledge in the field of modern processes and technologies of building engineering.
4. Students are able to critically evaluate the results of their own work.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Lecture - written or oral exam covering the scope of issues presented during the lecture - open and closed questions
Seminars - the report is evaluated or the presentation on the given issue is evaluated, together with oral or written defense.
Marks:
50-60% - 3.0
60-70% - 3.5
70-80% - 4.0
80-90% - 4.5
Od 90% - 5.0

Programme content

1) Lecture
Integrated building design: introduction
Contemporary building as a set of interdependent systems
Heat recovery technologies in buildigns
Air tightness and ventilation in integrated design
BIM as a tool in the design of integrated buildings
The importance of HVAC system efficiency for a building
Including building use in integrated design
Humanistic aspects of building design
Energy simulations of buildings: the basics of numerical modeling, examples

Methods for assessing energy and economic efficiency
Examples of integrated projection implementation
Review of simulation tools supporting integrated design
2) Seminars
Numerical analysis of a building partition
Simplified thermal model of the building (concentrated heat capacity method)
Analysis of ventilation needs in buildings (moisture and pollution removal, CO2 bala nce)
Thermal modeling and daylight illumination of the building in TRNSYS program
The importance of heat recovery for building efficiency
The role of ventilation and air tightness of the building
Interaction between the structure and technical equipment of the building
CFD in integrated design
Energy / economic efficiency assessment

Course topics

none

Teaching methods

1. Lecture: multimedia presentation, illustrated with examples on the board (Informative lecture, Problem lecture, Conversational lecture)
2. Seminars: multimedia presentation, illustrated with examples on the board, combined with discussion and solving cognitive tasks

Bibliography

Basic
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2. Skrzypek J., Górka A., Oprogramowanie do modelowania energetycznego budynków, Rynek Instalacyjny, t. 3, s. 73-79, 2016
3. Hauslanden, Liedl, de Saldanha, Building to Suit the climate. A Handbook, 2012
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7. Paul Appleby: Integrated Sustainable Design of Buildings. Wyd. Earthscan Publ. 2010
8. Architects Guide to Integrating Energy Modeling in the Design Process - http://aiad8.prod.acquia-sites.com/sites/default/files/2016-04/Energy-Modeling-Design-Process-Guide.pdf
9. Hensen J. L. M., I Lamberts R., Building Performance Simulation for Design and Operation. New York: Spon Press, 2011.
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Additional
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2. Anger A., Lisowski B., Piwkowski W., Wierzowiecki P.: Ogólne założenia procesu wdrażania BIM w realizacji zamówień publicznych na roboty budowlane w Polsce. "Przegląd Budowlany", nr 10/2015
3. KPMG Advisory: BIM - Ekspertyza dotycząca możliwości wdrożenia metodyki BIM w Polsce, 2016
4. Clarke J. A., Energy Simulation in Building Design, Butterworth-Heinemann, 2001
5. Harish V. S. K. V., I Kumar A., A review on modeling and simulation of building energy systems, Renewable and Sustainable Energy Reviews, t. 56, s. 1272-1292, 2016
6. IBPSA-USA, Building Energy Software Tools Directory http://www.buildingenergysoftwaretools.com/
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8. Nasyrov V., Stratbücker S., Ritter F., Borrmann A., Hua S., I Lindauer M., Building information models as input for building energy performance simulation - the current state of industrial implementations,

Proceedings of the 10th European Conference on Product and Process Modelling, ECPPM 2014, s. 479-486

Breakdown of average student's workload

	Hours	ECTS
Total workload	120	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	60	2,00