FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name of subject in Polish:	Fizyczne podstawy energetyki odnawialnej
Name of subject in English:	**Physics of renewable energy**
Main field of study (if applicable):	**Power Engineering**
Specialization (if applicable):	**Renewable sources of energy**
Profile:	**academic**
Level and form of studies:	**2nd level, full-time**
Kind of subject:	**optional**
Subject code:	**W09ENG-SM0041W**
Group of courses:	**YES**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	30			15	15
Number of hours of total student workload (CNPS)	60			30	30
Form of crediting	examination			crediting with grade	crediting with grade
For group of courses mark final course with (X)					
Number of ECTS points	2			1	1
including number of ECTS points for practical (P) classes				1	1
including number of ECTS points for direct teacher-student contact (BK) classes	1			0.75	0.75

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

Competence in mathematics and physics confirmed by positive grades in physics and mathematics at the first level of study

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SUBJECT OBJECTIVES

C1 - Detailed familiarization of students with the phenomena and physical processes used in energetics from renewable sources, taking into account new achievements and development trends
C2 - Developing skills to effectively acquire, critically evaluate and use information, including energy sources, for using in practice
C3 - Preparing students for the implementation of project tasks, including the use of current achievements related to physics and material engineering
C4 - To develop skills in public presentations of the results of literature studies and project work

SUBJECT LEARNING OUTCOMES

relating to knowledge:

PEU_W01 - has structured and theoretically founded detailed knowledge related to issues in the field of physical phenomena and processes used in renewable energy as well as the most important new achievements and development trends in the field of energy from renewable sources

relating to skills:

PEU_U01 - can obtain information from literature, databases and other sources; make a critical assessment of them, on this basis can design a simple energy system based on renewable energy sources, taking into account the initial economic analysis and is able to draw conclusions and formulate and comprehensively justify opinions as well as prepare a report

PEU_U02 - can prepare the presentation on the topic of renewable energy, lead the discussion and evaluate its course

PROGRAM CONTENT

	Lectures	**Number of hours**
Lec 1	Preface, course organization, requirements.	2
Lec 2	Introduction: basic problems associated with the energy production systems; the model of the greenhouse effect	2
Lec 3	Characteristics of solar radiation as an energy source: solar emission spectrum, interaction with the atmosphere, clear sky model - calculations of insolation, Liu-Jordan correlation - calculations at different climatic conditions, solar systems.	2
Lec 4	Characteristics of solar radiation as an energy source: solar emission spectrum, interaction with the atmosphere, clear sky model - calculations of insolation, Liu-Jordan correlation - calculations at different climatic conditions, solar systems - continuation	2
Lec 5	Direct conversion of the solar radiation to the electricity: photoelectric effect, PV systems and their operating conditions, PV technology	2
Lec 6	Direct conversion of the solar radiation to the electricity: photoelectric effect, PV systems and their operating conditions, PV technology - continuation	2
Lec 7	Direct conversion of the solar radiation to the electricity: photoelectric effect, PV systems and their operating conditions, PV technology - continuation	2
Lec 8	Direct conversion of the IR solar radiation to the electricity: thermoelectric effect, thermoelectric generator and heat pump.	2
Lec 9	Direct conversion of the IR solar radiation to the electricity: thermoelectric effect, thermoelectric generator and heat pump - continuation	2
Lec 10	Thermoinic effect and its applications. AMTEC & fuel-cells.	2
Lec 11	Thermoinic effect and its applications. AMTEC & fuel-cells – continuation. Thermoacoustics, thermoacoustic generator, heat pump and refrigerator.	2
Lec 12	Thermoacoustics, thermoacoustic generator, heat pump and refrigerator-continuation.	2
Lec 13	Waves and tidal – physics and characteristics from the energy source point of view	2
Lec 14	Wind energy. Nuclear fusion.	2
Lec 15	The supplement or the summary according to student suggestions	2
	Total hours	30

	Project	**Number of hours**
Proj 1	Introduction	1

Proj 2 - Proj 4	The establishing of the project assumptions and the project's tasks related to project implementation - localization, selection of the energy sources, selection of the energy system.	3
Proj 5 - Proj12	The project's calculations: power obtained from the selected source of energy depending on localization and climate conditions - analysis of obtained results	8
Proj13 - Proj15	Students present their design solutions at the whole group forum - summary, discussion and evaluation	3
	Total hours	15

Seminar		**Number of hours**
Sem 1	Introduction	1
Sem 2 - Sem 14	The student's reports on renewable energy with particular emphasis on the physics of the phenomena and technical solutions discussed, as well as development trends - discussion and assessment of the speech.	13
Sem 15	Summary	1
	Total hours	15

TEACHING TOOLS USED

N1. Lecture: information and problem lecture, multimedia presentation combined with traditional form,
N2. Seminar: multimedia or traditional presentation,
N3. Seminar: discussion
N4. Project: own work,
N5. Project: consultation
N6. Project: multimedia / traditional presentation of work stages
N7. Project: discussion of the results obtained
N8. Project: final report.

EVALUATION OF SUBJECT LEARNING OUTCOMES ACHIEVEMENT

Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Way of evaluating learning outcomes achievement
F1	PEK_W01	Exam
P=F1		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Report & presentation
F1	PEK_U01	
P=F1		
Evaluation (F – forming (during semester), P – concluding (at semester end)	Learning outcomes number	Presentation & discussion

F1	PEK_U02	
PeF1		

PRIMARY AND SECONDARY LITERATURE

PRIMARY LITERATURE:

[1] [1] Gilbert M. Masters, „*Renewable and efficient electric power systems"*, WILEY-INTERSCIENCE, 2004

[2] Sorensen B., „*Renewable energy*:", San Diego Academic Press,2000

[3] Aden B. Meinel, Marjorie P. Meinel, „*Applied solar energy, An Introduction*", Addison-Wesley Publishing Company,1997

[4] Aldo Viera da Rosa, "*Fundamentals of Renewable Energy Processes*", Elsevier Academic Press, 2005

SECONDARY LITERATURE:

[1] Gipe P., "Wind energy for the rest of us", any edition

[2] Boxwell M., Solar Electricity Handbook, any edition

[3] "*Some aspects of renewable energy*", scientific editors: D.Nowak-Woźny, M.Mazur, Oficyna Wydawnicza Politechniki Wrocławskiej, Wrocław, 2011

SUBJECT SUPERVISOR (NAME AND SURNAME, E-MAIL ADDRESS)

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