# STUDY MODULE DESCRIPTION FORM

| Name of the module/subject | | Code |
|---|---|---|
| **Unconventional Energy Sources in Urban Management** | | **1010135231010132022** |
| Field of study | Profile of study (general academic, practical) | Year /Semester |
| **Enviromental Engineering Extramural Second-** | **(brak)** | **2 / 3** |
| Elective path/specialty | Subject offered in: | Course (compulsory, elective) |
| **Heating, Air Conditioning and And** | **Polish** | **obligatory** |
| Cycle of study: | Form of study (full-time,part-time) | |
| **Second-cycle studies** | **part-time** | |

| No. of hours | | | | No. of credits |
|---|---|---|---|---|
| Lecture: **20** | Classes: **-** | Laboratory: **-** | Project/seminars: **-** | **4** |

| Status of the course in the study program (Basic, major, other) | (university-wide, from another field) |
|---|---|
| **(brak)** | **(brak)** |

| Education areas and fields of science and art | ECTS distribution (number and %) |
|---|---|
| | |

## Responsible for subject / lecturer:

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## Prerequisites in terms of knowledge, skills and social competencies:

| | | |
|---|---|---|
| 1 | **Knowledge** | Knowledge of selected topics in mathematics, physics, engineering mechanics, materials strength and thermodynamics<br>Knowledge of selected topics in physics, chemistry and biology.<br>Knowledge of basic principles and laws of thermodynamics, heat transfer and fluid mechanics. |
| 2 | **Skills** | Use the knowledge to explain processes and phenomena in mechanical and flow devices<br>The application of known physics laws to describe the phenomenon in devices converting energy from non-renewable sources.<br>Determination of indicators to assess the energy efficiency and economic of non-renewable energy sources systems. |
| 3 | **Social competencies** | Awareness of the need to constantly update and supplement knowledge and skills<br>Able to share their skills with people in the group |

## Assumptions and objectives of the course:

1. Purchase by the student knowledge of methods and plants used to generate energy from alternative energy sources

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

### Knowledge:

1. . The student has an ordered theoretical knowledge in physics, chemistry, biology and other fields relevant environmental engineering in order to identify and solve complex tasks in the field of environmental engineering - [ K2_W01]

2. The student has an ordered theoretical knowledge of the possibility of obtaining energy from non-renewable sources of energy - [K2_W05]

3. The student has knowledge of principles, schemes and construction of AES units and types of energy conversion - [K2_W05]

4. The student has an ordered and detailed knowledge of the life cycle of the units, facilities, and technical systems used in environmental engineering (solar collectors, heat pumps, wind turbines, photovoltaic cells) - [K2_W06]

5. . The student knows the basic methods, techniques, tools and materials used in technologies based on renewable and non-renewable primary energy sources - [K2_W07]

6. The student knows the general principles for the creation and development of forms of individual enterprises, utilizing knowledge of environmental engineering - [K2_W11]

### Skills:

1. The student is able to capture, analyze and appropriately use information from Polish and foreign literature in the field of alternative energy sources - [K2_U01]
2. The student is able to calculate, design and select the system to generate energy from alternative energy sources - [K2_U07, K2_U08]]
3. Students can compare on the basis of calculations of various energy efficiency of equipment and systems for obtaining energy from alternative energy sources - [K2_U11, K2_U12]
4. . The student is able to make a preliminary economic analysis in the field of engineering activities undertaken in relation to renewable and non-renewable primary energy sources - - [K2_U14]

**Social competencies:**

1. The student understands the need for systematic broadening its competence - [-]
2. The student is able to work in group and fulfill different tasks - [-]
3. The student understands the importance of engineering and its impact on the environment - [-]

## Assessment methods of study outcomes

Lectures: Written final test

## Course description

Conventional and non-conventional energy sources.

Solar energy: types of solar collectors, construction and operation of solar flat collectors, construction, operation and selection of solar vacuum collectors.

Heat Pumps: The compressor heat pump. Principle of operation, the definition of the COP, types of heat sources, examples of applications of heat pumps;

Absorption heat pumps, Thermoelectric heat pumps.

Geothermal water: Exploitation of geothermal sources, geothermal heating plants, monovalent and bivalent systems.

Biomass: Energy potential of biomass, use of biomass, combustion appliances examples.

Wind energy and its use: wind energy potential, types of wind turbines, wind turbines, basic information.

Photovoltaics: design and operation, examples of applications.

Theme of design project:

1. The heat pump and a solar collector as a non-conventional heat source to heat the hot water in apartment building

## Basic bibliography:

1. Tytko Ryszard, Odnawialne źródła energii, Wydawnictwo OWG, Warszawa 2009
2. Lewandowski Witold M., Proekologiczne odnawialne źródła energii, Wydawnictwa Naukowo-Techniczne Warszawa 2007
3. Foit Henryk, Zastosowanie odnawialnych źródeł ciepła w ogrzewnictwie i wentylacji, Wydawnictwo Politechniki Śląskiej Gliwice 2010
4. Rubik Marian, Pompy ciepła, Ośrodek Informacji ?Technika Instalacyjna w Budownictwie? Warszawa 1999

## Additional bibliography:

1. Kusto Zdzisław, Współpraca pomp ciepła ze źródłem konwencjonalnym. Algorytmy obliczania bilansu energetycznego i efektywności ekonomicznej, Wydawnictwo Gdańskiej Wyższej Szkoły Administracji, Gdańsk 2009
2. Wiśniewski Grzegorz , Kolektory słoneczne. Poradnik wykorzystania energii słonecznej, Wydawnictwo: centralny Ośrodek Informacji Budownictwa, Warszawa 1992
3. Jarzębski Zdzisław M., Energia słoneczna. Konwersja fotowoltaiczna, Państwowe Wydawnictwo Naukowe Warszawa 1990
4. Klugmann-Radziemska Ewa, Odnawialne źródła energii. Przykłady obliczeniowe, Wydawnictwo Politechniki Gdańskiej, Gdańsk 2009
5. Nowak W., Stachel A.A., Borsukiewicz-Gozdur A., Zastosowania odnawialnych źródeł energii, Wydawnictwo Uczelniane Politechniki Szczecińskiej Szczecin 2008

## Result of average student's workload

| Activity | Time (working hours) |
|---|---|
| 1. Participation in lectures | 30 |
| 2. Participation in project exercises | 15 |
| 3. Execution of 3 design projects (student individual work) | 20 |
| 4. Preparation (at home) for the project exercises | 5 |
| 5. Participation in consultations related to the project exercises | 2 |
| 6. . Preparation for the final test | 10 |

## Student's workload

| Source of workload | hours | ECTS |
|---|---|---|
| Total workload | 83 | 4 |
| Contact hours | 45 | 2 |
| Practical activities | 38 | 2 |