Course Handbook Bachelor

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Head of Studies	Prof. Dr. Oliver Scholz
Deputy Head of Studies	
Chairman of Examination	
Deputy Chairman of Examination	

Bachelor - mandatory courses (overview)

Module name (EN)	Code	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator
Electric Power Supply Systems 1	DFMEES-110	1	3V+1U	5	Prof. Dr. Michael Igel
Electric Power Supply Systems 2	DFMEES-210	2	3V+1U	4	Prof. Dr. Michael Igel
Power Electronics and Drive Systems Engineering	DFMEES-107	1	2V+1U+1P	5	Prof. Dr.-Ing. Stefan Winternheimer
Process Automation	DFMEES-108	1	4PA	4	Prof. Dr. Benedikt Faupel
The Electric Power Industry	DFMEES-111	1	2V	2	Prof. Dr. Michael Igel

(5 modules)

Bachelor - optional courses (overview)

Module name (EN)	Code	Semester	Hours per semester week / Teaching method	ECTS	Module coordinator

(0 modules)

Bachelor - mandatory courses

Electric Power Supply Systems 1

Module name (EN): Electric Power Supply Systems 1

Module code: DFMEES-110

Hours per semester week / Teaching method: 3V+1U (4 hours per week)

ECTS credits: 5

Semester: 1

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam, practical exam with composition (2 lab experiments, ungraded)

Curricular relevance:
EE1504 Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2018, semester 5, mandatory course
E2506 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018, semester 5, mandatory course, technical

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 150 hours (equivalent to 5 ECTS credits).
There are therefore 105 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Michael Igel

Lecturer: Prof. Dr. Michael Igel

[*updated 16.10.2020*]

Learning outcomes:
After successfully completing this course, students will be able to apply modal transformations to calculate symmetric and asymmetric network states in forward and backward transformations. They will be able to calculate voltages and currents in the symmetrical and asymmetrical normal and short-circuit operation of electrical power supply networks with the aid of symmetrical components. Students will be able to create the equivalent circuit diagram of an electrical power supply network in symmetric components and calculate short-circuit currents and node voltages. They will be able to select equivalent circuits for equipment on a case-by-case basis and parameterize them with nameplate data. They will able to calculate wire nameplate data from the wires´ geometrical and electrical parameters. Students will be able to analyze the design and structure of switchgear and assess the significance and functionality of the components used in it.

[*updated 08.01.2020*]

Module content:
1. Modal transformations: diagonal transformations, symmetric components, 012- and hab-system, physical interpretation 2. Power lines: Structure, transmission tower shapes, overhead line cables, mean geometric distance, ground wire reduction factor, inductors and capacities (symmetrical components), homogeneous transmission line, characteristic impedance and natural power, equivalent circuit diagrams 3. Transformers: Three-winding transformer, zero phase-sequence system 4. Asymmetrical mains operation: Symmetrical and asymmetrical errors, application of symmetrical components, transverse errors, longitudinal errors 5. Switches and switchgear: switch types, switch requirements, switching off in three-phase systems, construction and structure of switchgear, switching in switchgear, current and voltage transformers

[*updated 08.01.2020*]

Teaching methods/Media:
Lectures note as a PDF, projector, program for calculating electrical energy supply networks

[*updated 08.01.2020*]

Recommended or required reading:
Flosdorff, René; Hilgarth, Günther: Elektrische Energieverteilung, Teubner, (latest edition) Happoldt, Hans; Oeding, Dietrich: Elektrische Kraftwerke und Netze, Springer, 1978 Heuck, Klaus; Dettmann, Klaus-Dieter: Elektrische Energieversorgung, Springer Vieweg, (latest edition) Schlabbach, Jürgen: Elektroenergieversorgung, VDE, 2003, 2. Aufl.

[*updated 08.01.2020*]

Electric Power Supply Systems 2

Module name (EN): Electric Power Supply Systems 2

Module code: DFMEES-210

Hours per semester week / Teaching method: 3V+1U (4 hours per week)

ECTS credits: 4

Semester: 2

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam (50%), practical exam with composition (2 lab experiments, 50%)

Curricular relevance:
EE1603 Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2018, semester 6, mandatory course
E2606 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018, semester 6, mandatory course, technical

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Michael Igel

Lecturer: Prof. Dr. Michael Igel

[*updated 16.10.2020*]

Learning outcomes:
After successfully completing this course, students will be able to recognize the different types of star connections in electric power supply networks, evaluate the advantages and disadvantages of each and select the ideal solution on a case-to-case basis. They will be able to calculate the required equipment. Using the complex alternating current calculation and a network calculation program, they will be able to calculate voltages and currents in normal operation and assess their reliability using the applicable standards and application guidelines. Students will be able to draw up an equivalent circuit diagram of an electrical power supply network in short-circuit operation and calculate short-circuit currents and short-circuit voltages. They will be able to assess the dimensioning of the equipment used in the network. Students will be able to carry out short-circuit current calculations according to the standard or the superposition method. They will be able to compare their calculation results with those of a grid calculation program. They will be able to validate the results of the network calculation program with reference networks.

[*updated 08.01.2020*]

Module content: 1. Star connections: networks with isolated or compensated neutral point, networks with semi-rigid or rigid neutral point earthing, equivalent circuits, calculating with the aid of symmetrical components, compensation coil, degree of detuning, zero-sequence voltage 2. Operating behavior of generators: equivalent circuit diagram, steady state behavior (no-load and short-circuit operation) 3. Calculating dynamic network processes: applying symmetrical components, numerical models of equipment, short-circuit current calculation according to IEC60909, initial short-circuit alternating current, maximum aperiodic short-circuit current, breaking capacity, sustained short-circuit current, equivalent short-circuit current [*updated 08.01.2020*]
Teaching methods/Media: Lectures note as a PDF, projector, program for calculating electrical energy supply networks [*updated 08.01.2020*]
Recommended or required reading: Flosdorff, René; Hilgarth, Günther: Elektrische Energieverteilung, Teubner, (latest edition) Happoldt, Hans; Oeding, Dietrich: Elektrische Kraftwerke und Netze, Springer, 1978 Heuck, Klaus; Dettmann, Klaus-Dieter: Elektrische Energieversorgung, Springer Vieweg, (latest edition) Schlabbach, Jürgen: Elektroenergieversorgung, VDE, 2003, 2. Aufl. [*updated 08.01.2020*]

Power Electronics and Drive Systems Engineering

Module name (EN): Power Electronics and Drive Systems Engineering
Module code: DFMEES-107
Hours per semester week / Teaching method: 2V+1U+1P (4 hours per week)
ECTS credits: 5
Semester: 1
Mandatory course: yes
Language of instruction: German
Assessment: Written exam, practical exam with composition (3 lab experiments, ungraded)
Curricular relevance: EE1501 Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2018, semester 5, mandatory course E2505 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018, semester 5, mandatory course, technical
Workload: 60 class hours (= 45 clock hours) over a 15-week period. The total student study time is 150 hours (equivalent to 5 ECTS credits). There are therefore 105 hours available for class preparation and follow-up work and exam preparation.
Recommended prerequisites (modules): None.
Recommended as prerequisite for:
Module coordinator: Prof. Dr.-Ing. Stefan Winternheimer
Lecturer: Prof. Dr.-Ing. Stefan Winternheimer [*updated 16.10.2020*]
Learning outcomes: After successfully completing this course, students will have acquired basic knowledge about electrical drive technology and the power electronics required for it. They will be able to distinguish between different electric drives and identify their areas of application. [*updated 08.01.2020*]

Module content:
1 DC drives 1.1 Direct current machines: basic design and operating characteristics 1.2 DC chopper converter: buck converter, boost converter, two- and four-quadrant chopper 2 Three-phase drives 2.1 Asynchronous machines: basic design and operating characteristics 2.2 Synchronous machines: basic design and operating characteristics 3. Analysis of actuating and motion processes 3.1 Quantities of the motion cycle 3.2 Forces and torques 3.3 Mechanical drive power 3.4 Power requirements of selected machines 4. Lab 4.1 AC power controller 4.2 Three-phase bridge connection 4.3 DC machine

[*updated 08.01.2020*]

Teaching methods/Media:
Transparencies, blackboard, lecture notes and electronic handouts

[*updated 08.01.2020*]

Recommended or required reading:
Fischer, Rolf: Elektrische Maschinen, Hanser, (latest edition) Mohan, Ned; Undeland, Tore M.; Robbins, William P.: Power Electronics, Wiley, (latest edition) Seefried, Eberhard: Elektrische Maschinen und Antriebstechnik, Vieweg, Braunschweig/Wiesbaden, 2001 Vogel, Johannes: Elektrische Antriebstechnik, Hüthig, Heidelberg, 1989, 4. Aufl.

[*updated 08.01.2020*]

Process Automation

Module name (EN): Process Automation

Module code: DFMEES-108

Hours per semester week / Teaching method: 4PA (4 hours per week)

ECTS credits: 4

Semester: 1

Mandatory course: yes

Language of instruction:
German

Assessment:
Seminar presentation

Curricular relevance:
E2503 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018, semester 5, mandatory course, technical

Workload:
60 class hours (= 45 clock hours) over a 15-week period.
The total student study time is 120 hours (equivalent to 4 ECTS credits).
There are therefore 75 hours available for class preparation and follow-up work and exam preparation.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr. Benedikt Faupel

Lecturer: Prof. Dr. Benedikt Faupel

[*updated 16.10.2020*]

Learning outcomes:
Within the framework of project work, solution strategies, suitable automation systems, tools and simulation tools for process automation problems will be specifically selected and prototypically implemented. Students will create their own solutions for sub-tasks that typically occur in the course of industrial automation projects. They will prepare and present their solutions didactically.

[*updated 08.01.2020*]

Module content:
1. Standards and guidelines for automation technology 2. Process identification methods 2.1. Analysis methods for identifying analog LTI systems 2.2. Least-squares method for identification of discrete LTI systems 3. Processing sensors/actuators in automation technology 3.1. Interfacing/information processing of sensors and actuators 3.2. Analog value processing with SPS (standardization) 3.3. How actuators function and operate 4. Automating sequence controls 4.1. Sequential function chart in control technology according to IEC 1131 4.2. Structure and function of recipe control 4.3. Realization of sequential programs for PLC with step chain programming and S7-Graph 5. Communication systems in automation technology 5.1. Serial communication 5.2. ISO/OSI layer model of communication 5.3. Fieldbus systems (Profibus, ProfiNet, ASI) 5.4. Networking PLC systems 6. Implementation of controllers on SPS 6.1. Designing control functions (two-point, three-point, PID controller) at function block level 6.2. Adaptation / integration of controller function blocks in practical applications

[*updated 08.01.2020*]

Teaching methods/Media:
Presentation, lab equipment, control engineering/process automation lab

[*updated 08.01.2020*]

Recommended or required reading:
Berger, Hans: Automatisieren mit SIMATIC S7-1500, Publicis MCD, 2017, 2. Aufl., ISBN 978-3-8957-8451-4 Grupp Frieder; Grupp Florian: MATLAB für Ingenieure, Oldenbourg, München, (latest edition) Schneider, Ekkehard: Methoden der Automatisierung, Vieweg, Braunschweig, 1999, ISBN 978-3528065669 Seitz, Matthias: Speicherprogrammierbare Steuerungen für die Fabrik- und Prozessautomation, Hanser, (latest edition) Wellenreuther, Günter; Zastrow, Dieter: Automatisieren mit SPS - Theorie und Praxis, Vieweg, Wiesbaden, (latest edition) Wellenreuther, Günter; Zastrow, Dieter: Automatisieren mit SPS - Übersichten und Übungsaufgaben, Vieweg, Wiesbaden, (latest edition)

[*updated 08.01.2020*]

The Electric Power Industry

Module name (EN): The Electric Power Industry
Module code: DFMEES-111
Hours per semester week / Teaching method: 2V (2 hours per week)
ECTS credits: 2
Semester: 1
Mandatory course: yes
Language of instruction: German
Assessment: Written or oral exam
Curricular relevance: E1550 Electrical Engineering, Bachelor, ASPO 01.10.2012, optional course, non-technical EE-K2-513 Energy system technology / Renewable energies, Bachelor, ASPO 01.10.2012, semester 5, optional course, engineering EE-K2-513 Energy system technology / Renewable energies, Bachelor, ASPO 01.04.2015, semester 5, optional course, engineering E2532 Electrical Engineering and Information Technology, Bachelor, ASPO 01.10.2018, optional course, non-technical
Workload: 30 class hours (= 22.5 clock hours) over a 15-week period. The total student study time is 60 hours (equivalent to 2 ECTS credits). There are therefore 37.5 hours available for class preparation and follow-up work and exam preparation.
Recommended prerequisites (modules): None.
Recommended as prerequisite for:
Module coordinator: Prof. Dr. Michael Igel
Lecturer: Prof. Dr. Michael Igel [*updated 16.10.2020*]

Learning outcomes:
After successfully completing this course, students will be familiar with the fundamentals of the field, as well as the energy industry and the associated combination of technology and economics.
In addition, students will be able to:
- describe the entire chain of energy supply from the production, conversion, transmission and distribution to the supply of electrical energy and natural gas to the consumer
- explain technological-economic interrelationships and acknowledge them from the perspective of energy law
- explain the structure of the German energy market and the terms used in the energy industry
- calculate individual electricity supply contracts and demonstrate the importance of risk management for the energy industry

[*updated 23.11.2020*]

Module content:
1. Primary energy market
2. Procuring grid-bound energy
3. Energy law framework
4. Transmission and distribution of energy
5. Price factors and price systems in the energy industry

[*updated 23.11.2020*]

Recommended or required reading:
Konstantin: Praxisbuch Energiewirtschaft
Schiffer: Energiemarkt Deutschland
Dittmann; Gnüchtel; Stamer; u.a.: Energiewirtschaft
VDEW: Energierecht, Ergänzungsband zur EnWG-Novelle

[*updated 23.11.2020*]

Bachelor - optional courses