GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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| Subject name and code | Life cycle assesment of nuclear power plants, PG_00065902 | | |
| Field of study | Nuclear Engineering | | |
| Date of commencement of studies | February 2026 | Academic year of realisation of subject | 2026/2027 |
| 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 | 3.0 |
| Learning profile | general academic profile | Assessment form | exam |
| Conducting unit | Division of Thermal Power Systems -> Institute of Energy -> Faculty of Mechanical Engineering and Ship Technology -> Wydziały Politechniki Gdańskiej | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | dr inż. Michał Pysz | |
| | Teachers | | |

**Lesson types and methods of instruction**

| Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
|---|---|---|---|---|---|---|
| Number of study hours | 15.0 | 0.0 | 0.0 | 15.0 | 0.0 | 30 |

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 |
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| Number of study hours | 30 | 8.0 | 37.0 | 75 |

**Subject objectives**

To introduce students with the basic tools and methods for determining the environmental footprints generated by energy technologies and, in particular, by the nuclear power sector.

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
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| [K7_U04] creatively designs or modifies, either entirely or at least in part, nulear power systems, considering both technical and non-technical aspects, estimating costs and utilizing design techniques appropriate for tasks within the scope of Nuclear Power Technologies | performed a life cycle analysis for a designated facility, process or equipment using available tools and standards | [SU1] Assessment of task fulfilment<br>[SU4] Assessment of ability to use methods and tools |
| [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 | can analyse and present the results of the life-cycle analysis to the group | [SU3] Assessment of ability to use knowledge gained from the subject<br>[SU5] Assessment of ability to present the results of task |
| [K7_W03] demonstrates structured and theory supported knowledge encompassing key issues in the field of Nuclear Power Technologies, enabling design of energy processes and systems | knows the key processes involved in the construction, operation and decommissioning of a nuclear power plant and can assign the corresponding environmental impacts | [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 | is able to use scientific publications on life cycle analysis and extract the necessary information for the project. In addition, it is able to use the ISO 14040 and ISO 14044 standards to conduct a life cycle analysis of a nuclear power plant. | [SU2] Assessment of ability to analyse information<br>[SU4] Assessment of ability to use methods and tools |

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| Subject contents | Lecture: 1. Introduction to life cycle analysis (LCA) - historical background, limitations and drawbacks, assumptions used in models2. definition of the objective and scope of the analysis - introduction to ISO standards, reference to good engineering practice, presentation of examples, definition of model boundaries3. inventory - basic principles for creating databases, creating inventory questionnaires, global databases4 Impact assessment - representation of environmental impacts according to commercially available models, normalisation and weighting of impacts5 Interpretation of results - uncertainty analysis, sensitivity analysis, introduction to Monte Carlo method6. nuclear power plant life cycle analysis - nuclear power plant construction (site preparation, material transport, impact and composition of construction materials and equipment)7 Nuclear power plant life cycle analysis - nuclear fuel extraction and reprocessing8. nuclear power plant life cycle analysis - power plant operation (water consumption, equipment, overhaul)9. nuclear power plant life cycle analysis - decommissioning (spent fuel storage, post plant land use, material disposal)Project:Implementation of an environmental life cycle analysis based on the knowledge gained from the lectures. |
| Prerequisites and co-requisites | Chemistry: stoichiometric equations, materials engineering, Mechanical engineering: technological processes |

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
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| exam | 60.0% | 60.0% |
| project | 60.0% | 40.0% |

**Recommended reading**

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| Basic literature | G. Sonnemann, M. Tsang, M. Schuhmacher, Integrated Life-Cycle and Risk Assessment for Industrial Processes and Products, Taylor & Francis, Floryda 2019<br><br>M. Góralczyk, Z. Kowalski, Ekologiczna ocena cyklu życia procesów wytwórczych (LCA), Wydawnictwo Naukowe PWN, 2007<br><br>Standards ISO 14040 i ISO 14044 |
| Supplementary literature | Scientific literature from databases such as Scopus, WoS |
| eResources addresses | |

**Example issues/ example questions/ tasks being completed**

- Life cycle analysis phases: Goal and Scope Definition; Life Cycle Inventory (LCI) input-output data set analysis; Life Cycle Impact Assessment (LCIA); Interpretation of results.
- Principles of system boundaries in LCA (System Boundaries).
- Product Functionality Analysis: Functional Unit.
- The role of databases in life cycle analysis (e.g. Ecoinvent).
- Allocation methods in LCA (Allocation Methods): allocation of impacts in multi-product processes.
- Environmental impact categories in LCIA:
- What are the key phases of the life cycle of a nuclear power plant that should be included in the LCA analysis?
- How is the functional unit defined in a nuclear LCA analysis?
- What system boundaries should be adopted in an LCA for a nuclear power plant (e.g. from uranium mining to waste management)?

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| Work placement | Not applicable |