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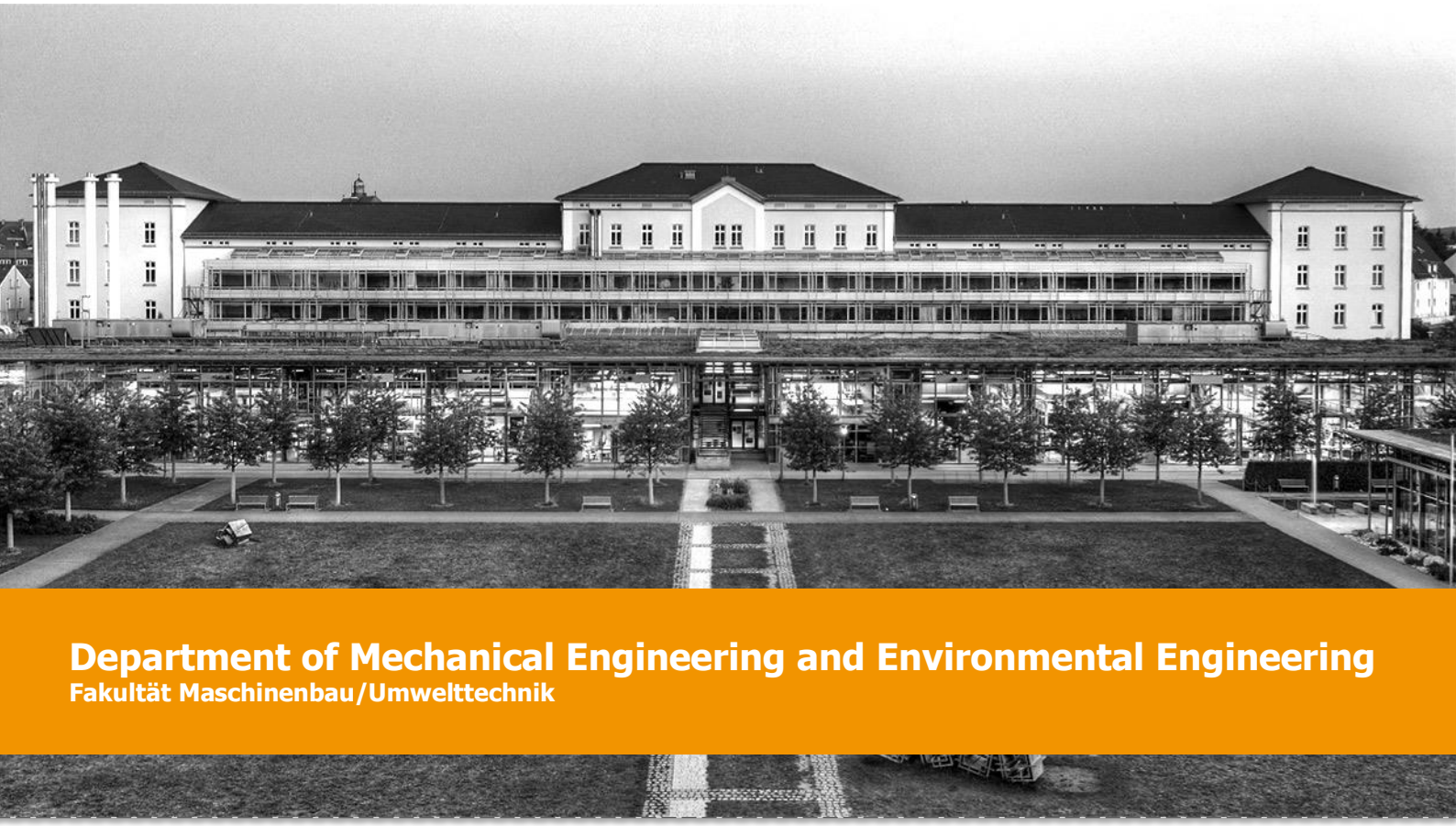
Ostbayerische Technische Hochschule
Amberg-Weiden

Course Catalogue – Bridge Modules

Modulhandbuch – Brückenmodule

Suitable for the master study programmes

International Energy Engineering
Global Research in Sustainable Engineering



Department of Mechanical Engineering and Environmental Engineering
Fakultät Maschinenbau/Umwelttechnik

Created by: Prof. Frank Späte / Silke Fersch
Decided in the faculty council: 16.06.2021
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Inhaltsverzeichnis

Preliminary notes

Vorbemerkungen

The bridge modules give graduates of a Bachelor's degree programme with less than 210 ECTS (but at least 180 ECTS) the opportunity to acquire the missing ECTS.
They are suitable for the following Master's degree programmes:
- International Energy Engineering
- Global Research in Sustainable Research

The modules can also be taken on a voluntary basis by students of a Bachelor's degree programme. In this case, please contact the module convenor.

- **Registration formalities:**

All examinations must be registered with the Students' Office (through PRIMUSS). Additional formalities are listed in the module descriptions.

- **Abbreviations:**

ECTS = The European Credit Transfer and Accumulation System (ECTS) is a credit point system for accreditation of course achievements.
SWS = Semesterwochenstunden = Semester hours per week

- **Workload:**

According to the Bologna Process, a credit point is based on a workload of 25-30 hours. The number of hours includes the time spent at the university, the time spent preparing for and following up on courses, the time spent writing papers or preparing for examinations.

Example calculation of workload (course with 4 SWS, 5 ECTS credits):

Workload: 5 ECTS x 30 h/ECTS = 150 h

- Lecture (4 SWS x 15 weeks) = 60 h
- Self study = 60 h
- Exam preparation = 30 h

= 150 h

Modules

1. Electric Power Engineering (EPE)
Elektrische Energietechnik

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Dr. Raphael Lechner	Prof. Dr. Raphael Lechner

Voraussetzungen*
Prerequisites

Fundamentals of mathematics incl. complex numbers
Fundamentals of physics incl. magnetism
Fundamentals of electrical engineering incl. electric circuits, AC/DC systems, single and three phase systems

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Usability	Lehrformen Teaching Methods	Workload
Suitable for • International Energy Engineering • Global Research in Sustainable Engineering	Seminar-based teaching, excercises	Lecture (4 SWS x 15 weeks) = 60 h Self-study Preparation and follow-up Examination preparation = 90 h = 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

- **Professional competence:** Basic understanding of electric power generation and transmission components.
- **Methodological competence:** The students are able to assess the field of application of different electric power components and select appropriate technologies for different use-cases. They are able to develop simple electric power generation and transmission systems from a systems engineering point of view.
- **Personal competence (social competence and self-competence):** The students have the capability to competently discuss basic electric power engineering concepts with specialists as well as colleagues from outside the field.

Inhalte der Lehrveranstaltungen
Course Content

- DC and AC power systems
- Synchronous and asynchronous electric generators and motors
- Transformers
- Power electronics for renewable energies
- Power factor and power quality in electric networks.

The contents of the course can be taught in presence and/or in virtual form.

Lehrmaterial / Literatur Teaching Material / Reading		
Lecture notes Basic literature Electric Power Engineering		
Internationalität (Inhaltlich) Internationality		
Modulprüfung (ggf. Hinweis zu Multiple Choice - APO §9a) Method of Assessment		
Prüfungsform	**Art/Umfang inkl. Gewichtung**	**Zu prüfende Lernziele/Kompetenzen**
Written exam	90 min / 100 %	Professional competence, methodological competence

2. Thermal Energy Technology (TET)

Thermische Energietechnik

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Dr. Andreas P. Weiß	Prof. Dr. Marco Taschek, Prof. Dr. Andreas P. Weiß

Voraussetzungen*
Prerequisites

Basic in Thermodynamics: gas laws, First and Second Law of Thermodynamics, cycles, real gases – properties and applications
Basics in Fluid Mechanics: conservation of mass, energy and momentum, viscous and compressible flows, basics of turbomachinery

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Usability	Lehrformen Teaching Methods	Arbeitspensum Workload
Suitable for • International Energy Engineering • Global Research in Sustainable Engineering	Seminar-based teaching, excercises	Lecture (4 SWS x 15 weeks) = 60 h Self-study Preparation and follow-up Examination preparation = 90 h = 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

- **Professional competence:** Knowledge, understanding and ability to calculate basic thermodynamic and fluid mechanical processes and cycles in the field of power engineering.
- **Methodological competence:** Identification of the physical problem, its modelling and selection of the appropriate conservation equations.
- **Personal competence (Social competence and self-competence):** Being able to correctly allocate and combine knowledge and skills from basic modules in the Bachelor's degree programme in order to independently derive and develop new solutions for practical engineering tasks.

Inhalte der Lehrveranstaltungen
Course Content

- Repetition of the thermodynamic fundamentals which are necessary for solving the problems in energy technology.
- Repetition of the fundamentals of fluid mechanics, which are necessary for solving the problems in energy technology.
- Application and exercises on exemplary basic cycles.

The contents of the course can be taught in presence and/or in virtual form.

Lehrmaterial / Literatur
Teaching Material / Reading

Pauken M., Thermodynamics for Dummies, ISBN 1118002911, http://site.ebrary.com/lib/academiccompletetitles/home.action
Elger D. F. et al., Engineering Fluid Mechanics – International Student Version, ISBN 1119249228
Anderson J. D., Fundamentals of Aerodynamics, ISBN 007-125408-0
Whitman, M., Thermodynamics: Basic Principles and Engineering Applications, ISBN 978-3-030-25221-2
Schmidt, A., Technical Thermodynamics for Engineers, ISBN 978-3-030-20396-2

Internationalität (Inhaltlich)
Internationality

Physics in general, thermodynamics and fluid mechanics in particular are per se internationally and everywhere equally applicable and understandable.

Modulprüfung (ggf. Hinweis zu Multiple Choice - APO §9a)
Method of Assessment

Prüfungsform	Art/Umfang inkl. Gewichtung	Zu prüfende Lernziele/Kompetenzen
Written exam	90 min / 100 %	Professional competence, methodological competence

3. Deepening of Scientific Knowledge (DSK)

Vertiefung naturwissenschaftlicher Kenntnisse

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Dr. Raphael Lechner	Prof. Dr. Raphael Lechner

Voraussetzungen*
Prerequisites

Mathematics, fundamentals of chemistry and physics

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Availability	Lehrformen Teaching Methods	Workload
Suitable for • International Energy Engineering	Seminar-based teaching, excercises	Lecture (4 SWS x 15 weeks) = 60 h Self-study Preparation and follow-up, Examination preparation = 90 h = 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

- **Professional competence:** Profound knowledge of the scientific principles required for the understanding, analysis, design and operation of conventional and renewable energy systems.
- **Methodological competence:** The students learn scientific methods of chemistry and physics. They recognise the context and learn methods for plausibility assessment.
- **Personal competence (social competence and self-competence):** The students can independently work out scientific problems in chemistry and physics, assess, evaluate and present the results.

Inhalte der Lehrveranstaltungen
Course Content

- Physics: oscillations and waves, wave-particle duality of light, electromagnetic radiation, solar radiation, solar constant, scattering, reflection, absorption, photovoltaic effect, semiconductors, band model
- Chemistry: electrochemistry, redox reactions, reaction kinetics, combustion, catalytic reactions

The contents of the course can be taught in presence and/or in virtual form.

Lehrmaterial / Literatur
Teaching Material / Reading

Lecture notes
Basic literature Physics and Chemistry

Internationalität (Inhaltlich) Internationality		
Modulprüfung (ggf. Hinweis zu Multiple Choice - APO §9a) Method of Assessment		
Prüfungsform	**Art/Umfang inkl. Gewichtung**	**Zu prüfende Lernziele/Kompetenzen**
Written exam	90 min / 100 %	Professional competence, methodological competence

4. Process Engineering in Energy Technology (PET)

Verfahrenstechnik in der Energietechnik

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Dr. Werner Prell	Prof. Dr. Werner Prell, Prof. Dr. Christoph Lindenberger

Voraussetzungen*
Prerequisites

Thermodynamics: Equations of state for ideal and real gases, main laws of thermodynamics, changes of state, phase and state diagrams for pure components and mixtures
Fluid mechanics: Conservation laws for mass, energy and momentum, viscosity, compressibility, state of flow.
Physics: similarity theory, dimensionless ratios, general principles such as balances, material properties, ...
Chemistry: Microkinetics (Arrhenius, reaction orders, sequential, parallel and equilibrium reactions, enthalpy of reaction, stoichiometry, ...)
Mathematics: Solving differential equations

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Availability	Lehrformen Teaching Methods	Workload
Suitable for • International Energy Engineering	Seminar-based teaching, excercises, practical training	Lecture (4 SWS x 15 weeks) = 60 h Self-study Preparation and follow-up Examination preparation = 90 h = 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

Professional competence:
- The students gain knowledge of process engineering in energy technology. They understand these processes and can calculate them based on the knowledge gained.
- The students know the structure and mode of operation of various process engineering apparatuses and processes in energy technology.

Methodological competence:
- The students are able to select and combine suitable calculation models for process engineering processes in energy technology.
- The students have the ability to challenge experimental results, calculations and plant data as well as other process information. If necessary they are able to change laboratory setup, technical setup or calculation method accordingly.
- Based on the acquired knowledge, the students can select and use apparatus and processes according to the given boundary conditions.

Personal competence (social competence and self-competence):
- In addition to theoretical knowledge, students also acquire the ability to apply process engineering principles in practice, both independently and in a team.
- They are able to critically analyse and comprehensibly document results from experiments and technical plant data.
- In small groups, they recognise and improve their own ability to work in a team.
- They can independently acquire new knowledge and transfer known contexts to new problems.

Inhalte der Lehrveranstaltungen
Course Content

- Heat transport (conduction, convection, radiation)
- Analogy of heat and mass transport
- Mechanical process engineering: characterisation of particle systems, particle separation from disperse systems, fluidised bed
- Thermal process engineering: absorption, adsorption, drying
- Chemical engineering: micro- and macrokinetics of heterogeneous reactions

The contents of the course can be taught in presence and/or in virtual form.

Lehrmaterial / Literatur
Teaching Material / Reading

- Lecture notes (including additional literature references)
- Chemical and Process Engineering; journal; Polish Academy of Sciences, Committee of Chemical and Process Engineering; https://journals.pan.pl/cpe
- Gyorgy Szekely: Sustainable Process Engineering; Walter de Gruyter GmbH, Berlin/Boston; 2021; https://www.degruyter.com/document/doi/10.1515/9783110717136/html
- Michael Kleiber: Process Engineering; Walter de Gruyter GmbH, Berlin/Boston; 2020; https://www.degruyter.com/document/doi/10.1515/9783110657685/html
- chemical engineering technology; journal; Wiley-VCH GmbH; Weinheim; https://onlinelibrary.wiley.com/journal/15214125
- Norbert Kockmann: Transport Phenomena in Micro Process Engineering; Springer Berlin Heidelberg New York; 2008; https://link.springer.com/book/10.1007/978-3-540-74618-8
- Zeki Berk: Food Process Engineering and Technology; Elsevier; 2018; https://www.sciencedirect.com/book/9780128120187/food-process-engineering-and-technology
- VDI heat atlas; Springer-Verlag Berlin Heidelberg 2010; https://link.springer.com/referencework/10.1007/978-3-540-77877-6
- P.H.M. Feron: Absorption-Based Post-Combustion Capture of Carbon Dioxide; Elsevier; 2016; https://www.sciencedirect.com/book/9780081005149/absorption-based-post-combustion-capture-of-carbon-dioxide
- Thomas, W. J: Adsorption technology and design; Reed Educational and Professional Publishing; 1998; https://web.p.ebscohost.com/ehost/detail/detail?vid=0&sid=41aee505-9dd0-4894-8fd4-65df698e6d52%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#anchor=tocAnchor&db=nlebk&AN=195057
- Eckhard Worch: Adsorption Technology in Water Treatment; Walter de Gruyter GmbH, Berlin/Boston; 2021; https://www.degruyter.com/document/doi/10.1515/9783110715507/html
- J.M.P.Q. Delgado, A. Gilson Barbosa de Lima: Drying and Energy Technologies; Springer International Publishing Switzerland 2016; https://link.springer.com/content/pdf/10.1007/978-3-319-19767-8.pdf
- Trevor Sparks, George Chase: Filters and Filtration Handbook; Elsevier; 2016; https://www.sciencedirect.com/book/9780080993966/filters-and-filtration-handbook
- Ken Sutherland; Filters and Filtration Handbook; Elsevier; 2008; https://www.sciencedirect.com/book/9781856174640/filters-and-filtration-handbook?via=ihub=
- Nicholas P. Cheremisinoff: Liquid Filtration; Elsevier; 1998; https://www.sciencedirect.com/book/9780750670470/liquid-filtration
- Stephen M. Hall: Rules of Thumb for Chemical Engineers; Elsevier; 2018; https://www.sciencedirect.com/book/9780128110379/rules-of-thumb-for-chemical-engineers
- Albright, L. (Ed.). (2008). Albright's Chemical Engineering Handbook (1st ed.). CRC Press.; https://www.taylorfrancis.com/books/mono/10.1201/9781420014389/albright-chemical-engineering-handbook-lyle-albright
- Pell Mlevyn: Handbook of powder technology – gas fluidisation; Elsevier; 1990; https://www.sciencedirect.com/handbook/handbook-of-powder-technology/vol/8/suppl/C
- https://www.chemeurope.com/en/encyclopedia/
- https://www.chemengonline.com/
- https://www.sciencedirect.com/journal/chemical-engineering-journal
- ...

Internationalität (Inhaltlich)
Internationality

Modulprüfung (ggf. Hinweis zu Multiple Choice -APO §9a) Method of Assessment
Method of Assessment

Prüfungsform	Art/Umfang inkl. Gewichtung	Zu prüfende Lernziele/Kompetenzen
Module work	Module work consisting of: • 4 credits (lecture-accompanying exercise performance in presence or online) during the semester (20 % each) • 1 credit (project work and presentation in presence or online) in the end of the semester (20 %)	Professional competence, methodological competence

5. Laboratory Course (LC)
Wissenschaftliches Praktikum

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Dr. Marco Taschek	Prof. Dr. Marco Taschek, Prof. Dr. Andreas P. Weiß, Prof. Dr. Markus Brautsch, Prof. Dr. Stefan Beer, Prof. Dr. Werner Prell, Prof. Frank Späte, Prof. Dr. Raphael Lechner, Prof. Dr. Christoph Lindenberger

Voraussetzungen*
Prerequisites

Thermodynamics, fluid mechanics, mechanics, electrical engineering (bachelor level)

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Availability	Lehrformen Teaching Methods	Arbeitspensum Workload
Suitable for • International Energy Engineering • Global Research in Sustainable Engineering	Practical training	Practical training Self-study Preparation and follow-up Examination preparation 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

- **Professional competence:** Knowledge, understanding and ability to carry out experiments, collecting measurement data, evaluation of the date and the scientific presentation. The subject areas addressed correspond to the assigned modules.
- **Methodological competence:** Selection and application of the appropriate, learned calculation and analysis methods to answer technical questions from the subject area of energy systems.
- **Personal competence (social competence and self-competence):** Combining existing knowledge and skills from basic modules in the bachelor's degree program with newly learned knowledge and skills to independently derive and develop new solutions for engineering tasks. Independent organization and execution of engineering tasks in a team - in cooperation with other international teams to achieve the course goals together.

Inhalte der Lehrveranstaltungen
Course Content

In the course, experiments are carried out for the modules
- Electrical power engineering (1,25 ECTS)
- Thermal power engineering (1,25 ECTS)
- In-depth knowledge of natural sciences (1,25 ECTS)
- Energy process engineering (1,25 ECTS)

The experiments may vary depending on the resources available.

The aim is the acquisition of technical questions, the adapted execution and evaluation of experiments as well as the scientific preparation and presentation of the data.

Lehrmaterial / Literatur
Teaching Material / Reading

Katz, M. J., From Research to Manuscript, ISBN 978-1-4020-9467-5

Internationalität (Inhaltlich) Internationality		
The experiments are carried out in small groups. If possible, heterogeneous groups are formed to create international and intercultural teams.		
Modulprüfung (ggf. Hinweis zu Multiple Choice - APO §9a) Method of Assessment		
Prüfungsform	**Art/Umfang inkl. Gewichtung**	**Zu prüfende Lernziele/Kompetenzen**
Module work	Practical report and/or oral test Weighting according to ECTS	Professional competence, methodological competence, personal competence

6. Intercultural Competence (IC)
Interkulturelle Kompetenzen

Zuordnung zum Curriculum Classification	Modul-ID Module ID	Art des Moduls Kind of Module	Umfang in ECTS-Leistungspunkte Number of Credits
		Bridge module	5

Ort Location	Sprache Language	Dauer des Moduls Duration of Module	Vorlesungsrhythmus Frequency of Module	Max. Teilnehmerzahl Max. Number of Participants
Amberg	English/German	1 semester	yearly/winter semester	50

Modulverantwortliche(r) Module Convenor	Dozent/In Professor / Lecturer
Prof. Frank Späte	Prof. Späte

Voraussetzungen*
Prerequisites

none

***Note: Please also observe the prerequisites according to examination regulations law in the current version of the SPO**

Verwendbarkeit Availability	Lehrformen Teaching Methods	Arbeitspensum Workload
Suitable for • International Energy Engineering • Global Research in Sustainable Engineering	Seminar-based teaching	Lecture (4 SWS x 15 weeks) = 60 h Self-study Preparation and follow-up Examination preparation = 90 h = 150 h

Lernziele / Qualifikationen des Moduls
Learning Outcomes

After completing this module successfully, students will have the following professional, methodological and personal competences:

The course provides students with no prior knowledge of German with basic competencies and the ability to deal with essential communicative situations of a subject-, profession- and culture-specific nature.

- **Professional competence:** Students understand the principles of the subject of interculturality. They learn the theoretical basics of intercultural communication and understanding.
- **Methodological competence:** Students are able to apply strategies to improve the handling of misunderstandings in professional and private situations. They learn to identify these situations and to appear interculturally competent.
- **Personal competence (social competence and self-competence):** Students acquire the interdisciplinary ability to perform in a culturally sensitive manner. Their intercultural competence is enhanced by sharpening their perception of themselves and others. They have expanded their ability to change perspective and are able to communicate with different nationalities.

Inhalte der Lehrveranstaltungen
Course Content

- Regional features
- Peculiarities of the participating nationalities
- Peculiarities of the European and especially the German culture (rules, norms, values, symbols, manners, etc.)
- Studying and working in Germany

The contents of the course can be taught in presence and/or in virtual form.

Lehrmaterial / Literatur
Teaching Material / Reading

Geert H. Hofstede: Culture's Consequences, SAGE Publications Inc., 2nd ed., 8/2/2003
Upasana Gautam: Hofstede's Cultural Dimensions Model, a summary
G. Hofstede, G.J. Hofstede, M. Minkov: Cultures and Organisations, McGraw-Hill Professional, 3. revised edition, 16/07/2010

Internationalität (Inhaltlich)
Internationality

By taking part at the module, students are able to act confidently and competently in an international environment.

Modulprüfung (ggf. Hinweis zu Multiple Choice - APO §9a)
Method of Assessment

Prüfungsform	Art/Umfang inkl. Gewichtung	Zu prüfende Lernziele/Kompetenzen
Presentation	100 %	Professional competence, methodological competence, personal competence

Update directory

Aktualisierungsverzeichnis

Nr	Reason	Date
0	Source document	16.06.2021
1	6 Intercultural Competence: Lecturers Späte, Spors and McCubbin-Vollath included	19.11.2021
2	6 Intercultural Competence: Modul Convener Dr. Annabelle Wolff replaced by Prof. Dr. Frank Späte	20.05.2022
3	3 Deepening of Scientific Knowledge: Lecturer Späte removed	07.07.2022
4	6 Intercultural Competence: Lecturer Spors and McCubbin-Vollath replaced by LBA (Lehrbeauftragte/r = external lecturer)	07.07.2022
5	5 Process Engineering in Energy Technology: - Added items to "Teaching Material /Reading" - Method of Assessment modified: "Module work consisting of exercise work (30 %) and a seminar paper with presentation (70 %)" replaced by "Module work consisting of 4 credits during the semester (20 % each), 1 credit in the end of the semester (20 %)"	11.11.2022
6	6 Intercultural Competence: Lecturer LBA (Lehrbeauftragte/r = external lecturer) removed. Only lecturer: Prof. Späte. Adaption of the module description.	02.04.2024