STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Municipal Energy Systems**		Code **1010135221010130349**
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: **-** Laboratory: **-** Project/seminars: **10**		No. of credits **4**
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**		ECTS distribution (number and %) **4 100%**

Responsible for subject / lecturer:

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Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Engineering air protection; meteorology and climatology; fluid mechanics; environmental management? at the level required for the degree Environmental Engineering
2	**Skills**	The use of differential calculus to describe physical phenomena. Ability to conduct measurements of physical quantities and the analysis of experimental results
3	**Social competencies**	Ability to work in a team. Awareness of the need for continuous replenishment of knowledge and skills.

Assumptions and objectives of the course:

-Broaden and deepen the knowledge and skills of a systemic approach to the prevention of air pollution and the active development of air quality, especially in urban structure

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

Knowledge:

1. The student knows and understands the processes associated with the dispersion of pollutants emitted from sources of high and low - [[K2_W01, K2_W07]]

2. The student knows and understands the processes that affect air quality in the urban agglomeration - [[K2_W01, K2_W05]]

3. The student has knowledge of atmospheric monitoring, standards and indicators of air quality and odorymetrii - [[K2_W05, K2_W06]]

4. The student knows the principles and mechanisms of basic techniques reduce nuisance emissions of dust, gas and odor - [[K2_W04, K2_W06]]

Skills:

1. Student is able to develop? Study of air protection? for the plant - [[K2_U03, K2_U08]]

2. The student is able to determine the effect of building structures and technical conditions for emission dispersion of pollutants from point sources and low mobile - [[K2_U01, K2_03, K2_U04; K2_U11]]

3. The student is able to determine the impact of natural and anthropogenic factors (including the structure of energy supply, urban structure, emissions) on air quality in the city - [[K2_U01, K2_03, K2_U04; K2_U10]]

4. The student is able to design the optimal technology to reduce nuisance air emissions - [[K2_U14, K2_U18]]

Social competencies:

1. The student understands the complexity of the technical environment? the natural and the need for cooperation of specialists from different fields to solve theoretical and practical problems - [[K2_K02, [K2_K07]]
2. The student is aware of the responsibility of environmental protection specialist for the quality of life especially in the urban agglomeration - [[K2_K02, K2_K04]]
3. Student recognizes the need for systematic and deepen and broaden their knowledge and skills - [[K2_K01]]

Assessment methods of study outcomes

-lecture:

written exam - duration 70 minutes. ; Individual possible discussion after the results of the written work; Evaluation of written work - based on points earned from individual tasks; Bonus activity during lectures; taking into account assessments of the exercises in the final assessment

-ćwiczenia design:

Ongoing control of the project during exercise and consultation; completion of the project

on the basis of an oral defense of the work.

-Laboratory exercises:

job control before exercise (entrance fee); checking in progress; report of the exercises; discussion during the counting exercise.

Course description

-The spread of pollutants from point emitters, mathematical model of Euler; boundary conditions and simplifying assumptions? formula calculation Pasquile? a? Sutton. Determination of instantaneous concentrations, medium and frequency exceeding the established concentrations of gases according to the formula Pasquile? A? Sutton; the notion of roughness of the terrain, diffusion coefficients, the apparent height of the emission determination influx of dust.

Chemical processes in the plume, precipitation and leaching of contaminants from streaking phenomenon of flow around buildings, shade and trace aerodynamic. Emitters low dispersion of pollutants from low emitters and in the canyon street model boxed; load emission (Emission).

Environmental aspects of internal and external affecting the air quality in the urban area.

Energy analysis and ecological accordance with the procedure LCA, supply structure in the energy of the city.

Energy balance of the city; natural and anthropogenic components of the balance sheet, their characteristics. Urban heat island, source, structure, consequences analysis. City island pollution sources, variability.

Photochemical reactions in the atmosphere; photochemical smog and acid.

Air quality standards expressed immission values ??of permissible concentrations of selected pollutants; upper and lower assessment threshold. Air Quality Index (AQI) Energy and Air Quality Indicator (EAQI).

Monitoring atmospheric; principle of location of measuring stations. Remote measurement of concentrations: the principle of absorption spectroscopy? DOAS and Differential Absorption? DIAL.

Physiological characteristics of the odor, the basic concepts related to the assessment of odor; Source odorów.Metody measurements of odor - odorymetria; electronic nose.

The principles and mechanisms underlying technologies pollution reduction odor.

Topics design exercises:

study of air protection for the agglomeration of several sources of emissions.

Topics of laboratory exercises:

Educational trips:

1.Elektrociepłownia Poznań Karolin EC-II, along with the installation of semi-dry flue gas desulphurisation

2.Automatyczna immission measuring station concentrations of air pollutants

3.Laboratoria Provincial Inspectorate for Environmental Protection

exercise laboratory

Research dispersion of pollutants from point sources and low line - physical model

Basic bibliography:

1. Szargut J., Ziębik A.: Termodynamika techniczna. Warszawa, WNT 2001.
2. Marecki J.: Podstawy przemian energetycznych. Warszawa, WNT 2000.
3. Chmielniak T: Technologie energetyczne. Warszawa, WNT 2008.
4. Szargut J., Guzik J.: Programowany zbiór zadań z termodynamiki technicznej. Warszawa, WNT 1980.
5. Rocznik statystyczny Rzeczpospolitej Polskiej 2010. Warszawa, ZWS 2011.
6. Mróz, T.M.: Planowanie modernizacji i rozwoju komunalnych systemów zaopatrzenia w ciepło. Wydawnictwo Politechniki Poznańskiej, seria rozprawy Nr 400, 2006.

Additional bibliography:

1. Kreith, F., West, R.E.: CRC Handbook of Energy Efficiency. CRC Press Inc. 1997.

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures	30
2. Participation in the design classes	30
3. Implementation of projects at home	30
4. Participation in laboratory exercises	15
5. Preparation for laboratory exercises	10
6. Consultation	10
7. Preparation for credit projects and laboratories	10
8. Preparation for the exam and exam	10

Student's workload

Source of workload	hours	ECTS
Total workload	100	4
Contact hours	45	2
Practical activities	35	2