

KLAIPĖDA STATE UNIVERSITY OF APPLIED SCIENCES

Faculty of Technologies

STUDY PROGRAMME: CONSTRUCTION
NAME OF THE SUBJECT: BUILDING STRUCTURES
CODE OF THE SUBJECT: TF-S-2-1618

Group of the subject*	Type of the subject**	Form of studies	Structure***				Total number of hours	Number of credits
			T	P	C	I		
SF	P	Full-time studies (FT)	53	80	11	149	293	11E
		Part-time studies (PT)	13	45	86	149		

*Group of the subject: GS – general study subjects; SF – subjects of the study field.

**Type of the subject: C – compulsory subject; A – optional subject (alternative), FE – freely elective subject.

***Structure: T – theory; P – seminars, workshops, laboratory works; C – consultations; I – individual work.

NECESSARY PREPARATION FOR THE STUDIES OF THE SUBJECT: mathematics; physics; applied mechanics; construction materials; special and computer graphics.

Annotation

The purpose of the subject is to provide knowledge about structural schemes and elements of buildings, as well as basics of building physics and design. To learn how to analyse and to assess structural solutions, to be able to prepare structural part of the building project and to introduce the features of the primary architectural styles. It also explores the classification of buildings, the essential requirements of buildings, normative technical construction documents, purpose of structural elements of buildings and their nature of work; analyses structural systems of low-rise and high-rise buildings; barrier structures are examined in terms of calorifics; investigates ways of sound propagation and structural soundproofing measures; natural and artificial bases; types of foundations and their constructions, structural measures of waterproofing and insulation used for foundations and basements; structural solutions of walls, floor slabs, partitions, roofs, windows, doors and stairs; discusses types and structures of wood houses; structural systems and elements of block houses; structural schemes types of frames and elements of frame houses, as well as their connection nodes; structural solutions of monolithic buildings; peculiarities of passive houses; describes design stages and components of a project; teaches how to prepare a structural part of the building projects. In order to improve knowledge, practical and individual works, as well as the course work are scheduled. Duration of the subject of building structures is two semesters.

Results of the study programme	Results of the study subject	Study methods	Evaluation methods of the learning achievements
1.2. A student knows, understands and applies the most important terms, related to the study field of civil engineering.	1.2.1. A student knows, understands and applies terms and definitions, used in the structural systems, as well as is able to apply them in the field of building design.	Explanation of theoretical material, demonstration and study of technical literature.	Tests (1; 2; 3). Presentation of practical works (1; 2; 3; 4; 5; 6; 7). Provision and defence of the course work. An examination.
2.1. A student recognises and analyses problems, related to construction activities, and plans their solution strategies.	2.1.1. A student knows structural systems of the buildings, their peculiarities, impact on the structural elements of the building.	Explanation of theoretical material, demonstration, discussion, individual works, practical works, design and study of the educational material in “Moodle” virtual learning environment.	Tests (1; 2; 3). Results of practical works (1; 2; 3; 4; 5; 6; 7). Provision and defence of the course work. An examination.

2.2. A student is able to collect, analyse, process and interpret data in the field of innovation implementation individually in order to solve problems.	2.2.1. A student is able to analyse the purpose of structural elements of the building, as well as opportunities of structural solutions.	Practical works, individual works and design. Discussion and situation analysis.	Tests (1; 2; 3). Provision and defence of the course work. Results of practical works (1; 2; 3; 4; 5; 6; 7).
3.1. A student knows properties of construction materials and products and applied them in the field of building design and construction process.	3.1.1. A student knows how to use construction materials and products in the structural elements and will be able to apply them in the field of building design.	Explanation of theoretical material, demonstration, case analysis, analysis of structural solutions, practical works, course-related design, work in the groups and discussion.	Tests (1; 2; 3). Presentation of practical works (1; 2; 3; 4; 5; 6; 7). Provision and defence of the course work. An examination.
4.1. A student is able to find and interpret professional information in databases and resources of scientific and engineering information.	4.1.1. A student is able to analyse and select the optimal structural systems for a building, materials and products of structural elements, solutions related to heating, waterproofing, soundproofing and ventilation solutions, as well as to apply them during preparation of a course work.	Explanation of theoretical material, demonstration, case analysis, discussion, analysis of information resources, individual work, practical works and course-related design.	Tests (1; 2; 3). Presentation of practical (1; 2; 3; 4; 5; 7) and individual works. Presentation of a course project, its defence and results. An examination.
5.1. A student is able to prepare structural part of a project, to select optimal construction methods, having regard to construction environment, aesthetic and architectural aspects, as well as economic factors and expected operating conditions.	5.1.2. A student is able to prepare the structural part of the building project, related to wall and frame system.	A course-related design, analysis of information resources, individual and group work, as well as study of the educational material in "Moodle" virtual learning environment.	Results of the course project.
5.2. A student applied international, European and Lithuanian normative technical construction documents and standards during the building design and construction process.	5.2.1. A student is able to apply international, European and Lithuanian normative technical construction documents and standards in the building design, regulating building design.	Demonstration of theoretical material, analysis of technical literature, situation analysis and design.	Presentation of a course project, its defence and results. An examination.
5.4. A student uses information technologies, basic software, applies software to design buildings and to prepare the estimated documentation.	5.4.1. A student is able to computer applications ("AutoCAD", "Revit" or "Tekla") in the building design.	Study of the educational material in "Moodle" virtual learning environment. Individual works, practical works, course-related design.	Results of practical works and course works (1; 2; 3; 4; 5; 6; 7) and assessment. Results of the course work.
6.1. A student thinks in a creative, innovative and motivated manner; is able to solve civil engineering tasks and problems individually and in a team.	6.1.1. A student is able to work in a multiprofile group. The skills of group work will form during the performance of practical works and a course work.	Discussion, situation analysis, group work, practical works and course-related design.	Performance of practical works. Provision and defence of a course project.
6.2. A student is able to convey information, design ideas and their solution methods for the audience of specialists and non-specialists.	6.2.1. A student is able to prepare written papers, present results of individually performed research in front of the audience and to discuss them.	Analysis of information resources, situation analysis, individual and group work, design and discussion.	Performance and defence of a course project, presentation of practical and individual works. Results
6.4. A student is able to improve knowledge individually, to analyse,	6.4.1. A student is able to find information individually,	Analysis of information resources, individual	Presentation of individual works.

process and demonstrate information, as well as to apply it during the process of problem solving and decision making	to structure, analyse and apply it in the field of building design.	works, practical works and design.	Provision of practical works, performance and presentation of a course project.
---	---	------------------------------------	---

Contents and scope of the subject

Topic name and content description	Number of the contact hours, FT form			Number of the contact hours, PT form			I	Total number of hours
	T	P	C	T	P	C		
1. General knowledge about the buildings and structures. A concept of building and structure. Building classification. The essential requirements. Normative technical construction documents. Modular system.	1	-	-	1	-	-	6	7
2. Structural elements and structural systems of the buildings. Classification of building structures. Effects affecting the building. Classification of building structures. Structural systems of the buildings.	1	-	-	1	-	-	6	7
3. Data collection of structural elements and structural systems of the buildings by using remote measurement technologies (3D scanner, nonpilot measuring instruments), as well as processing and analysis of the collected data.	2	-	-	-	-	2	6	8
4. Structural elements of the buildings. 4.1. Bases and structures of foundations. Requirements for bases. Base classification. Composition and classification of soil. Groundwater. Soil frost. Requirements for foundations. Structures of strip, column, continuous, pile and drilled foundations, as well as their application areas. Deepening of foundation. Insulation and waterproofing of foundation and basement walls. Practical task No 1: Selection of elements of precast strip foundation.	5	12	-	2	7	8	14	31
4.2. Walls and partitions. Purpose and classification of walls. The essential requirements. Wooden and masonry walls. Structures of insulated external walls. Normative and permissible heat transfer coefficients. Linear thermal bridges in walls. Thermal resistance. Moisture condition. Architectural-structural elements of walls. External and internal finish of walls. The purpose and classification of partition walls. The essential requirements. Structural solutions of small blocks, bricks, glass products, large boards, pressed straw and frame partitions. Sound insulation. Practical task No 2: Selection of external wall construction and its design in Bentley software environment. Calculation of thermal resistance. Practical task No 3: Selection of lintel elements.	8	13	2	1	9	13	20	43
Test No 1 (1, 2, 4.1, 4.2 topics).	-	-	1	-	-	1	-	1
4.3. Floor slabs and stairs. The purpose and classification of floor slabs. The essential requirements. Floor slabs of wooden and steel beams. Floor slabs made of reinforced monolith and precast elements. Precast-monolithic floor slabs. Anchorage of floor slabs to the walls. The purpose and classification of stairs. The essential requirements. The minimum dimensions of external and internal stair elements. Dimensions of a staircase. Wooden	5	10	1	1	3	12	14	30

stairs. Stairs made of large reinforced concrete elements. Monolithic-reinforced concrete stairs. Stairs on the steel beams. Practical task No 4: Selection of elements for the floor slab and their design in Bentley software environment.								
4.4. Roofs. The essential requirements. Types of roofs. Supporting structures of pitched roofs and their connections. Coverings of pitched roofs and their fastening. Installation peculiarities of cornice, ridge and other roof elements. Water run-off systems for the pitched roofs. Flat roofs. Coverings of flat roofs, installation of parapet and gully. Thermal resistance of insulated roofs, moisture condition and solution of ventilation problems. Structures of large span roofs: girders, shells, folds, etc. Practical task No 5: Selection of pitched roof structure and its design in Bentley software environment. Calculation of thermal resistance. Practical task No 6: Design of insulated pitched roof structure. Detailing of nodes.	8	8	2	2	6	10	15	33
Test No 2 (4.3, 4.4 topics)	-	-	1	-	-	1	-	1
4.5. Floor, windows, doors, gates and suspended ceiling. Essential requirements for the floors. Primary layers of floor structure and floor coverings. Solutions of heat, sound and water insulation. Essential requirements for windows, doors and gates. Types of windows, doors and gates, compositions, opening and closing methods and minimum areas of openings. Normative heat transfer coefficients. Fixing to walls. The purpose of suspended ceiling. The essential requirements. Structural solutions of suspended ceiling. Practical task No 7: Selection of floor structure.	5	7	-	2	4	6	15	27
Preparation for the examination (4 topics)								
5. Passive houses. Advantages, disadvantages and areas of application. Thermal resistance. Moisture condition. Structural solutions.	2	-	-	-	-	2	4	6
6. Wooden buildings. Wooden log houses and frame houses. Advantages, disadvantages, areas of application and installation peculiarities. Structural solutions.	2	-	-	-	-	2	8	10
7. Reinforced concrete and metal frame buildings. Advantages and disadvantages of reinforced concrete and metal frame buildings. Primary elements of a frame. Rigidity and stability of a frame. Structural schemes of reinforced concrete-frame buildings and areas of their application. Foundation and wall structures. Frame systems, elements and communication system of industrial buildings.	6	-	-	1	-	5	9	15
8. Block houses and monolithic buildings. Advantages, disadvantages and areas of application. Structural schemes.	4	-	-	1	-	3	7	11
Test No 3 (5, 6, 7, 8 topics)	-	-	1	-	-	1	-	1
9. Building design. A concept of building project. Procedure and stages for the preparation of project. Composition of a project. Mandatory documentation of a project. Signing and documentation of a project, confirmation and storage of original documents of a project. Building's location in the plot of land. Insolation requirements. Building density. Horizontal and vertical markings of the building. Rainwater run-off from the plot of land. Infrastructure elements of the plot of land. Indicators of the plot of land.	2	-	-	1	-	1	2	4
10. Plan of the land plot.	2	-	-	-	-	2	-	2

Building's location in the plot of land. Insolation requirements. Building density. Horizontal and vertical markings of the building. Rainwater run-off from the plot of land. Infrastructure elements of the plot of land. Indicators of the plot of land.								
A course project. Project of a residential house or a frame building.	-	30	2	-	18	14	14	46
Preparation for the examination	-	-	1	-	-	1	9	10
Total number of hours	53	80	11	13	45	86	149	293

Assessment system of results of the subject studies

Result number of the study subject	Assessment criteria of results of the study subject
1.2.1.	A student knows how to use the construction materials and products in structural elements.
2.1.1.	A student determines the purpose of structural systems and structural elements of buildings, as well as interoperability.
2.2.1.	A student analyses and assesses possible structural solutions of structure insulation. A student analyses the purpose of structural elements of a building and opportunities of structural solutions.
3.1.1.	A student uses construction materials and products in structural elements. A student applies information technologies in the building design.
4.1.1.	A student knows design masonry, reinforced concrete, wooden and metal frame buildings.
5.1.2.	A student is able to prepare a project of a structural part of the simple building. He also analyses and selects optimal solutions in the field of building design.
5.2.1.	A student applies documents regulating design during preparation of a project of a structural part of the building.
5.4.1.	A student applies information technologies in the field of building design.
6.4.1.	
6.2.1.	A student reasons and provides solutions selected for the building, as well as practical problems.
6.1.1.	A student presents and reasons solutions of a course work. He also applies knowledge, indicated in the subject results, in various situations.

Procedure of evaluation

A ten-point criterial grading system and cumulated grading are applied.

$$IKV = 0.5X_1 + 0.5X_2$$

X_1 – grading average of tests, workshops, individual and other works.

X_2 – evaluation of examination or a course work.

Where:

1st semester.

X_1 – grading average of 2 tests (0.2), grading average of 7 practical works (0.3).

X_2 – evaluation of examination from all topics (0.5).

2nd semester.

X_1 – evaluation of a test (0.2), interim evaluation of a course work (0.2).

X_2 – evaluation of a course work (0.6).

Recommended literature and other information sources

Primary literature and information sources			
No	Literature and information sources	Number of copies	
		At the library of the Faculty of Technologies	At other libraries of Klaipeda State University of Applied Sciences

1.	JUPATOVA J., PLUNGYTĖ D., BEKERIENĖ V. (2011). <i>Pastatų konstrukcijos. Konspektas</i> . UAB „Klaipėdos banga“, Klaipėda.	20	-
2.	MARČIUKAITIS G.(2004). <i>Pastatai ir jų konstrukcijos. Mokomoji knyga</i> . Technika, Vilnius.	An electronic version	-
3.	<i>Pastatų konstruktoriaus ir statybininko žinynas</i> . Lietuvos statybos inžinierių sąjunga. (2009). Naujasis lankas, Vilnius.	2	-
4.	RAŽAITIS V. (2004). Pastatų konstravimo pagrindai. Vadovėlis aukštųjų mokyklų studentams. Dailės akademija, Vilnius.	5	-
5.	SPENCE W.P., KULTERMANN E. (2011). <i>Construction materials, methods, and techniques</i> . Delmar, Cong age.	1	-
Additional literature and information sources			
No	Literature and information sources		
1.	Lietuvos Statybos inžinierių sąjunga. (2004). <i>Statybos inžinieriaus žinynas</i> . Technika, Vilnius.		
2.	GAJAUSKAS J. (2009). <i>Pastatų konstruktoriaus ir statybininko žinynas</i> . Kaunas.		
3.	BARKAUSKAS V., STANKEVIČIUS V. (2000). <i>Pastatų atitvarų šiluminė technika</i> . Technologija, Kaunas.		
4.	<i>Statybos techniniai reglamentai</i> . LR Aplinkos ministerija.		
5.	STAUSKIS V.J. (2005). <i>Statybinė akustika. Vadovėlis</i> . Technika, Vilnius.		
6.	NEUFERT E., NEUFERT P. (2014) <i>Neuter architects' data. Third edition</i> .		
7.	VALENTINAVIČIUS A. (2000). <i>Medinės konstrukcijos: vadovėlis</i> . Enciklopedija, Vilnius.		
8.	David G. Pollock, Donald E. Breyer, Kelly E. Cobeen, Kenneth J. Fridley (2014). <i>Design of Wood Structures- ASD/LRFD</i> 7th edition: McGraw-Hill		
9.	Edited by Ibo Osterreichisches Institute Fur Baubiologie Und –Ecologies (2016). <i>Details for Passive Houses Renovation: A Catalogue of Ecologically Rated Constructions for Renovation</i> : Birkhauser		
10.	MAT SANTAMOURIS (2016). <i>Energy Performance of Residential Buildings: A Practical Guide for Energy Rating and Efficiency</i> : Routledge		

Description of the subject was prepared by:

Lecturer
(Position)

(Signature)

Ovaltaite Vida
(Academic degree, name and surname)

Associate Professor
(Position)

(Signature)

Dr. Jevgenija Rutė
(Academic degree, name and surname)