COURSE DESCRIPTION CARD - SYLLABUS

Course name
Energy Efficient Architecture [S1Arch1E>AE]

Course

Field of study
Architecture

Year/Semester
3/6

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
0

Laboratory classes
0

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

1,00

Coordinators

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Lecturers

Prerequisites

- The student has basic knowledge of architecture and town planning as well as building physics - the student knows the basic methods, techniques, tools and materials used in solving simple engineering tasks in the field of architecture and urban planning, - the student is able to obtain information from Polish and foreign-language literature, legal acts and databases and other relevant sources, - is able to integrate and select information, formulate conclusions based on it, and justify its opinions, - the student has the ability to self-study, - the student understands the need for lifelong learning, - the student is able to think and act in an innovative way,

Course objective

1. To acquaint students with the pro-ecological approach to design, consistent with the principle of sustainable development. 2. Acquainting students with the basics of legal regulations (Poland and the EU) concerning energy- efficient buildings and renewable energy sources. 3. Understanding the principles of designing energy-efficient buildings (location, choice of form and materials, parameters of partitions), especially passive buildings. 4. Presentation of exemplary energy-saving and ecological solutions in the scale of the city, housing estate, building. 5. Particular attention to the possibility of applying the latest technologies of using renewable energy sources in architecture, taking into account Poland"s potential in this area. 6. Acquainting with the latest solutions and installations supporting the functioning of smart cities and buildings in the context of ecology.

Course-related learning outcomes

Knowledge:
A.W1. architectural design for the implementation of simple tasks, in particular: simple facilities taking into account the basic needs of users, single- and multi-family housing, service facilities in residential complexes, public facilities in an open landscape or in an urban environment;
A.W2. urban design in the scope of implementation of simple tasks, in particular: small building complexes, local spatial development plans, taking into account local conditions and connections, as well as forecasting transformation processes in the settlement structure of towns and villages;
A.W3. records of local spatial development plans to the extent necessary for architectural design;
A.W4. principles of universal design, including the idea of designing spaces and buildings accessible to all users, in particular for people with disabilities, in architecture, urban planning and spatial planning, and ergonomic principles, including ergonomic parameters necessary to ensure full functionality of the designed space and facilities for all users, especially for people with disabilities

Skills:
A.U1. design an architectural object by creating and transforming space so as to give it new value - in accordance with a given program that takes into account the requirements and needs of all users;
A.U2. design a simple urban complex;
A.U3. prepare planning studies concerning spatial development and interpret them to the extent necessary for designing in an urban and architectural scale;
A.U4. make a critical analysis of the conditions, including the valorization of the land development and building conditions;
A.U5. think and act creatively, using the workshop skills necessary to maintain and expand the ability to implement artistic concepts in architectural and urban design;
A.U6. integrate information obtained from various sources, formulate their interpretation and critical analysis;
A.U7. communicate using various techniques and tools in a professional environment appropriate for architectural and urban design;
A.U8. prepare architectural and construction documentation in appropriate scales in relation to the conceptual architectural design;
A.U9. implement the principles and guidelines of universal design in architecture, urban planning and spatial planning.

Social competences:
A.S1. independent thinking to solve simple design problems;
A.S2. taking responsibility for shaping the natural environment and cultural landscape, including the preservation of the heritage of the region, country and Europe.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

1. Written / oral test
Formative assessment
- test grade
Assessment scale: 2,0; 3.0; 3.5; 4.0; 4.5; 5.0
Summative assessment:
- grade from the written test, taking into account the required number of lectures (knowledge and drawing skills)

Assessment scale: 2,0; 3.0; 3.5; 4.0; 4.5; 5.0

Programme content

Issues related to pro-ecological shaping of architecture, with particular emphasis on energy-saving solutions, including renewable energy sources and "smart" technologies.

Course topics

1. Polish and European Union law on energy-saving construction and the use of renewable energy sources. Energy performance of buildings. Systematics of terms: energy-saving, low-energy, passive, zero-energy building, pro-ecological architecture, low-tech, green architecture, renewable energy sources. Discussion of selected examples of energy-saving architecture etc;
2. Principles of an ecological approach in architectural design. Building development: orientation, form, surroundings, development, glass surfaces, partitions and their thermal insulation, heat losses. Selection of housing materials for an energy-saving architectural building
(including biotic elements). Presentation of examples of ecological architecture;
3. Potential for the use of renewable energy in Poland, the use of geothermal energy, principles of architectural design: land development, use of heat recovery systems (installations with shallow boreholes, surface, heat pumps, ground heat exchangers, with recuperation);
4. Principles of shaping architectural objects with the use of solar energy or (protection) limiting the influence of solar rays. Passive and active solar energy use systems (Trombe wall, the so-called photovoltaic effect, greenhouse effect;);
5. The use of wind as an energy source (wind farms, turbines and household power plants). Ways of using wind to ventilate rooms inside the building - "breathing" building and ways to protect architectural structures from the wind;
6. Systems of obtaining energy from water (energy produced by the movement of water in rivers, water turbines). The principle of operation of the rainwater and used water recovery installation (gray water);
7. Technologies for energy-saving buildings using, among others, biomass, energy-saving energy-saving lighting;
8. New technologies and urban development: technologies for smart cities (e.g. intelligent transport) and intelligent buildings (installation management systems). Legal regulations. Presentation of examples of the concept and implementation of the idea of smart cities;

Teaching methods

1. Conventional lecture.
2. Lecture with a multimedia presentation.
3. eLearning Moodle (a system supporting the teaching process and distance learning).

Bibliography

Basic:
1. Asdrubali F., Desideri U., Handbook of: Energy Efficiency in Buildings. A Life Cycle approach, Butterworth-Heinemann Publ., 2018
2. Banach M., Od inteligentnego transportu do inteligentnych miast, PWN, Warszawa 2018.
3. Błaszczyński T., Ksit B., Dyzman B., Budownictwo zrównoważone z elementami certyfikacji energetycznej, DWE, Wrocław 2012;
4. Cotterell J. Dadeby A., The Passivhaus Handbook: A practical guide to constructing and retrofitting buildings for ultra-low energy performance (Sustainable Building), Green Books, 2012.
5. Gerring D., Renewable Energy Systems for Building Designers Fundamentals of Net Zero and High Performance Design, Routledge Publ., 2022.
6. Habermann K.J., Gonzalo R., Energy Efficient Architecture: Planning and Construction, Birkhauser Architeture Publ., 2006.
7. Kibert Ch.J., Sustainable Construction: Green Building Design and Delivery, 5th Edition, Wiley Publ., 2022.
8. Marchwiński J., Zielonko-Jung K., Współczesna architektura proekologiczna, PWN, Warszawa 2012;
9. Sinopoli J.M., Smart Buildings Systems for Architects, Owners and Builders, Butterworth-Heinemann Publ., 2009.
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11. Wines J., Green architecture, Taschen America LLc,2000.
12. Zimny J., Odnawialne źródła energii w budownictwie niskoenergetycznym, Polska Geotermalna Asocjacja, Warszawa-Kraków,2010.
Legal acts:
13. Ustawa z dnia 25 maja 2025 r. o efektywności energetycznej.
14. Ustawa z dnia 29 sierpnia 2014 r. o charakterystyce energetycznej budynków.
15. Ustawa z dnia 7 lipca 1994 r. Prawo budowlane.
16. Prawo energetyczne. Ustawa z dn.10.04.1997 z późn. zmianami.
17. Rozporządzenie Ministra Infrastruktury w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie.
18. Obwieszczenie Ministra Inwestycji i Rozwoju z dnia 15 kwietnia 2022 r. w sprawie ogłoszenia jednolitego tekstu rozporządzenia Ministra Infrastruktury w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie,
19. Rozporządzenia Ministra Infrastruktury i Rozwoju z dnia 27 lutego 2015 r. w sprawie metodologii wyznaczania charakterystyki energetycznej budynku lub części budynku oraz świadectw charakterystyki energetycznej
20. Dyrektywa Parlamentu Europejskiego i Rady 2009/28/WE z dnia 23 kwietnia 2009 r. w sprawie promowania stosowania energii ze źródeł odnawialnych.
21. Dyrektywa Parlamentu Europejskiego i Rady (UE) 2018/844 z dnia 30 maja 2018 r. zmieniająca dyrektywę 2010/31/UE w sprawie charakterystyki energetycznej budynków i dyrektywę 2012/27/UE w sprawie efektywności energetycznej
22. Strategia ramowa na rzecz stabilnej unii energetycznej opartej na przyszłościowej polityce w dziedzinie klimatu + Annex, Bruksela, 25.02.2015 COM(2015).
23. Energy Performance of Buildings Directive (EU/2024/1275).
24. Energy Efficiency Directive (EU/2023/1791)
25. DIRECTIVE (EU) 2024/1275 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 24 April 2024 on the energy performance of buildings.

Additional:
1. Baranowski A., Projektowanie zrównoważone w architekturze, Wyd. Pol.Gdańska,Gdańsk,1998.
2. Celadyn W., Przegrody przeszklone w architekturze energooszczędnej, Wyd. Pol.Krakowskiej, Kraków, 2004.
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4. Guzowski M., Towards zero-energy architecture. New solar design., LaurenceKing Publ., London, 2010.
5. Herzog T., Solar Energy In Architecture and Urban Planning, Prestel,Munich-New York,1996.
6. Januchta-Szostak A., Banach M., (praca pod red.) Zrównoważone miasto-idee i realia tom.1, Wyd.Pol.Poznańskiej, Poznań 2016.
7. Januchta-Szostak A., Banach M., (praca pod red.) Architektura wobec wyzwań zrównoważonego rozwoju tom.2, Wyd.Pol.Poznańskiej, Poznań 2016
8. Majerska-Pałubicka B., Rozwiązania energooszczędne w architektonicznym projektowaniu obiektów handlowych, Pol.Śląska, Gliwice, 2001.
9. Pakiet do projektowania budynków pasywnych PHPP, Polski Instytut Budownictwa Pasywnego,Gdańsk,2006.
10. Piotrowski R., Naciążek B., Jak zbudować dom energooszczędny, Przewodnik Budowlany 2013;
Legislation:
11. Ustawa z dnia 27 marca 2003 r. o planowaniu i zagospodarowaniu przestrzennym (Dz.U. Nr 80 poz. 717, z późn. zm.)
12. Uchwała nr 91 Rady Ministrów z dnia 22 czerwca 2015 r. w sprawie przyjęcia "Krajowego planu mającego na celu zwiększenie liczby budynków o niskim zużyciu energii"
13. Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej z dn.08.02.2012r., w sprawie uprawnień do sporządzania świadectwa charakterystyki energetycznej budynku
14. Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej zmieniające rozporządzenie w sprawie warunków technicznych, jakim powinny odpowiadać budynki i ich usytuowanie (Dz. U. z 2013 r, poz. 926)
15. Rozporządzenie Ministra Transportu, Budownictwa i Gospodarki Morskiej z dnia 25 kwietnia 2012 r. w sprawie szczegółowego zakresu i formy projektu budowlanego
16. Rozporządzenie Parlamentu UE i Rady ustanawiające ramy na potrzeby osiągnięcia neutralności klimatycznej i zmieniające rozporządzenie (UE) 2018/1999 (Europejskie prawo o klimacie), Bruksela, 04.03.2020 COM (2020) 2020/0036 (COD)

Breakdown of average student's workload

	Hours	ECTS
Total workload	25	1,00
Classes requiring direct contact with the teacher	15	0,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	10	0,50