

Course name: Pump Stations

ECTS	6.0
Course status	facultative
Course final assessment /evaluation of outcomes	Graded credit
Prerequisite	hydraulics, river engineering, sanitary engineering

Main field of study: Engineering and Water Management

Educational profile	General academic
Code of studies and education level	bachelor
Semester of studies	summer
Language of instruction	English

Course offered by:

Name of faculty offering the course	Environmental Engineering and Land Surveying
Name of department offering the course	Hydraulic Engineering and Geotechnics
Course coordinator	Dr. Eng. Jacek Florek, Ph.D.

Learning outcomes:

Symbol of outcome	Description of the learning outcome	Reference to main field of study outcomes	Area symbol*
KNOWLEDGE – student knows and understands:			
PST_K1	<i>pump classification, operating principles, concepts of suction and discharge head, efficiency, efficiency, power consumption, flow characteristics, throttling curve, pump applicability curve.</i>	IGW1_W08	T
PST_K2	<i>the mechanism of creating single and multi-stage pump systems, knows the laws of model speed similarity, determines the goals and tasks of pumping stations based on data.</i>	IGW1_W15	T
SKILLS – student is able to:			
PST_S1	<i>calculate the system with a single pump, selection of pump type.</i>	IGW1_U07	T
PST_S2	<i>determine the range of pump applicability, suction and discharge head, efficiency.</i>	IGW1_U16	T
PST_S3	<i>calculate the system of series and parallel pumps, taking into account the applicability of their connection pumps and cooperation curves.</i>	IGW1_U16	T
PST_S4	<i>perform calculations of the pumping station, power consumption, check the system and its threats.</i>	IGW1_U06	T
SOCIAL COMPETENCIES – student is ready to:			
PST_C1	<i>being aware of the importance of the correct functionality of devices, their environmental impact, the concept of energy efficiency, device performance, optimization of design assumptions.</i>	IGW1_K03 IGW1_K07	T

PST_C2	<i>making decisions at individual stages of calculations, designing and assessing potential risk in the implemented project.</i>	IGW1_K02	T
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Teaching contents

Lectures:	15 hours
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Topics	<ol style="list-style-type: none"> 1. Pump classification, structural and functional division. 2. Principles of displacement and centrifugal pumps. 3. Suction and discharge height. 4. Pump and system efficiency. 5. Pump power consumption. 6. Flow characteristic, throttling curve, characteristic curve of pump applicability. 7. Pump systems. 8. Single and multi-stage pumps, model speed similarity laws. 9. Pumping stations goals and task 10. Current methods of pump selection and pumping station design. 11. Cavitation.
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Accomplished learning outcomes	PST_K1, PST_K2, PST_C1, PST_C2
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Means of verification, rules and criteria of assessment	Choice test, positive assessment should be given at least 50% of correct answers to given questions: <50% – insufficient (2.0); 50–60% – sufficient (3.0); 61–70% – satisfactory plus (3,5); 71–80% – good (4.0); 81–90% – good plus (4,5); 91–100% – very good (5.0). The share of the lecture grade in the final grade is 50%.
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Classes:	30 hours
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Topics	<ol style="list-style-type: none"> 1. Single pump system, selection of pump type depending on the task. 2. Range of pump applicability, determination of suction and discharge heights, geometrical, manometric and useful values, hydraulic efficiency. 3. Pump performance, input power, useful power, internal, volumetric, general, mechanical efficiency. 4. Flow characteristics, stability, throttling. 5. Arrangement of parallel and series pumps, applicability, pump combination, cooperation curves. 6. Pumping stations, pump-pipeline work point, power consumption characteristics, system and its threats.
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Accomplished learning outcomes	PST_S1, PST_S2, PST_S3, PST_S4
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Means of verification, rules and criteria of assessment	Passing reports on exercises – a grade from exercises is an arithmetic average of formative grades. The share of the grade for the project exercises in the final grade of the subject is 50%.
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References:

Basic	<ol style="list-style-type: none"> 1. <i>Pompownie melioracyjne. Instrukcja CBPWIM, 1976. Warszawa.</i> 2. <i>Wieczysty A. 1999. Pompownie wodociągowe. Wyd. PK, Kraków.</i>
Supplementary	<ol style="list-style-type: none"> 1. <i>Stępniewski M. 1985. Pompy. WNT, Warszawa.</i>

Structure of learning outcomes

Area of academic study: R – Agricultural, forestry and veterinary sciences	0.0 ECTS **
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Area of academic study: T – technical sciences	6.0 ECTS**
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Structure of student activity

Contact hours	55	hrs.	2.2 ECTS**
Including: lectures	15	hrs.	
classes and seminars	30	hrs.	
consultations	10	hrs.	
participation in research	0	hrs.	
obligatory traineeships	0	hrs.	
participation in examination	2	hrs.	
e-learning	0	hrs.	0.0 ECTS**
student own work	95	hrs.	3.8 ECTS**

*Areas of academic study in the fields of: A – the arts; H – humanities; M – medical, sport and health sciences; N – natural sciences; P – biological sciences; R – agricultural, forestry and veterinary sciences; S – social studies; T – engineering and technology

** stated with an accuracy to 0.1 ECTS, where 1 ECTS = 25–30 hours of classes