Valid from 2024.HS

Module description: Thermal and electrical Fundamentals of Power Plant Technology

Module Code	t.BA.EU.TEGK.19HS
ECTS Credits	4
Language of Instruction/Examination	German
Organizational Unit	IEFE
Module Coordinator	Thomas Bergmann
Legal Framework	The module description is part of the legal basis in addition to the general academic regulations. It is binding. During the first week of the semester a written and communicated supplement can specify the module description in more detail.
Module Characteristic	Type 2a 4 consecutive lecture lessons per semester week and class
Module Description	This module comprises a thermal and an electrical part. The thermal part deals with the thermodynamic fundamentals of different types of thermal power plants and the function of individual system components. In the electrical part, the basics of electrical drive and generator technology are taught.

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Module Content	**Thermal power plant process** • Thermodynamic basics (thermal engine, Carnot efficiency, anergy & exergy, exergy loss, Clausius-Rankine process, Joule process) • Possibilities for improvement in the steam power process (steam parameters, intermediate superheater, regenerative feed water preheating) • Optimization of gas turbine systems (regeneration, optimal pressure ratio, multi-stage) • Combination of gas turbine and steam power process (GUD, STIG) **Special types of thermal power plants** • Thermal power plants based on fossil fuels - power plant components (steam generator, condenser / cooling, turbine, exhaust gas cleaning, fuel processing) • Nuclear power plant (physical basics, construction of nuclear reactors / types of nuclear power plants, processing / final storage, radioactivity - problems of using nuclear power) **Electrical devices and power electronics** • Magnetic fields in electrical devices • Rotating field, formation and effect • Structure, function and properties of synchronous and asynchronous devices • Function of self-commutated conversion circuits, modulation types in power system technology **Power systems** • Electrical and mechanical quantities • Calculations for dimensioning • Structures and their applications • Operating modes of power systems, their properties and settings • Selection, dimensioning and installation **Generators** • Behaviour of synchronous generators on the fixed grid, synchronisation • Asynchronous machines as generators • Particularities of the cascade circuit for energy production • Generators with electronic power converters **Power plants** • Electrical components of power plants • Introduction to switchgears and safety strategies
Prerequisite Knowledge	The course builds on knowledge of the modules FTH1, FTH2, ELHL1, ELHL2 and WSSN.

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Learning Objectives (Competences)

Students...	Competencies	Taxonomies
Students know the function of essential power plant components.	F	K1
Physical basics of the use of nuclear power are repeated, whereby problems of the use of nuclear power are dealt with.	F, SO	K2
Students have a basic knowledge of the electrical machines used in power plants They can explain their properties as generators.	F	K4
Students have basic knowledge of the Clausius-Rankine process and the Joule process and learn calculation methods for the design and efficiency evaluation of real power plant processes (steam power process, gas turbine process).	M, F	K3
Students know the influence of thermodynamic boundary conditions on the efficiency of real steam power and gas turbine processes and technical possibilities to improve the efficiency of the processes through special process designs. They have the ability to calculate power plant processes with different circuit variants.	M, F	K3
Students have an overview of the electrical installations of a power plant and are familiar with the most important safety aspects.	M, F	K2
Students know the basic principles for the dimensioning of an electrical drive system.You can identify the necessary specifications and apply these in a design.	M, F	K3
In addition to thermal power plants based on fossil fuels and renewable sources, the students learn about the structure and function of nuclear power plants.	F	K1
Students know the particularities of electrical power systems with regard to their application in energy production (steam, water and wind power plants) and can outline and explain the most important structures of the constant and variable speed generators.	F	K2
Students know the thermodynamic foundations for converting heat into work and can qualitatively characterize thermal energy based on the exergy and anergy content as well as quantitatively assess quality losses in energy conversion and transport processes due to the loss of exergy.	M, F	K3

Performance Assessment

End-of-module exam	Assessment	Length (min.)	Weighting	Form
written exam	Grade	90	80	acc. to module agreement

Performance assessment during the semester	Assessment	Length (min.)	Weighting	Form
written exam	Grade	45	20	acc. to module agreement

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Classroom Attendance Requirement	None
Learning material	
Comments	