COURSE DESCRIPTION CARD - SYLLABUS

Course name
Basics of refrigaration [S1MiBP1>PCh]

Course

Field of study
Mechanical and Automotive Engineering

Year/Semester
3/6

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
30

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

4,00

Coordinators

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Lecturers

Prerequisites

Knowlegedge: has a general knowledge of the impact of technical objects and technologies on the environment. Sills: can define categories of threats to the environment that constitute a specific technological process implemented in the area of production and operation of specialized vehicles, in particular refrigeration vehicles and devices, and indicate ways of counteracting these threats. Social competences: work in an interdisciplinary team. Ability to lead a team and expand team knowledge

Course objective

Getting to know the theoretical and practical problems related to the construction and operation of refrigerated vehicles.

Course-related learning outcomes

Knowledge:
1. Has basic knowledge of the technical mechanics of fluids, i.e. ideal liquids and gases, Newtonian and non-Newtonian viscous liquids, theory of thermal-flow machines.
2. Has basic knowledge of technical thermodynamics, ie the theory of thermodynamic changes, heat flow, thermal machines and heating, drying and cooling devices.

3. Is aware of the latest trends in machine construction, i.e. automation and mechatronization, automation of machine design and construction processes, increased safety and comfort of operation, the use of modern construction materials.
4. Has elementary knowledge of the impact of machinery and technology on the natural environment and global energy balances.

Skills:
1. Can search in catalogs and on manufacturers" websites ready-made machine components to be used in his own projects.
2. Can use learned mathematical theories to create and analyze simple mathematical models of machines and their elements, and simple technical systems.
3. Can competently advise on the selection of a machine for a given application in the industry covered by the selected diploma path based on the acquired knowledge about a given group of machines.
4. Can perform elementary technical calculations in the field of fluid mechanics and thermodynamics, such as heat and mass balances, pressure losses in pipelines, select parameters of blowers and fans for ventilation and transport systems, and calculate thermodynamic courses in thermal machines.
5. Can draw a diagram and a simple machine element by hand in accordance with the rules of technical drawing.
6. Has the ability to self-educate with the use of modern teaching tools, such as remote lectures, websites and databases, teaching programs, e-books.

Social competences:
1. Is ready to recognize the importance of knowledge in solving cognitive and practical problems and to consult experts in case of difficulties in solving the problem on its own.
2. Is ready to fulfill social obligations and co-organize activities for the benefit of the social environment.
3. Is ready to fulfill professional roles responsibly, including:
- observing the rules of professional ethics and requiring this from others,
- carring for the achievements and traditions of the profession.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
Laboratories - written test; Lectures - written exam;

Programme content

Division and principle of operation of refrigeration equipment. Linde cycles (wet and dry). Circuit with subcooling. Circuit with regeneration. Parameters characterizing single-stage refrigeration equipment. Multistage cycles. Losses in compressor refrigeration equipment, refrigerants. Coolant. Lubricating oils. Breakdown of compressors. Construction of reciprocating, screw and scroll compressors. Capacity control. Lubrication. Types of dangers and compressor safety devices. Factors affecting compressor performance. Condensers (classification, construction, operation). Evaporators (classification, construction, operation). Regulators (classification, principle of operation, construction, operation).

Course topics

Content of the lectures
Design solutions of refrigeration and air-conditioning devices in vehicles depending on the class. Types of aggregate drives. Prospective drives. Refrigerants currently used and expected to be used in the coming years in accordance with European Union directives. Construction and operation of refrigeration compressors (piston and scroll). Construction of evaporators and condensers - locations. Choking devices. Rules for selecting refrigeration units based on standards and manufacturer's guidelines. Evaporator defrosting methods. The influence of the evaporation temperature of the refrigerant on air humidity. Guidelines for generator users. Sources of "coldness" in ice-house vehicles.

Laboratory exercises
1. Using the CAREL system to monitor the operation of refrigeration systems.
2. Comparing the operation of a refrigeration installation with a thermostatic expansion valve with and without MOP.

3. Testing the refrigeration installation.
4. Monitoring the operating parameters of the refrigeration system with a low pressure switch.
5. Monitoring the operating parameters of the refrigeration system with an automatic release valve.
6. Monitoring the operation of the cooling system to stabilize the temperature of the cooled liquid.
7. Testing the throttling elements of the refrigeration system.
8. Comparison of the operation of a refrigeration system with a thermostatic expansion valve for internal and external pressure equalization.
9. Testing of small refrigeration devices.
10. Selection of units for installation.
11. Monitoring the operation of the automotive operating unit.

Teaching methods

Multimedia presentation; Laboratory exercises;

Bibliography

Basic
1. Starkowski D., Bieńczak K., Zwierzycki W. Samochodowy transport krajowy i międzynarodowy. Kompendium wiedzy praktycznej. Systherm Serwis Poznań 2006
2. Czapp M., Charun H., Bohdal T. Wielostopniowe urządzenia chłodnicze WSI Koszalin 1994
3. Bonca Z. Automatyka chłodnicza i klimatyzacyjna. Wyd. WSM Gdynia 1995
4. Postolski J., Gruda Z. Zamrażanie żywności. PWN 2001
Additional
B. Gaziński, Chłodnictwo dla praktyków, Systherm Serwis, Poznań 2013

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,00
Classes requiring direct contact with the teacher	60	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	40	2,00