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Technical University
of Applied Sciences
Würzburg-Schweinfurt

Module handbook
Engineering Science (B. Eng.)

Valid from Winter semester 2026/27

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Preliminary Remarks

This module handbook contains descriptions of all modules and their courses that have to be completed by students of the Bachelor's degree programme Engineering Science (BESE) at the Technical University of Applied Sciences Würzburg-Schweinfurt (please find an overview on the next page). The following descriptions are related to the Study and Examination Regulations (SPO) dated 12 May 2026. This means that the descriptions are valid for all students who start their studies on 1 October 2026 and later.

In the second part of studies (semester 10 and 11) students have to select Core elective modules from a catalogue of various courses. These courses are listed in Appendix 1.

Due to changing conditions (e.g. newly appointed professors), actual teaching staff and times/dates may vary from the details given in this module handbook. Only the Study plan published for the respective semester is binding; it is decided upon every semester and published in the e-Learning course "Studien- und Prüfungsangelegenheiten/study and examination matters" .

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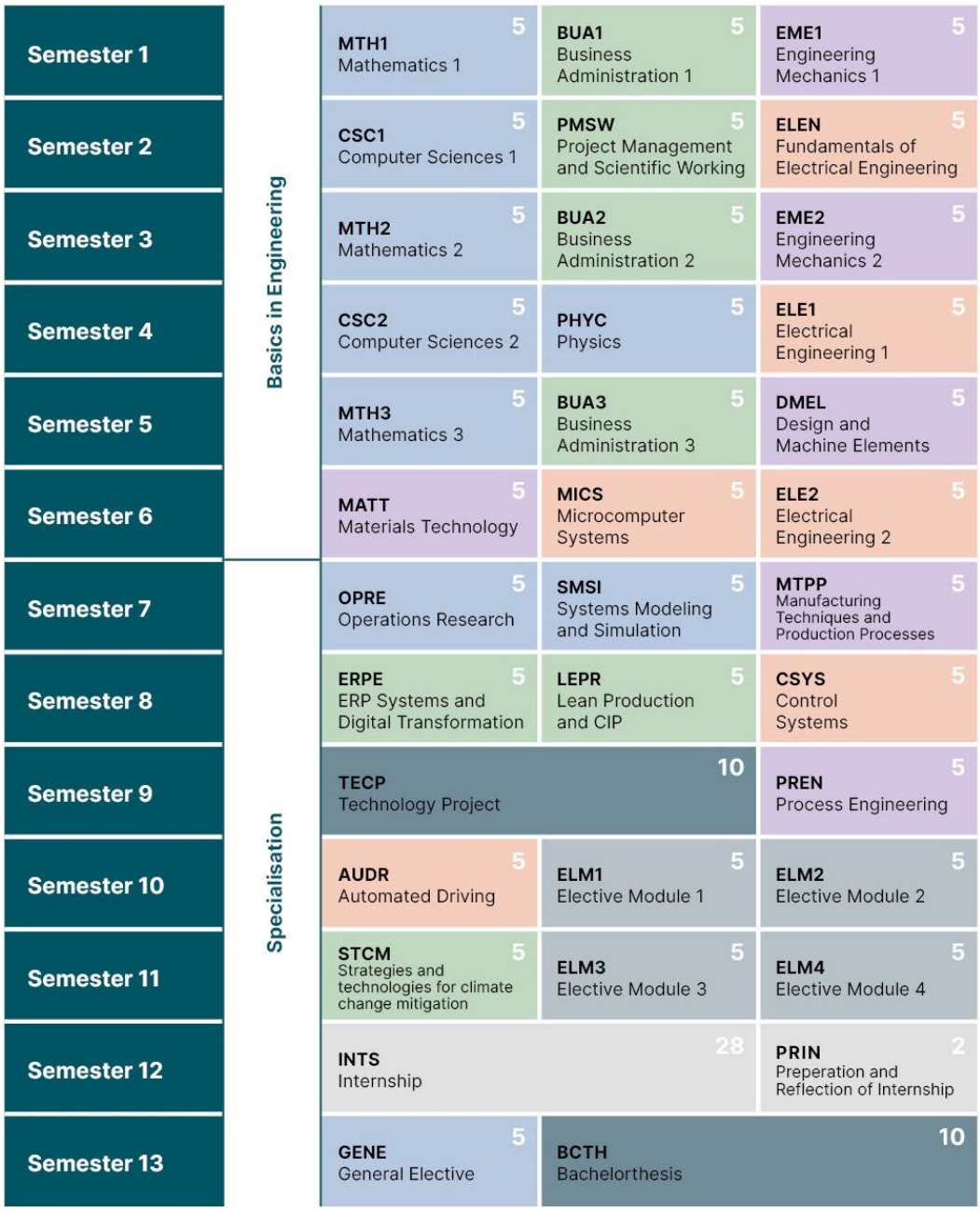
Module overview



Semester 1

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Module: MTH1
Mathematics 1

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Storath

Lecturer(s)
Prof. Dr. Storath

Applicability	BESE
Semester according to SPO	1st semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
High-school mathematics

Content

- Linear systems of equations
- Basic logic and sets
- Sequences and limits
- Differential calculus of one-dimensional functions
- Complex numbers

Learning outcomes
After completing this course, students are able to:

- Solve linear systems of equations.
- Formulate logical statement and apply set operations
- Work with sequences and evaluate limits.
- Apply one-dimensional differential calculus to compute derivatives and analyze function behavior.
- Solve mathematical problems of engineering using appropriate computational methods.

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Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Bird, J. (2017). Higher engineering mathematics. 8th ed. Routledge.
- Thomas, G. B., Weir, M. D., & Hass, J. (2017). Thomas' calculus: Early transcendentals. 14th ed. Pearson.
- Strang, G. (2023). Introduction to linear algebra. 6th ed. Wellesley-Cambridge Press.

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Module: BUA1
Business Administration 1

Module profile

Exam number
tbd

Courses
(1) Financial Accounting
(2 SWS)
(2) Marketing Basics
(2 SWS)

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Kraus

Lecturer(s)
Prof. Dr. Huttelmaier;
Prof. Dr. Kraus

Applicability	BESE
Semester according to SPO	1st semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
Financial Accounting:

- Introduction to the Double-Entry Bookkeeping System
- Account Organization and the Chart of Accounts
- Recording Business Transactions
- Measurement and Valuation of Assets

Marketing Basics:

- Understanding Marketing
- Capturing Marketing Insights
- Developing Marketing Strategies
- Building and Managing Brands and Customer Experience
- Shaping and Pricing the Offering
- Engaging Customers and Communicating Value
- Delivering Value: Selling and Sales Management

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- prepare journal entries and post them to the ledger, culminating in the creation of a trial balance.
- able to analyze the recognition and subsequent measurement of Property, Plant & Equipment (PPE) and Inventories according to IFRS standards.
- to compile adjusted financial statements from a trial balance, incorporating necessary adjustments for period-end reporting.
- interpret financial statements using basic ratio analysis and assess the financial health of an organization based on real-world financial reports.
- explain fundamental marketing concepts and apply them to real-world business scenarios.
- analyze consumer behavior and conduct basic market research to support data-driven marketing decisions.
- develop and evaluate branding, product, pricing, sales, and communication strategies to enable customer value and enhance competitiveness.

Literature

- Rich, J.; Jones, J.; Heitger, D.; Mowen, M. and Hansen, D. (2012): Financial and Managerial Accounting. The Cornerstone of Business Decisions, 2nd ed., Boston: Cengage Learning.
- Weber, J.; and Schäfer, U. (2008): Introduction to Controlling 1st ed., Stuttgart: Schäffer-Poeschel.
- White, A.; Franklin, M.; Graybeal, P.; and Cooper, D. (2022): Accounting and Accountability, Sydney: UTS Open Press. Available at: https://oer.pressbooks.pub/utsaccounting1/.
- Kotler, P., Keller, K. L., & Chernev, A. (2022). Marketing management (16th ed., global edition). Pearson.
- Kotler, P., Armstrong, G., & Opresnik, M. O. (2021). Principles of marketing (18th ed., global edition). Pearson.

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Module: EME1
Engineering Mechanics 1

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hofer

Lecturer(s)
Prof. Dr. Hofer

Applicability	BESE
Semester according to SPO	1st semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Addition and equilibrium of forces in central and general systems of forces
- Characteristic features of selected joints and supports
- Calculation of the center of gravity
- Method of sections, Newton's laws
- Calculation of support reactions and stress resultants
- Spatial systems of forces and systems of rigid bodies. Statical determinacy.
- Static friction, kinetic friction, belt friction

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type
Written examination
according to § 23 APO

Examination – length/format
90 minutes

Language of examination
English

Condition for the award of credit points
Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- decompose forces and moments into their components and determine the resultant of systems of forces acting on rigid bodies
- list the essential components of a mechanical model (beam, rod, supports, joints, load types, etc.), recognize the symbols in existing mechanical models, name the terms statical and kinematical determinacy, describe the meaning and analyze simple mechanical systems in this regard
- find the position of the center of gravity by calculation and, for example, consider the weight force of a body correctly in the mechanical model
- formulate the conditions of equilibrium for a free body diagram and solve the system of equations for the unknowns (e.g. support/ joint reactions, stress resultants, rod or contact forces)
- describe the difference between static friction (adhere) and kinetic friction (slide), calculate the contact forces using Coulomb`s theory of friction and enumerate the factors influencing the coefficient of friction
- use the correct technical terminology in group discussions as well as for questions and assess each other regarding the correct use of the technical terminology.

Literature

- D. Gross, W. Hauger, J. Schröder und W. Wall, N. Rajapakse, Engineering Mechanics 1 (Statics), 2nd edition. Berlin, Heidelberg: Springer, 2013.
- D. Gross, W. Ehlers, P. Wriggers, J. Schröder und R. Müller, Formeln und Aufgaben zur Technische Mechanik 1 (Statik), 12., überarbeitete Auflage. Berlin, Heidelberg: Springer Vieweg, 2016.
- C. Eller, Holzmann/Meyer/Schumpich, Technische Mechanik Statik, 15., überarbeitete Auflage. Wiesbaden: Springer Vieweg, 2018.
- U. Gabbert und I. Raecke, Technische Mechanik für Wirtschaftsingenieure, 8., aktualisierte Auflage. München: Carl Hanser, 2021.
- M. Mayr, Technische Mechanik, 9. Auflage. München, Wien: Carl Hanser Verlag, 2021.
- O. Romberg und N. Hinrichs, Keine Panik vor Mechanik, 9. Auflage. Wiesbaden: Springer Vieweg, 2020.
- Lecture notes, video tutorials and online tests in the university's eLearning system.
- Interactive simulations on the topics of “equilibrium”, “force and motion” and “vector addition” on the PhET website, e. g. https://phet.colorado.edu/en/simulation/forces-and-motion-basics

Semester 2

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Module: CSC1
Computer Science 1

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Motzek

Lecturer(s)
Prof. Dr. Motzek,
Prof. Dr. Linsenmann

Applicability	BESE
Semester according to SPO	2nd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
- Data types and variables
- Expressions and operators
- Numerical Error
- Branching and looping
- Functions and modules
- Data structures
- Simple algorithms
- Reading and writing of files
- Basics of map, filter and reduce operations

Learning outcomes
- The students are able to read simple programs and to describe what they do.
- They implement simple algorithms themselves in a high level programming language.
- They adapt standard algorithms to new situations.
- They are able to formulate algorithms for solving simple problems.
- They can identify situations in which numerical error might lead to unexpected results.
- They are able to choose an adequate data structure to work on a given problem.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Langtangen, H. P. (2016): A Primer on Scientific Programming with Python, 5th ed. Berlin: Springer.
- Downey, A. B. (2015): Think Python, 2nd ed., Needham: Green Tea Press; http://greenteapress.com/thinkpython2/thinkpython2.pdf

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Module: PMSW
Project Management and Scientific Working

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Schmidt

Lecturer(s)
Prof. Dr. Beer;
Prof. Dr. Panshef;
Prof. Dr. Schmidt;
Prof. Dr. Farmanara;
Prof. Dr. Hiemer;
Mrs. Muci;
Mr. Mantel

Applicability	BESE
Semester according to SPO	2nd semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Function, types, content and processes of conventional project management
- Content and use of basic project documents such as project proposal, project order, work breakdown structure and Gantt chart
- Target, process and resource planning in projects
- Use of an IT tool with practical relevance for project planning and control
- Communication, teamwork, self-reflection and versatility in projects
- Introduction and practise of agile project management methods
- Scientific citation and citation methods
- Developing research questions and writing an introduction
- Structure and organisation of an outline in scientific papers
- Scientific methods and empirical tools
- Organisation and planning of scientific papers
- Literature research in electronic databases and selection of suitable sources
- Use of writing and citation programmes
- Scientific writing style
- Presentation of methodological and content-related results

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Passed successfully/failed

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- Describe and apply the approaches, methods and tools of conventional and agile project management.
- Plan, document and control the content and timing of a project with the help of IT tools.
- Identify technical, organisational and team-related problems in project management and develop solution strategies.
- Develop or derive a logically coherent introduction, structure and research questions for seminar papers and bachelor theses.
- Apply the rules of proper scientific citation in a scientific paper.
- Identify relevant scientific sources and methods for your research question.
- Develop a coherent argument in the paper using scientific language and present the research results.

Literature

- Aken van, J.; Berends, H. and Bij van der, H. (2012): Problem solving in organizations. A methodological handbook for business and management students, Cambridge: Cambridge University Press.
- Campell, C. (2007): The One-Page-Project Manager, Communicate and manage any project with a single sheet of paper. Hoboken: Wiley.
- Easterby-Smith, M.; Thorpe, R. and Jackson, P.R. (2015): Management & Business Research, 5th ed., Los Angeles: SAGE.
- Hermarij, J. (2016): The Better Practices of Project Management. Based on the IPMA Competences, 4th ed., Amersfoort: Van Haren Publishing.
- Minto, B. (2009): The Pyramid Principle, Logic in Writing and Thinking.,Harlow: Prentice Hall Education.
- Müller, S. and Roth A. (2015): Academic Writing. Guidelines for a Term Paper, Bachelor and Master Thesis, Nürnberg: self-publishing.

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Module: ELEN
Fundamentals of electrical engineering

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Hansmann

Lecturer(s)
Prof. Hansmann

Applicability	BESE
Semester according to SPO	2nd semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Basics of Direct Current circuits
  (resistance, current, voltage, power)
- Kirchhoff laws and circuit transformation
- Systematic analysis of linear circuits
- Basics of alternating current circuits
- Phasor diagrams to describe sinusoidal currents and voltages
- Frequency-responsive behavior of passive electric networks
- Analog filters
- Three-phase circuits

Learning outcomes
On successful completion of this module, the student is able to:

- comprehend basic definitions of electrical engineering and the physics of current and voltage
- name different methods for analyzing linear electric networks and apply these methods accordingly
- apply complex numbers to describe sinusoidal currents and voltages in single- and multi-phase circuits
- interpret the dynamics of passive components, and design frequency-responsive circuits to filter a signal.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- J.W. Nilsson, S.A. Riedel, Electric Circuits, 11th edition. London: Pearson, 2019.
- J.D. Irwin, R.M. Nelms, Engineering Circuit Analysis, 10th edition. Hoboken: Wiley, 2011.
- T.L. Floyd, Principles of Electric Circuits, 9th edition. London: Pearson, 2009.
- C.K. Alexander, M.N.O. Sadiku, Fundamentals of Electric Circuits, 6th edition. New York City: McGraw-HillEducation, 2016.
- J. Hansmann, slides and additional material (e-learning), Schweinfurt, 2025.

Semester 3

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Module: MTH2
Mathematics 2

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Storath

Lecturer(s)
Prof. Dr. Storath

Applicability	BESE
Semester according to SPO	3rd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Completion of module MTH1

Content

- Integration of one-dimensional functions
- Vector spaces and bases
- Matrices and determinants
- Eigenvalues and Eigenvectors

Learning outcomes
On successful completion of this module, the student is able to:

- Apply integration techniques to compute definite and indefinite integrals and apply it to engineering problems.
- Understand vector spaces and bases, including linear dependence, span, and dimension, and apply these concepts for engineering problems.
- Perform matrix operations such as addition, multiplication, and inversion, and use determinants to analyze matrix properties.
- Compute eigenvalues and eigenvectors.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Bird, J. (2017). Higher engineering mathematics. 8th ed. Routledge.
- Thomas, G. B., Weir, M. D., & Hass, J. (2017). Thomas' calculus: Early transcendentals. 14th ed. Pearson.
- Strang, G. (2023). Introduction to linear algebra. 6th ed. Wellesley-Cambridge Press.

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Module: BUA2
Business Administration 2

Module profile

Exam number
tbd

Courses
(3) Cost Accounting (2 SWS)
(4) Trade Law (2 SWS)

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Ankenbrand

Lecturer(s)
Prof. Dr. Ankenbrand
Prof. Dr. Kraus
Prof. Dr. Ehret

Applicability	BESE
Semester according to SPO	3rd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
- Cost Type, Cost Center, and Cost Unit Accounting
- Activity-Based Costing (ABC) and Process Costing
- Contribution Margin Analysis and Break-Even Calculations
- Budgeting and Cost Control
- Fundamentals of Law and International Trade Regulations
- Global Trade Governance and Institutional Frameworks
- Dispute Resolution and Trade Conflicts

Learning outcomes
On successful completion of this module, the student is able to:
- Define fundamental cost accounting concepts, including cost types, cost centers, and cost units.
- Explain the differences between fixed and variable costs and illustrate how indirect costs are allocated through cost center accounting.
- Apply Activity-Based Costing (ABC) and traditional costing methods to allocate costs in different business scenarios.
- Describe key budgeting principles and explain how cost control measures help improve financial performance.
- Identify fundamental legal concepts relevant to international trade.
- Explain how trade relations are structured internationally, including tariffs and trade restrictions.
- Describe the roles and functions of states and international organizations, such as the WTO and WHO, in global trade.
- Illustrate dispute settlement mechanisms in international trade and their application in practice.
- analyze and explain fundamental legal concepts relevant to international trade.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Rich, J.; Jones, J.; Heitger, D.; Mowen, M.; and Hansen, D. (2025): *Managerial Accounting: The Cornerstone of Business Decision-Making*. 9th ed., Boston: Cengage Learning .
- Weber, J.; and Schäfer, U. (2008): Introduction to Controlling 1st ed., Stuttgart: Schäffer-Poeschel.
- White, A.; Franklin, M.; Graybeal, P.; and Cooper, D. (2022): Accounting and Accountability, Sydney: UTS Open Press. Available at: https://oer.pressbooks.pub/utsaccounting1/.
- August, R.A.; Mayer, D. and Bixby, M.B (2012): International Business Law: International Ed.: Text, Cases, and Readings, 6th ed., London: Pearson Education Limited.
- Herdegen, M. (2016): Principles of International Economic Law, 2nd ed., Oxford: Oxford University Press.
- Kratz, A.W. (2006): Remedies for breach of contract under the CISG. International review of law and economics, pages 378-396, volume 25, Issue 3, Amsterdam: Elsevier B.V.
- Schweizer, I.; Fountoulakis, C. and Dimsey, M. (2019): International Sales Law, a guide to the CISG, 3rd ed., Oxford: Hart Publishing.

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Module: EME2
Engineering Mechanics 2

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hofer

Lecturer(s)
Prof. Dr. Hofer
Prof. Dr. Spielfeld

Applicability	BESE
Semester according to SPO	3rd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
EME1 and MTH1 should be completed successfully.

Content
- Calculation of stresses and deformations under tension/compression, bending and torsion
- Stress and distortion states, strength hypotheses, material laws
- Thin-walled rings and containers under rotationally symmetrical loading
- Cross-section parameters, in particular moments of inertia, principal axes
- statically indeterminate systems
- Bending and buckling

Learning outcomes
On successful completion of this module, the student is able to:
- list and define the key terms and relationships in the field of strength of materials, in particular the terms stress and distortion.
- describe the distortion states and name the restrictions and boundary conditions that arise when using the underlying material model.
- find the position of surface centers of gravity and principal axes and the value of surface moments of inertia by calculation.
- write down the essential basic equations for calculating the stresses and deformations for the basic load cases such as tension/compression, bending and torsion.
- calculate the stresses and deformations under tension/compression, bending and torsion.
- analyses and optimize given constructions with regard to strength verification, e.g. optimum cross-sectional shapes.
- name the difference between statically determinate and statically indeterminate systems and categories given systems accordingly.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

- calculate both statically determinate and simple statically indeterminate systems, i.e. dimension the components or carry out the strength verification for the components.
- describe failure due to instability.
- calculate the critical buckling loads for linear components.
- analyze given structures with regard to their tendency to instability.
- use the correct technical terminology in group discussions and in questions and assess each other with regard to the correct use of technical terminology

Literature

- Callister, W. (2007): Materials Science and Engineering, 7th ed., New York: Wiley.
- Gross, D.; Hauger, W.; Schröder, J.; Wall, W. and Bonet, J. (2018): Engineering mechanics 2: mechanics of materials, 2nd ed., Berlin: Springer
- Lecture notes in the THWS eLearning system

Semester 4

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Module: CSC2
Computer Science 2

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Linsenmann

Lecturer(s)
Prof. Dr. Linsenmann;
Prof. Dr. Motzek

Applicability	BESE
Semester according to SPO	4th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Computer Science 1

Content

- Basic concepts of object-oriented programming (OOP)
- Creating a class in Python and an instance from it
- Methods and attributes
- Getter and setter methods
- Encapsulation techniques and function decorators
- Inheritance from parent classes
- Operator overloading (polymorphism) in Python
- Working with standard Python modules/packages
- Exception handling
- Application of OOP to real-world problems

Learning outcomes
On successful completion of this module, the student is able to:

- Distinguish the OOP paradigm from procedural/structured programming by explaining the main principles of OOP and their advantages.
- Explain the difference between classes, instances and objects.
- Read object-oriented (OO) code and describe in own words what it is supposed to do.
- Adapt existing OO code to a given problem formulation. This includes using inheritance and defining own classes based on more abstract classes.
- Make use of standard Python modules/packages containing class definitions, for instance numpy, scipy, matplotlib.
- Work with Python's exception handler and explain its mechanism.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- H. P. Langtangen: *A Primer on Scientific Programming with Python.* Springer, 5th ed., 2016.
- I. Kalb: *Object-Oriented Python*. O'Reilly, 2022.
- A. B. Downey: *Think Python*. Green Tea Press, 3rd ed., 2024.

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Würzburg-Schweinfurt

Module: PHYC
Physics

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Seufert

Lecturer(s)
Prof. Dr. Seufert

Applicability	BESE
Semester according to SPO	4th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
Mechanics

- Basics of kinematics
- Introduction to dynamics
- Momentum and collisions
- Rotational motion

Fluid mechanics

- Basics of fluid statics and fluid dynamics
- The Bernoulli equation and its applications
- Laminar flow
- Turbulent flow
- The Bernoulli equation with friction

Oscillations

- Simple harmonic motion
- Undamped and damped harmonic oscillations

Learning outcomes
On successful completion of this module, the student is able to:

- Understand the importance of physics for the engineering sciences.
- Describe the fundamental principles of physics and recognize the physical laws behind technological applications.
- Evaluate and calculate simple mechanical and fluid-mechanical systems

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- P.A. Tipler, *Physics for Scientists and Engineers*, W.H. Freeman & Co
- D. Halliday / R. Resnick, *Principles of Physics*, Wiley
- H. Young / R. Freedman, *University Physics,* Pearson

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Module: ELE1
Electrical Engineering 1

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
N.N.

Lecturer(s)
N.N

Applicability	BESE
Semester according to SPO	4th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Vector and potential fields
- Maxwell's equations
- Electric and magnetic fields
- Passive components
- Active components
- Semi-conductors
- Circuit design

Learning outcomes
On successful completion of this module, the student is able to:

- describe the transient response of a dynamic electric circuit
- construct, calculate and draw the physics of electric and magnetic fields
- name relevant components of electronics
- design circuits based on passive and active components.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- R.C. Dorf, The Engineering Handbook, 2nd edition. Raton: CRC Press Inc., 2004.
- S.N. Makarov, R. Ludwig, S.J. Bitar, Practical Electrical Engineering, 2nd edition. Berlin: Springer, 2019.
- J. Hansmann, slides and additional material (eLearning), Schweinfurt: 2021.

Semester 5

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Module: MTH3
Mathematics 3

Module profile

Exam number
tbd

Courses

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Storath

Lecturer(s)
Prof. Dr. Storath

Applicability	BESE
Semester according to SPO	5th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Completion of modules MTH1 and MTH2

Content

- Multivariate differential calculus
- Multivariate integration
- Ordinary differential equations
- Fourier series
- Fundamentals of probability and statistics

Learning outcomes
After completing this course, students are able to:

- Apply multivariate differential calculus, including partial derivatives, gradients, directional derivatives, and apply it to optimization problems.
- Perform multivariate integration, computing double and triple integrals in Cartesian, polar, cylindrical, and spherical coordinates, and applying them to engineering problems.
- Solve ordinary differential equations using analytical and numerical methods, including separable, linear, and higher-order differential equations and apply it for solving engineering problems.
- Develop periodic functions in Fourier series and applying them for engineering problems.
- Apply fundamental statistical methods for data analysis and problem-solving in an engineering context.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Bird, J. (2017). Higher engineering mathematics. 8th ed. Routledge.
- Thomas, G. B., Weir, M. D., & Hass, J. (2017). Thomas' calculus: Early transcendentals. 14th ed. Pearson.
- Montgomery, D.C., Runger, G.C. (2018). Applied Statistics and Probability for Engineers. 7th ed. Wiley.

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Module: BUA3
Business Administration 3

Module profile

Exam number
tbd

Courses
(1) Investment Decisions (2 SWS)
(2) Operation Management (2 SWS)

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation: 15 hours
Asynchronous participation: 45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Beer

Lecturer(s)
Prof. Dr. Beer;
Prof. Dr. Ankenbrand;
Prof. Dr. Kraus;

Applicability	BESE
Semester according to SPO	3rd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
- Introduction to Investment Appraisal Techniques
- Risk Analysis and Decision-Making under Uncertainty
- Accountability, Transparency, and Ethics in Investment Decision-Making
- Doughnut Economics and Sustainable Investment Decisions
- Introduction to Operations and Process Understanding
- Production and Service Systems
- Key Performance Metrics and Process Analysis
- Inventory and Material Flow Management
- Capacity, Layout, and Scheduling Optimization

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type
Written examination
according to § 23 APO

Examination – length/format
90 minutes

Language of examination
English

Condition for the award of credit points
Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- recall fundamental concepts of investment appraisal, including Net Present Value (NPV), Internal Rate of Return (IRR), Payback Period, and Profitability Index;
- apply investment appraisal techniques to evaluate the financial viability of various investment opportunities;
- analyze the risks associated with investment decisions using sensitivity analysis, and scenario analysis;
- assess investment opportunities based on financial performance and ethical considerations, incorporating principles from Doughnut Economics;
- understand and explain key concepts in Operations Management, including fundamental terms such as throughput, capacity, and cycle time;
- apply quantitative tools in operations analysis to analyze (i.a.) system performance, inventory levels, and cost;
- analyze process and system performance, including bottlenecks and their impact on material flow;
- evaluate and compare production and inventory strategies;
- design and optimize operations strategies.

Literature

- Rich, J.; Jones, J.; Heitger, D.; Mowen, M.; and Hansen, D. (2025): *Managerial Accounting: The Cornerstone of Business Decision-Making*. 9th ed., Boston: Cengage Learning.
- Barinaga, E. (2024): Remaking money for a sustainable future: Money Commons. Bristol University Press. Available at: https://library.oapen.org/handle/20.500.12657/89799.
- Raworth, K. (2017): Doughnut Economics: Seven Ways to Think Like a 21st-Century Economist, London: Random House Business.
- White, A.; Franklin, M.; Graybeal, P.; and Cooper, D. (2022): Accounting and Accountability, Sydney: UTS Open Press. Available at: https://oer.pressbooks.pub/utsaccounting1/.
- Heizer, J.; Render, B.; and Munson, C. (2024): *Operations Management: Sustainability and Supply Chain Management*, 14th ed., Global edition, London: Pearson.
- Cachon, G.; and Terwiesch, C. (2019): *Matching Supply With Demand: An Introduction to Operations Management*, 4th ed., New York City: McGraw-Hill Education.
- Goldratt, E. M.; and Cox, J. (2014): *The Goal: A Process of Ongoing Improvement*, 4th rev. ed., Great Barrington, Mass: North River Press.
- Hopp, W. J.; and Spearman, M. L. (2008): *Factory Physics*, 3rd international ed., New York City: McGraw-Hill.

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Module: DMEL
Design and Machine Elements

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hofer

Lecturer(s)
Prof. Dr. Hofer
Prof. Dr. Hofmann
Prof. Dr. Hörtnagl

Applicability	BESE
Semester according to SPO	3rd semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
EME 1, EME 2 and MTH1 should be completed successfully.

Content

- Basics of drawing creation and product documentation
- Representation and projection of a component
- Dimensioning of components
- Representation of standardised components and non-standardised components
- Principles of tolerancing
- ISO fitting system and fit calculation
- Specification of surface qualities, shape and position tolerances
- Exercises on freehand drawing and the 3D CAD system
- Basis of design methodology
- Fundamentals of design
- Basic concepts of methodical development
- Discussion of selected machine elements

Learning outcomes
On successful completion of this module, the student is able to:

- interpret technical drawings and documentation correctly.
- use their knowledge of the rules of technical drawing in mechanical engineering in accordance with standards.
- assess technical drawings and correctly derive the essential information from these drawings.
- create standardized technical drawings of given, more complex components in the form of freehand drawings.
- analyze an assembly drawing correctly, can identify all individual parts from it and convert them into standard-compliant drawings or create an assembly from individual parts.
- specify the basics of production-orientated design.
- describe the basic procedure of the VDI design methodology.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

- dimension elements correctly.
- name different construction elements (bearings, screws, axles and shafts).
- choose the right element for a specific problem.
- understand the operation of the different elements and apply the rules of the design of screw connections.
- describe how bearings work and apply their knowledge of bearing life calculation.
- the students carry out dimensioning calculations on selected machine elements and provide strength proofs by acquiring specialized and methodical competencies in strength theory and machine elements.
- develop machine elements methodically.

Literature

- Grote, K.-H. (2009): Springer handbook of mechanical engineering, New York: Springer.
- Parthasarathy, N.S.and Murali, V. (2015): Engineering Drawing, Delhi: Oxford University Press.
- Childs, P. R., & Masen, M. A. (2024). *Mechanical design engineering handbook* (3rd edition). Butterworth-Heinemann.
- Gross, D.; Hauger, W.; Schröder, J.; Wall, W. and Bonet, J. (2018): Engineering mechanics 2: mechanics of materials, 2nd ed., Berlin: Springer

Semester 6

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Module: MATT
Materials Technology

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hörtnagl

Lecturer(s)
Prof. Dr. Spielfeld
Prof. Dr. Hofer
Prof. Dr. Jung

Applicability	BESE
Semester according to SPO	6th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Overview of basic engineering materials
- Microstructure of engineering materials
- Crystallization and heat treatment
- Alloying of metals
- Mechanisms of elastic and plastic deformation
- Mechanical material properties and material testing
- Interaction of materials with their environment
- Fundamentals of damage mechanisms
- Systematic material selection

Learning outcomes
On successful completion of this module, the student is able to:

- decode the standard designations of steels and apply them appropriately.
- know and calculate the typical mechanical-technological characteristic values of selected materials
- assess the properties of metals based on their internal structure (crystal lattice, lattice defects, microstructure) and select suitable materials.
- create binary phase diagrams, evaluate them and interpret the results.
- differentiate between the different types of materials and describe the reasons for their different properties, e.g. in terms of their ductility.
- evaluate atoms in terms of their ability to form metallic, ionic or covalent bonds.
- identify the difference between an acid and a base and correctly assign the pH value.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

- assign the correct oxidation states to the elements involved in a redox reaction.
- evaluate the corrosion tendency of metallic materials based on the acid/base concept and the electrochemical series.
- evaluate the susceptibility of different materials and systems to environmental conditions (e.g. different temperatures, humidity, chemical aggressiveness).
- analyse the polarity of molecules based on their chemical structure and identify
- the partially positive and negative areas in a polar molecule.
- explain the difference between an exothermic and an endothermic reaction and the influence of the catalyst on the course of the reaction.
- name organic groups that occur in common plastics.
- name the three groups of plastics and their characteristic properties.
- evaluate the influence of the monomer structure on mechanical material properties such as strength and rigidity.
- identify the most prominent semi-crystalline and amorphous thermoplastics and their distinguishing features in the field of application.
- evaluate the most important types of plastic in terms of their areas of application.
- explain the three common recycling approaches.

Literature

- Callister, W.D. and Rethwisch, D.G. (2014): Materials Science and Engineering, 9. Aufl., Hoboken: Wiley & Sons.
- Perez, N. (2024). *Materials Science: Theory and Engineering* (1st ed. 2024.). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-57152-7
- Brinson, H. F. (2015). *Polymer engineering science and viscoelasticity: An Introduction* (2nd ed. 2015). Springer. https://doi.org/10.1007/978-1-4899-7485-3

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Module: MICS
Microcomputer Systems

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr.-Ing. Schreier

Lecturer(s)
Prof. Dr.-Ing. Schreier

Applicability	BESE
Semester according to SPO	6th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Binary and hexadecimal number representation
- Addition, subtraction and multiplication in the binary system
- Calculation rules of Boolean algebra
- Digital circuit design and basic circuits
- Classification and use of bi-stable flip-flops
- Finite state machines

Learning outcomes
On successful completion of this module, the student is able to:

- apply various number systems
- analyze, synthesize and optimize digital circuits
- develop and analyze time-dependent digital circuits and finite-state machines.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Michael Collier, Svetlana Bebova, Wendy Weu, Digital Circuit Design: Principles and Practice, 1st edition. North Charleston: CreateSpace, 2014.
- Anil K. Maini, Digital Electronics: Principles, Devices and Applications, 1st edition. West Sussex: John Wiley & Sons Ltd., 2007.
- Neil Weste, David M. Harris, CMOS VLSI Design: A Ciruits and Systems Perspective, 4th edition. London: Pearson Education Inc., 2010.

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Module: ELE2
Electrical Engineering 2

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar like lecture;
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Lorrmann

Lecturer(s)
Prof. Dr. Lorrmann

Applicability	BESE
Semester according to SPO	6th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Successful completion of the module ELEN, ELE1

Content

- Four-pole equations, elementary four-pole networks, combining elementary four-pole networks, calculating operating parameters.
- Determining differential equations for systems with one or two energy storage components, finding solutions in the time and Laplace domain, significance and determination of initial conditions.
- Determination of a system's transfer function, finding the step/impulse response and frequency response, making statements about stability.

Learning outcomes
On successful completion of this module, the student is able to:

- analyze and calculate operating parameters of elementary four-pole networks and interconnections of those
- explain the transient behavior of electrical circuits
- mathematically describe a linear dynamic system in form of a differential equation
- calculate solutions to 2nd order differential equations with constant coefficients
- explain the purpose and application of transfer functions to analyze electrical systems
- determine the output signals of a system described by a transfer function given different types of input signals
- apply the abovementioned methods to technical systems, including non-electrical systems.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination
according to § 23 APO

Examination – length/format

90 minutes

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Lorrmann H., online script and exercises based on work of Prock J, Kaupp, T. and Schormann G.
- Van Valkenburg, M. E, Network Analysis, 3rd edition. New Delhi, India: PHI, Pearson Education, 2002.
- Paul J. Nahin, Transients for Electrical Engineers, Springer International Publishing, 2018.

Semester 7

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Module: OPRE
Operations Research

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Bittner

Lecturer(s)
Prof. Dr. Bittner

Applicability	BESE
Semester according to SPO	7th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Successful participation in the modules MATB and STAC.

Content

- Classifications, representations and properties of graphs
- Algorithms on graphs
- Modelling of optimisation problems
- Linear optimisation
- Network optimisation

Learning outcomes
On successful completion of this module, the student is able to:

- Identify tasks related to Operations Research in business environments.
- Transfer actual optimisation problems into formal models.
- Analyse the structure and the complexity of optimisation problems.
- Solve optimisation problems using an algorithmic approach.
- Judge the quality of solution methods.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Bronson, R. and Govindasami, N. (1997): Operations Research, 2nd ed., New York: McGraw-Hill.
- Hillier, F. S. and Lieberman, G. J. (2015): Introduction to Operations Research, New York: McGraw-Hill.
- Poler, R.; Mula Bru, J. and Díaz-Madroñero, M. (2014): Operations Research Problems, London: Springer.

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Module: SMSI
Systems Modeling and Simulation

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Walter

Lecturer(s)
Prof. Dr. Walter

Applicability	BESE
Semester according to SPO	7th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Computer Science 1 & 2 (Python)

Content
General principles:

- Introduction to mathematical modeling and systems simulation
- Procedure of a numerical simulation (process chain including model construction/pre-processing, actual calculation, and evaluation/post-processing)
- Validation, verification and calibration; sensitivity analysis

Time-independent systems:

- Static simulation models and Monte Carlo simulation

Time-dependent systems:

- Ordinary differential equations and autonomous systems
- State space representation
- Non-linear dynamical systems

Systems described by partial differential equations:

- Examples from natural science and engineering
- Mathematical background of used numerical methods

Time series analysis and forecasting

- Methods used in time-domain
- Methods used in frequency-domain, Fourier analysis

Implementation and deepening of the acquired knowledge through selected application examples from various disciplines of natural and engineering sciences

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the students are able to translate problems from the fields of natural sciences, engineering, and economics into the language of mathematics. They will be familiar with the basic principles of modeling and can apply them. Students will be capable of formulating correct system equations, verifying the correctness of given system equations, and solving such equations. They will understand the qualitative theory for evaluating the behavior of linear and nonlinear dynamical systems.

Starting from a specific problem, students can create an appropriate model and implement it on the computer. They will be able to conduct simulations of simple systems, analyze the results, interpret them, and validate the models. Through such simulations, students can assess and predict the behavior of simple real-world systems in an idealized manner.

Additionally, the following abilities are strengthened:

- Students can read original scientific literature.
- Students can interpret simulation results critically, assess their quality, and correctly evaluate their range of validity.

Literature

- B. Barnes, G.R. Fulford, Mathematical Modelling with Case Studies, CRC Press, 2015. (e-book)
- C. Eck et al., Mathematical Modeling, Springer, 2017. (e-book)
- C.L. Dym, Principles of Mathematical Modeling, 2nd edition, Elsevier, 2004. (e-book)
- J.H. Argyris et al., An Exploration of Dynamical Systems and Chaos. Springer, 2015. (e-book)
- A. Friedman, W. Littman, Industrial Mathematics: A Course in Solving Real-World Problems, SIAM, 1994.
- C.C. Lin, L.A. Segel, Mathematics Applied to Deterministic Problems in the Natural Sciences, SIAM, 1988.
- B.L. Nelson, L. Pei, Foundations and Methods of Stochastic Simulation, A First Course. 2nd edition, Springer, 2021. (e-book)
- H.P. Langtangen, A Primer on Scientific Programming with Python 5th edition, Texts in Computational Science and Engineering, Springer, 2016. (e-book)
- S. Linge, H.P. Langtangen, Programming for Computations – Python, 2nd edition, Texts in Computational Science and Engineering, Springer, 2020. (e-book)

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Module: MTPP
Manufacturing Techniques and Production Processes

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Krüger

Lecturer(s)
Prof. Dr. Tiesler
Prof. Dr. Versch

Applicability	BESE
Semester according to SPO	7th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- Introduction to manufacturing technology
- Fundamentals of machining (kinematics, geometry, forces, chip formation)
- Cutting materials, wear mechanisms, tool life and cooling lubricants
- Machining with a geometrically defined cutting edge: turning, drilling, milling
- Machining with a geometrically undefined cutting edge: grinding, honing
- Calculation of tool life and tool life optimization
- Calculation of the cutting force, drive power and main time for the processes: turning, drilling, milling
- Moulding and forming
- Fundamentals of metal physics
- Parameters of forming technology
- Selected processes including raw parts, process design, tools and machines, tribology
- Aspects of Industry 4.0 for various processes

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- describe the differences in the manufacturing processes.
- define the kinematic differences between the individual machining processes and describe the limits of these processes.
- specify the movements and chip sizes in machining.
- list the properties of cutting materials and name the wear mechanisms and their causes.
- calculate the tool life and optimise the process based on this calculation.
- calculate the cutting forces, drive power and the main time for various processes.
- describe the essential primary shaping and forming processes.
- explain the basics of plastic deformation and assess forming processes on this basis.
- apply the basic parameters such as degree of deformation and flow stress, calculate forces and select suitable press types.

Literature

- Kumar, K., Kalita, H., Zindani, D., & Davim, J. P. (2019). Materials and manufacturing processes. Springer. https://doi.org/10.1007/978-3-030-21066-3
- Shaker, K., & Nawab, Y. (2025). *Engineering Materials: Fundamentals, Processing and Properties* (1st ed. 2025.). Springer Nature Switzerland. https://doi.org/10.1007/978-3-031-72263-9
- Brinson, H. F. (2015). *Polymer engineering science and viscoelasticity: An Introduction* (2nd ed. 2015). Springer. https://doi.org/10.1007/978-1-4899-7485-3

Semester 8

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Würzburg-Schweinfurt

Module: ERPE
ERP Systems and Digital Transformation

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar
This module is provided via the virtual university of Bavaria [VHB]

Language of instruction
English

Organisation

Responsible
Prof. Dr. Dobhan

Lecturer(s)
Prof. Dr. Dobhan;
Prof. Dr. Knobloch;
Mr. Senner

Applicability	BESE
Semester according to SPO	8th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content

- ERP systems as elements of a company's IT environment
- Model-based assignment of digital actors to activities of a business process
- Integration types and architectures of ERP systems
- Use of ERP systems as digital actors
- Architecture for integration of sensor data in ERP systems (IoT)
- software-based possibilities for the application of web services and cloud computing.

Learning outcomes
On successful completion of this module, the student is able to:

- Identify main characteristics and functionalities of ERP systems and to compare specific ERP systems with each other.
- Recognize the integration impact of ERP systems (on business processes) and their architecture.
- Assign digital actors to operational tasks in a target-oriented way.
- Describe a basic architecture for the integration of sensor data into an ERP system in the context of the Internet of Things and to implement it exemplarily.
- Know and apply web services and cloud architectures.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Kurbel, K. (2013): Enterprise Resource Planning and Supply Chain Management, Berlin: Springer, DOI: https://doi.org/10.1007/978-3-642-31573-2
- Holtschulte, A. (2022). Digital supply chain and logistics with IoT: Practical guide, methods, tools and use cases for industry. Springer.
- Kocaoglu, B. (2024). Logistics Information Systems: Digital Transformation and Supply Chain Applications in the 4.0 Era. Springer.
- Laudon, K. C.; Laudon, J.P. (2021): Management Information Systems, Managing the digital Firm. 17th ed., Hoboken, NJ: Pearson.
- Serpanos, D. and Wolf, M. (2018): Internet-of-Things (IoT) Systems: Architectures, Algorithms, Methodologies, Cham: Springer International Publishing AG, DOI: https://doi.org/10.1007/978-3-319-69715-4.
- Vogel-Heuser, B. (2023). Digital Transformation: Core Technologies and Emerging Topics from a Computer Science Perspective. Springer Berlin / Heidelberg.

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Würzburg-Schweinfurt

Module: LEPR
Lean Production and CIP

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Bräutigam

Lecturer(s)
Prof. Dr. Bräutigam;
Prof. Dr. Engelmann;
Prof. Dr. J. Schmitt

Applicability	BESE
Semester according to SPO	8th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
Lean Management Methods and Tools

- Kaizen
- Value stream design
- Levelling
- 5S
- Kanban
- SMED

Control of material and information flow

- Push - Pull
- Shop Floor Management Cycle
- Visual Management
- Basics SCM

Examples for production systems in practice

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP) according to § 23 APO

or

Other examined assignment (soP) according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes

If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- Describe the individual elements, the relationships and the underlying philosophy of Lean Management (LM).
- Explain the underlying philosophy of LM.
- Select and apply the various methods and tools of LM depending on the individual case.
- Recognize the links and differences with classical production control models.
- Derive elements of Lean Management on their own and to compare different production systems.
- Determine the requirements of the process participants (stakeholders).
- Apply the taught methods and tools of LM in various application scenarios.
- Reflect the obtained results in the team.

Literature

- Liker, J.K. (2004): The Toyota Way – 14 Management Principles from the World´s greatest manufacturer, Tata McGraw.
- Liker, J.K. and Meier, D.P. (2005): The Toyota-Way Fieldbook, McGrawHill.
- Rother, M. (2009): Learning to See: Toyota Kata, McGraw Hill Professional.

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Module: CSYS
Control Systems

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr.-Ing. Ali

Lecturer(s)
Prof. Dr.-Ing. Ali

Applicability	BESE
Semester according to SPO	8th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Mathematics 1 to 3

Content

- Introduction

  Basic terminology, plan of action, feedback control
- Behavior of control system components
  - Deriving system equations
  - Description in time and frequency domain
  - Transfer function,
  - Modelling and simulation
- PID control
- Control loop analysis
  - Stability, speed of response, oscillation behavior, steady-state accuracy
- Controller design
  - Empirical design methods
  - Model-based control design
  - Controller design in frequency domain (loop shaping)
  - Pole placement method/root locus.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP **one** of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- name basic terminology of control engineering and describe mechanism of the feedback control
- explain static and dynamic behavior of control-loop components, describe them in time and frequency domain and identify fundamental characteristics of important systems (P, I, D, first-order lag, second-order lag etc.)
- explain the working principle of the classical PID control, describe characteristic features and properties of each controller component and select a suitable controller for a given application
- analyze control systems for stability, oscillations, steady-state accuracy and speed of response using open-loop frequency response and pole-zero maps
- build a simulation model for a simple control loop and execute a model-based controller design
- use heuristics and empirical methods to select suitable controller structure and adjust its parameters
- design a feedback controller for a single-input-single-output system using frequency response and pole-placement techniques

Literature

- K. J. Åström and R. M. Murray, Feedback systems: an introduction for scientists and engineers. Princeton, NJ: Princeton University Press, 2009.
- K. Ogata, Modern Control Engineering, 5th ed. Upper Saddle River, NJ: Pearson Education, 2010.
- R. Dorf, R. Bishop, Modern Control Systems, 13th ed. Hoboken, NJ: Pearson Education, 2017.
- H. Unbehauen, Regelungstechnik I, 15th ed. Wiesbaden: Springer Vieweg, 2008.
- J. Lunze, Regelungstechnik 1, 12th ed. Berlin: Springer-Verlag, 2020.

Semester 9

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Module: TECP
Technology Project

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
10

Workload
Guided study time:
Synchronous participation:
30 hours
Asynchronous participation:
60 hours

Self-study: 210 hours
Total: 300 hours

Teaching format
Seminar; Project

Language of instruction
English

Organisation

Responsible
Programme Director ISE

Lecturer(s)
XX

Applicability	BESE
Semester according to SPO	9th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
-

Content
Project management in the field of sustainable energy systems

- Team organization, idea generation strategies and project and product description for sustainable energy systems.
- Organization, structure and essential contents of a specification sheet.
- Planning procedures, components of a schedule, avoidance of rookie mistakes.
- Basics of development costing.

Project realization: from the idea to reality

- Application of modern methods of project and product development, preparation of planning documents.
- Implementation of the self-planned development steps.
- Bringing together the individual components, e.g. hardware, software, mechanics and commissioning, including error detection, analysis and rectification as well as final presentation.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Other examined assignment according to §§ 26, 27 APO

Examination – length/format

If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment
- practical or artistic assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- apply essential methods and components of project management and organize themselves in the application of the acquired methods.
- independently define the project task either with a scientific character or with a concrete practical reference to sustainable energy systems.
- work out the specifications of the project task and plan the sequence of the individual implementation steps in detail in the form of a timetable and then check and ensure the timely progress of the project themselves.
- to work out and secure the financial framework with the help of a development calculation.
- present the individual intermediate steps to all participants in a comprehensible manner and discuss any problems that arise.
- to present the finally developed and realized project or product to a broad audience at a final event.

Literature

- Balzert, H.; Schröder, M. und Schäfer, C. (2011): *Wissenschaftliches Arbeiten – Ethik, Inhalt & Form, wiss. Arbeiten, Handwerkszeug, Quellen, Projektmanagement, Präsentationen*, 2. Aufl. Herdecke.
- Gellert, M. und Nowak, C. (2014): *Teamarbeit, Teamentwicklung, Teamberatung. Ein Praxisbuch für die Arbeit in und mit Teams*, 5. Aufl., Meezen: Limmer.
- Trucare, Project Performance (Hrsg.): http://www.projektmanagementhandbuch.de

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Module: PREN
Process Engineering

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronos participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Renner

Lecturer(s)
Prof. Dr. Paulus
Prof. Dr. Blotevogel

Applicability	BESE
Semester according to SPO	9th semester
Type of module	Core module
If applicable specialization	-

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
MTH1 should be completed successfully.

Content

- Conservation equations of thermodynamics, thermal and caloric state variables of substances as well as process variables.
- The essence and interrelations of energy (as a generic term) as well as the forms of energy heat and work.
- Methodology for processing thermodynamic and process-related tasks.
- Introduction to cyclic processes and the structure as well as the mode of operation of power plants and engines.
- Introduction to the behavior of machines and processes under real-life conditions.
- Description of reaction mechanisms in chemical process engineering.
- Fundamentals and basic operations of mechanical process engineering: crushing, mixing, stirring, separating particle mixtures and material systems, filtering, particle analysis.
- Fundamentals of chemical process engineering (stoichiometry, material quantity balances, chemical thermodynamics of mixed-phase and multi-component systems, energetics of chemical reactions, chemical equilibria, reaction kinetics).
- Fundamentals for the creation of plant concepts for the various processes of material conversion.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- list and define the essential terms and relationships in the field of thermodynamics, in particular the process variables of heat and work, as well as the thermal and caloric state variables.
- write the essential basic equations (e.g. first law of thermodynamics).
- describe the differences between the terms heat, temperature and internal energy.
- use the correct technical terminology in the description of technical facts and discussions as well as in questions and assess each other regarding the correct use of the technical terminology.
- transfer subject-specific basic knowledge of chemical, mechanical and thermal process engineering to real technical processes and analyse them.
- analyse and optimise new or further developed processes in the field of chemical process engineering with the help of the specific theoretical principles they have learned.
- find mathematical solutions for calculating process balances and process kinetics.
- implement theoretical tasks from process engineering in modern, efficient and resource-saving processes.
- find mathematical solutions and perform numerical calculations.
- evaluate processes and real technical systems in terms of their suitability and quality and suggest improvements.
- analyse engineering tasks, develop sub-tasks from them, make meaningful, physically plausible assumptions (e.g. when data is incomplete) and solve the sub-tasks.

Literature

- Schmidt, A. (2022). *Technical Thermodynamics for Engineers: Basics and Applications* (2nd ed. 2022.). Springer International Publishing. https://doi.org/10.1007/978-3-030-97150-2
- Michael, K. (2016). *Process Engineering: Addressing the Gap Between Study and Chemical Industry (2016)*. De Gruyter. https://research.ebsco.com/linkprocessor/plink?id=b793789b-c9b0-3f47-a0d2-908f98e22690.
- Lecture notes in the THWS eLearning system

Semester 10

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Würzburg-Schweinfurt

Module: AUDR
Automated Driving

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Summer semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr.-Ing. Schreier

Lecturer(s)
Prof. Dr.-Ing. Schreier

Applicability	BESE
Semester according to SPO	10th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Control Systems

Content

- Motivation & History
- Terminology & Paths Towards Automated Driving
- Building Blocks, Hardware, and Components
- Vehicle Environment Models
- Object Detection & Semantic Segmentation
- Data Fusion & State Estimation
- Bayesian Inference & Kalman Filtering
- Target Tracking & Traffic Participant Fusion
- Grid Mapping & Free Space Estimation
- Localization & High-Definition Maps
- Situation Understanding & Prediction
- Planning & Decision Making
- Motion Control

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- comprehend the history and terminology of automated driving systems
- describe important architectures, building blocks, and components of automated vehicles
- explain different ways of perceiving and modeling the driving environment
- apply the foundations of deep learning for object detection and semantic segmentation
- compare various data fusion and state estimation approaches.
- select adequate Bayesian Inference and Kalman Filtering methods, e.g. for target tracking, traffic participant fusion, grid mapping, and localization
- highlight the challenges of situation understanding and prediction including exemplary solutions
- differentiate between various behavior & trajectory planning methods
- analyze vehicle motion control systems.

Literature

- Eskandarian, A.: Handbook of Intelligent Vehicles. Springer, London, 2012.
- Siciliano, B.; Khatib, O.: Springer Handbook of Robotics. 2nd Edition, Springer, Berlin Heidelberg 2016.
- Thrun, S.; Burgard, W.; Fox, D.: Probabilistic Robotics. Intelligent Robotics and Autonomous Agents. The MIT Press, Cambridge, 2006.
- Watzenig, D.; Horn, M.: Automated Driving. Safer and More Efficient Future Driving. Springer, Switzerland, 2017.
- Winner, H. et al.: Handbook of Driver Assistance Systems. Basic Information, Components and Systems for Active Safety and Comfort. Springer, Switzerland, 2016.

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Module: ELM1/2
Core Elective Module 1/2

Module profile

Exam number
Depends on the chosen modules.

Duration
1 semester each

Frequency
Winter and summer semester

Some courses are only offered once a year. Please find further information in the respective ELM course description (see appendix).

Credit hours (SWS)
4 each

ECTS-Credits (CP)
5 each

Workload for each module
Guided study time:
Synchronous participation: 15 hours
Asynchronous participation: 45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Programme Director ISE

Lecturer(s)
Depends on the chosen course. Please find further information in the respective course description (see appendix).

Applicability	BESE
Semester according to SPO	10/11th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module
Depending on the chosen course. Further information can be found in the respective course description (see appendix).

Content
The core electives ELM1/2/3/4 offer courses on specific topics from the field of logistics.

The available ELM1/2/3/4 courses change regularly. Therefore, the actual courses offered will be announced each semester.

Learning outcomes
On successful completion of this module, the student is able to:

- Explain specific topics from the field of logistics.
- Know the basic terms, the relevant market participants and their technical and business problems.
- Apply this knowledge to practical logistics problems.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Depends on the chosen ELM1/2/3/4. Please find further information in the respective course description (see appendix).

Examination – length/format

Depends on the chosen ELM1/2/3/4. Please find further information in the respective course description (see appendix).

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

Depends on the chosen ELM1/2/3/4. Please find further information in the respective course description (see appendix).

Semester 11

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Würzburg-Schweinfurt

Module: STCM
Strategies and technologies for climate change mitigation

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter semester

Credit hours (SWS)
4

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation:
15 hours
Asynchronous participation:
45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Gonzalez-Salazar

Lecturer(s)
Prof. Dr. Gonzalez-Salazar

Applicability	BESE
Semester according to SPO	11th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
-

Recommended prerequisites for the participation in the module

- Physics and mathematics
- Fundamentals of electrical engineering
- Technical mechanics

Content

- Introduction to the science of climate change, including the causes and effects of global warming.
- The history of climate change research and policy.
- Climate change impacts on ecosystems and biodiversity.
- Climate change impacts on human health and society.
- Overview of most important drivers for climate change.
- Climate change mitigation strategies, including:
  - Renewable and sustainable energy and carbon sequestration.
  - Sustainable transport technologies.
  - Sustainable buildings and cities.
  - Others (e.g., improved food consumption and supply, sustainable materials, land use, etc.).

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Written examination (sP)
according to § 23 APO
or
Other examined
assignment (soP)
according to §§ 26, 27 APO

Examination – length/format

If sP: 90 minutes
If soP one of the following formats:

- seminar paper/ research project
- portfolio assignment

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Learning outcomes

On successful completion of this module, the student is able to:

- Explain the basic science of climate change, including the causes and effects of global warming.
- Describe the impacts of climate change on human society and the economy, as well as on ecosystems and biodiversity.
- Explain the various policy mechanisms in place to address climate change, including international agreements and national/local actions.
- Evaluate the effectiveness of different climate change mitigation and adaptation strategies, including sustainable energy and transport, buildings and cities, food supply and consumption, materials, land use, etc.
- Develop an awareness of the complexity of the problem and an understanding that climate change is a global issue that requires collective action and cooperation.

Literature

- IPCC (2021): Climate Change 2021: The Physical Science Basis.
- Hawken, P. (2017): Drawdown: the most comprehensive plan ever proposed to reverse global warming, Penguin Books.
- Mathez, E. and Smerdon, J.E. (2018): Climate change: the science of global warming and our energy future, 2nd ed., Columbia University Press.

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Module: ELM3/4
Core Elective Module 3/4

See description at ELM1/2.

Semester 12

Module: INMO
Internship Module

The Internship Module consists of

a) a continuous, supervised internship lasting 20, but no more than 26 weeks and is

b) accompanied by the seminar "**Preparation and Reflection of Internship**". (see § 6 SPO BESE)

The internship Module is deemed to be successfully completed if

a) evidence of the activities during the internship and its duration in relation to a full-time activity is provided through the employer and

b) a report on the activities during the internship, signed by the employer, is available and has been approved by the supervisor of the faculty. (see § 11 (7) APO)

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Module: INTS
Internship

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
0

ECTS-Credits (CP)
28

Workload
Attendance: 0 hours
Self-study: 840 hours
Total: 840 hours

Teaching format
Practical

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hofer

Lecturer(s)
Prof. Dr. Hofer

Applicability	BESE
Semester according to SPO	12th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO

- Acquisition of all 90 CPs of the first three regular semesters (§ 6 (2) SPO IBE resp. § 6 (2) SPO IBL).
- Submission of an internship contract to students' office prior to starting the internship (§11 (5) APO).

Recommended prerequisites for the participation in the module

-

Content

- Immersion in business practice
- Practical application and consolidation of knowledge, skills, and methods acquired in the degree course
- Autonomous execution of planning, organization, and control tasks in organisations
- Generation of business solutions in a specialization area of the degree course

Learning outcomes

On successful completion of this module, students are able to:

- Analyse, understand, and interpret real business processes and structures hands-on, in particular related constraints and opportunities.
- Deploy the soft skills needed in real business environments (e.g. abilities to communicate, to convince others, to manage conflicts, and to work within a team) confidently, appropriately, professionally, and in a goal-oriented manner.
- Develop systematically solutions for business challenges.
- Be fully employable on the graduate job market.

Examination

Particular conditions for the participation in the examination according to the SPO appendix
Acquisition of all 90 CPs of the first three regular semesters (§ 6 (2) SPO IBE resp. § 6 (2) SPO IBL).

Examination – type
-

Examination – length/format
-

Language of examination
English

Condition for the award of credit points
Submission of certificate of employment (issued by employer at which the internship has been conducted).

Literature

- Will be provided by company (internal documentation).
- Standard textbooks of the relevant functional areas.

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Module: PRIN
Preparation and Reflection of Internship

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
2

ECTS-Credits (CP)
6

Workload
Guided study time:
Synchronous participation:
30 hours
Asynchronous participation:
0 hours

Self-study: 120 hours
Total: 150 hours

Teaching format
Seminar

Language of instruction
English

Organisation

Responsible
Prof. Dr. Hofer

Lecturer(s)
Prof. Dr. Hofer

Applicability	BESE
Semester according to SPO	12th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO

- Acquisition of all 90 CPs of the first three regular semesters (§ 6 (2) SPO IBE resp. § 6 (2) SPO IBL).
- INTS, i.e. the internship must already have been conducted (at least completed to a large degree).
- Submission of the internship report.

Recommended prerequisites for the participation in the module
-

Content

- Interactive presentation of contents and experiences during the internship as well as elaborations on employers, industries, and functional areas
- Discussions of experiences made during the internships
- Comparison of experiences with personal expectations
- Overview of a variety of job-relevant information

Learning outcomes
On successful completion of this module, students are able to:

- Reflect on patterns of personal behaviour and success criteria in the organizational environment.
- Assess critically and constructively goals, structures, processes, and culture of organizations.
- Evaluate critically and constructively their own professional behavior as well as that of colleagues and supervisors.

Examination

Particular conditions for the participation in the examination according to the SPO appendix
Acquisition of all 90 CPs of the first three regular semesters (§ 6 (2) SPO IBE resp. § 6 (2) SPO IBL).

Examination – type
Other examined assignment according to §§ 26, 27 APO

Passed successfully/failed

Examination – length/format
One of the following formats:

- multimedia presentation
- documentation

The concrete length/format of the examination will be determined in the study plan and published at the beginning of each semester in the e-Learning course "Studien- und Prüfungsangelegenheiten/ study and examination matters".

Language of examination
English

Condition for the award of credit points
Successful passing of the examination.

Literature

- Minto, B. (2010): The Pyramid Principle, 3rd ed., Upper Saddle River, NJ: Prentice Hall.

Semester 13

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Module: GENE
General Elective

Module profile

Exam number
Depends on the chosen courses.

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
4

Either two general electives (Allgemeinwissenschaftliche Wahlpflichtfächer, AWPF) (2 x 2 teaching units/week) or one AWPF (1 x 4 teaching units/week) from the AWPF-catalogue of the Faculty of Applied Natural Sciences and Humanities (FANG).

ECTS-Credits (CP)
5

Workload
Guided study time:
Synchronous participation: 15 hours
Asynchronous participation: 45 hours

Self-study: 90 hours
Total: 150 hours

Teaching format
Seminar-like lecture; Seminar; Exercise course

Language of instruction
The respective language(s) will be laid down and published by the Faculty of Applied Natural Sciences and Humanities.

The module serves to develop interdisciplinary competences ("studium generale"); it is not closely related to any other module of the degree programme. It can be applied to all bachelor's programmes without blocking note.

Applicability	BESE
Semester according to SPO	13th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO
Usually none; exceptions are defined and published by the Faculty of Applied Natural Sciences and Humanities.

Recommended prerequisites for the participation in the module
Usually none; exceptions are defined and published by the Faculty of Applied Natural Sciences and Humanities.

Content
FANG offers AWPFs from the areas of

- Languages
- Cultural Sciences
- Natural Sciences and Technology
- Politics, Law, Economics
- Pedagogy, Psychology, Social Sciences
- Soft Skills
- Creativity and Art

Contents that are already included or closely related to other module contents of the degree programme are excluded from the FANG catalogue. In the FANG catalogue, the respective classes are marked by a blocking note.

The content of each AWPF is published on FANG's website.

Organisation

Responsible
Dean of the Faculty of Applied Natural Sciences and Humanities

Lecturer(s)
Lecturers of the Faculty of Applied Natural Sciences and Humanities and/or lecturers instructed by the Faculty.

Examination

Particular conditions for the participation in the examination according to the SPO appendix
-

Examination – type
Every AWPF is completed by an examination; its type will be laid down and published by the Faculty of Applied Natural Sciences and Humanities.

Examination – length/format
The duration of the examination(s) will be laid down and published by the Faculty of Applied Natural Sciences and Humanities in case of a written examination.

Language of examination
The language of the examination depends on the chosen AWPF. It will be laid down and published by the Faculty of Applied Natural Sciences and Humanities.

Condition for the award of credit points
Successful passing of the examination.

Learning outcomes
Subject-specific learning outcomes depend in each case on the chosen AWPF. Students…

- will additionally acquire knowledge and skills outside their discipline that, however, may be important for their intended careers. As for example specialist knowledge of foreign languages, or knowledge in the fields of natural sciences and social sciences.
- will analyse a variety of problems.
- connect their subject-specific knowledge to that of other disciplines and thus get an interdisciplinary perspective.
- transfer acquired knowledge to current training situation
- will have broadened their key competences and, if applicable, foreign language skills which both contribute to their character formation also in terms of interculturality.
- are aware of their personal, social, and ethical responsibility.

Literature
Depends in each case on the chosen AWPFs.

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Module: BCTH
Bachelorthesis

Module profile

Exam number
tbd

Duration
1 semester

Frequency
Winter and summer semester

Credit hours (SWS)
0

ECTS-Credits (CP)
10

Workload
Attendance: 0 hours
Self-study: 300 hours
Total: 300 hours

Teaching format
-

Language of instruction
English

Organisation

Responsible
Programme director
Engineering Science

Lecturer(s)
Depends on the chosen topic.

Applicability	BESE
Semester according to SPO	13th semester
Type of module	Core module

Particular conditions for the participation in the module according to the SPO

- At least 150 CPs

Recommended prerequisites for the participation in the module
Successful passing of the module PMSW.

Content
The aims and content of the Bachelor's thesis are either chosen by the student or suggested by the lecturer. These can be concrete practical topics or scientific topics in connection with practical application. The topic must be related to the curriculum and/or relate to general or specific current issues and topics.

Learning outcomes
On successful completion of this module, the student is able to:

- Independently work on a topic agreed between the supervisor and the candidate within the given time frame according to scientific criteria.
- Work on a topic agreed between the supervisor and the candidate within the given time frame according to scientific criteria.
- Understand the topic and derive the research question from it.
- Select appropriate scientific methods and procedures and use them to find suitable solutions.
- Are able to interpret, evaluate and prepare the results in an appropriate manner and to communicate them according to the needs.

Examination

Particular conditions for the participation in the examination according to the SPO appendix

-

Examination – type

Bachelor's Thesis

Examination – length/format

-

Language of examination

English

Condition for the award of credit points

Successful passing of the examination.

Literature

- Easterby-Smith M.; Thorpe R.; Jackson P. and Jaspersen L. (2018): Management and Business Research, 6th Ed., Sage Publishing, Los Angeles.
- Minto, B. (2009): The Pyramid Principle, Logic in Writing and Thinking, 3rd ed., Prentice Hall, Upper Saddle.
- Balzert, H.; Schröder, M. and Schäfer, Chr. (2011): Wissenschaftliches Arbeiten - Ethik, Inhalt & Form wiss. Arbeiten, Handwerkszeug, Quellen, Projektmanagement, Präsentationen, 2. Aufl., Herdecke, W3L Verlag.

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Appendix 1:
Catalogue of Core Elective Modules

By completing the Core Elective Modules the students enlarge their know-how and skills by specific subjects out of the field of Business Engineering, Electrical Engineering, Mechanical Engineering and/or Natural Sciences. Overall four core elective courses must be completed. The list of available courses will be published shortly.