RTU Course "Heat Study"

15016 Siltumenerģētisko sistēmu katedra

General data

Code	MSE201
Course title	Heat Study
Course status in the programme	Compulsory/Courses of Limited Choice; Courses of Free Choice
Course level	Undergraduate Studies
Course type	Professional
Field of study	Heat Engineering, Heat, Gas and Water Technology
Responsible instructor	Turlajs Daniels
Academic staff	Strautmanis Guntis Jaundālders Sigurds Cars Ainārs Soročins Aleksandrs
Volume of the course: parts and credits points	1 part, 2.0 Credit Points, 3.0 ECTS credits
Language of instruction	LV, EN, RU, DE
Possibility of distance learning	Planned
Maximum auditorium capacity	50
Maximum number of students per semester	50
Abstract	The course ``Basics of Thermal Engineering`` includes topics related to the thermal phenomena in various systems, processes and power plants: Thermodynamic systems and parameters. Basic laws of thermodynamics. Specific heat, internal energy, entropy. Processes and cycles. Water and steam tables and charts. Humid air. Cycles of thermal machines. Steam power equipment. Heat transfer with conduction, convection, radiation. Complex heat transfer. Design methods of heat exchangers. Fuel and combustion theory. Water and steam boilers. Heat utilizing equipment.
Goals and objectives of the course in terms of competences and skills	To get background knowledge on the heat extraction, conversion into other forms of energy, transport and utilization. To get knowledge in fundamentals of technical thermodynamics and heat transfer. Be able to understand and explain concepts and laws of thermodynamic, to analyze the thermodynamic processes and cycles, to know and be able to find the thermodynamic and thermophysical properties of heat carriers and parameters of processes. To understand working principles of heat power and heating equipment. To be able to explain and to perform calculus of thermodynamic and heat transfer technological processes and cycles.
Structure and tasks of independent studies	Individual studies of special technical literature, tables, graphs, other sources of information and computer programs. The accomplishment of calculation works and tasks according to given time schedule. Individual work with information sources and software programs for the calculus and analysis of thermodynamic processes and thermal equipment.
Recommended literature	1.Nagla J., Saveļjevs P., Turlajs D. Siltumenerģētikas teorētiskie pamati. Rīga, RTU, 2008, 194 lpp. 2.J. Nagla, P. Saveļjevs, R.Ciemiņš. Siltumtehnikas pamati. Rīga, "Zvaigzne", 1981.-356 lpp. 3.J. Nagla, P. Saveļjevs, A. Cars. Siltumtehniskie aprēķini piemēros. Rīga, "Zvaigzne", 1982.-310 lpp. 4.Lienhard J.H.,IY, Lienhard J.H.,Y. A Heat Transfer Texbook. 4-th edition, Phlogiston Press, 2006, 760 p. http://web.mit.edu/lienhard/www/ahtt.html 5.Теплотехника. Под ред.В.И.Крутова .М., Машиностроение, 1986-427 с. 6.Кириллин В.А. и др. Техническая термодинамика. М., Энергия, 1979- 512 с. 7.Osipovs L.. Ķīmijas tehnoloģijas pamatprocesi un aparāti. Rīga, «Zvaigzne», 1991.-680 lpp. 8.Cars A. Energoresursi.Rīga, Jumava, 2008, 102 lpp. 9.Rubīna M. Siltumapgāde, "Pērse", Rīga, 2003., 172 lpp. 10. Āboliņš, E. Jurevičs. Siltums ražošanā un sadzīvē. Rīga, "Zinātne", 1986.-123 lpp. 11.Cengel Y., Boles M., Thermodynamics: An Engineering Approach. 6-th edition, McGraw-Hill, 2007, 960 p.
Course prerequisites	Physics

Course outline

Theme	Hours
Kinds of energy. Thermodynamic systems and parameters, working bodies.	2
Laws of ideal and real gases. Mixtures of gases. First law of thermodynamics. Thermodynamical processes.	4
Thermodynamic cycles. Enthrophy. II law of thermodynamics. Exergy.	2
Real gases. Water and water steam tables and h-s charts. Processes in steam machines.	2
Gas-vapor mixtures. Humid air, h-x charts. Gas and steam flows. Cycles of gas and steam turbines.	2
Cycles of thermal engines. Compressors, engines of internal combustion, refrigerators, heat pumps.	4
Steam power engineering. Cycles of heat and power plants, cogeneration, trigeneration. District heating.	2
Heat transfer theory. Heat exchange with conduction, convection and radiation. Complex heat transfer.	4
Heat exchangers – classification, design methods. Heat transfer enhancement in thermal equipment. Heat pipes.	4
Kinds and characteristics of fuels. Boilers` equipment. Industrial furnaces.	2

Analogies of heat and mass transfer. Material drying processes and equipment.	2
Alternative sources of energy. Ecological problems in thermal engineering.	2

Learning outcomes and assessment

Learning outcomes	Assessment methods
Ability to explain and analyze the physical essence and regularity of thermodynamic processes in nature, technological equipment, to know thermodynamic terms and laws.	Assessment methods: solving of exercises, individual calculation work, seminars, tests. Criteria: ability to explain and analyze the principles of thermal processes and operation of heat utilizing equipment.
Ability to explain and calculate basic thermodynamic and heat transfer processes in thermal engines, heat & power plants, refrigerators and heat pumps.	Assessment methods: calculation, home works, preparation of reports, tests. Criteria: Ability to work with gases, steam and humid air tables and charts. Ability to explain the processes and phenomena of the most common heat & power units and technological devices.
Ability to calculate and choose the optimal type and parameters of realistic heat utilizing systems, to evaluate thermal efficiency of basic heat utilizing equipment.	Assessment methods: calculations, home works, tests. Test / Exam. Criteria: ability to explain, analyze and calculate the principles and choice of most common thermal processes and devices, heat carriers. Quality of completed calculation works and tests.

Study subject structure

Part	CP	ECTS	Hours per Week			Tests			Tests (free choice)		
			Lectures	Practical	Lab.	Test	Exam	Work	Test	Exam	Work
1.	2.0	3.0	1.0	1.0	0.0		*		*		