COURSE DESCRIPTION CARD - SYLLABUS

Course name

Heat Engineering in Building

Course

Field of study

Sestainable Building Egineering

Area of study (specialization)

Level of study

First-cycle studies

Form of study

full-time

Year/Semester

2/4

Profile of study

general academic

Course offered in

English

Requirements

Number of hours

Lecture

30

Tutorials

15

Laboratory classes

Projects/seminars

Other (e.g. online)

Number of credit points

3

Lecturers

Responsible for the course/lecturer:

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Responsible for the course/lecturer:

Prerequisites

Mathematics: basic algebra, functions, equations and inequalities, trigonometry, analitycal geometry, systems of equations, fundamentals of differential and integral calculus. Analysis and solving of equations and systems of equations, mathematical formulation of engineering problems, solving of simple differential equations, aplication of integral calculus in heat engineering. Physics: laws of conservation in physics.

Course objective

Gain by students basic knowledge and calculation skills in heat engineering necessary of solving fundamental and simple problems they can meet in buildings and built environment.

Course-related learning outcomes

Knowledge

1. Student knows physical properties characterizing gazes, liquids and solids, and understands their behaviour and knows their units

2. Student has a general knowledge concerning heat engineering and heat flow

3. Student knows basic methods needed for solving basic problems concerning processes and equipment occuring in civil engineering

4. Student knows basic rules concerning energy balances and knows definitions of energy efficiency, heat effects and heat losses concerning buildings and equipment in civil engineering

5. Student knows and understands the tendencies and development directions concerning heat equipment in civil engineering

Skills

1. Student is able to find and apply appropriate thermal properties necessary for thermal calculations

2. Student can find the needed relationships describing thermal problems in buildings

3. Student can recognize and solve simple design and operation problems concerning heat equipment of buildings

4. Student can assess the design solution and find a correct way to achieve appropriate performance conditions for thermal equipment

5. Student can determine an accuracy of calculation results

6. Student can develop a general energy balance and determine thermal efficiency and heat losses of analysed equipment

Social competences

1. Student is aware of the ranges and limits of the used relationships and methods in solving heat engineering problems

2. Student is convinced of the need of examine and verification of the applied methods of calculation

3. Student is aware of the importance of team cooperation in solving engineering problems and the need to constantly develop their own professional skills

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lectures:

The final exam consists of two parts. Part 1: Test of skills and competencies involving the solution of 2 problems of heat engineering. Part 2: Test for understanding the basics of heat engineering involving answering 4 questions.

In some cases the oral examination is used. Also the activity of students during lectures and tutorials is taken into account.

To pass each of the two parts of the exam (as well as to pass the tutorials) there is necessary to obtain at least 50% of the maximum points (max=20 points). The exam is passed if both part 1 and part 2 are passed. Corrected (Improved) is only this part which was failed.

Grading system: 0-9 points = 2,0 (failed); 10-12 points = 3,0 (sufficient); 13-14 points = 3,5 (sufficient plus); 15-16 points = 4,0 (good); 17-18 points = 4,5 (good plus); 19-20 points = 5,0 (very good)

Tutorials:

One 45 minute written test at the end of the semester. Continuous assessment of student activity (rewarding activity).

Programme content

Lectures

Introduction, subject contents. Application of the heat engineering in civil engineering. Thermodynamic system and control volume, thermodynamic parameters. Ideal gas equation of thermal state. Ideal and real gas. Amount of substance. Gas mixtures. Principle of mass and energy conservation. Energy of system. Heat specific. Internal energy and enthalpy. Energy of fluid flow. Typical thermodynamic processes. Work and heat of the thermodynamic process. First law of thermodynamics. Irreversible processes. Second law of thermodynamics. Entropy. Efficiency of the compression and expansion processes. Ventilators, blowers and compressors. Working fluids. Properties of liquid and vapour water. Thermodynamic cycles: Carnot cycle. Refrigeration and heat pump coefficient of performance (COP). Humid air, psychrometric chard, dew point temperature. Fuels, combustion process, enthalpy of formation (higher and lower heating value). Introduction to heat transfer. Heat flux by conduction, convection and radiation. Overall heat transfer. Steady and transient heat conduction. Lumped capacitance method, Biot and Fourier numbers. Heating and cooling of plate and regular bodies. Forced and natural convection, Nusselt number, Reynolds, Prandtl and Grashof numbers. Heat transfer by radiation, solar radiation. Heat exchangers.

Tutorials

1. Ideal gas equation of state. 2. Energy balance. First law of thermodynamics. 3. Thermodynamic cycles of ideal and real gases. 4. Properties of humid air. 5. Steady state heat transfer in plane walls. 6. Steady state heat transfer in cylindrical walls. 7. Heat exchangers. 8. Combustion.

Teaching methods

Classical lecture with elements of conversation

Tutorials: solving problems method

Bibliography

Basic

1. SCHMIDT P., BAKER D., EZEKOYE O., HOWELL J., Thermodynamics. An Integrating Learning System. International Edition., John Wiley and Sons, Inc., U S A, 2006

2. SONNTAG R.E., BORGNAKKE C., Introduction to Engineering Thermodynamics, 2nd Edition, John Wiley and Sons, Inc., U S A, 2007

3. CENGEL Y.A., BOLES M.A., Thermodynamics. An Engineering Approach. 6 Edition (SI Units), McGraw-Hill Higher Education, 2007

Additional

4. SZARGUT J., Termodynamika techniczna. Wyd. Politechniki Śląskiej, Gliwice 2000

5. SZARGUT J., GUZIK A., GÓRNIAK H., Zadania z termodynamiki technicznej. Wyd. Politechniki Śląskiej, Gliwice 2008

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	3,0
Classes requiring direct contact with the teacher	50	2,0
Student's own work (literature studies, preparation for tutorials, preparation for test/exam) [1]	30	1,0

[1] delete or add other activities as appropriate