Solar energy in power engineering					**Code of the course**		**Year / Semester**
Type of subject:		**Education Profile**		**The level of education**		**Form of studies**	
Obligatory		**General Academic**				**Stationary**	
Type of subject							**ECTS**
Lecture	**Exercises**	**Laboratory**	**Project**	**Seminar**	**Practical classes**	**Exam**	
15	**15**	**30**	**-**	**-**	**-**	**-**	**7**
Subject coordinator:							
Dr inż. Michał Wichliński, michal.wichlinski@pcz.pl							

II. COURSE CONTENT		
Course type – Lecture		**Number of hours**
1-2	The Solar Radiation	2
3-6	Photovoltaic Generator	3
7-9	Properties of PV Generators in Operation Conditions	3
10-11	Shading effects on PV cells	2
12-13	Inverters	2
14	Storage	2
15	Test	1
	TOTAL:	**15**
Course type - Exercises		
	Calculation of the work of the PV installation – off grid installation	5

	Calculation of the work of the PV installation – on grid installation	5
	Calculating the distance between rows	2
	PV installation with self-consumption of energy	2
	Test	1
	TOTAL:	**15**
Course type - Laboratory		**Number of hours**
	Introduction to laboratory exercises, safety rules etc.	2
	Physical behaviour of solar cells under varying illuminance and temperature	6
	Solar module measurements	8
	Application aspects of electrical components for photovoltaic systems	8
	Results and processing of the obtained results	4
	Defense of studies	2
	TOTAL:	**30**

DIDACTIC METHODS	
1.	Blackboard
2.	Multimedia presentation
3.	Laboratory setup
4.	The literature and instructions for laboratory classes

METHODS OF ASSESSMENTS: (F – FORMATIVE; S – SUMMATIVE)	
F01	activity in classes
F02	evaluation of work during laboratory exercises
S01	test
S02	evaluation of the laboratory reports

III. STUDENT WORKLOAD

L.p.	Form of activity	Numer of hours for activity [hours]
1. Direct teaching hours:		
1.1	Hours of classes organized by universities – lectures	15
1.2	Hours of classes organized by universities – exercises	15
1.3	Hours of classes organized by universities – laboratory	30
1.4	Hours of classes organized by universities – project	
1.5	Hours of classes organized by universities – field activities	
1.6	Hours of classes organized by universities – seminar	
1.7	Exam	
	Total direct hours:	**60**
2. Student's own work		
2.1	Preparation for exercises and for final exams	30
2.2	Preparation for laboratory test reports, preparation of individual	50
2.3	Preparing your own project	
2.4	Preparation for the final exam from the lecture	30
2.5	Exam Preparation	
2.6	Reading the literature	
	Total student's self-studies:	**110**
	Overall student workload:	**170**
TOTAL NUMBER OF ECTS FOR THE COURSE:		**7**
The number of ECTS credits that a student obtains in classes requiring the direct participation of the teacher:		**2,47**
The number of ECTS credits that the student obtains as part of his/her own work		**4,52**

IV. PRIMARY AND SUPPLEMENTARY LITERATURE	
Primary literature	
1	Advances in Renewable Energies and Power Technologies Volume 1: Solar and Wind Energies Edited by Imene Yahyaoui University Carlos III of Madrid, Spain, 2018

2	Energy harvesting; Solar, Wind, and Ocean Energy Conversion Systems; Alroza Khaligh, Omar G. Onar; Energy, Power Electronics, and Machines Series; AH Emadi, Series Editor 2021
3	Stefan C.W. Krauter; Generation - Photovoltaic Energy Systems Modeling of Optical and Thermal, Solar Electric Power Performance, Electrical Yield, Energy Balance, Effect on Reduction of Greenhouse Gas Emissions, Berlin 2006
4	Kaolgirou, Soteris; Solar energy engineering: processes and systems; Elsevier, 2009
5	Power systems and renewable energy design, operation, and systems analysis; Gary D. Price; Momentum Press, LLC, New York, 2014
Supplementary literature	

VII. OTHER USEFUL INFORMATION ABOUT THE SUBJECT	
1.	Opportunity to review supporting materials and literature:
	Appropriate to the type of material - in teaching classes, in the TUC Central Library.
2.	Information on when and where the classes will be held
	Notice board at the Faculty of Infrastructure and Environment and on the website of the Faculty of Infrastructure and Environment, MSz USOS system.
3.	Information about the consultation (times + place):
	the staff consultation schedule is available on the Faculty of Infrastructure and Environment website and on the staff room door.