HOCHSCHULE COBURG

Department of Mechanical Engineering and Automotive Technology

Automotive Mechatronics Bachelor's

Degree in Automotive Technology

Module Manual

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Preliminary remarks

Module Plan

Specialization in Automotive Mechatronics
in the Automotive Technology Program

Semester \ CP	1-5	6-10	11-15	16-20	21-25	26-30
WS (1)	Engineering Mathematics I	Statics and Strength of Materials	Materials Engineering	Computer Science for Mechatronics Engineers I	Construction and Machine Elements	Electrical Engineering I
SS (2)	Engineering Mathematics II	Dynamics and Vibration Theory I	General Business Administration	Computer Science for Mechatronics Engineers II	Automotive Engineering I	Electrical Engineering II
WS (3)	Engineering Mathematics III	Dynamics and Vibration Theory II	Project Management	Control Techonology I	Automotive Engineering II	Electronics
SS (4)	Modelling of Mechatronics Systems	Simulation of Mechatronics Systems	Techn. and Busn. English	Control Techonology II	CEM	Microconrollers and Embedded Systems

- Mathematical - Engineering basics
- Mechatronics - Information technology
- Mechatronics - Electrics / Electronics
- Mechatronics - Mechanics
- Supra-Disciplinary Qualification

CEM: e.g. Tech. Thermodyn. / Higher Mech. Electr. Drives / Prod. Techn.

Semester \ CP	1-5	6-10	11-15	16-20	21-25	26-30
WS (5)	Industry Internship					Scientific/Academic Work and Presentation

- Work experience
- Supra-Disciplinary Qualification

Semester \ CP	1-5	6-10	11-15	16-20	21-25	26-30
SS (6)	Automotive Software Engineering	Bus and Communication Systems in Automobiles	Sensor Systems and Actuators in Vehicles	CEM ID	CEM 1	CEM 2
WS (7)	Scientific Foundation of the Bachelor Thesis		Bachelor Thesis and Colloquium			CEM 3

- Compulsory modules for technical specialization
- Compulsory elective modules for technical specialization
- Methodological competence
- Professional Practice
- Supra-Disciplinary Qualification

General Business Administration for Automotive Mechatronics

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	General Business Administration for Automotive Mechatronics
Abbrev.	BWLM
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Philipp Precht
Instructor(s)	Dr. Philipp Precht
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students - Will know and understand basic business terms and economic facts. - Will know the most important constitutive decisions a company needs to make (business model, choice of location, legal form) and are able to describe possible forms of cooperation with other companies. - Can analyze and explain the management process and can link the elements of this process (planning, decision-making, management, organization, control) with the company's objectives. - Know which essential functions interact in processes of business performance.

	- Can point out the multi-faceted relationships between the business management sub-areas and can interpret and evaluate these relations.
Contents	Introduction to Business Administration - Terms & general relationships in business administration - Development of business administration management process - Company objectives - Planning - Decision-making - Control - Organization Constitutive decisions - Business model - Location selection - Cooperation programs - Legal form The individual functional areas according to Porter's value chain - Research and development - Purchasing and materials management - Production - Marketing and sales - Logistics - Customer service - Finances - HR - IT
Requirements for successful completion	Written examination
Media	Projector, blackboard, overhead projector
Literature	Schmalen, Helmut; Pechtl, Hans: Grundlagen und Probleme der Betriebswirtschaft, 14th ed., Stuttgart, Verlag Schäffer-Poeschel 2009.

	Vahs, D.; Schäfer-Kunz, J.: Einführung in die Betriebswirtschaftslehre, 5th ed., Stuttgart (Schäffer-Poeschel) 2007. Wöhe, G.; Döring, U.: Einführung in die Allgemeine Betriebswirtschaftslehre, 24th ed., Munich (Vahlen) 2010.

Automotive Mechatronics Internship and Occupational Safety

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Automotive Mechatronics Internship and Occupational Safety
Abbrev.	AMP
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dipl.-Ing. Michael Florschütz
Instructor(s)	Dipl.-Ing. Michael Florschütz et al.
Language	German
Classification in curriculum	Compulsory elective modules AMEC and WIAM
Use in other academic programs	-
Format / SWH	Internship / 4 SWH
Work requirement	In-class program: 24 hrs. Self-directed study: 128 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to ... - Study theoretical foundations themselves. - Carry out practical experiments. - Prepare reports on the individual experiments. - Deepen / link basic theory.
Contents	Model-based application/development Engine control unit application Sensors and actuators Programming Data preparation Control engineering Vehicle aerodynamics
Requirements for successful completion	Proof of performance to accompany program

Media	-
Literature	-

Automotive Software Engineering

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Automotive Software Engineering
Abbrev.	ASE
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Ralf Reißing
Instructor(s)	Dr. Ralf Reißing
Language	German
Classification in curriculum	Compulsory module AMEC, Compulsory elective module WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lecture and exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Basics of computer science and programming from previous modules
Qualification objectives	- Naming framework conditions of software development for automobiles, e.g. applicable norms and standards, and describing their effects on development - Using processes, methods, notations and tools for the development of high-quality embedded automotive software
Contents	- Fundamentals of software engineering - Fundamentals of software development for automobiles - Core process of automotive software development, esp. engineering and management requirements, modeling, design, quality assurance, and testing

	- Selected supporting processes of automotive software development, esp. defect management as well as version and configuration management
Requirements for successful completion	Written examination
Media	Presentation, projector, blackboard, script
Literature	Schäuffele, Zurawka: Automotive Software Engineering. Vieweg und Teubner. Ludewig, Lichter: Software Engineering. dpunkt Verlag. Pohl, Rupp: Basiswissen Requirements Engineering. dpunkt Verlag. Rupp, Queins: UML 2 glasklar, Hanser Verlag. Spillner, Linz: Basiswissen Softwaretest. dpunkt Verlag.

Bachelor Thesis and Colloquium

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Bachelor Thesis and Colloquium
Abbrev.	BAC
Subtitle	-
Courses	Bachelor thesis, final colloquium presentation
Semester	7
Module coordinator	Dr. Stefan Gast
Instructor(s)	Supervising professor
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Bachelor’s thesis
Work requirement	Bachelor thesis: - In-class program: 12 hrs. - Self-directed study: 348 hrs. Colloquium: - In-class program: 6 hrs. - Self-directed study: 54 hrs.
ECTS	Bachelor thesis: 12 Colloquium: 2
Technical prerequisites	According to SPO §5 (3), scientific/academic work and presentation
Qualification objectives	Students will be able to ... Develop complex, practical tasks using scientific methods to find solutions with successful personal integration in an industrial company. Generate scientifically sound, written elaborations. Explain their own ideas and results in the face of professional criticism. Independently implement time management while working on the task.

Contents	Scientific, application-oriented paper with practical relevance on a self-contained engineering or industrial engineering topic in the field of automotive mechatronics.
Requirements for successful completion	Bachelor thesis with subsequent colloquium / presentation
Media	(Not relevant)
Literature	see Scientific/Academic Work and Presentation

Bus and Communication Systems in Automobiles

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Bus and Communication Systems in Automobiles
Abbrev.	BKA
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Peter Raab
Instructor(s)	Dr. Peter Raab
Language	German
Classification in curriculum	Compulsory module AMEC, Compulsory elective module WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH, integrated exercises (25%)
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Basics of computer science and programming (from computer science modules), electrical engineering
Qualification objectives	Students will be able to: - Name the most important bus systems in the motor vehicle. - Describe the basics of serial data communication (e.g. bus physics, bus access methods, error detection in data transmission, ...) and transfer them to bus systems in the motor vehicle. - Explain the bit transmission and the data link layer (layer 1 + 2 in the ISO layer model) of the important bus systems in the vehicle (e.g. CAN) and transfer them by example to data communication in the motor vehicle. - Observe and explain the data traffic of an existing bus communication with the help of typical SW tools.

	- Realize simple ECU simulations in relation to bus communication in a tool-based manner.
Contents	- Basics of automotive bus systems (layer model, coding, wave propagation on conductors) - CAN bus (function, coding): Physical layer, data link layer, design - LIN bus (function, coding, configuration with ldf and lcf files) - FlexRay (function, coding, configuration with FIBEX files) - Ethernet (basics, applications: diagnostics and multimedia) - Measurements on CAN bus, LIN bus, and FlexRay - Configuration of CAN bus, LIN bus, and FlexRay - Introduction to programming with CAPL
Requirements for successful completion	Written examination
Media	Presentation, projector, blackboard, script
Literature	Werner Zimmermann, Ralf Schmidgall: Bussysteme in der Fahrzeugtechnik. Protokolle und Standards. Vieweg & Teubner Verlag. Konrad Etschberger: Controller-Area-Network. Hanser Verlag. Andreas Grzemba, Hans-Christan von der Wense: LIN-Bus Franzis Verlag. Robert Bosch GmbH: Autoelektrik/Autoelektronik. Horst Engels: CAN-Bus. Franzis Verlag. Mathias Rausch: FlexRay. Grundlagen, Funktionsweise, Anwendung. Hanser Verlag. Andreas Grzemba: MOST: Das Multimedia-Bussystem für den Einsatz im Automobil. Franzis Verlag. Robert Bosch GmbH. CAN 2.0 Specification.

Business English (B2)

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Business English (B2)
Abbrev.	BE
Subtitle	-
Courses	-
Semester	4
Module coordinator	Barney Craven, M.A.
Instructor(s)	Barney Craven, M.A., Richard Fry, MCLFS
Language	English
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures, seminar and exercise / 2 SWH
Work requirement	In-class program: 22 hrs. Self-directed study: 68 hrs.
ECTS	3
Technical prerequisites	No formal prerequisites, but a plus are at least 6 years of school English enabling student to use language independently (B1 level of Common European Framework of Reference for Languages)
Qualification objectives	Expansion and improvement of individual English skills (reading, writing, listening comprehension, speaking) to the B2 level of the Common European Framework of Reference for Languages, with particular consideration of technical and professional topics From the Common European Framework of Reference for Languages (http://www.europaeischer-referenzrahmen.de/): "B2 – Independent use of language: Is able to understand the main contents of complex texts on specific and abstract topics; also understands technical discussions in own specialty

	. Is able to communicate spontaneously and fluently enough to permit normal conversations with native speakers without great effort on either side. Is able to express himself/herself clearly and in detail on a wide spectrum of topics, explain an opinion on a current question, and state the advantages and disadvantages of different possibilities.”
Contents	- Establishing and expanding basic vocabulary with business terminology and expressions using texts from different areas - Training in written expression in English by working through texts and writing professional correspondence - Training verbal expression in English through discussion - As needed, review of grammar with exercises
Requirements for successful completion	Course-related work and written examination
Media	Projector and chalk board / whiteboard, electronic scripts, and work documents language lab
Literature	Current literature will be recommended during the course.

CAx Techniques

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	CAx Techniques
Abbrev.	CAX
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dipl.-Eng. Frank Höllein
Instructor(s)	Dipl.-Eng. Frank Höllein
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with integrated exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to model components and assemblies using the CAx system "Siemens NX" and will
Contents	- Parametric associative modeling - Sketch creation - Reference elements - Part modeling (3D bodies and 2D surfaces) - Sheet metal part modeling - Extraction of drawings of components, detail elements - Bottom-up / top-down assemblies - Extraction of drawings of assemblies
Requirements for successful completion	One take-home paper
Media	CAx-workstation, beamer, script with videos in Moodle course

Literature	Sándor Vajna, Andreas Wünsch: Siemens NX für Einsteiger – kurz und bündig Maik Hanel, Michael Wiegand: Designing with NX

Dynamics and Vibration Theory I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Dynamics and Vibration Theory I
Abbrev.	DYS1
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Martin Prechtl
Instructor(s)	Dr. Martin Prechtl
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Description of motion processes in different coordinate systems Basic understanding of relative kinematics Application of the Newton's second law for point masses Formulation of energy balances for point masses Calculation of central collision processes
Contents	Foundations of kinematics: Definition of speed/velocity and acceleration, point kinematics, motion in a straight line (Cartesian coordinates), polar coordinates, natural coordinates, integration of the equations of motion, relative kinematics, kinematics of rigid bodies (fixed axis of rotation, 2D and 3D kinematics), instantaneous center of rotation

	Kinetics of point masses: Newton's laws, basic dynamic equation ("F=m · a"), free and guided point mass motion, constraint forces, resistance forces (incl. Coulomb friction), (principle of) momentum and angular momentum, collision processes, principle of work and energy, conservative forces and potential, d'Alembert's principle, dynamic force balance, systems of point masses (kinematic and physical constraints, degrees of freedom), principle of center of gravity/ angular momentum
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Prechtl, M.: Mathematische Dynamik – Modelle und analyt. Methoden der Kinematik und Kinetik. Berlin, Heidelberg: Springer Spektrum; 2015. Gross, D.; Hauger, W.; Schröder, J.; Wall, W.A.: Technische Mechanik 3 – Kinetik. Berlin, Heidelberg: Springer-Verlag; 2012. Gross, D.; Ehlers, W.; Wriggers, P.; Schröder, J.; Müller, R.: Formeln und Aufgaben zur Technischen Mechanik 3. Berlin, Heidelberg: Springer-Verlag; 2012

Dynamics and Vibration Theory II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Dynamics and Vibration Theory II
Abbrev.	DYS2
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Martin Prechtl
Instructor(s)	Dr. Martin Prechtl
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	DYS1
Qualification objectives	Formulation of kinematic relationships for multi-body systems Creation of free body diagrams for rigid bodies Calculation of multi-body systems using force and momentum equations and based on an energy balance Calculation of eccentric collision processes Modeling of simple oscillating systems and analysis of properties of motion
Contents	Kinetics of systems of point masses: Degrees of freedom, kinematic relationships, principle of center of gravity/ angular momentum, principle of work and energy, d'Alembert's principle Rigid body kinetics in the plane:

	Rotation about a fixed axis, axial mass moment of inertia, Steiner's theorem, rotational energy, reduced mass moment of inertia, rotational collisions, plane rigid body motion, principle of center of gravity and angular momentum, principle of work and energy, rolling/ adhesion, rolling friction, d'Alembert's principle, principle of momentum and angular momentum, eccentric collisions, center of collision Harmonic oscillations: State variable, period/ oscillation duration, (circular) frequency, amplitude, phase diagram, complex representation, free oscillations of conservative systems, damped natural angular frequency, damping proportional to speed (viscous), Lehr's damping factor, harmonic excitation (via spring / damper and/or due to a rotating imbalance), solution of corresponding oscillation differential equations, dimensionless time, magnification function / amplitude frequency response, resonance effect
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Prechtl, M.: Mathematische Dynamik – Modelle und analyt. Methoden der Kinematik und Kinetik. Berlin, Heidelberg: Springer Spektrum; 2015. Gross, D.; Hauger, W.; Schröder, J.; Wall, W.A.: Technische Mechanik 3 – Kinetik. Berlin, Heidelberg: Springer-Verlag; 2012. Gross, D.; Ehlers, W.; Wriggers, P.; Schröder, J.; Müller, R.: Formeln und Aufgaben zur Technischen Mechanik 3. Berlin, Heidelberg: Springer-Verlag; 2012.

Introduction to Transport Policy

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Introduction to Transport Policy
Abbrev.	VP
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Mathias Wilde
Instructor(s)	Dr. Mathias Wilde
Language	German
Classification in curriculum	Compulsory elective modules AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will receive an introduction to the subject area of transport policy along the three dimensions of the concept of politics: form (polity), content (policy), and process (politics). Knowledge of the political decision-making process, policy instruments, and legal regulations are conveyed. Students will get an overview of the players in transport policy in Germany, government institutions, and stakeholders. The possibilities and limits of the power to shape transport policy are taught and the development paths of future transport policy are shown. Students will become familiar with economic, social and ecological guiding principles, and will learn to evaluate social power and dominance relationships. In this way,

	students will learn to recognize the interrelationships of transport policy decisions across the various political levels, to classify conflicts of interest, and to identify the possibilities of influencing transport policy as well as instruments of control.
Contents	- Goals and instruments of transport policy - Players/stakeholders in transport policy - Decision-making levels - Transport policy in the federal states and municipalities - Transport policy in Germany between market regulation, services of general interest, and competition - European transport policy, goals, and basics - Regulation of transport markets - Liberalization of transport markets - Transport infrastructure planning and investment as a core public task - Transport services in public and private ownership
Requirements for successful completion	Portfolio (seminar paper 70% and presentation 30%)
Media	Projector, blackboard, overhead projector
Literature	Schwedes, Oliver (publ.) (2011): Verkehrspolitik. Eine interdisziplinäre Einführung. 1st ed. Wiesbaden: VS Verl. für Sozialwiss (Perspektiven der Gesellschaft). Schwedes, Oliver; Canzler, Weert; Knie, Andreas (publ.) (2016): Handbuch Verkehrspolitik. 2nd ed. Wiesbaden: VS Verlag für Sozialwissenschaften. Wilde, Matthias; Gather, Matthias; Neiberger, Cordula (2017): Verkehr und Mobilität zwischen Alltagspraxis und Planungstheorie. Ökologische und soziale Perspektiven. Wiesbaden: Springer VS (Studien zur Mobilitäts- und Verkehrsforschung). Wilde, Mathias (2015): Die Re-Organisation der Verkehrssysteme. Warum sich die städtische Verkehrsplanung zu einer Mobilitätsplanung weiterentwickeln sollte. In: Standort 39 (1)

	Wilde, Mathias; Klinger, Thomas (2017): Städte für Menschen. Transformationen urbaner Mobilität. In: Aus Politik und Zeitgeschichte (48), pp. 32–38.

HOCHSCHULE COBURG

Electric Drives and Power Electronics in Motor Vehicles

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Electric Drives and Power Electronics in Motor Vehicles
Abbrev.	EAL
Subtitle	
Courses	
Semester	6
Module coordinator	Dr. Omid Forati Kashani
Instructor(s)	Dr. Omid Forati Kashani
Language	German
Classification in curriculum	Compulsory elective module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture 3 SWH / lab exercises 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Electrical Engineering, Electronics
Qualification objectives	Students will learn about the mode of operation and various characteristics of electrical machines for traction drives. They will become familiar with the basics of power electronics and power converter technology for traction drives in a motor vehicle and know the requirements for the machine and the converter. They will know the basics about the heating up of electrical machines and power converters.
Contents	- Electric machines for drives in theory and practice: Mode of operation and characteristic curves of the electrical machines (ASM, PSM, FSM), special requirements for machines for traction drives in vehicles and the measures and procedures for setting the speed or torque of the above-mentioned machines. - Basics of (power) electronics (MOSFET, IGBT, thyristors)

	- Power electronics for traction drives in vehicles in theory and practice: The set-up and function of power converters for three-phase drives, control of power converters for three-phase drives, the set-up and operation of chop controllers (DC-DC converters), control of DC-DC converters, special requirements for power converters for traction drives in vehicles and the measures. - Heat dissipation of electric drives
Requirements for successful completion	Written examination
Media	Blackboard, projector (visualizer)
Literature	- Helmut Späth, Elektrische Maschinen und Stromrichter, Verlag Braun Karlsruhe - Rolf Fischer, Elektrische Maschinen, Karl Hanser Verlag Munich - Dirk Schröder, Elektrische Antriebe-Grundlagen, Springer Verlag - Joachim Specovius, Grundkurs Leistungselektronik, Springer Verlag

Electrical Engineering

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Electrical Engineering
Abbrev.	EMAB
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Matthäus Brela
Instructor(s)	Dr. Matthäus Brela
Language	German
Classification in curriculum	Compulsory elective modules AMEC and WIAM
Use in other academic programs	Bachelor in "Automation Technology and Robotics" / Bachelor in "Electrical Engineering and Information Technology" / Bachelor in "Power Engineering and
Format / SWH	Seminar-type lectures / 2 SWH, excursion / 1 SWH, seminar paper / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Basic knowledge of electrical drive technology
Qualification objectives	Students will be able to... • Understand the operation and structure of electrical machines. • Name and evaluate the steps involved in the manufacture of electrical machines. • Reproduce the manufacturing processes necessary for production. • Analyze, evaluate and develop the manufacturing chain of electrical machines holistically.
Contents	• Typical applications / fields of application of electrical machinery manufacturing

	• Electromagnetic and mechanical fundamentals of electrical machines • Basic motor topologies • Components of the drive train • Manufacturing processes for electrical steel strip, electrical single sheet and sheet stack as well as production-related influencing factors • Fundamentals of loss effects and numerical analysis methods • Production of hard magnetic materials as well as quality assurance and failure analysis • Magnetization and magnet assembly • Winding technology, impregnation, and insulation • Manufacturing of power electronics • Assembly processes and testing technology for quality assurance at the end of the value chain • Electromagnetic actuators, their manufacturing processes, and quality assurance • Recycling of electrical machines and their components • Traceability and I4.0 in electrical engineering • Basics of contactless power transmission and inductive charging systems • Additive manufacturing in electrical engineering • Superconductor electric motors and transfer systems
Requirements for successful completion	Written exam 60 min. and seminar paper (weighting 3:1)
Media	Projector and blackboard/whiteboard, simulation programs, electronic scripts and working documents, practical exercises.
Literature	Elektrische Servoantriebe, Manfred Schulze, 2008, ISBN 978-3-446-41459-4 Elektrische Antriebssysteme, Ulrich Riefenstahl, 2nd ed., 2006, ISBN 3-8351-0029-7 Elektrische Maschinen, Hans-Ulrich Giersch, 2003, ISBN 3-519-46821-2

Electronics

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Electronics
Abbrev.	ELEK
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Peter Raab
Instructor(s)	Dr. Peter Raab Yannick Pfister (B.Eng.)
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture / 3 SWH, internship / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Electrical engineering 1 and 2
Qualification objectives	Students will learn about applications from the field of electronics / digital technology in the automotive sector. Students will be able to... - Name electronic components and explain their function. - Explain basic electronic circuits (e.g. transistor circuits) and their applications. - Dimension basic electronic circuits. - Recognize electronic circuits in automobiles and adapt them to the requirements of automotive engineering. - Understand and explain the function and structure of simple digital circuits.

	- Carry out measurements with typical measuring instruments in electronics.
Contents	Part 1: Electronic components 1. Basics of semiconductor electronics (conduction mechanisms, pn-junction, metal-semiconductor junction, MOS capacitor) 2. Semiconductor diodes 3. Bipolar transistors 4. Field effect transistors 5. Components of power electronics part 2: Circuitry (analog) 6. Basic circuits of transistors 7. Circuit design 8. Operational amplifier 9. Analog-to-digital and digital-to-analog converters 10. Power supply Part 3: Digital technology (optional) 11. Boolean (switching) algebra 12. Circuit families 13. Digital circuit technology 14. Sequential logic 15. Memory technologies
Requirements for successful completion	Written examination and practical proof of performance
Media	Lecture, beamer, blackboard
Literature	Reisch, Michael: Halbleiter-Bauelemente. Springer-Verlag, 2007. E. Hering, K. Bressler, J. Gutekunst: Elektronik für Ingenieure und Naturwissenschaftler. Springer-Verlag, 2014. Tietze / Schenk / Gamm: Halbleiter-Schaltungstechnik. Springer-Verlag, 2012.

Electrical Engineering I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Electrical Engineering I
Abbrev.	ET1
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 3 SWH, exercise and internship / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to ... Interpret DC networks. Evaluate the effect of passive components (resistor, capacitor, coil) in DC networks. Relate the effect of DC electrical networks in motor vehicles. Explain the effect of magnetic circuits. Relate applications of magnetic circuits in motor vehicles.
Contents	Current, voltage and power in DC electrical circuits, parallel and series connections of resistors, effect of passive components (resistors, capacitors, inductors) in DC circuits, switching on and off processes in DC circuits, electromagnetism, induction processes
Requirements for successful completion	Written examination

Media	Projector, blackboard
Literature	Wolfgang Böge (publ.), Wilfried Plaßmann (publ.): Handbuch Elektrotechnik - Grundlagen und Anwendungen für Elektrotechniker. Vieweg & Sohn Verlag Wiesbaden 2007. Wilfried Weißgerber: Elektrotechnik für Ingenieure 1. Vieweg+Teubner, Wiesbaden 2009. Martin Vömel, Dieter Zastrow: Aufgabensammlung Elektrotechnik 1: Gleichstrom, Netzwerke und elektrisches Feld. Vieweg Verlag Wiesbaden, 2009. Martin Vömel, Dieter Zastrow: Aufgabensammlung Elektrotechnik 2: Magnetisches Feld und Wechselstrom. Vieweg Verlag Wiesbaden, 2009.

Electrical Engineering II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Electrical Engineering II
Abbrev.	ET2
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 3 SWH, exercise and internship / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to ... Evaluate AC networks in terms of their effect on apparent, active, and reactive power. Evaluate the effect of passive components (resistor, capacitor, coil) in AC networks using pointer diagrams. Evaluate the effect of passive components (resistor, capacitor, coil) in AC networks using complex numbers. Explain the operation of electrical machines (synchronous machine, asynchronous machine).
Contents	Sinusoidal signals in the time domain, characterization of oscillations using imaginary numbers, electrical components (resistors, inductors, capacitors) in AC circuits,

	reactive and active resistances, reactive and active powers, and analysis of AC circuits with passive components
Requirements for successful completion	Written examination
Media	Projector, blackboard
Literature	Wolfgang Böge (publ.), Wilfried Plaßmann (publ.): Handbuch Elektrotechnik - Grundlagen und Anwendungen für Elektrotechniker. Vieweg & Sohn Verlag Wiesbaden 2007. Wilfried Weißgerber: Elektrotechnik für Ingenieure 1. Vieweg+Teubner, Wiesbaden 2009. Martin Vömel, Dieter Zastrow: Aufgabensammlung Elektrotechnik 1: Gleichstrom, Netzwerke und elektrisches Feld. Vieweg Verlag Wiesbaden, 2009. Martin Vömel, Dieter Zastrow: Aufgabensammlung Elektrotechnik 2: Magnetisches Feld und Wechselstrom. Vieweg Verlag Wiesbaden, 2009.

Production Technology

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Production Technology
Abbrev.	FT
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Oliver Koch
Instructor(s)	Dr. Oliver Koch
Language	German
Classification in curriculum	Compulsory module WIAM, Compulsory elective module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Basic knowledge in metallic materials
Qualification objectives	- Familiarization with manufacturing processes for machining metallic materials. - Ability to select suitable manufacturing processes depending on defined boundary conditions.
Contents	- Principles of chipping, wear - Cutting materials and cooling lubricants - Tool monitoring - Lathing - Milling - Drilling - Sanding - Honing, lapping

	- Sintering - Foundations forming technology - Rolling - Continuous and discontinuous extrusion - Smithing - Deep-drawing - Bending - Splitting, punching - Ablation - Welding - Soldering, gluing
Requirements for successful completion	Written examination
Media	Projector and chalk board Scripts and work documents
Literature	Scheipers: Handbuch der Metallbearbeitung, Europa Lehrmittel 2002. Fritz, Schulze: Fertigungstechnik, Springer Verlag 2001. König, Klocke: Fertigungsverfahren Vol. 1 to 5, VDI-Verlag 2008.

Advanced Dynamics / Machine Dynamics

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Advanced Dynamics / Machine Dynamics
Abbrev.	HDY
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Martin Prechtl
Instructor(s)	Dr. Martin Prechtl
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering Mathematics I and II, Statics and Strength of Materials, Dynamics and Vibration I and II
Qualification objectives	Prediction of a drive on the basis of the basic methods of dynamics Application of the principle of virtual work as well as Lagrangian equations of 1st and 2nd kind for the determination of equations of motion Basic understanding of the properties of the motion of spinning tops Calculation of dynamic bearing reactions and the required masses for balancing components Mathematical description and analysis of coupled oscillators Calculation of bending natural frequencies and critical speeds

	Basic understanding of mathematical modeling of continuum oscillations
Contents	Mathematical methods: d'Alembert's principle according to Lagrange, virtual work, Lagrangian equations of 1st and 2nd kind, generalized coordinates and forces, constraints Spatial rigid body kinetics: principle of center of gravity or principle of moments, principle of work and energy, angular momentum, inertia tensor / matrix, Steiner-Huygens theorem, principal axis system, Euler derivation, Euler's equations, motion of force-free and non-force-free, symmetrical tops, gyroscopic movement, self-centering effect, dynamic bearing reactions, structural analysis and dynamic balancing Advanced vibration theory: systems with several degrees of freedom (DE system), damped natural angular frequency, harmonic excitation, frequency response and vibration damping, bending vibrations (massless beams with attached point masses), influence coefficient and Castigliano's theorem, critical revolution speeds, and bending vibrations of continua
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Prechtl, M.: Mathematische Dynamik – Modelle und analyt. Methoden der Kinematik und Kinetik. Berlin, Heidelberg: Springer Spektrum; 2015. Gross, D.; Hauger, W.; Schröder, J.; Wall, W.A.: Engineering Mechanics 3 - Kinetics. Berlin, Heidelberg: Springer-Verlag; 2012. Gross, D.; Ehlers, W.; Wriggers, P.; Schröder, J.; Müller, R.: Formeln und Aufgaben zur Technischen Mechanik 3. Berlin, Heidelberg: Springer-Verlag; 2012.

Industry Internship

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Industry Internship
Abbrev.	IP
Subtitle	-
Courses	-
Semester	5
Module coordinator	Dr. Michael Steber
Instructor(s)	Dr. Michael Steber
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Required practical course in industrial operations
Work requirement	22 weeks (4 days) or 20 weeks (5 days if more than 100 km distance from Coburg)
ECTS	25
Technical prerequisites	Advancement authorization to 3rd semester pursuant to SPO (§5 Para. 2) and successful completion and recognition of the basic internship pursuant to SPO (§7 Para. 1 and 2)
Qualification objectives	Engineering collaboration in operational processes and/or projects
Contents	- Development, design, project planning - Manufacturing, production preparation and control - Assembly, operation, maintenance - Testing, production control - Application engineering (technical consulting), sales
Requirements for successful completion	Practical report (approx. 30 pages) Examination performance is the prerequisite for recognition of the required semester-long internship.
Media	Projector, blackboard

Literature	Coburg University of Applied Sciences, Department of Mechanical Engineering and Automotive Technology (2012): Information sheet on the required internship in the bachelor's degree program in Automotive Engineering and Management at Coburg University of Applied Sciences. Coburg.

HOCHSCHULE COBURG

Computer Science for Mechatronics Engineers I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Computer Science for Mechatronics Engineers I
Abbrev.	INM1
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Ralf Reißing
Instructor(s)	Dr. Ralf Reißing
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 2 SWH, programming exercises / 2 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	- Interpreting and calculating number and symbol presentations in computers - Describing basic concepts of programming languages - Analyzing and representing algorithms in different forms - Analyzing and programming simple C programs
Contents	History and foundations of information technology Representation of numbers and symbols in computers Algorithms, representation of algorithms, sample algorithms Basic constructs of the C programming language
Requirements for successful completion	Written examination
Media	Presentation, projector, blackboard, computer exercises
Literature	Ernst: Grundkurs Informatik. Vieweg und Teubner.

	Herold, Lurz, Wohlrabe: Grundlagen der Informatik. Pearson.

HOCHSCHULE COBURG

Computer Science for Mechatronics Engineers II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Computer Science for Mechatronics Engineers II
Abbrev.	INM2
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Ralf Reißing
Instructor(s)	Dr. Ralf Reißing Dipl.-Ing. Andreas-Michael Geißler
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 2 SWH, programming exercises / 2 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Computer Science for Mechatronics Engineers I
Qualification objectives	- Applying advanced algorithm concepts - Using advanced concepts of the C programming language - Analyzing and programming complex C programs - Solving technical problems with C - Perform independent software project in a team
Contents	Algorithm analysis Design methods for algorithms More complex examples for algorithms Advanced concepts in C Quality aspects of design and implementation Practical training in software development in a team
Requirements for successful completion	Written examination

Media	Presentation, projector, blackboard, computer exercises
Literature	-

Automotive Engineering I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Automotive Engineering I
Abbrev.	KT1
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Markus Jakob
Instructor(s)	Dr. Markus Jakob
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to correctly describe components and subsystems of road vehicles in terms of concept and function, and can assess them correctly in terms of the overall vehicle system.
Contents	Vehicle types; four-stroke Otto engine, four-stroke diesel engine; fuels; power transfer: drive types, clutch, manual transmission, automatic transmission, wheel drive; Chassis: axle geometry, steering, suspension, vibration damping; current trends in
Requirements for successful completion	Written examination
Media	Projector
Literature	Gerigk, Bruhn e.a.: Kraftfahrzeugtechnik (westermann). Lecture manuscripts (of external) speakers

HOCHSCHULE COBURG

Automotive Engineering II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Automotive Engineering II
Abbrev.	KT2
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Markus Jakob
Instructor(s)	Dr. Markus Jakob
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to correctly describe components and subsystems of road vehicles in terms of concept and function, and will be able to assess them correctly in terms of the overall vehicle system.
Contents	Chassis: wheel suspension, tires and wheels; Brakes: basics, hydraulic brake system, vehicle dynamics control systems; vehicle body; electrical system, electronic systems; new drive concepts; current development trends
Requirements for successful completion	Written examination
Media	Projector
Literature	Gerigk, Bruhn e.a.: Kraftfahrzeugtechnik (westermann). Lecture manuscripts (of external) speakers

HOCHSCHULE COBURG

Construction and Machine Elements

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Construction and Machine Elements
Abbrev.	KM
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Kai Hiltmann
Instructor(s)	Dr. Kai Hiltmann
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 2 SWH, exercise / 2 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Representing a simple geometry in a hand sketch Reading and interpreting a technical drawing Recognizing individual parts from overall drawings or models Assigning the most important machine elements such as screws, welded, soldered, and glued connections, springs, dampers, axles and shafts, bearings and important types of gears to an application situation Designing simple construction elements to given loads
Contents	Technical communication: sketching, drawing, model, diagram, table. Freehand sketching. Standardized representation, drawing, and dimensioning. Drawing sets; surfaces and

	Qualitative overview of important machine elements and types of gears.
Requirements for successful completion	Exam 90 min with multiple-choice section
Media	Presentation, projector, blackboard, script
Literature	Labisch, S. and Weber, C.: Technisches Zeichnen, Wiesbaden : Vieweg , 3rd ed. 2009: Viewegs Fachbücher der Technik . -- ISBN 978-3-8348-0312-2. Schmid, D.: Konstruktionslehre Maschinenbau, Haan-Gruiten : Verl. Europa-Lehrmittel Nourney, Vollmer , 1st ed. 2009 . -- ISBN 978-3-8085-1400-9. Decker, K.-H. und Kabus, K.: Maschinenelemente, Munich: Hanser, 18th ed. 2011 . -- ISBN 978-3-446-42608-5. Wittel, H.; Roloff, H. und Matek, W.: Maschinenelemente, Wiesbaden : Vieweg + Teubner , 20th ed. 2011 . -- ISBN 978-3-8348-1454-8.

Fuel Analysis and Exhaust Gas Measurement Technology

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Fuel Analysis and Exhaust Gas Measurement Technology
Abbrev.	KAA
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Markus Jakob
Instructor(s)	Dr. Thomas Garbe Dr. Markus Jakob Dr. Olaf Schröder
Language	German, English
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Engineering Physics"
Format / SWH	Seminar-type lectures / 2 SWH, internship block / 2 SWH
Work requirement	In-class program: 60 hrs. Self-directed study: 90 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Part 1 (Fuels): Students will be able to identify and analyze the physical, chemical, and analytical problems of fuel and engine oil interactions, and can evaluate them in terms of engine and exhaust effects. Part 2 (Emissions): Students will be able to understand engine combustion (technical aspect), the formation of pollutants (chemical aspect), and their analytical measurement techniques (analytical aspect). In addition, the

	chemical functions of exhaust gas after-treatment are explained and the analytical instruments for the determination of the limited and non-limited exhaust gas components are clarified.
Contents	Part 1 (Fuels): Fluid analysis; introduction to fuel and oil chemistry, fossil and biogenic components, chemical reactions and their effects on physical and engineering applications. Aging studies. Practical training: Chemical analyses using UV-Vis, FTIR, GC-FID, GC- MS, HPLC, ASS, ICP-MS, GPC-MS, ZLIF, NIR, dielectric spectroscopy, and standard fuel analysis Part 2 (Emission Focus): Gas analysis; introduction to combustion chemistry and presentation of policy framework. Engine fundamentals; fuel as an engine design element. Exhaust gas sampling and chemical measurement techniques, particle counting, impact studies. Practical training: Engine testing, determination of HC, NOx, CO, PM, particle count, NH3, PAH, summer smog formers, aldehydes. Investigation of load dependency in pollutant formation.
Requirements for successful completion	Colloquium à 60min (2 participants each)
Media	Common presentation techniques; exercise and test material on the intranet
Literature	Handbuch Dieselmotoren (Springer- Verlag) The Biodiesel Handbook (AOCS Press) Literatur der Fuels Joint Research Group (Cuviller Verlag Göttingen) Publications of the Working Group Fuel Standards DIN EN590, DIN EN 15940, DIN EN 228 (DIN FAM); Handbuch Verbrennungsmotor (Springer- Verlag)

Mechatronics in the Power Train

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Mechatronics in the Power Train
Abbrev.	MEA
Subtitle	-
Courses	-
Semester	7
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory elective module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures with integrated exercise / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Introduction to Automotive Engineering 1 and 2
Qualification objectives	Students will be able to ... Recognize longitudinal dynamic problems from automotive engineering. Implement models of the automotive powertrain as a basis for the simulation of mechatronic powertrain functions. Develop mechatronic powertrain functions (cruise control, transmission automation, ...). Verify the quality of the developed powertrain function by
Contents	Basics of the powertrain in vehicles, longitudinal dynamic modeling and powertrain simulation with Matlab / Simulink, powertrain manager functions, powertrain as Torion oscillation system, mechatronic components and functions in the powertrain (engine controls, transmission control, ...), selected control functions in the

	powertrain (clutch control, optimum gear selection, cruise control, ...)
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Naunheimer, Bertsche, Lechner: Fahrzeuggetriebe. Springer, 2007 Winner, H.; Hakuli, S.; Wolf, G.: Handbuch Fahrerassistenzsysteme. Vieweg, 2009

Methods of Experimental Methodology

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Methods of Experimental Methodology
Abbrev.	MVD
Subtitle	-
Courses	-
Semester	7
Module coordinator	Dr. Thomas Garbe
Instructor(s)	Dr. Thomas Garbe
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Academic programs of the AN department
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	After successful completion, students will be familiar with: - The theoretical background on conducting experiments in science and industry - Flowcharts for performing experiments - Selected tools for planning and conducting experiments - Examples of real experimental projects with different objectives
Contents	The lecture contents include - The classification of experiments in the methodology of knowledge acquisition - Theoretical and application-related backgrounds for the execution of experiments

	- Details of a test procedure during the planning, execution, and evaluation phases - Selected tools for carrying out experiments such as statistical test planning, use of test rigs, and test cycles - The application of standardized methods - The transfer of test results into real applications
Requirements for successful completion	Written examination
Media	Projector, blackboard, PC, crafts materials
Literature	

Microcontrollers and Embedded Systems

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Microcontrollers and Embedded Systems
Abbrev.	MES
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Peter Raab
Instructor(s)	Dr. Peter Raab Yannick Pfister (B.Eng.)
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture / 2 SWH; internship parallel to lectures / 2 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Computer Science for Mechatronics Engineers I and II
Qualification objectives	At the end of the semester, students will be able to: - Describe the structure and operation of microprocessors/microcontrollers. - Program microcontrollers used for automotive applications. - Name important peripheral units of microcontrollers and use them in embedded systems. - Describe and evaluate the real-time requirement of automotive ECUs. - Configure a real-time operating system (OSEK) used for automotive applications.
Contents	- Overview of microprocessor architectures

	- Structure, function, and programming of a microcontroller used in automotive applications and important peripheral units (interrupt controller, timer, ADC, ...) - Development tools (assembler, compiler, linker, debugger) for embedded SW development - Basics of real-time operating systems (multitasking, scheduler, scheduling algorithms, synchronization and communication mechanisms) - Services and configuration of an automotive real-time operating system (introduction to OSEK)
Requirements for successful completion	Written examination
Media	Presentation, projector, blackboard, script
Literature	Beierlein, Hagenbruch: Taschenbuch Mikroprozessortechnik, Hanser. Bollow, Homann, Köhn: C und C++ für Embedded Systems, mitp. Brinkschulte, Ungerer: Mikrocontroller und Mikroprozessoren, Springer. Buzatto: Hard Real-Time Computing Systems. Springer. Hanser. Homann: OSEK: Betriebssystemstandard für Automotive und Embedded. mitp. Liu: Real-Time-Systems. Prentice Hall. Schmitt: Mikrocomputertechnik mit Controllern der Atmel AVR-RISC-Familie, Oldenbourg. Joseph Yiu: The definitive Guide to ARM Cortex-M3 and Cortex-M4 Processors, Elsevier 2014 Streichert, Traub: Elektrik/Elektronik Architekturen im Kraftfahrzeug - Modellierung und Bewertung von Echtzeitsystemen, Springer. Wörn, Brinkschulte: Echtzeitsysteme. Zöbel: Echtzeitsysteme - Grundlagen der Planung, Springer.

Modelling of Mechatronic Systems

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Modelling of Mechatronic Systems
Abbrev.	MMS
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture, exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering mathematics, engineering mechanics, electrical engineering, control engineering 1
Qualification objectives	This course will enable students to: Describe dynamic systems. Contrast constraints and derive degrees of freedom. Apply modeling approaches and classify appropriate modeling approaches.
Contents	Modeling: Basic definitions, mathematical models, state space representation. Mechanics: Constraints, generalized coordinates, principle of virtual work, principle of D'Alembert, Lagrange equations. Modeling for simple coupled electromagnetic-mechanical systems.

	Moving reference frames.
Requirements for successful completion	Written examination
Media	Projector, blackboard
Literature	Bode, H., "Matlab-Simulink, Analyse und Simulation dynamischer Systeme", Teubner Verlag. Janschek, K., "Systementwurf mechatronischer Systeme. Methoden – Modelle – Konzepte", Springer. Kuypers, F., "Klassische Mechanik", Wiley-VCH Verlag 2010. Nollau, R., "Modellierung und Simulation technischer Systeme. Eine praxisnahe Einführung", Springer. Roddeck, W., "Einführung in die Mechatronik". Vieweg und Teubner. Scherf, Helmut E., "Modellbildung und Simulation dynamischer Systeme", Oldenbourg Wissenschaftsverlag, 2007.

Automotive Mechatronics Project

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Automotive Mechatronics Project
Abbrev.	PAM
Subtitle	-
Courses	-
Semester	6 or 7
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Take-home assignment
Work requirement	In-class program: 30 hrs. Self-directed study: 120 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to ... Plan an independent solution for a technical and / or industrial engineering specific task from the field of automotive mechatronics - also in a team - while taking into account time management. Implement the time management independently in the project. Undertake independent familiarization of the task and independently develop a solution for the task. Generate documentation according to engineering standards.
Contents	Familiarization with a task from the field of automotive mechatronics, independent solution finding, independent time management, documentation as a final report as defined in

	the module "Scientific/academic work and presentation".
Requirements for successful completion	Final report
Media	(Not relevant)
Literature	Assignment-specific

Project Formula Student

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Project Formula Student
Abbrev.	PFS
Subtitle	-
Courses	-
Semester	6 or 7
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Take-home assignment
Work requirement	In-class program: 30 hrs. Self-directed study: 120 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to ... Develop independent solutions in coordination with the Formula Student Team of Coburg University (CAT Racing) for a technical / business engineering-specific assignment from the area of Formula Student. Organize the necessary training. Independently plan time management while taking overriding constraints for the assignment into consideration.
Contents	Studying a task from the area of Formula Student, independent solution development, independent time management, each under consideration of overriding constraints due to the requirements of the team

	. Documentation as final report as defined in the module "Scientific/academic work and presentation".
Requirements for successful completion	Final report
Media	(Not relevant)
Literature	Assignment-specific

Project Management of Mechatronic Vehicle Systems I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Project Management of Mechatronic Vehicle Systems I
Abbrev.	PMA1
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Alexander Rost
Instructor(s)	Dr. Alexander Rost
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 1 SWH, exercise / 1 SWH
Work requirement	In-class program: 22.5 hrs. Self-directed study: 52.5 hrs.
ECTS	5 (PMA1 and PMA2)
Technical prerequisites	-
Qualification objectives	Students will know what fundamental project management methods there are and how to apply them. Students will learn how to consistently plan and work on their project as a process in a team. Students will be able to develop project visions and goals. Students will improve their collaboration abilities and work techniques. The "social skills" of the students will be improved.
Contents	Role understanding From idea to clarified assignment Project influences Highlighting the benefits of the project

	Project collaboration Vision and goals Procedure and milestones Overview of all Pj tasks Project phases Process and time planning Presentation techniques Voice training
Requirements for successful completion	Written examination according to PMA 2
Media	Script, projector, blackboard, overhead projector, audio and video presentations
Literature	The lecturer provides a script in the form of checklists and questions.

Project Management of Mechatronic Vehicle Systems II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Project Management of Mechatronic Vehicle Systems II
Abbrev.	PMA2
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Alexander Rost
Instructor(s)	Dr. Alexander Rost
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with integrated exercise / 2 SWH
Work requirement	In-class program: 22.5 hrs. Self-directed study: 52.5 hrs.
ECTS	5 (PMA1 and PMA2)
Technical prerequisites	-
Qualification objectives	Students will know what fundamental project management methods there are and how to apply them. Students will learn how to consistently plan and work on their project as a process in a team. Students will improve their collaboration abilities and work techniques. The "social skills" of the students will be improved. Students be able to independently present issues e.g. in a milestone meeting. They will be able to independently evaluate and reflect on the results of their work.
Contents	Stakeholder analysis

	Cost and resource planning Managing risks Agile project management
Requirements for successful completion	Written examination
Media	Projector, blackboard, overhead projector
Literature	Burghardt (2008): Project management Cleland / King (1997): Project Management Handbook GPM, Gessler (2009): Kompetenzbasiertes Projektmanagement (PM3) PM Guide 2.0, IAPM, https://www.iapm.net/de/zertifizierung/zertifizierungsgrundlagen/pm-guide-2-0 Kerzner (2003): Project management Litke (2005): Projektmanagement - Handbuch für die Praxis Patzak / Rattay (2004): Project management RKW / GPM (2003) (publ.): Projektmanagement Fachmann Schelle / Ottmann / Pfeiffer (2008): ProjektManager Schelle et.al. (Publ.): Projekte erfolgreich managen (collection of sheets)

Quality Management

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Quality Management
Abbrev.	QM
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Oliver Koch
Instructor(s)	Dr. Oliver Koch
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	- Understanding the need for and objectives of quality management - Getting acquainted with the standards and definitions - Understanding the structure of quality management systems and organization - Knowing the tools of quality management in the product development process, in production, and in product use - Ability to select suitable quality management tools and to apply them in principle
Contents	- Historical development - Standardization and definition - Organization of QM systems

	- Methods of quality management in the product development process (QFD, FTA, FMEA, DRBFM) - Methods of quality management in production (process and measurement capability, SPC, supplier management) - Quality management in product use (8D systematics, documentation) - Operational improvement programs (Kaizen lean production and Six Sigma methodology)
Requirements for successful completion	Written examination
Media	Lecture, projector, blackboard, script/textbook
Literature	Schmitt, Pfeifer: "Qualitätsmanagement".

Control Technology I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Control Technology I
Abbrev.	RT1
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture, exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering Mathematics I and II
Qualification objectives	This course will enable students to: Represent elementary control circuit structures, calculate system responses, and create transfer functions. Analyze and classify single-loop control circuit structures and synthesize simple controllers.
Contents	Goals and basic concepts of control technology, Laplace transformation, transfer function, block diagram algebra, control loop structure, root locus curve.
Requirements for successful completion	Written examination
Media	Visualizer, projector, chalk board, laptop (Matlab / Simulink)
Literature	Föllinger, Otto, "Regelungstechnik“, Hüthig-Verlag. Lunze, Jan, "Regelungstechnik 1", Springerverlag.

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	Schulz, Gerd: Regelungstechnik 1 – Lineare und nichtlineare Regelung. Oldenbourg, 2010.

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Control Technology II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Control Technology II
Abbrev.	RT2
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lecture, exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Control Technology I, Engineering Mathematics I - III
Qualification objectives	This course will enable students to: Represent multi-loop control loop structures and calculate system responses. Establish transfer functions of multi-loop control structures. Analyze and classify multi-loop control structures. Classify synthesis approaches and synthesize controllers.
Contents	Design of more complex control loops, quality criteria, frequency characteristics, cascade control, feed-forward control, multivariable systems in the frequency domain, introduction to state control
Requirements for successful completion	Written examination
Media	Visualizer, projector, chalk board, laptop (Matlab / Simulink)
Literature	Föllinger, Otto, "Regelungstechnik“, Hüthig-Verlag.

	Lunze, Jan, "Regelungstechnik 1", Springerverlag. Schulz, Gerd: Regelungstechnik 1 – Lineare und nichtlineare Regelung. Oldenbourg, 2010.

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Sensor Systems and Actuators in Vehicles

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Sensor Systems and Actuators in Vehicles
Abbrev.	SAK
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Stefan Gast
Instructor(s)	Dr. Stefan Gast
Language	German
Classification in curriculum	Compulsory module AMEC, Compulsory elective module WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 3 SWH, exercise / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Electrical Engineering I, Electrical Engineering for business information systems specialists
Qualification objectives	Students will be able to ... Recognize resistive, capacitive, and inductive operating principles and assign these operating principles to common automotive sensors. Apply methods of sensor signal processing (amplification, filtering, FFT) and recognize the role of sensor technology in motor vehicle-specific higher-level applications (e.g. driver
Contents	Function of sensors and actuators in mechatronic automotive systems; signal processing and signal conditioning; signal shapes, characteristics, physical principles of action; conversion of sensors and actuators; resistive, inductive, galvanic and capacitive sensor technologies; and their application in motor vehicles, electromechanical actuators.

Requirements for successful completion	Written examination
Media	Projector, blackboard, lab applications
Literature	Reif, Konrad: Automobilelektronik. Vieweg + Teubner, Wiesbaden 2009. Bosch (publ.): Autoelektrik, Autoelektronik. Vieweg + Teubner, Wiesbaden 2008. Kai Borgeest: Elektronik in der Fahrzeugtechnik. Vieweg + Teubner, Wiesbaden 2010.

Simulation of Mechatronic Systems

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Simulation of Mechatronic Systems
Abbrev.	SMS
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Seminar-type lecture, exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering Mathematics I - III, Control Technology, Engineering Mechanics
Qualification objectives	This course will enable students to: Derive different representations of dynamic models and implement models of dynamic systems on a simulation platform. Perform simulations. Present numerical solution methods.
Contents	Introduction of the concepts of dynamic system and state space and the principles of simulation of dynamic systems Representation of signal flow based system models in Matlab-Simulink Discontinuous system behavior - reinitialization Fundamentals of state machines and StateFlow Fundamentals of numerical solution of differential equations

	Explicit and implicit methods One-step method (Runge-Kutta), stability
Requirements for successful completion	Written examination
Media	Visualizer, projector, laptop, computer center for exercises
Literature	Beater, P. "Control Technology und Simulationstechnik mit Scilab und Modelica", Books on Demand GmbH, 2010. Hermann, M., "Numerik gewöhnlicher Differentialgleichungen", Oldenbourg Verlag 2004. Scherf, Helmut E., "Modellbildung und Simulation dynamischer Systeme", Oldenbourg Wissenschaftsverlag, 2007.

Statics and Strength of Materials

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Statics and Strength of Materials
Abbrev.	SFL
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Markus Stark
Instructor(s)	Dr. Markus Stark
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 3 SWH, exercise / 1 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to: - Calculate central systems of forces and structures in equilibrium for the plane, including adhesion. - Calculate section reactions for bodies loaded by forces and momenta. - Calculate stresses and deformations of beams with different cross-sections under tension/compression, shear, bending and torsion loads and check them for safety or dimension them appropriately for simple load cases.
Contents	Stereostatics: Equilibrium conditions, center of gravity, bearings and joints, distributed loads

	Elastostatics/strength theory: Load types, plane stress state, deformations, bending, torsion loading, strength hypotheses
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Gross, D.; Hauger, W.; Schröder, J.; Wall, W.: Technische Mechanik 1 – Statik. Springer Vieweg; 2013. [Erg.: Formeln und Aufgaben zur Techn. Mechanik 1]. Gross, D.; Hauger, W.; Schröder, J.; Wall, W.: Technische Mechanik 2 – Elastostatik. Springer Verlag; 2014. Hibbeler, R.C.: Technische Mechanik (Band 1) – Statik. Pearson Studium; 2005. Hibbeler, R.C.: Technische Mechanik (Band 2) – Festigkeitslehre. Pearson Studium; 2005.

Technical English (B2)

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Technical English (B2)
Abbrev.	TE
Subtitle	-
Courses	-
Semester	3
Module coordinator	Richard Fry, MCLFS
Instructor(s)	Barney Craven, M.A., Richard Fry, MCLFS
Language	English
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures, seminar and exercise / 2 SWH
Work requirement	In-class program: 22 hrs. Self-directed study: 38 hrs.
ECTS	2
Technical prerequisites	No formal prerequisites, but a plus are at least 6 years of school English enabling student to use language independently (B1 level of Common European Framework of Reference for Languages)
Qualification objectives	Expansion and improvement of individual English skills (reading, writing, listening comprehension, speaking) to the B2 level of the Common European Framework of Reference for Languages, with particular consideration of technical and professional topics From the Common European Framework of Reference for Languages (http://www.europaeischer-referenzrahmen.de/): "B2 – Independent use of language Is able to understand the main contents of complex texts on specific and abstract topics; also understands technical discussions in own specialty

	. Is able to communicate spontaneously and fluently enough to permit normal conversations with native speakers without great effort on either side. Is able to express himself/herself clearly and in detail on a wide spectrum of topics, explain an opinion on a current question, and state the advantages and disadvantages of different possibilities.”
Contents	- Structure and expansion of basic vocabulary with technical terminology and expressions using texts from different areas - Training in written expression in English by working through texts and writing professional correspondence - Training in verbal expression in English through discussion - As needed, review of grammar with exercises
Requirements for successful completion	Course-related work required for admission to the examination and written exam
Media	Projector and chalk board / whiteboard, electronic scripts, and work documents language lab
Literature	Current literature will be recommended during the course.

Engineering Mathematics I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Engineering Mathematics I
Abbrev.	MAT1
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Specialized skills: Students will have a sound basic knowledge of linear algebra (vector calculus, matrix calculus, solving linear equations). Students can calculate with complex numbers. Students will be familiar with the elementary properties of real-valued functions. Students will be able to transform function terms by polynomial division as well as partial fraction decomposition. Methodological skills: Students will be able to mathematically apply the acquired technical knowledge to physical and engineering problems and solve them. Personal skills (social skills and self-competence):

	Students will be able to optimize their personal time management for material preparation and follow-up, practice,
Contents	Foundations: Propositional logic and elementary methods of proof. Basics of linear algebra: Matrices, vectors, determinants, Laplacian development theorem, systems of linear equations, Gauss algorithm, matrix rank, Cramer's rule, eigenvalue problems, eigenvalues and eigenvectors. Complex numbers: Definition, component, polar and exponential form, Gaussian number plane, Moivre's theorem, Euler's relation, circle division equation "z^n = a", quadratic equations (sol. in complex). Sequences and series, limits: Arithmetic and geometric number sequences, limit definition, numerical series, convergence and divergence, summation formulas Real-valued functions: Concept of a function, inverse function, shifting and reflection of graphs, continuity, trigonometric equations, hyperbolic and area functions, polynomials, fundamental theorem of algebra, rational functions, polynomial division and Horner's scheme, function series (uniform convergence) Introduction to differential calculus: Slope of a curve, definition of first derivative, differential quotient, higher derivatives, product rule, quotient rule, chain rule, derivation of inverse function, implicit differentiation, curve discussion, zeros and poles/singularities, and relative and absolute maxima
Requirements for successful completion	Written examination
Media	Visualizer, projector, laptop, chalk board
Literature	Papula, L.: Mathematik für Ingenieure und Naturwissenschaftler (3 volumes, 1 exercise book, and collection of formulas),

	Bronstein-Semendjajew: Mathematische Formelsammlung "Taschenbuch der Mathematik, Harri Deutsch.

Engineering Mathematics II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Engineering Mathematics II
Abbrev.	MAT2
Subtitle	-
Courses	-
Semester	2
Module coordinator	Dr. Ingo Faber
Instructor(s)	Dr. Ingo Faber
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures with exercises / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering Mathematics I
Qualification objectives	Application of differential calculus with one variable to specific problems Mastery of integral calculus with one real variable Application of integral calculus with one variable to specific problems Basic understanding of functions with several variables Mastery of the technique of partial derivative Calculation of absolute and relative error Solution of multiple integrals in different coordinates as well as their application to specific problems
Contents	Applications of differential calculus:

	Extreme value problems, Newton-Raphson method, linearization, differential, error estimation, Taylor series, Lagrange residual representation, power series expansion, MacLaurin series, linear differential equations (DGLs) with constant coefficients Fundamentals of integral calculus: Root function, indefinite integrals, calculation rules, substitution in indefinite integrals, integration of fractional rational functions, fundamental domain, main theorem of differential and integral calculus, integral function, substitution in definite integrals, partial integration, improper integrals, selected applications of integral calculus: Integral averages, volume calculation, center of gravity of solids of revolution. Functions with several variables: Concept of a function, partial derivatives, continuity, complete differential, moment of area and mass inertia, relative extrema, optimization with constraints.
Requirements for successful completion	Written examination
Media	Visualizer, projector, laptop, chalk board
Literature	Papula, L.: Mathematik für Ingenieure und Naturwissenschaftler (3 volumes, 1 exercise book, and collection of formulas),

Engineering Mathematics III

Academic program	Automotive Technology
Specialization	Automotive Mechatronics
Module name	Engineering Mathematics III
Abbrev.	MAT3
Subtitle	-
Courses	-
Semester	3
Module coordinator	Dr. Marcus Baur
Instructor(s)	Dr. Marcus Baur
Language	German
Classification in curriculum	Compulsory module AMEC
Use in other academic programs	-
Format / SWH	Seminar-type lectures with integrated exercise / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	Engineering Mathematics I and II
Qualification objectives	Ability to solve ordinary differential equations
Contents	Extremal problems with constraints Fundamentals of vector analysis Ordinary differential equations: First order differential equations Linear differential equations
Requirements for successful completion	Written examination
Media	Visualizer, projector, blackboard, laptop
Literature	Heuser, H., "Gewöhnliche Differentialgleichungen", Springer Verlag, 2006. Papula, L.: "Mathematik für Ingenieure und Naturwissenschaftler - Vol. 2", Vieweg+Teubner Verlag.

Technical Thermodynamics

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Technical Thermodynamics
Abbrev.	TTD
Subtitle	-
Courses	-
Semester	4
Module coordinator	Dr. Philipp Epple
Instructor(s)	Dr. Philipp Epple
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Seminar-type lectures / 2 SWH, exercise / 2 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to: - Differentiate state and process variables and calculate special gas constants. - Understand phase diagrams and calculate state variables in two-phase domain. - Apply the first law of thermodynamics to closed and open systems. - Apply the second law of thermodynamics to various systems. - Calculate the properties of ideal gases and gas mixtures. - Calculate simple cycles.
Contents	System and state processes and process parameters

	Phase diagrams 1. Principal law of thermodynamics 2. Principal law of thermodynamics State variables of ideal gases Gas mixtures, moist air, and steam Cycles of engines Selected adiabatic flow process
Requirements for successful completion	Written examination
Media	Chalk board, projector, supplemental written documents
Literature	Windisch, H.: Thermodynamik - Ein Lehrbuch für Ingenieure, 5th edition, Oldenbourg Verlag, Munich, 2014. Hahne, E.: Technische Thermodynamik, Einführung und Anwendung, 5th edition, Oldenbourg Verlag, Munich, 2011. Cerbe, G. and Wilhelms, G.: Technische Thermodynamik, Einführung und Anwendung, 16th edition, Oldenbourg Verlag, Munich, 2011. Döring, E., Schedwill, H., Dehli, M.: Grundlagen der Technischen Thermodynamik, Lehrbuch für Studierende der Ingenieurwissenschaften, 7th edition, Springer Vieweg, Heidelberg, 2012. Geller, W.: Thermodynamik für Maschinenbau, Grundlagen für die Praxis, 4th edition, Springer Verlag, 2006. Langeheinecke, K., Jany, P., Thieleke, G.: Thermodynamik für Ingenieure, 7th edition, Vieweg Teubner Verlag, Wiesbaden 2008. Meyer, G., Schiffner, E.: Thechnische Thermodynamik, 3rd edition, VCH Verlagsgesellschaft Weinheim, 1968. Kretzschmar, H.-J. and Kraft, I.: Kleine Formelsammlung Technische Thermodynamik, 4th updated edition, Carl Hanser Verlag, Munich, 2011. Cengel, Turner, Cimbala: Fundamentals of Thermal-Fluid Sciences with Student Resource DVD and Property Tables Booklet, 4th Edition, Mcgraw-Hill Higher Education, 2012. Potter, M. and Somerton, C.: Thermodynamics for Engineers, Second Edition, Schaums Outlines, 2006.

Technical Combustion

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Technical Combustion
Abbrev.	TV
Subtitle	-
Courses	-
Semester	7
Module coordinator	Dr. Markus Jakob
Instructor(s)	Dr. Markus Jakob
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	After successful completion, students will be familiar with: - Theoretical principles of technical combustion - Two main forms of technical combustion - Details of the combustion processes up to elementary reaction equations and their summary to gross reaction equations for technical consideration - Application examples of the combustion processes on gas burners, turbines, and internal combustion
Contents	The lecture contents include - Premixed and diffusive combustion - Material and energy balances - Gross and elementary reaction equations - Chain reaction mechanisms

	- Ignition and extinguishing processes in homogeneous systems - Laminar and turbulent combustion rates
Requirements for successful completion	Written examination
Media	Projector, blackboard, PC
Literature	

Internal Combustion Engines I

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Internal Combustion Engines I
Abbrev.	VKM1
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Hartmut Gnuschke
Instructor(s)	Dr. Hartmut Gnuschke
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Seminar-type lectures with 15% integrated internship / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to: Correctly describe concept and function of components of combustion engines. Describe and assess the engine process in terms of mechanics and thermodynamics. Understand and interpret typical measurement activities at engine
Contents	Mechanical structure: Crank shaft, piston rod, pistons, crank case, cylinder head Kinematics / Kinetics: Laws of motion and forces in engines, assessing engine components, mass compensation, thermodynamics of combustion engine, and engine tests
Requirements for successful completion	Written examination

Media	Projector, blackboard
Literature	Grohe, Otto- und Dieselmotoren, Vogel-Verlag 2003. Basshuysen, Schäfer (Publ.), Vieweg Handbuch Verbrennungsmotor, Vieweg 2010. Bosch Kraftfahrttechnisches Taschenbuch, Vieweg 2012. Mollenhauer, Tschöke (publ.) Handbuch Dieselmotor, Springer-Verlag 2007.

Internal Combustion Engines II

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Internal Combustion Engines II
Abbrev.	VKM2
Subtitle	-
Courses	-
Semester	6
Module coordinator	Dr. Hartmut Gnuschke
Instructor(s)	Dr. Hartmut Gnuschke
Language	German
Classification in curriculum	Compulsory elective module AMEC and WIAM
Use in other academic programs	Bachelor in "Mechanical Engineering"
Format / SWH	Seminar-type lectures with 15% integrated internship / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Students will be able to: Correctly describe concept and function of components of combustion engines. Describe and assess the engine process including exhaust treatment. Understand and interpret typical measurement activities at
Contents	Fluid dynamics: charge cycle, charging Carburetion: injection systems Combustion: (self) ignition, formation of pollutants and exhaust treatment, engine tests
Requirements for successful completion	Written examination
Media	Projector, blackboard

Literature	Grohe, Otto- und Dieselmotoren, Vogel-Verlag 2003. Basshuysen, Schäfer (Publ.), Vieweg Handbuch Verbrennungsmotor, Vieweg 2010. Bosch Kraftfahrttechnisches Taschenbuch, Vieweg 2012. Mollenhauer, Tschöke (publ.) Handbuch Dieselmotor, Springer-Verlag 2007.

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Materials Engineering

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Materials Engineering
Abbrev.	WST
Subtitle	-
Courses	-
Semester	1
Module coordinator	Dr. Alexander Rost
Instructor(s)	Dr. Alexander Rost
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures, internship / 4 SWH
Work requirement	In-class program: 45 hrs. Self-directed study: 105 hrs.
ECTS	5
Technical prerequisites	-
Qualification objectives	Ability to connect the material structure and properties of metals and knowledge on how to treat and use metal materials appropriately Ability to connect structure, properties, and processing of the most important plastics with their specific processing procedures Competence to select suitable material testing procedures; assessment of the significance of different material tests
Contents	Atoms, periodic table of elements, bonding; crystal systems; state diagrams; microstructure; iron-carbon diagram; heat treatments; hardening and tempering steel; material short names; alloying elements; steels;

	precipitation hardening of aluminum alloys; practical training: tensile test, hardness test, metallography; structure of polymers; macromolecular structure of plastics; fundamentals of the relationship between structure and properties; overview of the most important plastics; plastics processing; plastics testing methods; practical training: plastics determination, tensile test, hardness test
Requirements for successful completion	Practical performance and written examination
Media	Projector, chalk board, visualizer, work sheets
Literature	Seidel: Werkstofftechnik, Hanser 2012. Bergmann: Werkstofftechnik 1, Hanser 2013. Domke: Werkstoffkunde und Werkstoffprüfung, Cornelsen 2001. Schwarz, Ebeling: Kunststoffkunde, Vogel 2007. Kaiser: Kunststoffchemie für Ingenieure, Hanser 2011. Menges et al.: Werkstoffkunde Kunststoffe, Springer 2011.

Scientific Foundation of the Bachelor Thesis

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Scientific Foundation of the Bachelor Thesis
Abbrev.	WFUN
Subtitle	-
Courses	-
Semester	7
Module coordinator	Dr. Stefan Gast
Instructor(s)	Supervising professor
Language	German
Classification in curriculum	Compulsory module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Mainly self-study
Work requirement	In-class program: 15 hrs. Self-directed study: 315h
ECTS	11
Technical prerequisites	Recommended: Successful completion of all modules of the first six semesters of study.
Qualification objectives	Students will able to ... Develop complex, practical tasks using scientific methods to find solutions with successful personal integration in an industrial company. Generate scientifically sound, written elaborations and explain their own ideas and results in the face of professional criticism. Independently implement time management while working on the task.
Contents	In-depth specialization in a technical / business-related topic - preferably the bachelor thesis - from the field of automotive mechatronics; application of scientific methodological skills;

	scientific documentation and defense of the specialized content; preparation for the content requirements of the bachelor thesis
Requirements for successful completion	Final report and final presentation
Media	Projector
Literature	see Scientific/Academic Work and Presentation

Scientific/Academic Work and Presentation

Academic program	Automotive Technology
Specialization	Automotive Mechatronics / Automotive Industrial Engineering
Module name	Scientific/Academic Work and Presentation
Abbrev.	WA
Subtitle	-
Courses	-
Semester	5
Module coordinator	Dr. Philipp Precht
Instructor(s)	Dr. Philipp Precht Dr. Michael Steber
Language	German
Classification in curriculum	Practice-based specialization module AMEC and WIAM
Use in other academic programs	-
Format / SWH	Seminar-type lectures / 2 SWH
Work requirement	In-class program: 23 hrs. Self-directed study: 127h
ECTS	5
Technical prerequisites	-
Qualification objectives	Imparting knowledge of the methodical procedures in scientific/academic work, as well as instruction on how to document and present scientific results.
Contents	Techniques of scientific work, basics of an academic paper, structure of an academic paper, dealing with library and literature, literature research, argumentation structure, presentation of results, presentation techniques, preparation of technical reports and theses Part Dr. Precht: Basics of an academic paper

	Topic identification (creativity techniques, topic delimitation, work planning) Information acquisition (literature research, source selection, empiricism) Information processing (reading & comprehension, follow-up) Elements of an academic paper (introduction & motivation, main section, conclusion, summary & outlook) Contents of an academic/scientific paper (sequence and form, outline, figures and tables, references, bibliography, other formalities)
Requirements for successful completion	Dr. Steber: practical lecture Dr. Precht: scientific report Completion of both parts is a prerequisite for recognition of the required internship.
Media	Projector, blackboard, eLearning
Literature	Jacob, R. (1997): Wissenschaftliches Arbeiten. Opladen. Sesink, W. (2005): Einführung in das wissenschaftliche Arbeiten ohne und mit PC. Munich, Vienna. Scholz, D. (2006): Diplomarbeiten normgerecht verfassen. Vogel, Würzburg. Coburg University of Applied Sciences, Department of Mechanical Engineering and Automotive Technology (2015): Guideline on scientific work. Coburg. Theisen, Manuel-René (2011): Wissenschaftliches Arbeiten: Technik – Methodik – Form, Munich.