FACULTY OF MECHANICAL AND POWER ENGINEERING

SUBJECT CARD

Name of subject in Polish:	**Energetyka wodna**
Name of subject in English:	**Water Power Engineering**
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-SM0048**
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)	60	30		60	
Form of crediting	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*	Examination / crediting with grade*
For group of courses mark final course with (X)					
Number of ECTS points	2	1		2	
including number of ECTS points for practical (P) classes	0	1		2	
including number of ECTS points for direct teacher-student contact (BK) classes	1	0,75		1,5	

*delete as applicable

PREREQUISITES RELATING TO KNOWLEDGE, SKILLS AND OTHER COMPETENCES

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

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SUBJECT OBJECTIVES

C.1 Learning by students, ways of using water resources as a form of renewable energy for energy purposes, including the accumulation of energy.

C.2 To provide students with the importance of hydropower for electricity system, ecology and economy.

C.3 Learning by students, principles of operation of water turbines.

C.4 To provide students with the construction of hydroelectric power.

C.5 Developing skills identification and assessment of water energy resources.

C.6 Developing skills to propose a technical solution to the use of energy resources, water

PROGRAM CONTENT		
Lectures		**Number of hours**
Lec1	Introduction to the lecture and requirements. Water as a renewable energy and a base of economy operation.	2
Lec2	Basic information about hydrology. Hydrographs, types of rivers, energy concentration.	2
Lec3	The energetics system, significance and classification of hydroelectric power plants.	2
Lec4	River hydro - plants parameters determination.	2
Lec5	Parameters determination of the hydro - plants working with daily and weekly controlled tanks (reservoirs).	2
Lec6	Running hydro - plants in compact and dispersed cascade.	2
Lec7	Theory and turbine specific speed. Types of water turbines, their property and configuration.	2
Lec8	Water turbines operating parameters and rules of rational construction. TEST	2
Lec9	Basic of water-turbine and electric generator selection.	2
Lec10	Building flow elements of hydro plants.	2
Lec11	Derivation and closings.	2
Lec12	Hydroplants forming.	2
Lec13	Mechanical supportive devices for hydroplants.	2
Lec14	Turbine auxiliary equipment. TEST	2
Lec15	Recapitulate. CREDIT	2
	Total hours	30

Classes		**Number of hours**
Cl 1	Introduction to the classes. The calculation of the hydropotential of selected river.	2
Cl 2	Parameters determination of the run on river hydro power plant.	2
Cl 3	Parameters determination of the daily regulated hydro power plant.	2
Cl 4	Parameters determination of the cascade hydro power plant.	2
Cl 5	The water turbine selection for the dedicated parameters.	2
Cl 6	The calculation of the number of turbines and its size.	2
Cl 7	The selection of the generator and the calculation of the trash rack.	2
Cl 8	Recapitulate. TEST	1
	Total hours	15
Project		**Number of hours**

Proj1	Basic information and introduction to the project, types of hydropower plants, design point (credit conditions of the course, input data).	2
Proj2	Compositions of hydropower plants and water turbines. Run-of-the-river hydroelectricity scheme and calculation. Determination of numbers and size of water turbines and hydro generators.	2
Proj3	Turbine selection based on operating and working characteristic curves. Cavitation calculation in water turbines.	2
Proj4	Power of hydropower plant, cooling system and generator selection (air cooling system).	2
Proj5	Determination of the basic dimension of the Kaplan turbine and spiral case.	2
Proj6	Determination of the type and size of elements which direct water into hydropower plant. Determination of the type and size of elements which direct water out of hydropower plant (draft tube).	2
Proj7	Determination of the auxiliary devices of a hydropower.	2
Proj8	Final exam.	1
	Total hours	15

TEACHING TOOLS USED
N1. Traditional lecture using slides, animation and presentation software. N2. Exercise: discussion of the calculation algorithms. N3. Project: discuss the algorithms and methods of selection elements of the plant. N4. Own work: - calculate the parameters of the installed power, dimensions of the main components of power plant using Excel or Mathcad. - geometry modeling of power plant selected elements using CAD methods in 2D or 3D. - drawings for proposal: longitudinal section through a power plant turbine chamber, steering. N5. Consultation.

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	Lec1 – Lec15	Written exam
F2	Cl1 –Cl8	Reports
F3	Proj1 – Proj8	Reports
P1 = 0,6*F1 + 0,2*F2 + 0,2*F3		

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 English Press 2011.

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

Przemysław Szulc przemyslaw.szulc@pwr.edu.pl

*delete if not necessary