Water power engineering

Faculty of	**Mechanical and Power Engineering**
Name in English	**Water power engineering**
Name in Polish	**Energetyka wodna**
Main field of study	**Water Power Engineering**
Specialization	**-**
Level of studies	**II level**
Form of studies	**full-time**
Kind of subject	**optional-specialization**
Subject code	**W09ENG-SM2354**
Group of courses	**NO**

	Lecture	Classes	Laboratory	Project	Seminar
Number of hours of organized classes in University (ZZU)	15		15	15	
Number of hours of total student workload (CNPS)	25		25	25	
Form of crediting	Zaliczenie		Zaliczenie	Zaliczenie	
For group of courses mark final course with (X)					
Number of ECTS points	1		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	0,68		0,68	0,76	

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

1.	Knowledge of issues related to solid mechanics and fluid mechanics.
2.	Basic knowledge of turbomachinery.
3.	Ability to use spreadsheets and CAD programs.

SUBJECT OBJECTIVES

C1	Students will learn various methods of harnessing water resources for renewable energy purposes, which will include the process of energy accumulation.
C2	To provide students with the importance of hydropower for the electricity system, ecology and economy.
C3	Students will learn the types and principles of operation of water turbines.
C4	To provide students with the construction of hydroelectric power.
C5	Developing skills identification and assessment of water energy resources.

SUBJECT LEARNING OUTCOMES

relating to knowledge:	
PEU_W01	Understands concepts of water management, has knowledge about the possibilities of the use of the energy contained in the water.
PEU_W02	Have knowledge of how the select turbine type, their numbers, arrangement and generators
PEU_W03	Understands the concept: installed parameters, draft tube, halfspiral, open chamber,
PEU_W04	Have knowledge of the calculation and operations of different types of hydro power plants
relating to skills:	

PEU_U01	is able to: conduct the investigation of water turbines.
PEU_U02	is able to: assess the hydro potential of the river and select installation parameters of HPP.
PEU_U03	is able to: calculate energy potential for different types of HPP
PEU_U04	is able to: select turbines by means of peak performance characteristics.

PROGRAMME CONTENT

Form of classes - lecture		Number of hours
Wy1	Introduction to the lecture. Water as a renewable energy and a base of economy operation.	2
Wy2	Basic information about hydrology. Hydrographs, types of rivers, energy concentration.	2
Wy3	Run of river hydro power plants - parameters determination.	2
Wy4	Parameters determination of the hydro - plants working with daily and weekly controlled reservoir	2
Wy5	Theory of water turbines. Specific speed. Types of water turbines. Hydraulic similarity.	2
Wy6	Water turbines operating parameters and rules of rational construction. Turbine characteristics.	2
Wy7	Basic of water-turbine and electric generator selection.	2
Wy8	Building flow elements of hydro - plants. Turbine auxiliary equipment.	1
Suma godzin		15

laboratory		Number of hours
La1	Basic information and introduction to the laboratory.	2
La2	Introduction to the subject of water turbine research.	2
La3	Determination of the operating characteristics of the Francis turbine	2
La4	Energy study of a pump in turbine operation.	3
La5	Determination of the operational characteristics of the Pelton turbine.	3
La6	Determination of the characteristics of the universal Francis turbine.	3
Suma godzin		15

project		Number of hours
Pr1	Basic information and introduction to the project, types of hydropower plants, design point (credit conditions of the course, input data).	1
Pr2	Compositions of hydropower plants and water turbines. Run-of-the-river hydroelectricity scheme.	2
Pr3	Assessment of the hydropotential of the selected river.	2
Pr4	Determination of numbers and size of water turbines and hydro generators.	2
Pr5	Turbine selection based on characteristic curves.	2
Pr6	Cavitation calculation in water turbines.	2
Pr7	Determination of the basic dimension of the Kaplan turbine, spiral case and draft tube.	2
Pr8	Designing the offer draft of a hydropower plant.	2
Suma godzin		15

TEACHING TOOLS USED	
N1	Traditional lecture using slides, animation and presentation software.
N2	Laboratory.
N3	Project: discuss the algorithms and methods of selection elements of the plant.
N4	Own work.
N5	Consultation.

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
C1	PEU_W01 - PEU_W04	Test.
F1-F3	PEU_U03 - PEU_U04	Reports.
C2=(F1-F5)/3		
F1-F5	PEU_U01	Reports.
C3=(F1-F5)/5		

PRIMARY AND SECONDARY LITERATURE

Primary literature	
1	H. Moazam, S. Hamza, J. Umer „Hydropower with Kaplan hydro turbine : a theory and approach to kaplan turbine design (future of micro hydro turbines)", LAP Lambert Academic Publishing, 2011.
2	S. Michałowski, J. Plutecki „Energetyka wodna", WNT, Warszawa 1975.
3	P. Stawski, at All „Water Power Plants", Wroclaw 2011.
4	T. Jiandong, Z. Naibo, W. Xianhuan, H. Jing, d. Huishen, „Mini Hydropower", John Wiley & Sons, New York 1996.
5	F. R. Frsund, „Hydropower economics", Springer, New York 2007.
6	J. Fritz, „Small and mini hydropower systems : resource assessment and project feasibility", McGraw-Hill Book Co., New York 1984.
7	ESHA „Guide on How to Develop a Small Hydropower Plant" (European Small Hydropower Association), 2004.
Secondary literature	
1	International Water Power and Dam Construction - Magazine
2	Carrasco F., „Introduction to hydropower", The Englisch Press 2011
3	PN-EN 60041:1999 Badania odbiorcze przeprowadzane w warunkach eksploatacyjnych celem określenia hydraulicznych parametrów ruchowych turbin wodnych, pomp zasobnikowych i turbin odwracalnych.

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

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