STUDY MODULE DESCRIPTION FORM

Name of the module/subject **Audyting and Energy Management**			Code **1010135231010100351**
Field of study **Enviromental Engineering Extramural Second-**	Profile of study (general academic, practical) **(brak)**		Year /Semester **2 / 3**
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: **18** Classes: **10** Laboratory: **-** Project/seminars: **-**			No. of credits **3**
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 %) **3 100%** **3 100%**

Responsible for subject / lecturer:

dr hab. inż. Małgorzata Basińska
email: malgorzata.basinska@put.poznan.pl
tel. (61) 647 5824
Faculty of Civil and Environmental Engineering
ul. Piotrowo 5 60-965 Poznań

Prerequisites in terms of knowledge, skills and social competencies:

1	**Knowledge**	Knowledge of selected aspects of building physics, heat and mass transfer, thermodynamic cycles. Basic knowledge of building construction. The basic economic knowledge.
2	**Skills**	Ability to effectively use knowledge of mathematical analysis, physics and economic. Application of energy balance equation in evaluation of energy systems in built environment. Calculation of coefficients of energy, economic and ecologic efficiency of energy systems in built environment.
3	**Social competencies**	Awareness of the need to constantly update and supplement knowledge and skills.

Assumptions and objectives of the course:

Widening and deepening of knowledge, skills assessment of energy efficiency, economic and ecological energy systems in buildings.

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

Knowledge:

1. The student has a theoretical and practical knowledge on the energy balancing of complex energy systems of complex systems in environmental engineering (obtained at the lecture) - [K2_W04, K2_W05]

2. The student knows the methods of static and dynamic evaluation of economic efficiency (obtained at the lecture and exercises) - [K2_W06, K2_W08]

3. The student knows the principles of energy auditing of buildings and technical equipment of buildings (obtained at the lecture and exercises) - [K2_W04, K2_W06, K2_W08]

4. The student is able to perform an energy performance certificate (obtained at exercises) - [K2_W02, K2_W04, K2_W06, K2_W07]

Skills:

1. The student can construct evaluation model and energy balance equations for simple and complex energy systems in built environment (obtained at the lecture) - [K2_U10, K2_U11]

2. The student can calculate simple payback time (SPBT), net present value (NPV) and internal rate of return (IRR) for elements and energy systems used in built environment (obtained at the lecture and exercises) - [K2_U10, K2_U14]

3. The student is able to compare the energy assessment methods of buildings (energy performance certificate, LEED, BREEAM and other) (obtained at the lecture and exercises) - [K2_U11, K2_U12, K2_U15, K2_U16]

Social competencies:

1. The student understands the need for teamwork in solving theoretical and practical problems (obtained at the lecture and exercises) - [K2_K03]
2. The student is aware of the need for change in energy management in buildings arising from the implementation of the European Directive on the energy performance of buildings (obtained at the lecture and exercises) - [K2_K07]

Assessment methods of study outcomes

Lectures (effect W2, W4, W5, W6, W8, U10, U11, U12, U14, K3, K7):

Written test of competences checking knowledge (4 open questions)

Exercises: (effect W2, W4, W6, W8, U10, U11, U12, U14, K3, K7):

Written test of competences checking skills (2 exercises)

Evaluation criteria depending on the percentage obtained

Obtained percentage - mark

0% - 40% - insufficient (2.0)

41% - 60% - sufficient (3.0)

61% - 70% - sufficient plus (3.5)

71% - 80% - good (4.0)

81% - 90% - good plus (4,5)

91% - 100% - very good (5.0)

Course description

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Energy policy in Poland, basic financing mechanisms and effects of thermo-modernization projects, energy audit of the building - basics.

Detailed methodology for developing an energy audit for a building.

Energy-ecological assessment of buildings in full life cycle (LCA), application of standards PN-EN 15978 and PN-EN 15804.

Heat energy costs.

Heat protection requirements for WT buildings.

Energy balancing of buildings.

Static and Dynamic Methods of Economic Evaluation of Energy Projects.

Energy certificates for buildings (GREENBUILDING, LEED, breeam, DGNB).

Learning methods:

Lecture with multimedia presentation.

Exercises - exercise method.

Basic bibliography:

1. Kurtz K., Gawin D.: Certyfikacja eneregtyczna budynków mieszlanych z przykładami. Wrocławskie Wydawnictwo Naukowe Atla 2, Wrocław 2009

2. KOCZYK H. [i in.]: Ogrzewnictwo praktyczne. Projektowanie. Montaż. Eksploatacja. Certyfikacja energetyczna budynków. pod red. Haliny KOCZYK. Aut.: KOCZYK H., ANTONIEWICZ B., BASIŃSKA M., GÓRKA A., Makowska Hess R.. Poznań: SYSTHERM SERWIS S.C. 2009. 524 s., ISBN 978-83-61265-12-2.

3. USTAWA z dnia 29 sierpnia 2014 r. (Dz. U. z 2014 r. poz. 1200) o charakterystyce energetycznej budynków

4. Dz.U. poz. 376: Rozporządzenie Ministra Infrastruktury i rozwoju z dnia 27 lutego 2015 r. w sprawie metodologii wyznaczania charakterystyki energetycznej budynku lub części budynku oraz świadectw charakterystyki energetycznej

5. Dz.U. 2009 Nr 43 poz. 346 z dnia 17 marca 2009 r. w sprawie szczegółowego zakresu i form audytu energetycznego oraz części audytu remontowego, wzorów kart audytu, a także algorytmu oceny opłacalności przedsięwzięcia termomodernizacyjnego

6. Dz. U. z 2008 r. Nr 223, poz. 1459 z dnia 21 listopada 2008 r. o wspieraniu termomodernizacji i remontów

7. PN-EN-15459-2008 Charakterystyka energetyczna budynków. Ekonomiczna ocena instalacji energetycznych w budynkach

Additional bibliography:

Result of average student's workload

Activity	Time (working hours)
1. Participation in lectures (contact hours)	18
2. Participation in tutorials (contact and practical hours)	10
3. Participation in consultations related to the tutorials (we assume that the student uses a 3 consultation) (contact hours)	3
4. Preparation for the final test of lectures (indywidual work)	30
5. Preparation for the final test of exercises (indywidual work)	14

Student's workload		
Source of workload	**hours**	**ECTS**
Total workload	75	3
Contact hours	31	1
Practical activities	10	1