Curriculum: Energy Systems and Renewable Energies

Bachelor of Engineering, 7 semesters, Technische Hochschule Ingolstadt



7. Semester		Elective		Bachelor's Thesis and Seminar					Energy from Biomass and Biogenic Residues	Mobility within the Energy System
6. Semester		Project		Elective		Elective	Solar Buildings and Energy Consulting		Energy Markets and Coupling Sectors	Smart Grids and Wind Energy
5. Semester		Practical Semina	ar			Internship				Project and Quality Management
4. Semester		Project: Design a Development	nd	Control Engineering		Energy Distribution and CHP Plants	Building Technology and Smart Homes		Solar Energy Technologies	Cost and Investment Management
3. Semester2. Semester1. Semester		Product Development an CAD	nd	Measurement Engineering		Machine Elements	Thermodynamics	2	Fluid Mechanics	Thermal Energy Technology and Power Plants
		Engineering Mathematics 2		е	Mechanics of Materials Thermodynamics 1		1	Energy Storage	Entrepreneurship and Sustainability	
		Engineering Mathematics 1		Computer Science Engineering	e in	Basics of Mechanical Design	Statics		Electrical Engineering	Energy Systems and Energy Economics
egend:	N	Management 3 M		odules Ge		General Basics	3 Modules		Electives	3 Modules
	Gene	General Engineering 13 Modules		Nodules	Specialization Energy		11 Modules	Personal and Practical Skills		4 Modules

Technische Hochschule Ingolstadt | Energy Systems and Renewable Energies (B. Eng.)

Short description of the module contents

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Entrepreneurship and Sustainability [5 ECTS] - en -	 Sustainability and sustainable development Implementing Sustainability in companies Entrepreneurship Innovation management Practical Exercise in teamwork: Design Thinking (incl. Business 	Engineering Mathematics 2 [5 ECTS] - en -	 Series and Power Series Matrices System of Equations Linear Transformations Differential and Integral Calculus with several variables Vector Analysis 	Mechanics of Materials [5 ECTS] - en -	 Stress analysis and integrity of mechanical structures Stress Tensor, Mohr´s Circle Area moments of Inertia Analysis of stress, strains and deformation under Tension, Bending, Torsion and Shear loads Strength of materials
Cost and Investment Management [5 ECTS] - en -	Model) - Buyer and sales motivation - External Accounting - Internal Accounting - Calculation methods of product costs	Computer Science in Engineering [5 ECTS] - en -	 Fundamentals of Computer Science in Engineering and Digitalization Data Processing principles Computer Technology Algorithms and Programming Classes and Object Oriented Programming 	Electrical Engineering [5 ECTS] - en -	 Direct current circuits Electric Field Magnetic Field Alternating current circuits Three-phase system Electric machines Electronics
Project and Quality Management [5 ECTS] - en -	 Project Definition and Organization of Projects Project structure planning Risk management in projects, FMEA Quality management systems Process management 	Basics of Mechanical Design [5 ECTS] - en -	 Fundamentals of Technical Drawings and Mechanical Design Projection methods Sectional representations, views Dimensioning, Dimensioning rules Deviations in shape and tolerance specifications 	Material Science [5 ECTS] - en -	 Fundamentals of Material Science Structure of materials Reaction to temperature and mechanical influences Iron-based alloys Material testing methods Practical exercises in the laboratory
Engineering Mathematics 1 [5 ECTS] - en -	 Complex Numbers Sequences and Series Functions Differential and Integral Calculus with one variable Ordinary Differential Equations 	Statics [5 ECTS] - en -	 Analysis of mechanical structures, including trusses Forces, Moments, Resultants Support Reactions Internal forces and moments Spatial mechanical systems Center of gravity Friction 	Thermodynamics 1 [5 ECTS] - en -	 Fundamentals of Thermodynamics Exchange and Conservation of Energy Exchange and Conservation of Entropy Changes in the state of fluids

Short description of the module contents



T	hermodynamics 2 [5 ECTS] - en -	 Heat Transfer through conduction convection and radiation Practical analysis of heat transfer problems Practical exercises in the laborate 	, Machine Elements [5 ECTS] - en -	 Analysis and Design of typical machine components Screws, pins and bolts; springs Axles and Shafts Shaft-hub connection Rolling bearings, gears, clutches Eurther machine elements 	Energy Storage [5 ECTS] - en -	 Basic concepts of Energy Storage Technologies Storage of thermal, electrical and chemical energy (including batteries, hydrogen and "green fuels") Storage of mechanical energy 	
	Product Development and CAD [5 ECTS] - en -	 Product Development Process Solution and creativity techniques Concepts and concept selection Practical Mechanical Design Training on a 3D-CAD program 	Fluid Mechanics	 Basic concepts; Fluid properties Hydrostatics and Aerostatics Conservation laws Internal and external flow 	Thermal Energy Technology and Power Plants [5 ECTS]	 Basic concepts of Thermal Energy Technology Heat Generation Fundamentals of Turbomachinery Steam Power process, gas turbine 	
E	Measurement	 Basic concepts Measurement errors Measurement of mechanical and oloctrical quantities 	- en -	 Compressible flow, high Mach numbers Computational Fluid Dynamics Practical exercises in the laboratory 	- en -	 Internal combustion engine Fuel Cell Practical exercises in the laboratory 	
	[5 ECTS] - en -	Measurement of temperature and fluid-flow Special sensors Practical training in the laboratory	Project: Design and Development	 Team Project: students work together on a practical engineering problem Practical solving of a mechanical 	Energy Distribution and CHP Plants [5 ECTS] - en -	 Combined Heat and Power Plants Use of new fuels in CHP plants Supply and distribution of electricity, heat and gas Operation of heat, gas and electricity networks 	
		Control Loops Practical exercises with Matlab on	[5 ECTS] - en -	 Acquisition of practical and social skills; Project management; 		Building Technology (incl. heat	
	Control Engineering [5 ECTS] - en -	 Laplace Transformation Frequency response Closed-loop control analysis Control unit design Nonlinear control loops Stability 	Energy Systems and Energy Economics [5 ECTS] - en -	 Energy consumption and energy supply today (including impact on climate change) Economy, politics, law Practical exercises 	Building Technology and Smart Homes [5 ECTS] - en -	demand calculation) Supply of thermal energy Heat Exchange Systems Air conditioning and ventilation technology Smart Home; Building control technology	

Short description of the module contents



Note and end Energy Consulting (S ECTS) - en -Recommendations for modernizationFuture Mobility electricity demand for mobility (synthetic fuels, e-mobility, e-gas production)skills-Energy Markets and Coupling Sectors (S ECTS) - enEnergy Markets (heat, electricity, mobility, system security) and their price regulations-Future Mobility (electricity demand for mobility (synthetic fuels, e-mobility, e-gas production)Insight into the structure and the way of working in companiesEnergy Markets and Coupling Sectors (S ECTS) - enEnergy Markets (synthetic fuels, e-mobility (incl. hydrogen) - Interaction with eletricity grids-Team Project: students work together on a practical engineering problem from definition of the task to the presentation of the final resultsCoupling Sectors (S ECTS) - enElectives (s Ectors) - en/deThe electives serve for the individual profiling of the course according to your preferences - en/deSmart Grids and Wind Energy (S ECTS) - enNetwork stability strategies - en/de <th>Solar Energy Technologies [5 ECTS] - en -</th> <th> Photovoltaic systems (planning, installation, economic efficiency) Solar heating of drinking water Thermal Solar Systems (components, design, costs) Simulation of solar systems Seminar: design of a solar system Practical exercises in the laboratory Building Energy Act; practice Thermal bridges and calculation </th> <th>Energy from Biomass and Biogenic Residues [5 ECTS] - en -</th> <th> Greenhouse effect, climate change Renewable raw materials; Biogenic Residues Heat generation Power generation (combustion, thermal gasification, biogas) Fuels from renewable biomass Practical Seminar: Planning a bioenergy generation plant </th> <th>Internship [24 ECTS] - en/de -</th> <th colspan="2"> Internship in a company (in Germany or abroad) Independent, practical work on projects and problems whose topics are related to the degree Application and deepening of knowledge, methods and procedures that are taught and conveyed in the theoretical studies </th>	Solar Energy Technologies [5 ECTS] - en -	 Photovoltaic systems (planning, installation, economic efficiency) Solar heating of drinking water Thermal Solar Systems (components, design, costs) Simulation of solar systems Seminar: design of a solar system Practical exercises in the laboratory Building Energy Act; practice Thermal bridges and calculation 	Energy from Biomass and Biogenic Residues [5 ECTS] - en -	 Greenhouse effect, climate change Renewable raw materials; Biogenic Residues Heat generation Power generation (combustion, thermal gasification, biogas) Fuels from renewable biomass Practical Seminar: Planning a bioenergy generation plant 	Internship [24 ECTS] - en/de -	 Internship in a company (in Germany or abroad) Independent, practical work on projects and problems whose topics are related to the degree Application and deepening of knowledge, methods and procedures that are taught and conveyed in the theoretical studies 	
 Energy Markets and Coupling Sectors is ECTSJ - en - Energy Markets (heat, electricity, mobility, system security) and their price regulations Renewable gas in the natural gas network System security of power grids System security of power grids Sector coupling technologies Technical and economical evaluation, smart markets Network equipment, producers and consumers (incl. Smart Metering) Network stability strategies Future Energy Systems; Smart [5 ECTS] - en - Network stability strategies Future Energy Systems; Smart [5 ECTS] - en /de - Block course on competencies that are related to the job profile of an engineer in "Energy systems and Renewable Energies" Block course on competencies that are related to the job profile of an engineer in "Energy systems and Renewable Energies" Graduation thesis in the field of Engineering standards Scientific research and 	and Energy Consulting [5 ECTS] - en -	 Recommendations for modernization Ventilation concepts Energy management in the building 	Mobility within the Energy System	 Future Mobility electricity demand for mobility (synthetic fuels, e-mobility, e-gas production) 		 skills Insight into the structure and the way of working in companies 	
Coupling Sectors [5 ECTS] - en -network Network scale individual profiling of the course according to your preferences - The electives serve for the individual profiling of the course according to your preferences - You may select your electives from a module catalogueIs Electives - en/de -results - Acquisition of practical and social skills; - Project and time management - Projec	Energy Markets and	 Energy Markets (heat, electricity, mobility, system security) and their price regulations Renewable gas in the natural gas 	[5 ECTS] - en -	 Legal framework Gas-Mobility (incl. hydrogen) Interaction with eletricity grids 	Project	- Team Project: students work together on a practical engineering problem from definition of the task to the presentation of the final	
 Smart Grids and Wind Energy [5 ECTS] - en - Wind Energy; evaluation of wind data; wind turbine technology; Network stability strategies - Metwork stability strategies - Network stability strategies - Wind Energy; evaluation of wind data; wind turbine technology; Network stability strategies - en/de - Network stability strategies - Block course on competencies that are related to the job profile of an engineer in "Energy systems and Renewable Energies" Bachelor's Thesis and Seminar [15 ECTS] - en/de - Graduation thesis in the field of Engineering Independent processing of a task according to scientific and engineering standards Scientific research and 	Coupling Sectors [5 ECTS] - en -	network System security of power grids Sector coupling technologies Technical and economical evaluation, smart markets	Electives [15 ECTS] - en/de -	 The electives serve for the individual profiling of the course according to your preferences You may select your electives from 	[5 ECTS] - en/de -	 results Acquisition of practical and social skills; Project and time management Presentation and documentation 	
	Smart Grids and Wind Energy [5 ECTS] - en -	 Network equipment, producers and consumers (incl. Smart Metering) Network stability strategies Future Energy Systems; Smart Grids Wind Energy; evaluation of wind data; wind turbine technology; 	Practical Seminar [2 ECTS] - en/de -	 Block course on competencies that are related to the job profile of an engineer in "Energy systems and Renewable Energies" 	Bachelor's Thesis and Seminar [15 ECTS] - en/de -	 Graduation thesis in the field of Engineering Independent processing of a task according to scientific and engineering standards Scientific research and 	

Curriculum: Energy Systems and Renewable Energies



Bachelor of Engineering, 7 semesters

	7. Semester	Elective [5 ECTS]	Bachelor's Thesis and Seminar [15 ECTS]			Energy from Biomass and Biogenic Residues [5 ECTS]	Mobility within the Energy System [5 ECTS]
	6. Semester	Project [5 ECTS]	Elective [5 ECTS]	Elective [5 ECTS]	Solar Buildings and Energy Consulting [5 ECTS]	Energy Markets and Coupling Sectors [5 ECTS]	Smart Grids and Wind Energy [5 ECTS]
	5. Semester	Practical Seminar [2 ECTS]		Project and Quality Management [4 ECTS]			
	4. Semester	Project: Design and Development [5 ECTS]	Control Engineering [5 ECTS]	Energy Distribution and CHP Plants [5 ECTS]	Building Technology and Smart Homes [5 ECTS]	Solar Energy Technologies [5 ECTS]	Cost and Investment Management [5 ECTS]
	3. Semester	Product Development and CAD [5 ECTS]	Measurement Engineering [5 ECTS]	Machine Elements [5 ECTS]	Thermodynamics 2 [5ECTS]	Fluid Mechanics [5ECTS]	Thermal Energy Technology and Power Plants [5ECTS]
	2. Semester	Engineering Mathematics 2 [5 ECTS]	Material Science [5 ECTS]	Mechanics of Materials [5 ECTS]	Thermodynamics 1 [5 ECTS]	Energy Storage [5 ECTS]	Entrepreneurship and Sustainability [5 ECTS]
	1. Semester	Engineering Mathematics 1 [5 ECTS]	Computer Science in Engineering [5 ECTS]	Basics of Mechanical Design [5 ECTS]	Statics [5 ECTS]	Electrical Engineering [5 ECTS]	Energy Systems and Energy Economics [5 ECTS]
Leo	gend:	Management	3 Modules	General Basics	3 Modules	Electives	3 Modules
General Engineerin			13 Modules	Specialization Energy 11 Modules		Personal and Practical	Skills 4 Modules