GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Operation and safety of nuclear power plants, PG_00065897 | | |
| Field of study | Nuclear Engineering | | |
| Date of commencement of studies | February 2027 | Academic year of realisation of subject | 2027/2028 |
| Education level | second-cycle studies | Subject group | Specialty subject group<br>Subject group related to scientific research in the field of study |
| Mode of study | Full-time studies | Mode of delivery | at the university |
| Year of study | 1 | Language of instruction | Polish |
| Semester of study | 2 | ECTS credits | 4.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Department of Electrical Power Engineering -> Faculty of Electrical and Control Engineering -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Tomasz Minkiewicz | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 30.0 | 0.0 | 15.0 | 0.0 | 15.0 | 60 |

E-learning hours included: 0.0

**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 | 60 | 10.0 | 30.0 | 100 |

**Subject objectives**

The aim of the course is to provide the student with knowledge in the field of nuclear power plant operation, security and safety. During the course, the student will learn about aspects related to the construction and operation of a nuclear power station (with particular focus on electrical systems) as well as issues concerning nuclear power plant safety and selected systems responsible for its safe operation.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
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| [K7_U11] communicates and justifies opinions on specialized topics in a manner understandable to diverse audiences, including the use of modern techniques, including information technology | The student presents a presentation on a topic related to the scope of the subject. | [SU1] Assessment of task fulfilment |
| [K7_U02] formulates and tests hypotheses concerning problems related to processes occurring in Nuclear Power Technologies, their efficiency, rationality, operation, safety and impact on the environment, as well as simple research problems | The student performs laboratory tasks by formulating and verifying hypotheses related to the operation of a nuclear power plant | [SU1] Assessment of task fulfilment |
| [K7_W01] explains and describes, based on general knowledge in the field of scientific disciplines forming the theoretical foundations of Nuclear Power Technologies, the physics of processes, structure, principle of operation, operation, safety aspects, fuels and materials for reactors, systems, machines and devices of a nuclear power plant | The student defines and describes processes related to the operation, security and safety of nuclear power plants. | [SW1] Assessment of factual knowledge |
| [K7_U14] integrates information obtained from literature and other properly selected sources, including those in a foreign language, creatively interpreting and critically evaluating them, and drawing conclusions | The student reviews relevant literature and prepares a presentation on a topic related to the scope of the course. | [SU1] Assessment of task fulfilment |

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| Subject contents | Course content – lecture<br><br>Lecture: Construction of nuclear power plants (general issues). Commissioning of nuclear power plants. Selected topics related to the operation of nuclear power plants (including current operational data of nuclear units worldwide, thermal cycles, calculation of electric power and energy generation efficiency). Maintenance and repairs of selected equipment operating in nuclear power plants. Electrical systems of nuclear power plants (including electrical schematics, electric generators used in nuclear power plants, and power station internal load). Operation of nuclear power plants in the power system. Potential adaptation of nuclear power plants for cogeneration. Management of radioactive waste and spent nuclear fuel during nuclear power plant operation. Emissions and releases of radioactive substances during normal nuclear power plant operation. Nuclear power plant safety (including IAEA requirements, safety principles, facility protection and characteristics of selected safety systems). Decommissioning of nuclear power plants (general issues).<br><br>Laboratory: Computer-based calculations related to the operation of nuclear power plants. Presentation and application of software tools provided by the International Atomic Energy Agency (IAEA).<br><br>Seminar: Expansion of topics covered during the lecture (including issues related to accidents that have occurred in nuclear power plants - causes, progress and consequences). |
| Prerequisites and co-requisites | General knowledge of the structure and operation of the power system and thermal power plants. Knowledge of basic physics (basic laws of physics, physical quantities and their units and measures, mechanics, electrical engineering, thermodynamics, heat transfer), mathematics (algebra, geometry, trigonometry, differential and integral calculus) and energy processes' properties (efficiency of single conversion, efficiency of conversion cycle and thermodinamic cycle efficiency |

Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
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| Written exam | 60.0% | 50.0% |
| Presentation | 60.0% | 20.0% |
| Laboratory reports | 60.0% | 30.0% |

Recommended reading

Basic literature


Zieliński A. (red.): Elektrownie jądrowe w nowoczesnej gospodarce. Wydawnictwo Naukowe PWN, Warszawa 2024.

Król K.: Bezpieczeństwo radiologiczne. Wydawnictwo Naukowe PWN, Warszawa 2024.

Tucker C.: Jak zostać operatorem reaktora jądrowego. Wydawnictwo Dragon, Bielsko-Biała, 2022.

Paska J.: Wytwarzanie energii elektrycznej. Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2020.

Kubowski J.: Elektrownie jądrowe. Wydawnictwo Naukowe PWN, Warszawa 2017.

Meiswinkel R., Meyer J., Schnell J.: Design and Construction of Nuclear Power Plants. Ernst & Sohn, 2013.

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| | Supplementary literature | Bartnik R.: Elektrownie i elektrociepłownie jądrowe z reaktorami HTGR I SMR. Wydawnictwo Naukowe PWN, Warszawa 2024.<br><br>Pawlik M., Strzelczyk F.: Elektrownie. Wydawnictwo Naukowe PWN, Warszawa 2016.<br><br>Ackermann G.: Eksploatacja elektrowni jądrowych. Wydawnictwo WNT, warszawa 1987.<br><br>Celiński Z., Strupczewski A.: Podstawy energetyki jądrowej. Warszawa: Wydawnictwo WNT, Warszawa 1984.<br><br>Góra S.: Elektrownie jądrowe. Państwowe Wydawnictwo Naukowe, Warszawa 1978. |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | Describe the process of starting up a nuclear power plant.<br><br>Calculate the electrical power and annual production of electricity in a nuclear power plant.<br><br>Describe the basic elements of the electrical system of a nuclear power plant.<br><br>Present the division of safety standards according to the IAEA.<br><br>Describe 5 selected principles belonging to the Safety Fundamentals.<br><br>Describe a selected safety system used in nuclear power plants with generation III/III+ reactors.<br><br>Present the reason, course and effects of the nuclear power plant accident in Fukushima. | |
| Practical activites within the subject | Not applicable | |

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