REPUBLIC OF UZBEKISTAN

MINISTRY OF HIGHER EDUCATION, SCIENCE AND INNOVATIONS

FERGANA STATE TECHNICAL UNIVERSITY

Energy-efficient buildings

MODULE HANDBOOK

Field of knowledge:	700000	- Engineering, manufacturing and construction
Field of education:	730 000	- Architecture and construction
Education program (Major):	60730300	- Civil engineering

Fergana 2025

Module title	*Energy-efficient buildings*
Code (if available)	*EEBM76*
Semester(s) of module teaching	*7*
Responsible for the module	*Mumin Nabiyev- Associate professor, department of civil engineering, Nasriddinov Xasan Shavkatovich- Senior lecturer, department of civil engineering*
Language of instruction	*Uzbek*
Connection to the curriculum	*Compulsory*
Teaching methods	*Lecture, practical training and independent study.*
Study load (including classroom and independent study hours)	*Total hours: 180 hours* *Auditorium hours: 72 hours, including:* *Lectures – 22 hours* *Practical training – 50 hours* *Independent work: 108 hours*
Credit units	
Required and recommended prior knowledge for studying the module	*Energy-efficient buildings*
Module objectives/intended learning outcomes	***Module Objective**: The objective of this module is to train highly qualified specialists with broad expertise in the field of building design and construction. The aim of teaching the subject "Energy-Efficient Buildings" is to address the crucial issue of reducing energy consumption across all sectors of industry, particularly in the operation of buildings. Solving such issues requires specialists who are capable of assessing the energy efficiency of construction objects and who possess practical knowledge in thermal modernization of existing buildings. Such professionals play a significant role in the construction sector.* ***Course Tasks**– The main task of the subject is to provide students with the knowledge and skills necessary to design energy-efficient buildings under the dry and hot climatic conditions of Uzbekistan.* *Upon successful completion of the "Energy-Efficient Buildings" course, students will be able to:* – *Understand the methods of reducing energy consumption during the construction and operation of buildings;* – *Explain the climatic features of Central Asia and their influence on indoor microclimate formation;* – *Know and apply the basic principles of designing energy-efficient buildings in arid and hot climates;* – *Develop architectural and design solutions that contribute to energy conservation in civil buildings;* *Acquire practical experience and skills in calculating and designing thermal insulation for building envelope structures based on thermal protection requirements.* *"The teaching of "Energy-Efficient Buildings" involves the use of computer graphics and modern information technologies.* *Throughout the course, physical building models and mock-ups are widely used. Visual and instructional materials are delivered to*

	students through specialized computer software. *Students are expected to gain skills in using electronic tools to independently study the subject in depth. They must also acquire competencies in researching topic-related information through academic literature, preparing presentations, and delivering them effectively.*
Content	***Module 1: Introduction to Energy-Efficient Buildings*** – *Subject and objectives of the Energy-Efficient Buildings course* – *Principles of designing energy-efficient buildings suitable for Uzbekistan's conditions (urban planning, volumetric-architectural, structural, engineering, use of alternative energy sources, and improving building performance)* – *Utilization of solar energy in buildings; solar exposure based on orientation and surfaces; solar houses* – *Heat loss through windows, floors, and walls, and methods to reduce it* – *Architectural methods of reducing heat loss in buildings; application of national construction standards (QMQ) in designing energy-efficient buildings* – *Theoretical foundations of designing energy-efficient buildings for dry and hot climates* ***Module 2: Renewable Energy Sources in Uzbekistan*** – *Potential and practical use of renewable energy sources in Uzbekistan* – *Low- and high-temperature heliotechnical devices and their applications in construction* – *Conversion of solar energy into thermal energy using active solar systems* – *Types of passive solar heating systems and their use for heating residential buildings* – *Designing envelope structures for solar houses; calculation and design of heliosystems for such buildings* – *Eco-houses and principles of their design* ***Module 3: Designing with Local Building Materials*** –*Experimental rural houses heated by solar energy using local materials* –*Projects implemented in cooperation with Germany, Norway, and the World Bank* –*Energy audit in public buildings; energy passport certification* –*Heat loss calculation through building envelopes in accordance with QMQ standards* –*Comprehensive energy audit of buildings: total heat loss, architectural and structural solutions* *Application of solar heating systems in designing energy-efficient buildings* ***Module 4: Model Project Analysis*** – *Determining heat loss through each building envelope element using a sample project* – *Assessing the effectiveness of energy-saving measures defined in QMQ using a sample project* – *Calculating heat loss in two-story buildings based on a model design*

	– *Verifying compliance with normative heat loss requirements based on model project results* – *Thermal engineering calculations for flat solar collectors* – *Evaluation of the effectiveness of heliotechnical devices in construction* ***Module 5: Helioengineering Systems*** – *Application of heliotechnical requirements in practical design* – *Design of building envelope structures for solar houses* – *Volumetric-architectural solutions for solar houses* – *Practical training on improving energy efficiency in multi-story buildings* – *Examples of calculating specific heat consumption* ***Module 6: Building Physics and Technical Calculations*** – *Lighting engineering* – *Natural lighting* – *Mixed and artificial lighting* – *Acoustics* – *Noise sources and their characteristics* *Sound insulation of building envelope structures*
Forms of assessment	*Presentations, practical assignments, and final examinations.*
Requirements for study and assessment	*To successfully complete the module, the student must attend classes and achieve the minimum required scores in current, midterm, and final assessments.*
Bibliography	1. *N.I. Goncharova. Engineering of Energy-Efficient Buildings. Textbook. Fergana, 2022.* 2. *Y.V. Shipacheva, M.M. Bakhromov, Sh.M. Davlyatov. Designing Energy-Efficient Infrastructure Facilities in Arid and Hot Climate Conditions. Textbook. Tashkent, 2019.* 3. *M. Nabiyev. Building Energy Efficiency Engineering. Building Physics. Study Guide. Fergana, 2023.* 4. *Yu.K. Rashidov. Energy-Saving Engineering Communications in Buildings. Tashkent, 2019.* 5. *E.I. Shchipachyova. Design of Low-Rise Residential Buildings with Load-Bearing Walls. Tashkent, 2006.* 6. *Jose Manuel Andújar, Sergio Gomez Melgar. Energy Efficiency in Buildings. MDPI, 2020.* 7. *QMQ 2.01.04–18. Construction Thermal Engineering Standards.* 8. *QMQ 2.01.05–19. Natural and Artificial Lighting Standards.* 9. *SHNQ 2.01.01–22. Climatic and Physical-Geological Data for Design. Urban Planning Norms and Regulations.*
Reviewers	*N.I.Goncharova - Professor, department of civil engineering, Fergana state technical university;* *D.O.Son - Head of the department for building testing laboratory and technical condition assessment of structures, regional inspection for construction and housing-communal services, Fergana region*