Lodz University of Technology

Thermal Power Plants I

Course description

Basic information

Study programme Power Engineering **Speciality/path** - **Organizational unit** Faculty of Mechanical Engineering **Study level** first-cycle programme (inżynier) **Study mode** full-time studies **Education profile** general academic	**Didactic cycle** 2025/26 **Course code** W1ENES.18.00160.25 **Language of instruction** polish **Obligatory** Obligatory **Block** Directional subjects **Course related to scientific research** No

Course coordinator	Janusz Buchta
Course instructor(s)	Janusz Buchta, Andrzej Oziemski, Tomasz Kotlicki

Period	**Form of verification**	**Total ECTS points**
Semester 4	Graded assignment **Classes and hours** • Lecture: 30 • Laboratory classes: 15 • Project work: 30	5

Prerequisites

Student has got competences in the field of thermodynamic processes and issues related to the power machinery construction.

Learning outcomes

Code	Programme outcomes	Detailed outcomes indicators
1ENE1	Possesses necessary for engineering purposes advanced knowledge of generation, conversion and transmission methods for energy from both conventional and renewable sources.	1ENE1.1 Identifies flow, thermodynamic and electrical phenomena and processes enabling an understanding of key problems in the energy industry. 1ENE1.2 Describes methods of generation, conversion and transmission of energy from conventional sources.
1ENE3	Demonstrates detailled knowledge of electrotechnics and electronics, covering: structure, operation, design and performance of electric installations and devices used in power engineering.	1ENE3.3 Describes the construction, operation, and principles of selection, design, and operation, of typical power engineering plant, machinery, and equipment.
1ENE5	Is able at an advanced level to identify, formulate and solve basic engineering problems including elements of economic and safety assessment, taking advantage of the elements of detailled knowledge gained within general engineering and specialist courses.	1ENE5.3 Uses design documentation in the field of mechanical engineering and prepares technical documentation for selected machinery and equipment in the fields of energy and mechanical engineering and construction. 1ENE5.4 Uses design documentation in the fields of electrical engineering, electrical engineering and automation in the fields of electrical power engineering, electrical engineering and automatic control engineering.
1ENE7	Is able to apply mathematical models (analytical, empirical, numerical), perform calculations and numerical simulations of basic phenomena and processes present in heat and power engineering.	1ENE7.1 Applies physical and mathematical models to analyse flow, thermal and electrical phenomena and processes typical of the power engineering industry.

Course contents

Basics of the conversion of thermal energy into mechanical and electrical energy. Technological systems and main components of thermal power plants. Energy flow calculations of the thermal power plant cycle and its basic indices.

Complementary information

Contents - detailed selection

No.	Contents - detailed selection	Class type
1.	LECTURE. Energy resources. Classification of power stations. Characterization of Polish and European power generation sector. Daily load profile and its influence on power plant operation. Efficiency measures of Rankine cycle. Improvement of an efficiency of Rankine cycle. Combined heat and power plants (CHP). Technological cycles and devices in steam power station. Simple cycle and combined cycle gas turbine power plants. Nuclear energy. Fusion and fission. Nuclear reactors and their classification. Nuclear power plants. TUTORIAL. Calculation of basic measures characterising thermodynamic cycle of thermal power plant with use of h-s diagram and tables of the properties of water and steam. Mass and heat balance. Student makes a project task referring to a certain thermal power station. Project task is focused on evaluation of power machinery parameters and calculation of thermodynamic cycle indexes. LABORATORY Thermodynamic calculations with use of Excel add-in including IAPWS-IF97 equations. Use of software tools (IPSEpro, EbsilonProfessional) in analysis of simple cycles of power plants.	Laboratory classes, Project work, Lecture

Teaching methods and techniques, passing conditions

Class type	Teaching methods and techniques	Passing conditions
Lecture	Lecture	A test covering the scope of lecture material
Laboratory classes	Group work method, Laboratory/computer-based exercises	Short entrance tests at the laboratory, quality assessment of the reports after each laboratory unit, assessment of class activity.
Project work	Project execution, Group work method	Project report

Examination methods, weighed grades

Class type	Examination methods and weighed grades
Lecture	Final test: 30%
Laboratory classes	Lab report(s): 30%
Project work	Design Project: 40%

Verification of learning outcomes

Detailed outcome indicators	Verification criteria	Assesment tool (class type)
1ENE1.1	In the final test, the student provides logical answers. In the laboratory reports, the student correctly describes energy processes.	Lab report(s) (Laboratory classes), Final test (Lecture)
1ENE1.2	In the final test, the student provides logical answers. In the laboratory reports, the student correctly describes energy processes.	Lab report(s) (Laboratory classes), Final test (Lecture)
1ENE3.3	In the final test, the student provides logical answers. In the laboratory reports, the student correctly describes energy processes.	Lab report(s) (Laboratory classes), Final test (Lecture)
1ENE5.3	In completing the project task, the student correctly applies the description of machinery.	Design Project (Project work)
1ENE5.4	In completing the project task, the student correctly applies the description of machinery.	Design Project (Project work)

Detailed outcome indicators	Verification criteria	Assesment tool (class type)
1ENE7.1	In completing the project task, the student correctly applies the principles of mathematical description of machinery. In the laboratory reports, the student correctly describes energy processes and performs logical calculations.	Design Project (Project work), Lab report(s) (Laboratory classes)

Literature

Compulsory reading

1. Pawlik M., Strzelczyk F.: Elektrownie, Wydawnictwo Naukowe PWN, WNT Warszawa, 2023
2. Paska J.: Wytwarzanie energii elektrycznej. Oficyna Wydawnicza Politechniki Warszawskiej, 2018
3. Buchta J., Oziemski A.: Nowoczesne technologie wytwarzania energii elektrycznej, skrypt PŁ, 2011
4. Buchta J., Oziemski A.: Procesy energetyczne w wytwarzaniu energii elektrycznej w zadaniach, skrypt PŁ, 2009
5. Buchta J., Oziemski A.: Procesy energetyczne w wytwarzaniu energii elektrycznej w zadaniach, skrypt PŁ, 2009

Other reference materials

1. Marecki J.: Podstawy przemian energetycznych. Wydawnictwo Naukowe PWN, WNT Warszawa, 2023
2. Chmielniak T.: Technologie energetyczne. Wydawnictwo Naukowe PWN, Warszawa 2023
3. Pawlik M., Strzelczyk F.: Zbiór zadań z elektrowni cieplnych. PWN, Łódź 1967
4. Szafran R.: Podstawy procesów energetycznych. Wydawnictwo Politechniki Wrocławskiej, Wrocław 1989

Student workload

Activity type	Average number of hours* needed to complete an activity
Lecture	30
Laboratory classes	15
Project work	30
Participation in academic consultations	5
Preparation for test	20
Preparation of a report	20
Preparation of the project	30
Total student workload	**No. of hours** 150
Workload involving teacher	**No. of hours** 75
Total ECTS points	**ECTS** 5

* activity hour equals to 45 minutes

Directional learning outcomes

Code	Content
1ENE1.1	Identifies flow, thermodynamic and electrical phenomena and processes enabling an understanding of key problems in the energy industry.
1ENE1.2	Describes methods of generation, conversion and transmission of energy from conventional sources.
1ENE3.3	Describes the construction, operation, and principles of selection, design, and operation, of typical power engineering plant, machinery, and equipment.
1ENE5.3	Uses design documentation in the field of mechanical engineering and prepares technical documentation for selected machinery and equipment in the fields of energy and mechanical engineering and construction.
1ENE5.4	Uses design documentation in the fields of electrical engineering, electrical engineering and automation in the fields of electrical power engineering, electrical engineering and automatic control engineering.
1ENE7.1	Applies physical and mathematical models to analyse flow, thermal and electrical phenomena and processes typical of the power engineering industry.