GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

| | | | |
|---|---|---|---|
| Subject name and code | Nuclear Power, PG_00037319 | | |
| Field of study | Technical Physics | | |
| Date of commencement of studies | October 2025 | Academic year of realisation of subject | 2028/2029 |
| Education level | first-cycle studies | Subject group | Optional 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 | 4 | Language of instruction | Polish<br>Classes are conducted in Polish and English; in the case of foreign students, classes are conducted exclusively in English. |
| Semester of study | 7 | ECTS credits | 1.0 |
| Learning profile | general academic profile | Assessment form | assessment |
| Conducting unit | Division of Molecular Photophysics -> Institute of Physics and Applied Computer Science -> Faculty of Applied Physics and Mathematics -> Faculties of Gdańsk University of Technology | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Piotr Grygiel | |
| | Teachers | | |

**Lesson types**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15 |

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 | 15 | 2.0 | 8.0 | 25 |

**Subject objectives**

Deeper knowledge of chosen problems of nuclear power engineering.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [K6_W01] understands the importance of physics and its applications in connection to civilization | Understands the civilisational significance of physics and nuclear technology and their applications in nuclear energy. | [SW1] Assessment of factual knowledge |
| [K6_U01] learns independently, obtains information from literature, databases and other properly selected sources | They are able to independently acquire knowledge on various aspects of nuclear energy, independently obtaining information from literature, databases and industry sources. | [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 |

**Subject contents**

Course content – lecture
1. Elements of nuclear physics in power reactors: neutron-induced reactions, fission of heavy nuclei, fissile materials, neutrons (immediate and delayed, moderation, diffusion, chain reaction, mean generation time, flux density distribution in the reactor, multiplication factor and its characteristics), critical mass, reactor reactivity. 2. Reactor kinetics: kinetics equation without delayed neutrons and with delayed neutrons, step change in reactivity, critical and supercritical state, change in reactor power, effect of temperature on reactor reactivity. 3. Reactor poisoning: with xenon, xenon oscillations, samarium poisoning, reactivity loss during samarium poisoning, reactivity in transient states. 4. Reactor power control: using rods, boric acid, use of burn-up poisons. 5. Generations and basic types of nuclear power reactors and their applications. 6. Heat exchange and heat flow in nuclear reactors, sources and distribution of heat in the reactor, shutdown heat, boiling crisis: mechanism and consequences. 7. Fuel cycle: diagram, production of pure uranium compounds, uranium enrichment, fuel assembly production, fuel management in the core, spent fuel management, radioactive waste and its storage, fuel cycle economics. 8. Start-up, reactor control during operation, planned and emergency reactor shutdown, changes in fuel during reactor operation, fuel operations, processes in the primary circuit of the reactor, sources of radiation in a nuclear power plant, hazards to power plant personnel, hazards in the vicinity of the power plant. 9. Selected aspects of nuclear power plant safety: possible accidents in a PWR power plant, behaviour of molten nuclear fuel, defence-in-depth system, threat of terrorist attack, power plant safety requirements, International Nuclear Event Scale, overview of nuclear reactor accidents.

| | | |
|---|---|---|
| Prerequisites and co-requisites | 1. Basic knowledge of quantum mechanics. 2. Basic knowledge of chemistry. 3. Knowledge of a basic university course in physics (incl. nuclear physics). | |
| Assessment methods and criteria | | |

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Written exam | 50.0% | 100.0% |

| | | |
|---|---|---|
| Recommended reading | Basic literature | . J. Massalski ,,Fizyka dla inżynierów cz. 2 fizyka współczesna", Wydawnictwa Naukowo -Techniczne, Warszawa 2005.<br><br>2. V. Acosta, C.L. Cowan, B.J. Graham ,,Podstawy fizyki współczesnej"", PWN Warszawa 1987.<br><br>3. H.A. Enge, M.R. Wehr, J.A. Richards ,,Wstęp do fizyki atomowej, PWN, Warszawa 1983.<br><br>4. G. Jezierski, ,,Energia jądrowa wczoraj i dziś, Wydawnictwa Naukowo - Techniczne, Warszawa 2005.<br><br>5. E. Boeker, R. van Grondelle ,,Fizyka środowiska, Wydawnictwo Naukowe PWN, Warszawa 2002.<br><br>6. Z. Celiński, A. Strupczewski Podstawy energetyki jądrowej, Wydawnictwa Naukowo - Techniczne, Warszawa 1984.<br><br>7. J. Kubowski Elektrownie jądrowe, Wydawnictwo WNT Warszawa 2013<br><br>8. J.K. Shultis, R.E. Saw Fundamentals of nuclear science and engineering, CRC Press 2017 |
| | Supplementary literature | 1.Publications of the International Atomic Energy Agency |
| | eResources addresses | |
| Example issues/ example questions/ tasks being completed | 1. The fission of the U235 nucleus.<br><br>2. Nuclear reactor time constant.<br><br>3. The PWR reactor. | |
| Practical activites within the subject | Not applicable | |

Document generated electronically. Does not require a seal or signature.