COURSE DESCRIPTION CARD - SYLLABUS

Course name
Air Conditioning in Advanced Technologies [N2IŚrod2-ZwCKiOP>KZT]

Course

Field of study
Environmental Engineering

Year/Semester
2/3

Area of study (specialization)
Heating, Air Conditioning and Air Protection

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
part-time

Requirements
compulsory

Number of hours

Lecture
18

Laboratory classes
0

Other
0

Tutorials
8

Projects/seminars
18

Number of credit points

6,00

Coordinators

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Lecturers

Prerequisites

1. Knowledge: Knowledge of mathematics, physics, chemistry and biology, which is the basis for understanding the mathematical transformations and the identification and evaluation of thermal and microbiological areas and devices for air preparation. Knowledge of thermodynamics, heat transfer, fluid mechanics and ventilation - in the field of thermodynamics of moist air, the theory of penetration, conductivity and heat transfer and flow of indoor air and ventilation units. 2. Skills: The ability to perform mathematical transformations, derivation of mathematical formulas and solving classic linear equations and differential equations. The ability to perform hydraulic calculations, calculations of heat losses, cooling loads and perform engineering drawings in AutoCAD. 3. Social competencies: The student should be aware of the consequences of decisions. The student understands of the need to constantly update and supplement knowledge and skills.

Course objective

The aim is to gain knowledge and skills in the field of air conditioning and the cooling in buildings in the design processes and technology of those systems and conduct analyzes of pre processes and equipment used in air conditioning installation and performance in this area.

Course-related learning outcomes

Knowledge:
1. Knows climatic comfort parameters, determining thermal and cooling loads for the selection of air-conditioning devices.
2. Knows the processes of thermodynamic air preparation in air conditioning equipment and central units (also on the h-x chart) and the fundamental structures of air conditioning and refrigeration systems for air conditioning used in construction.
3. Knows the selection of air conditioning AHUs and the characteristics of all components of AHUs, in particular: air filters, heaters, coolers, humidifiers, heat recovery exchangers, fans, refrigerating units, condensers, air conditioners.
4. Has general knowledge regarding the development of the concept of the structure of an air conditioning and refrigeration system for a room/building, and knows the fundamental structures of air conditioning control panels and air conditioning systems.
5. Understands the basic programs for calculating air conditioning systems.

Skills:
1. Can determine the calculation parameters of thermal comfort and air quality in air-conditioned rooms and calculate heat and cooling loads as well as the amount of supply air.
2. Can perform calculations in the scope of air distribution in the room to select diffusers and extractors in air conditioning systems.
3. Can perform calculations of the efficiency and size of components in an air-handling unit, taking into account the effectiveness of heat recovery devices from exhaust air and present the interpretation of calculations on the h-x graph.
4. Can choose the air conditioning system for the room.
5. Can use the catalogs of device manufacturers and select devices based on charts or selection programs.

Social competences:
1. Is aware of the impact of climate comfort on human well-being.
2. Is aware of the need to systematically deepen and expand their competences.
3. Is aware of the importance of air conditioning as a technical element of building equipment affecting human health, safety, and productivity

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

> Lecture
Written exam: duration 90 min, checking skills (1 task), checking knowledge (5 questions), the maximum number of points: 40 points (5 points for each item and 15 points for calculating the task), pass mark: 20 points Oral exam: random questions, the possibility of increasing the grade obtained in the written exam.
> Tutorials
Knowledge test at the end of the semester. The threshold to pass 50% of the maximum number of points.
> Design
Individual design; ongoing control of project implementation during the exercises in the form of a written test, 3 tests are provided, for each test a grade of 2.0-5.0, and the pass mark is 50%. You must pass every test with a minimum score of 3.0. The grade for each part of the project is the grade for the test and the inclusion of classwork and timeliness of donating individual sections of the project. The drawing part and hydraulic calculations will be assessed separately. The project grade is the average of four grades.

Programme content

1. Characteristics and features of advanced technologies.
2. Indoor swimming pools -water and air parameters, water and air circuit. Air conditioning devices.
3. Clean rooms - scope of the issue. Classification of clean rooms. Dust and bacteriological purity classes.
4. Balance of impurity particles.
5. Air distribution systems in clean rooms.
6. Concepts of air distribution in clean cabins.
7. Determining the cleanliness class of the room.
8. Tests and filter classes for clean rooms.
9. Construction and structure of filters for clean rooms.
10. Structures of air conditioning systems depending on the cleanliness class.
11. Air treatment systems and equipment selection.
12. Systems of air-conditioning devices for specific cleanliness classes.
13. Passive and active air locks.
14. Tightness of air conditioning systems.
15. Ventilation and air conditioning in hospitals. Air distribution.
16. Layout structures for operating rooms in hospitals.
17. Microbiological assessment of supply systems in operating rooms.
18. Air-conditioning devices for operating theaters.
19. Air flow regulators.
20. Elements of equipment for clean room installations.
21. Installation costs for clean rooms.
22. Precision air conditioning.
23. Systems for accurate temperature and humidity maintenance.
24. Air conditioning for server rooms and telephone exchanges.
25. Air conditioning of metrology laboratories and precision mechanics.
26. Air conditioning of cellular base stations.
27. Special air conditioners for precision air-conditioning.
28. Optimizing air treatment and energy consumption. Air conditioning reliability.
Project 2 topics:
For selected clean rooms (health protection or technological rooms) design an air conditioning system with the selection of basic devices and drawings of the proposed solutions.

Course topics

none

Teaching methods

Informative lecture, lecture with multimedia presentation, problem lecture.
Design exercises: presentation of solutions for analytical and design issues, case studies, consultation of individual solutions, discussion.

Bibliography

Basic:
1. Jones W.P.: Klimatyzacja. Arkady Warszawa 1981, 2001.
2. Gaziński B., Szczechowiak E.: Kształtowanie klimatu budynków trzody chlewnej. PWRiL Warszawa, Poznań 1988.
3. Recknagel/Sprengel/Schramek: Ogrzewnictwo, Klimatyzacja, Ciepła woda, Chłodnictwo. Poradnik. Wyd. Omni Scala Wrocław 2008.
4. Porowski M., Szczechowiak E.: Klimatyzacja pomieszczeń czystych. Wyd. TerMedia 1999.
5.Mizieliński B., Kubicki G.: Wentylacja pożarowa. Oddymiania. WNT Warszawa 2012.
6. Pełech A., Szczęśniak S.: Wentylacja i klimatyzacja. Zadania z rozwiązaniami i komentarzami. Oficyna Wydawnicza Politechniki Wrocławskiej. Wrocław 2012.
7. Lipska B.: Projektowanie wentylacji i klimatyzacji. Podstawy uzdatniania powietrza. Wydawnictwo Politechniki Śląskiej Gliwice 2012.

Additional:
1. Praca zbiorowa: Handbuch der Klimatechnik. Band 1: Grundlagen 1989, Band 2: Berechnung und Regelung 1989, Band 3: Bauelemente 1988. C.F. Mueller Karlsruhe.
2. Daniels K.: Gebäudetechnik. Oldenbourg Verlag Munchen 1992.. Mizieliński B.: Systemy oddymiania

budynków. WNT Warszawa 1999.
3. Gaziński B.: Technika klimatyzacyjna dla praktyków. Komfort cieplny, zasady obliczeń i urządzenia. Systherm Serwis. Poznań 2005.
4. Baumgarth, Horner, Reeker: Poradnik Klimatyzacji. Tom 1: Podstawy. Wydanie 1 polskie na podstawie
5. zmienionego i rozszerzonego wydania niemieckiego. Systherm, Poznań 2011.
5. Eicher U.: Low Energy Cooling for Sustainable Buildings. Wiley & Sons Inc. 2009
6. Randall T. (ed.): Environmental Design - An Introduction for Architects and Engineers. Spon Press, London 2001.
7. Hawkes D., McDonald J., Steemers K.: The Selective Environment - An Approach to Environmentally Responsive Architecture. Spon Press, London 2002.
8. Daniels K.: Low-Tech, Light-Tech, Hight-Tech - Building in the Information Age. Birkhäuser, Basel 1998.

Breakdown of average student's workload

	Hours	ECTS
Total workload	150	6,00
Classes requiring direct contact with the teacher	44	2,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	106	4,00