COURSE DESCRIPTION CARD - SYLLABUS

Course name
Operation of nuclear power plants [S2EJ1>EEJ]

Course

Field of study
Nuclear Power Engineering

Year/Semester
2/3

Area of study (specialization)
–

Profile of study
general academic

Level of study
second-cycle

Course offered in
Polish

Form of study
full-time

Requirements
elective

Number of hours

Lecture
15

Laboratory classes
15

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

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Lecturers

Prerequisites

Student has basic knowledge of technologies and energy machines used in the professional power industry, fluid mechanics, and basics of metrology. Understands the principles of operation of basic machine parts and knows the structure of basic nuclear energy devices: reactors, steam turbines, heat exchangers, pumps. Knows the thermal systems of nuclear power plants. He is aware of the need to expand his competences and is ready to cooperate within a team.

Course objective

Acquiring the ability to apply the principles of correct operation of basic machines and equipment used in nuclear power plants.

Course-related learning outcomes

Knowledge:
1. Student knows technical and economic indicators describing the results of operation of nuclear power plants.
2. Student has basic knowledge of the use of power equipment in various operational states.
3. Stuident has general knowledge of ways to optimize the operation of generation sources in the power

system.
4. Student has knowledge of the system for distributing electrical power from a nuclear power plant to the power system and the system of supplying own needs.

Skills:
1. Student is able to formulate the rules for the correct operation of basic machines and energy equipment used in a nuclear power plant.
2. Student is able to apply the basic principles of proper operation of generating sources in the power system.
3. Student distinguishes operational states of a nuclear power plant.

Social competences:
1. Student is aware of the impact of energy technologies and machines on the natural environment and understands the need to counteract these phenomena.
2. Student is aware of the need for dialogue with people and organizations skeptical about nuclear energy.

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture
Continuous assessment in each class (rewarding activity). - assessment of knowledge and skills demonstrated in a problem-based written exam,
Laboratory classes
Assessment of knowledge and skills related to the implementation of the exercise task, assessment of the report on the exercise performed. - obtaining additional points for the ability to cooperate within a team that practically carries out a detailed task in the laboratory and for the aesthetic care of the prepared reports.

Programme content

Principles of operation of a nuclear power plant.
Operation procedures of the nuclear power plant block,

Course topics

Lecture
Basic operational concepts. Technical and economic indicators of a nuclear power plant with a pressurized reactor. Principles of operation of equipment used in nuclear power plants. Auxiliary motor systems of a nuclear power plant block. Electrical systems: power output from the power plant to the power system and supplying the nuclear power plant's own needs. Operational conditions of a nuclear power plant. Quasi-steady state - operational requirements for a pressure vessel, steam generator, pressure stabilizer, steam turbine. Regulation of power fed into the power system. Planned and unplanned transients of a nuclear power plant. Shutdown and startup of the power unit of a nuclear power plant. Renovation management of a nuclear power plant. Operation of a nuclear power plant in the power system. Operational characteristics of a nuclear power plant. Flexibility of operation of power units of nuclear power plants. Nuclear power plant in emergency shutdown conditions. Conditions for rebuilding the generating capacity of a nuclear power plant.

Laboratory classes
Change in power of the NPP unit, planned shutdown and start-up
block of a nuclear power plant, synchronization of the turbine set with the power system - C-PWR simulator

Teaching methods

Lecture delivered remotely using synchronous access methods.
Lecture:
multimedia presentation.
Laboratory classes:
Classes conducted at computer workstations using EBSILON Professional software Classes carried out at

a computer station with a C-PWR block simulator

Bibliography

Basic:
1. Gładyś H., Matla R., Praca elektrowni w systemie elektroenergetycznym, WNT Warszawa, 1995
2. Kubowski J. Elektrownie jądrowe WNT 2013,
3. Ackermann G., Eksploatacja elektrowni jądrowych WNT 1987
4. Sierchuła J. Rozruch elektrowni jądrowej na przykładzie symulatora C-PWR. Poznań University of technology Academic Journals, Electrical Engineering 2016

Additional:
1. Pawlik M., Strzelczyk F., Elektrownie, WNT Warszawa, 20173. Murray R.L., Nuclear Energy (6th Ed.), Elsevier, Amsterdam 2009.
2. Nowicki J. Część elektryczna elektrowni jądrowej, Ministerstwo Energii, Warszawa 2017
3. Radosław Szczerbowski,/redakcja naukowa. Energetyka węglowa i jądrowa: wybrane aspekty, Poznań 2017,
4. Sierchuła J. Wielokryterialna analiza porównawcza jednostek wytwórczych w elektrowniach jądrowych i konwencjonalnych na wybranych przykładach. Przeglad Elektrotechniczny, 2016
5. Sokólski, P.; Rutkowski, T.A.; Ceran, B.; Złotecka, D.; Horla, D. The Influence of Cooperation on the Operation of an MPC Controller Pair in a Nuclear Power Plant Turbine Generator Set. Energies 2022, 15, 6702. doi: 10.3390/en15186702

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00