GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|---|---|---|---|
| Subject name and code | Pumps, turbines and small hydropower, PG_00053657 | | | | | | |
| Field of study | Mechanical Engineering, Mechanical Engineering | | | | | | |
| Date of commencement of studies | October 2020 | | Academic year of realisation of subject | 2022/2023 | | | |
| Education level | first-cycle studies | | Subject group | | | | |
| Mode of study | Full-time studies | | Mode of delivery | at the university | | | |
| Year of study | 3 | | Language of instruction | English | | | |
| Semester of study | 5 | | ECTS credits | 2.0 | | | |
| Learning profile | general academic profile | | Assessment form | assessment | | | |
| Conducting unit | Department of Energy and Industrial Apparatus -> Faculty of Mechanical Engineering and Ship Technology | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr inż. Marzena Banaszek | | | | |
| | Teachers | | dr inż. Marzena Banaszek | | | | |
| Lesson types and methods of instruction | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 0.0 | 15.0 | 0.0 | 0.0 | 30 |
| | E-learning hours included: 0.0 | | | | | | |
| | Pumps, Turbines and Small Hydropower, LEC/LAB, DaPE, sem.5 winter 2022/23 (M:320403W0) - Moodle ID: 26602 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=26602 | | | | | | |
| Learning activity and number of study hours | Learning activity | Participation in didactic classes included in study plan | Participation in consultation hours | Self-study | SUM | | |
| | Number of study hours | 30 | 0.0 | 0.0 | 30 | | |
| Subject objectives | The aim of the course is to provide students with knowledge of basic information about hydrotechnical structures used for damming water used for small hydropower, discussing the machine equipment of a small power plant and its cooperation with the power grid, providing basic concepts and principles of operation of water turbines and pumps and their selection, and the environmental impact of the energetic use of the river. | | | | | | |

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| K6_W12 | The student has basic knowledge necessary to understand non-technical determinants of engineering activity, has basic knowledge in the field of management, including quality management and running a business, in the field of intellectual property protection and patent law; knows the general principles of creating and developing forms of individual entrepreneurship and the basic principles of occupational health and safety applicable in the machinery industry. | [SW1] Assessment of factual knowledge |
| K6_U06 | The student is able to use mathematical and physical models to analyze the processes and phenomena occurring in mechanical devices in the field of material strength, thermodynamics and fluid mechanics. | [SU2] Assessment of ability to analyse information<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools |
| K6_U01 | The student is able to obtain information from professional literature, databases and other resources necessary to solve engineering tasks; is able to integrate the obtained information and interpret it, as well as draw conclusions and present reasoned opinions. | [SU2] Assessment of ability to analyse information<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools |
| K6_W09 | The student has basic knowledge in the field of thermodynamics and fluid mechanics, construction and operation of thermal energy devices, process apparatus, including renewable energy sources as well as refrigeration and air conditioning. | [SW1] Assessment of factual knowledge |

**Subject contents**

**LECTURES:** Hydropower, Potential of hydropower, Environmental, climate and social issues and impact on hydropower development, Assessment and characterisation of hydropower energy resources, River hydrology & flow alteration, Hydrometry: water level measurement and discharge techniques, Hydraulic structures, Hydropower plants, Hydraulic turbines basic theory, Conventional and non-conventional hydraulic turbines, Centrifugal and rotary pumps

**LABORATORIES:** HYDROMETRY: Determination of the flow rate, Characteristics of a sharp-crested weir, Determination of the flow rate using a current meter, HYDRAULIC TURBINES: Determination of the characteristics of a Kaplan turbine, PUMPS: Determination of the characteristics of a centrifugal pump

**Prerequisites and co-requisites**

not applicable

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| written test | 50.0% | 100.0% |

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| Recommended reading | Basic literature | 1. Davis S.: Microhydro: Clean Power from Water, Mother Earth News Wiser Living Series, 2004<br>2. Thake J.: The Micro-Hydro Pelton Turbine Manual: Design, Manufacture and Installation for Small-Scale Hydro-Power, 2001<br>3. 21st Century Ultimate Hydropower Toolkit: Microhydropower, Hydroelectric Power, Dams, Turbine, Environmental Impact, Fish, Impoundment, Pumped Storage, Diversion, Run-of-River<br>4. Harvey A.: Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes, 1993<br>5. Layman's handbook on how to develop a small hydro site, 1998<br>6. Farias C.F.: Fish-friendly Water Turbines: design and evaluation, LAP LAMBERT Academic Publishing, 2017<br>7. Peng W.: Fundamentals of turbomachinery, John Wiley & Sons 2008<br>8. Leyland B.: Small Hydroelectric Engineering Practice, Taylor & Francis Ltd 2014<br>9. Karassik I.J. (et al.): Pump Handbook, McGraw-Hill Education 2008<br>10. Gülich J.F.: Centrifugal and rotary pumps, Springer - Verlag Berlin, Heidelberg, 2008<br>11. Lobanoff V.S., Ross R. R.: Centrifugal Pumps Design & Application, Butterworth - Heinemann, 1992<br>12. Nelik L.: Centrifugal and rotary pumps fundamentals with applications, CRC Press LLC, 2000 |
| | Supplementary literature | 1. ESHA: Guide on How to Develop a Small Hydropower Plant https://energiatalgud.ee/img_auth.php/a/ab/Guide_on_How_to_Develop_a_Small_Hydropower_Plant.pdf<br>2. IRENA: Hydropower, Data and Statistics https://www.irena.org<br>3. Full report – BP Statistical Review of World Energy 2020 https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf<br>4. IHA: 2020 Hydropower Status Report https://www.hydropower.org/statusreport |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | **SELECTED PROBLEMS OF PUMPS, TURBINES AND SMALL HYDROPOWER**<br>1. The status and future prospects for small hydropower in the selected country.<br>2. Hydrograph, flow duration curve, rating curve as methods of assessment and characterisation of hydropower resources.<br>3. Selected structures of hydraulic structures for small hydropower applications in the selected country.<br>4. Description of the selected hydropower plant in the selected country.<br>5. Hydraulic turbine installed in the selected hydropower plant. | |
| Work placement | Not applicable | |