

Physics of renewable energy

Faculty of	Mechanical and Power Engineering
Name in English	Physics of renewable energy
Name in Polish	Fizyczne podstawy energetyki odnawialnej
Main field of study	Power Engineering
Specialization	-
Level of studies	II level
Form of studies	full-time
Kind of subject	obligatory
Subject code	W09ENG-SM2336
Group of courses	NO

	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)	75			25	25
Form of crediting	Exam			Credit	Credit
For group of courses mark final course with (X)					
Number of ECTS points	3			1	1
including number of ECTS points for practical (P) classes				1	1
including number of ECTS points for direct teacher-student contact (BU) classes	1,44			0,76	0,68

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	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
relating to social competences:	
PEU_K01	can lead a discussion

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Wy1	Preface, course organization, requirements.	2
Wy2	Introduction: basic problems associated with the energy production systems; the model of the greenhouse effect 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. 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	8
Wy3	Direct conversion of the solar radiation to the electricity: photoelectric effect, PV systems and their operating conditions, PV technology Direct conversion of the solar radiation to the electricity: photoelectric effect, PV systems and their operating conditions, PV technology - continuation Direct conversion of the IR solar radiation to the electricity: thermoelectric effect, thermoelectric generator and heat pump. Direct conversion of the IR solar radiation to the electricity: thermoelectric effect, thermoelectric generator and heat pump - continuation	10
Wy4	Thermionic effect and its applications. AMTEC & fuel-cells – continuation. Thermoacoustic, thermoacoustic generator, heat pump and refrigerator. Thermoacoustic, thermoacoustic generator, heat pump and refrigerator- continuation. Waves and tidal – physics and characteristics from the energy source point of view Waves and tidal – physics and characteristics from the energy source point of view Wind energy. Nuclear fusion.	8
Wy5	The supplement or the summary according to student suggestions	2
Suma godzin		30

project		Number of hours
Pr1	Introduction	1
Pr2	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. The project's calculations: power obtained from the selected source of energy depending on localization and climate conditions - analysis of obtained results	10
Pr3	Students present their design solutions at the whole group forum - summary, discussion and evaluation	4
Suma godzin		15

seminar		Number of hours
Se1	Introduction	1
Se2	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.	14
Suma godzin		15

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

EVALUATION OF SUBJECT EDUCATIONAL EFFECTS ACHIEVEMENT

Evaluation (F- forming (during semester), C- concluding (at semester end))	Educational effect number	Way of evaluating educational effect achievement
F1=P1	PEU_W01	Exam
F2=P2	PEU_U01	Report & presentation
F3=P3	PEU_U02	Presentation & discussion

PRIMARY AND SECONDARY LITERATURE

Primary literature	
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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