Ministry of Education and Science of Ukraine

ODESA STATE ACADEMY OF CONSTRUCTION AND ARCHITECTURE

Architectural and Art Institute
Department of architectural structures

SYLLABUS
educational component
Educational discipline - Modern energy-efficient architectural and planning solutions of multi-storey buildings

Educational level	second (master's)	
Training program	selective	
Branch of knowledge	19	Architecture and construction
Specialty	192	Construction and civil engineering
Educational program	Construction and civil engineering	
Scope of the discipline	**4 ECTS credits**(120 academic hours)	
Types of classroom classes	lectures, practical classes	
Individual and (or) group tasks	calculation and graphic work	
Forms of semester control	test	

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In the process of studying this discipline, students will GET TO KNOW THE MAIN**THE PRINCIPLES OF ENERGY-EFFICIENT ARCHITECTURAL PLANNING SOLUTIONS IN THE DESIGN OF MULTI-STORY BUILDINGS.**

For example: Ability to determine with methods and tools the energy efficiency of buildings and use standards and certification systems such as LEED and BREEAM.

Prerequisites for studying the disciplineis the acquisition of theoretical knowledge and practical skills in the following disciplines: Normative regulation of construction activities in construction, Construction materials science, Architecture of buildings and structures.

Differentiated learning outcomes:
know:
- understanding the concept of energy efficiency in construction and its role in sustainable development;
- knowledge of modern technologies and materials used to ensure energy efficiency in construction;

- familiarization with regulatory and legal acts and certification systems that regulate the energy efficiency of buildings in Ukraine;
- understanding the principles of calculating and modeling the energy efficiency of buildings;

understand:

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have:

- the method of calculating the energy efficiency of buildings and the ability to use specialized modeling software;
- methodology to design and plan buildings taking into account the principles of energy efficiency, using optimal lighting, ventilation, insulation and other energy-saving technologies;
- the method of analyzing the energy efficiency of buildings and determining the potential for improvement;

be able:

- to carry out and develop energy-efficient projects of buildings taking into account specific needs and restrictions;
- to to determine and evaluate the economic feasibility of energy-efficient solutions and conduct cost and payback analysis;
- to perform green certification of buildings and the ability to work with the requirements of these certification systems;
- to use to analyze and critically evaluate modern trends and challenges in the field of energy-efficient construction.

THEMATIC PLAN

No	Name of topics	Number of hours			
		lectures	practical	laboratory	independent
1	Introduction to energy efficiency in construction: Definition of energy efficiency, significance in modern construction, role in sustainable development. Legislative and regulatory acts regulating energy efficiency in construction in Ukraine.	2			10
2	Principles of energy efficiency in architecture: Design and planning of buildings taking into account energy efficiency. Use of natural lighting, natural ventilation and energy-saving materials in construction.	2			8
3	Energy-saving technologies in construction: An overview of modern energy-saving technologies, including innovative materials, insulation, heating and cooling, ventilation and air conditioning systems. The impact of these technologies on the energy efficiency of buildings.	2	4		8
4	Renewable energy systems in construction: Using solar energy to generate electricity and heat water. Geothermal systems for heating and cooling buildings. Wind energy and its application in construction.	2			6

5	Energy-efficient lighting systems: Use of energy-saving lighting systems, such as LED lamps, motion and daylight sensors. Optimal planning of lighting to ensure comfortable conditions and energy saving.	2	2		10
6	Energy-efficient heating and cooling systems: The role of energy-efficient heating and cooling systems in providing comfortable conditions in buildings. The use of heat pumps, underfloor heating, air conditioning systems with a reverse heat pump and other energy-efficient solutions.	2			6
7	Integrated energy management systems: Automation of energy management systems in buildings. Monitoring and analysis of energy performance. Use of modern technologies of "smart houses" for energy saving.	2	2		10
8	Green certification systems: An overview of green certification systems such as LEED and BREEAM. Criteria for obtaining certificates, requirements for energy efficiency and sustainable construction. Advantages of building certification.	2	4		10
9	Energy efficiency retrofit strategies: Methods and technologies for improving the energy efficiency of existing buildings. Modernization of insulation, replacement of windows, installation of energy-efficient heating and cooling systems.	2			6
10	Energy efficiency and economic aspect: Assessment of the economic feasibility of energy-efficient solutions in construction. Calculation of costs and payback. Financial incentives and support for energy efficient buildings.	2	4		10
	In total	**20**	**16**		**84**

Evaluation criteria and diagnostic tools

The minimum and maximum assessment level for obtaining a "credit" for the academic discipline "Modern energy-efficient architectural and planning solutions of multi-storey buildings" is 60 points and 100 points, respectively, and can be achieved by the following means of assessment:

Evaluation tools		Minimal scores	Maximum scores
Evaluation tools	Quantity per semester		
Calculation and graphic work	1	30	60
Knowledge control:			
- Current knowledge control (standardized tests), or	2	30	40
- Final (semester) knowledge control	1		
Together		**60**	**100**

Calculation and graphic work provided from the general section of the educational component. This work considers a multi-story structure or a public building, the energy efficiency of which needs to be calculated.

The student needs to: select a real high-rise building and conduct an energy analysis of it using appropriate software (eg EnergyPlus, DesignBuilder or other similar tools).

Students should identify potentials to improve the building's energy efficiency, for example through improved insulation, replacement of heating/cooling systems, use of renewable energy sources, etc.

The work consists of two parts: calculation and graphic and is performed in the form of an explanatory note, which includes a graphic part (A-4 format).

Methodical recommendations for performing calculation and graphic work.[3]

Twice a semester, express control of knowledge is held - standardized tests (20 test questions), for example

1. What does energy efficient building design include?
   a) use of energy-saving materials;
   b) optimal use of natural lighting and ventilation;
   c) use of renewable energy systems;
   d) all the above options.
2. What is LEED (Leadership in Energy and Environmental Design)?
   a) standard for assessing the energy efficiency of buildings;
   b) international certification system for sustainable construction;
   c) regulatory act regulating energy efficiency in Ukraine;
   d) energy efficiency modeling software.
3. What type of renewable energy can be used in buildings to generate electricity and heat water?
   a) solar energy;
   b) geothermal energy;
   c) wind energy;
   d) all the above options.

Final control of knowledgeis held for students who could not for any reason score the required number of points, or for students who wish to increase the number of points already scored. The final control of knowledge is carried out in the form of an oral conversation with the teacher (committee of teachers) on the subject of the academic discipline.

Information support

Basic literature

1. Yeremeev I.S., Yeshchenko O.I. Energy saving in housing and communal economy. - K.: Helvetica, 2021. - 352 p.
2. Krasnianskyi M.O. Energy conservation: a study guide. — K.: Condor-Press, 2018. — 136 p.: illustrations.
3. Grynyova I.I. Methodical instructions for calculation and graphic work in the discipline "Modern energy-efficient architectural and planning solutions of multi-storey buildings" for students of the direction 6.060101 "Construction", Odesa, ODABA, 2018. - 38 p.
4. Dvoršak B., Havelka Ju., Mainardi E., Pandžić H., Selič T., Tretinjak M. Smart home systems. SHVET, 2022. 80 p.

Auxiliary sources of information

5. Troi A., Bastian Z. Energy Efficiency Solutions for Historic Buildings: Study. Manual. — Walter de Gruyter GmbH, 2014. — 336 p.
6. Klaus Jä., Olindo I., Arno H.M. Smets, René A.C.M.M. van Swaaij, Miro Z. A Student Introduction to Solar Energy. Delft University of Technology, 2014. 420 p.
7. D. Yogi Goswami. Principles of solar engineering. Taylor & Francis Group, LLC, 2015. 790 p.