Tadeusz Kosciuszko Cracow University of Technology

Course Card

Faculty of Civil Engineering

Field of study: Civil Engineering

Study profile: general academic

Study form: full-time

Field of study code: BUD

Study cycle: 1st

Specialty: no specialty

1 COURSE INFORMATION

Course name	Fizyka budowli
Course name in English	Physics of Building Structures
Course code	WIL BUD oIS C29 24/25
Course category	Basic
No. of ECTS points	2.00
Semester	4

2 CLASS TYPE, NUMBER OF HOURS ACCORDING TO THE STUDY PLAN

Semester	Lecture	Class exercise	Laboratory	Computer lab	Design exercise	Seminar
4	15	0	30	0	0	0

3 COURSE OBJECTIVES

Objective 1 Introduction of the basic concepts regarding heat transfer, moisture, building spaces lighting and building acoustics.

Objective 2 Introduction of the students to physical phenomena connected with heat transfer description, ways of calculation of wall thermal characteristic, designing rules and basic measurement methods.

Objective 3 Introduction of the students to the forms of moisture appearance and transfer in building materials and walls, to the rules of wall calculation, design and measurement in this field.

Objective 4 Introduction of the basic issues regarding natural and artificial lighting of the building spaces.

Objective 5 Introduction to sound insulation and acoustical comfort.

4 PREREQUISITES IN TERMS OF KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1 Credits for Building Materials

5 LEARNING OUTCOMES

LO1 Knowledge Student understands and is able to use correctly the concepts and quantities connected with heat transfer, building shell insulation and acoustics.

LO2 Skills Student is able to calculate thermal resistance and heat transfer coefficient of the complex walls, calculate heat losses, draw wall temperature distribution diagram and conduct thermal diagnostics.

LO3 Knowledge Student is able to make the conclusions regarding the results of his work. He is able to articulate his achievements in multi-media presentations.

LO4 Skills Student knows the basic issues associated with heat and moisture transfer.

6 COURSE CONTENT

Laboratory		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Temperature definition, scales, measurement methods and tools, bimetallic and resistance thermometer. Thermocouple: single and differential circuit	4
L2	Remote measurement of temperature. Pyrometer, infra-red camera. Interpretation of thermal images	2
L3	Calculation of the wall thermal resistance and transmittance according to EN ISO 6946.	1
L4	Calculation of the complex wall thermal resistance and transmittance according to EN ISO 6946.	1
L5	Temperature distribution in the wall section. Corrected thermal transmittance. Computational exercise topic.	2
L6	Saturated and non-saturated air. Principles and instruments for relative humidity measurement.	3
L7	The principles of the moisture content calculation according to EN ISO 13788.	4
L8	Water vapour distribution in building shell	2
L9	Moisture content assessment of a building wall according to the building code regulations.	2

Laboratory		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L10	Thermal resistance measurement - method and instrument. Measurement in real conditions.	2
L11	Basic lighting parameters. Luminance and lighting intensity (illumination) in educational spaces.	2
L12	Noise level measurements. Airborne sound insulation measurements	2
L13	Structure borne sound insulation measurements. Reverberation time measurements.	2
L14	Final test and exercise receipt.	1

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L1	Introduction. Basic information about the Polish climate. Basic forms of the natural heat transfer. Surface heat transfer.	1
L2	Convective heat transfer, radiation. greenhouse effect. LE coating. Complex heat transfer at the wall surface. Surface thermal resistance.	1
L3	Thermal conductivity of building materials. Measured, declared and design values. Influence of the external conditions on thermal resistance of the building materials.	1
L4	Fourier's and Newton's equations. Total thermal resistance and thermal transmittance of the wall.	1
L5	Wall temperature distribution. Designing rules of the multilayer walls. Internal surface temperature.	1
L6	Multi-dimensional heat transfer. Linear and spot thermal transmittance. Account for extra losses through thermal bridges.	1
L7	Basic information about non-stationary heat transfer. Thermal stability of the walls and spaces. Energy saving by temporary internal temperature reduction.	1
L8	Economic aspects of thermal resistance pf the heated buildings. Optimum insulation thickness.	1
L9	Water sorption in building materials. Sorption isotherm. Capillary condensation. A difference between capillary condensation and the dew point.	1
L10	Vapour diffusion in the air and in the building materials. Air relative humidity. Water vapour resistance factor, water vapour diffusion-equivalent air layer thickness. Real and saturated vapour pressure.	1
L11	Interstitial condensation conditions within the wall. Calculated maximum amount of moisture, moisture accumulation.	1

Lecture		
No.	Subject matter of the course Detailed description of thematic blocks	No. of class hours
L12	The rules of selection, design and evaluation of the walls because of moisture.	1
L13	Wetting effect. Concave meniscus. Conditions of capillary action. Significance of capillary action for moisture condition of the building wall.	1
L14	Basic concepts and units in building acoustics; Human hearing mechanism and risk hearing loss; Reflection and absorption of sound; Transmission of sound in buildings; Building acoustics standards	1
L15	Laboratory and terrain sound insulation measurements. Air-borne sound insulation; Impact sound insulation; Transmission of sound in open space.	1

7 TEACHING TOOLS

N1 Lectures

N2 Laboratory

N3 Discussion

N4 Multimedia presentations

N5 Presented examples

N6 Consultations

N7 Design exercise

8 Student workload

Activity form	Number of hours of activity
Hours realized in contact with the teacher	
Hours resulting from the study plan	45
Consultation hours	2
Exams and tests during session	4
Hours of autonomous student work	
Preparing for classes, studying literature	0
Developing results	0
Preparing of reports, projects presentations, discussion	4
preparation for test	3
Total number of hours devoted to the subject	**58**
Total number of ECTS points	2.00

9 Methods of grading

Partial grades

F1 Laboratory test

F2 Lecture test

Summary grade

P1 Weighted mean grade

Conditions for passing the course

L1 After passing lab test it is possible to take part in a lecture test