STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Air-conditioning, ventilation and refrigeration**		Code **1010135221010132039**
Field of study **Enviromental Engineering Extramural Second-**	Profile of study (general academic, practical) **(brak)**	Year /Semester **1 / 2**
Elective path/specialty **Heating, Air Conditioning and And**	Subject offered in: **Polish**	Course (compulsory, elective) **obligatory**
Cycle of study: **Second-cycle studies**	Form of study (full-time,part-time) **part-time**	
No. of hours Lecture: **20** Classes: **20** Laboratory: **-** Project/seminars: **20**		No. of credits **6**
Status of the course in the study program (Basic, major, other) **(brak)**	(university-wide, from another field) **(brak)**	
Education areas and fields of science and art **technical sciences** **Technical sciences**		ECTS distribution (number and %) **6 100%** **6 100%**

Responsible for subject / lecturer:

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Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of mathematic, physic, chemistry and biology which is a basis for microbiological and chemical pollution in air. Thermodynamics, Fluid Mechanics, moisture air and heat transfer calculations - the scope of I degree.
2	**Skills**	Calculations of heat and mass transfer. Hydraulic calculations Acoustic calculations for ventilation systems Calculations of air-conditioning equipments with the h-x chart. Drawing ventilation ant technical systems with AutoCAD software
3	**Social competencies**	The student should be aware of getting knowledge and skills

Assumptions and objectives of the course:

The main aim of the course is to extend knowledge about methods used in ventilation and air-conditioning, about equipments and strategies of ventilation and air-conditioning used in different situations and about problems occurring in operating phase of them.

Study outcomes and reference to the educational results for a field of study

Knowledge:

1. The student has deep and extended knowledge of internal environment engineering used for complex problems - [K2_W01]
2. The student has detailed knowledge of ventilation and air-conditioning systems, materials and construction works - [K2_W02]
3. The student has general knowledge of thermodynamics, heat and mass exchanges, fluid mechanics connected with ventilation and air-conditioning systems - [K2_W03]
4. The student has detailed knowledge of creating and dimensioning and selection of ventilation and air-conditioning systems - [K2_W04]
5. The student has knowledge about development trends and achievement in ventilation and air-conditioning systems - [K2_W05]
6. The student knows methods, techniques, equipments and materials used for solving engineering problems of ventilation and air-conditioning systems - [K2_W07]

Skills:

1. The student is able to get information from literature analyze them and use them in designing problems - [K2_U01]
2. The student is able to exchange information in HVAC engineering society - [K2_U02]
3. The student has self-education ability - [K2_U05]
4. The student is able to use information and communication techniques in engineering activity - [K2_U07]
5. The student is able to integrate knowledge of different parts of environmental engineering - [K2_U10]

Social competencies:

1. The student understand the need for getting knowlage for all live - [K2_K01]
2. The student understand the impact of ventilation and air conditioning on internal environment - [K2_K02]

Assessment methods of study outcomes

Written classes of teory and calculations, projects.

Course description

Internal air quality, the impact of air pollution and thermal comfort parameters on human behavior, integrated thermal comfort indices, thermal comfort classes. Air flows in rooms, air streams theory, displacement ventilation - calculation of air flow, CO2 concentration measurement.

Buildings air tightness, buildings tightness characteristics, air tightness measurements and indication.

Ventilation systems aerodynamic adjustment.

Air filtration, filtration mechanisms, filtration effectiveness, air filters classification and division, ventilation ducts cleaning and diagnostic, ventilation systems cleanliness and tightness classes.

Fans and air ducts, fans classification, characteristic parameters of fans, charts of characteristic, proportional and similarity rules, pressures lines, air ducts optimization.

Air humidifying In air-conditioning, water and steam air humidifiers, humidifiers division and characteristic.

Acoustic, SPL and SWL definitions, limited and free sound fields, reverberation time, noise absorption.

Suckers, extraction hoods , local suckers, suckers and hoods division and characteristic, air speed spectrums, defining the exhaust air quantity, low and big heat emission hoods, hoods effectiveness improving ,pollution air transportation and filtering .

Living and fire ventilation of underground car parks, detrimental effect of car exhaust fumes, methodology of determining the air flow in duct and stream ventilation, fire ventilation fans. Over pressure ventilation systems for staircases.

Generating cooling energy, compressor and absorption water chillers, evaporating cooling, Freon air-conditioning systems, pipelines and equipment of Freon systems, radiation air-conditioning systems, thermo-active systems.

Constant and variable flow chilled water systems.

Integrated systems for production of cooling energy co- and three- generating.

Storage of cooling energy, PCM materials.

Basic bibliography:

1. Przydróżny S.:, Wentylacja., Wydawnictwo Politechniki Wrocławskiej., Wrocław , 1991
2. Pełech A.: Wentylacja i klimatyzacja - Podstawy, Oficyna Wydawnicza Politechniki Wrocławskiej, 2011
3. Pełech A., Szczęśniak S.: Wentylacja i klimatyzacja. Zadania z rozwiązaniami i komentarzami. Oficyna Wydawnicza Politechniki Wrocławskiej. Wrocław 2012
4. Malicki M.:, Wentylacja i klimatyzacja., PWN , Warszawa, 1980
5. Jones W.P.:, Klimatyzacja., ARKADY., Warszawa, 2001
6. Recknagel, Schramek, Sprenger, Honmann:, Kompendium wiedzy OGRZEWNICTWO, KLIMATYZACJA, CIEPŁA WODA, CHŁODNICTWO 08/09, OMNI SCALA, Wrocław, 2008
7. Mizieliński B.:, Systemy oddymiania budynków., WNT, Warszawa, 1999

Additional bibliography:

1. Gaziński B. i inni:, Technika klimatyzacyjna dla praktyków. Komfort cieplny, zasady obliczeń i urządzenia. , Systherm Serwis., Poznań , 2005

Result of average student's workload

Activity	Time (working hours)
1. Lectures participation	20
2. Training projects participation	20
3. Classes participation	20
4. Training project consultations	5
5. Working on project outside of university	20
6. Participation and preparing for examination	20

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	105	6
Contact hours	60	6
Practical activities	20	1