Course Handbook Mechanical Engineering / Production Technology Bachelor

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Qualifikation Goals of Study Programme

Mechanical Engineering / Production Technology Bachelor - mandatory courses (overview)

Module name (EN)	Code	SAP-P	Academic Year	Clock hours	ECTS	Module coordinator
Electrical Engineering	DBMAB-230	P720-0003	2	72UV+12UP	6	Prof. Dr.-Ing. Jan Christoph Gaukler
Practical Training Module IV	DBMAB-371	P720-0071	3	200UP+12US	6	Prof. Dr.-Ing. Jan Christoph Gaukler
Scientific Basics	DBMAB-131	P720-0043, P720-0044, P720-0045	1	48UV+32UU+16UP	6	Prof. Dr.-Ing. Jan Christoph Gaukler

(3 modules)

Mechanical Engineering / Production Technology Bachelor - optional courses (overview)

Module name (EN)	Code	SAP-P	Academic Year	Clock hours	ECTS	Module coordinator

(0 modules)

Mechanical Engineering / Production Technology Bachelor - mandatory courses

Electrical Engineering

Module name (EN): Electrical Engineering

Degree programme: Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024

Module code: DBMAB-230

Hours per semester week / Teaching method:
72UV+12UP (84 teaching units, accumulated)

ECTS credits:
6

Academic Year: 2

Duration: 2 semester

Mandatory course: yes

Language of instruction:
German

Assessment:
Graded exam (Duration 150 min., 100 pts.)
o The exam will be written in the 4th semester (Block 4A) according to the examination schedule.
o Distribution
- 70 pts. (105 min) on "Fundamentals of Electrical Engineering" and the associated laboratory exercises
- 30 pts. (45 min) on "Electric Drive Systems" and the corresponding laboratory exercises

Prerequisites for receiving credits:
The achievement of at least 40 out of 100 points in the module exam.
The grade corresponds to the student s performance in the module exam and is shown as a decimal grade according to the htw saar grading scheme.

[*updated 28.04.2023*]

Applicability / Curricular relevance:

DBING-220 (P750-0014) Integrated Sustainable Building Technology, Bachelor, SO 01.10.2024 , study year 2, mandatory course
DBMAB-230 (P720-0003) Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2021 , study year 2, mandatory course
DBMAB-230 (P720-0003) Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024 , study year 2, mandatory course

Workload:
The total student study time for this course is 180 hours.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:
DBMAB-341

[*updated 13.02.2025*]

Module coordinator:
Prof. Dr.-Ing. Jan Christoph Gaukler

Lecturer: Prof. Dr.-Ing. Jan Christoph Gaukler

[*updated 11.06.2021*]

Learning outcomes:
After successfully completing this module, students will be familiar with the basic laws and physical relationships of electrical engineering and have mastered their application in mechanical engineering and production technology. They will be able to classify and evaluate the analogies between mechanics and electrical engineering as well as the economic significance of electrical engineering in a superordinate context. Students will be able to design, draw and calculate simple electrotechnical circuits independently and choose between electrotechnical and mechanical solutions according to technical and economic aspects, or to complement solutions from both areas in a meaningful way. They will be familiar with the principles and methods for measuring electrical and non-electrical quantities and will be able to apply them. Students will be able to understand basic correlations in electrical engineering processes and select and apply adequate problem solving methods.

They will be able to name electrical machines and their components and analyze the operating behavior of electrical machines based on given data in order to calculate selected variables and characteristic curves. In doing so, they will use the usual equivalent circuit diagrams and graphical methods.

They will have a good command of the terms, symbols and language used in electrical engineering in order to be able to communicate in an interdisciplinary team with electrical engineers, among others.

[*updated 28.04.2023*]

Module content:
Fundamentals of Electrical Engineering:
Electric field with quantities and methods:
charge, current, current density, potential, voltage, field strength, force on charge carriers,
Ohm´s law, resistance, conductance, electric circuit, source voltage, voltage drop, power,
electric displacement flow, capacitance, EMC
Magnetic field with quantities and methods: magnetic poles, source-free fields, right-hand rule,
magnetic flux, induction flow-through, field strength, flow-through law, magnetic voltage, magnetic
resistance, permeability, magnetic field constant, hysteresis, Lorentz force, induction law, generator,
self-induction, counter-induction, inductance, transformer, eddy currents, energies and forces in magnetic field,
passive components
Calculating circuits with direct current:
Kirchhoff´s laws, basic circuits, short circuit, open circuit, adaptation, energy and
power, efficiency, non-linear resistances, graphical determination of operating point, resistance networks,
meshed networks, systematic network analysis using the node and mesh method
Calculating circuits for alternating current:
Generating alternating current with an electrical machine, time average, effective value, passive sign convention,
voltage and current at capacitance and inductance, series circuits with
alternating current, pointer diagrams, parallel circuits with alternating current, complex pointer in
in alternating current technology, complex representation of resistances and conductance values with alternating current, active power,

reactive power, apparent power, series and parallel resonant circuits, reactive power compensation.
Three-phase electric power (three-phase current):
connected three-phase system, power in the three-phase system, star/delta switching, neutral conductor currents,
frequent cases of asymmetrical faults

Electric drive systems:
Torque generation, electrical and mechanical power, rotary field generation and torque generation in three-phase machines
DC machines:
design, mode of operation, armature reaction, equivalent circuit, characteristic curve, generator and motor operation,
speed setting, special designs, speed control
Three-phase asynchronous machine:
Design, operating principle, equivalent circuit, vector diagrams, characteristic curve, current locus curve, current displacement rotor, Three-phase asynchronous machine on
frequency inverter
Synchronous machine:
design, rotor designs, excitation devices, equivalent circuit, vector diagrams, characteristic curve, current locus curves
DC and three-phase motors on single-phase alternating current

Electrical engineering laboratory:
The Elektrotechnisches Labor (Electrical Engineering Laboratory) component provides practical training and enables the application of the knowledge acquired in the lectures by means of the following tests/exercises/experiments: Unloaded and loaded voltage divider, bridge circuit using the deflection method, filter circuit (RC low-pass filter), series resonant circuit, symmetrical and asymmetrical loading of a three-phase system (star circuit), three-phase asynchronous machine controlled by means of a frequency converter, recording a characteristic curve on a slip ring motor, fan control (bridge circuit with temperature-dependent resistor, threshold switch and transistor switch).

[*updated 28.04.2023*]

Teaching methods/Media:
Lecture: Lecture, demonstration, group work on concrete problems
Labs: Learning and experiencing scientific and technical interrelationships by means of experiments carried out in groups

[*updated 28.04.2023*]

Recommended or required reading:
R. Busch: Elektrotechnik für Maschinenbauer und Verfahrenstechniker, Teubner Verlag
R. Fischer, H. Linse: Elektrotechnik für Maschinenbauer, Teubner Verlag
E. Hering, R. Martin, J. Gutekunst, J. Kempkes: Elektrotechnik und Elektronik für Maschinenbauer, Springer Verlag
G. Flegel, K. Birnstiel, W. Nerreter: Elektrotechnik für Maschinenbau und Mechatronik, Hanser-Verlag.
G. Hagmann: Grundlagen der Elektrotechnik, Aula Verlag.

[*updated 28.04.2023*]

Practical Training Module IV

Module name (EN): Practical Training Module IV

Degree programme: Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024

Module code: DBMAB-371

Hours per semester week / Teaching method:
200UP+12US (212 teaching units)

ECTS credits:
6

Academic Year: 3

Mandatory course: yes

Language of instruction:
German

Assessment:
See course work

[*updated 30.04.2025*]

Applicability / Curricular relevance:

DBMAB-371 (P720-0071) Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024 , study year 3, mandatory course

Workload:
The total student study time for this course is 180 hours.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:

Module coordinator:
Prof. Dr.-Ing. Jan Christoph Gaukler

Lecturer:
Lehrbeauftragte (seminar (units))

[*updated 11.11.2025*]

Learning outcomes:
Practical Training Module IV seminar:
Students are aware of their own resources and can mobilize them. They can better assess their fellow human beings and treat them individually, encouraging and challenging them to achieve better results and progress in their work. Students learn to define their own goals and set priorities. They can structure their time effectively and use effective methods to allocate their time to the important things.

Practice-oriented project:

Students will improve their methodological skills by applying the knowledge they have acquired thus far from various subject areas to a practical project of moderate complexity in the field of mechanical engineering, with a focus on manufacturing technology, mechatronics, or production management. They will demonstrate that they are capable of developing or improving solutions to technical problems by applying scientific methods with little guidance. Students will be proficient in analyzing problems and choosing appropriate methods to solve problems. Students we be able to collect, evaluate, and interpret relevant information. They will be able to work in a team, take responsibility, defend the results of their practical project with arguments, and exchange ideas with engineers and other scientists.

[*updated 30.04.2025*]

Module content:
Practical Training Module IV seminar:
Mobilizing your own resources:
- Recognizing, utilizing, and promoting characters
- Leadership responsibility - Leadership begins with oneself
- Creating value through appreciation
- Reflection, self-assessment, clarity of roles

Time management:
- Saving time through planning
- Defining suitable goals
- 60/40 principle, Pareto principle, Eisenhower principle
- ALPEN method
- ABC analysis
- Planning and improvisation
- Possible obstacles

Practical Phase (= practical professional activities):

In Block 5B (4th semester), students work on a specific, practical business project totaling 150 hours, which they complete or develop further within 60 working days using scientific methods and with minimal guidance from a suitably qualified business supervisor. The topic of the practical project is proposed by the company and reviewed, approved, and assigned by the examination board. The presentation given as part of the seminar for Practical Training Module IV serves as documented proof of the students practical work experience.

[*updated 30.04.2025*]

Teaching methods/Media:
Seminar: Seminaristic instruction
Practical phase: Work experience in a partner company

[*updated 30.04.2025*]

Recommended or required reading:

[*updated 30.04.2025*]

Scientific Basics

Module name (EN): Scientific Basics

Degree programme: Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024

Module code: DBMAB-131

Hours per semester week / Teaching method:
48UV+32UU+16UP (96 teaching units)

ECTS credits:
6

Academic Year: 1

Mandatory course: yes

Language of instruction:
German

Assessment:
Written exam 120 min.

[*updated 23.09.2025*]

Applicability / Curricular relevance:

DBMAB-131 (P720-0043, P720-0044, P720-0045) Mechanical Engineering / Production Technology, Bachelor, ASPO 01.10.2024 , study year 1, mandatory course

Workload:
The total student study time for this course is 180 hours.

Recommended prerequisites (modules):
None.

Recommended as prerequisite for:
DBMAB-221
DBMAB-261
DBMAB-332

[*updated 11.11.2025*]

Module coordinator:
Prof. Dr.-Ing. Jan Christoph Gaukler

Lecturer:
Prof. Dr.-Ing. Jan Christoph Gaukler

[*updated 11.11.2025*]

Learning outcomes:
Basic Chemistry:

After successfully completing this module, students will be familiar with the essential basics of general chemistry, including atomic structure, the periodic table of elements, chemical bonding, states of matter, chemical reactions and chemical thermodynamics. They will understand the connection between the electron configuration of the atoms, the structure of the periodic table and the properties of the elements derived from it. They will be able to describe the chemical bonding of substances, prepare molecular formulas and, in the case of covalently bonded substances, also structural formulas, and derive structure-property relationships. Students will be familiar with the basic principles of chemical reactions (reaction equation, stoichiometry, equilibrium, redox and acid-base reactions) and can apply them in order to interpret simple chemical processes. This includes the use of simple, chemical calculations. Students will be familiar with the basic principles of chemical thermodynamics (thermochemistry, chemical reaction processes, catalysts, and inhibitors) and chemical reaction kinetics and will be able to apply this knowledge to interpret and calculate simple chemical processes.

Experimental Physics:

Students will be familiar with the scientific principles of the dynamics of a single point mass and systems of point masses. They will be familiar with the basic terms, phenomena and concepts and understand the physical relationships. This knowledge will enable students to reduce simple engineering problems to basic physical principles or questions, to answer these physical questions independently using mathematical methods, and thus, find a solution to the actual engineering problem in a targeted manner.

Chemistry Lab:

They will be able to set up and perform basic chemical experiments. Based on observations and existing knowledge, they will be able to derive conclusions and link them to the contents of the "General Chemistry" lecture. In addition, students will also be able to write lab reports/experiment reports.

Physics Lab:

By means of experiments, students will independently study the essential physical principles of the mechanics of rigid and real (liquids, gases) bodies, as well as waves, optics, atomic and quantum physics. They will be able to set up basic, physical experiments, carry out series of experiments and measurements and evaluate them, taking into account the calculation of errors. In addition, they will be able to draw conclusions after critically evaluating measurement results and to prepare laboratory reports/test reports.

[*updated 23.09.2025*]

Module content:
Basic Chemistry:

Atomic structure and the periodic system of elements: Classical elementary particles, structure of atoms, isotopes, orbital model, electron configuration, structure of the periodic table
Chemical Bonding:: Ionic bonding, covalent bonding, metallic bonding, dispersion, induction, and dipole-dipole interactions, hydrogen bonding, structure-property relationships
States of Matter: (ideal gases, Boyle´s, Gay-Lussac´s, and Avogadro´s laws, ideal gas equation), liquids, crystalline and amorphous solids, structural principles of ideal crystals, coordination number, Bravais lattice, metallic lattice structures, packing density, Miller indices, lattice

vacancies and their significance for alloy formation)
Homogeneous mixtures (gas mixtures and Dalton´s law, solutions, single-phase alloys), heterogeneous mixtures
Chemical Reactions: Reaction equations and stoichiometry, equilibrium, redox and acid-base reactions, chemical thermodynamics (reaction heat, energy and enthalpy, enthalpy of formation, Hess´s law, reaction entropy, chemical reaction sequences, free enthalpy, catalysis (homogeneous, heterogeneous))

Experimental Physics:

Units of measurement, measuring physical quantities and calculating errors
Mechanics of point masses: One- and multidimensional motion, average velocity, instantaneous velocity, average acceleration, instantaneous acceleration, velocity-time and distance-time laws, free fall, projectile motion, uniform circular motion, angular velocity, centripetal and centrifugal acceleration, Newton´s axioms, momentum, gravitational, spring, normal, and frictional forces, air resistance, work and power in conservative and non-conservative force fields, kinetic energy, potential energy of gravity near the Earth´s surface and in general, spring energy, total energy of a mass point, conservation of energy, superimposed force fields
Mechanics of a system of mass points: Center of mass, velocity, acceleration, force, momentum and conservation of momentum, systems with variable mass (thrust force and velocity of a rocket; basic rocket equation), impact processes (conservation of momentum, energy and angular momentum, types of impact [elastic, inelastic, superelastic], elasticity number)

Chemistry Lab:
Laboratory and safety regulations
Experiments on acid-base reactions, buffer systems, quantitative determination (titration), electrochemistry, and redox chemistry
Qualitative and quantitative analysis of water (ion detection, hardness determination)

Physics Lab:
Unit of measurement, measuring physical quantities and calculating errors
Experiments in mechanics and optics
Experiments in atomic and quantum physics

[*updated 23.09.2025*]

Teaching methods/Media:
Lectures: Presentation, work on specific problems in groups
Exercises: Group work on concrete problems
Labs: Self-study and hands-on experience with scientific concepts through partner work involving experiments.

[*updated 23.09.2025*]

Recommended or required reading:
J. Hoinkis, E. Lindner: Chemie für Ingenieure (Wiley-VCH)
P. W. Atkins, J. de Paula: Physikalische Chemie (Wiley-VCH)
P. A. Tipler, G. Mosca: Physik für Wissenschaftlicher und Ingenieure (Springer)
D. Gross, W. Hauger, J. Schröder, W. Wall: Technische Mechanik 3: Kinetik (Springer)
R. C. Hibbeler: Technische Mechanik 3 Dynamik (Pearson)

[*updated 23.09.2025*]

Mechanical Engineering / Production Technology Bachelor - optional courses