GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Life cycle assesment of nuclear power plants, PG_00065902		
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 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 -> Faculties of Gdańsk University of Technology		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Dariusz Mikielewicz	
	Teachers		

Lesson types

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
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
[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.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information
[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_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	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
[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	[SU4] Assessment of ability to use methods and tools [SU1] Assessment of task fulfilment

Subject contents	Course content – lecture 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
project	60.0%	40.0%
exam	60.0%	60.0%

Recommended reading

Basic literature	G. Sonnemann, M. Tsang, M. Schuhmacher, Integrated Life-Cycle and Risk Assessment for Industrial Processes and Products, Taylor & Francis, Floryda 2019 M. Góralczyk, Z. Kowalski, Ekologiczna ocena cyklu życia procesów wytwórczych (LCA), Wydawnictwo Naukowe PWN, 2007 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)?

Practical activites within the subject

Not applicable

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