

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module Descriptions
for the professional field of Metals Technology
in the Bachelor Degree Course PBE EM

Index

Mathematics 1 and 2.....	2
Technical Mechanics 1 and 2	4
TD/CAD	6
Machine Elements 1 and 2	7
Materials Engineering	9
Technical Thermodynamics.....	10
Electrical Engineering 2	11
Manufacturing Technology	12
Measurement Engineering.....	13
Production and Quality Assurance.....	14
Control Engineering.....	15
Sensor and Actuator Engineering.....	17
Machine Tools, 3Se/1P.....	18
Vibration Technology	19
Mining and Extraction	20
Microsystems Engineering	22
Technical Optics	23
Electrical Drives	24
Automotive Engineering.....	25
Automotive Drives.....	26
Piston Machines	27

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Mathematics	1 st + 2 nd sem.	12 CP
Bachelor	Professional and Business Education		
Module	Mathematics 1 and 2		
Faculty/Subject/Department	University of applied sciences: Faculty 06/MNI		
Associated degree course/Semester taken	Bachelor PBE, 1 st + 2 nd semester		
Module coordinator	cf. German version		
Prerequisites	None		

Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the fundamentals of vector algebra and have the ability to apply these command of systematic solving of linear. equation systems ability to confidently handle elemental functions command of the fundamental rules of differential and integral calculus of a variable and ability to apply these ability to exponentiate and to extract a root in a complex area command of the fundamental terms and rules of differential and integral calculus of multiple variables and ability to apply these are familiar with the fundamental terms of lines and have the ability to deal with
--------------------------	---

Module contents	<ol style="list-style-type: none"> 1. Fundamentals (sets, real and complex numbers, (in)equations) 2. Vector algebra, linear equation systems 3. Elemental functions 4. Limit values 5. Differential calculus of a variable 6. Integral calculus of a variable 7. Powers and roots of complex numbers 8. Differential calculus of multiple variables 9. Integral calculus of multiple variables 10. Lines and line integrals
------------------------	--

Percentage share of instruction form(s)	2 lectures 67%/2 tutorials 33%
---	--------------------------------

Workload in hours	Total workload	360 hours = 12 ECTS credits (1 ECTS = 30 hours)				
	Course type and title	A courses a contact hours	B auto-nomous b preparation/ revision, module-component examination	C examination incl. preparation	Sum	
	L Mathematics 1	60	30	15	15	120
	T Tutorials	30	30			60
	L Mathematics 2	60	30	15	15	120
	T Tutorials 2	30	30			60
	Sum	180	120	30	30	360

Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> 1. Regular and active participation in courses 2. Successful completion of homework
	Form(s) of assessment (scope) module-component	<ol style="list-style-type: none"> 1. Examination of lecture 1 (90 min.) 2. Examination of lecture 2 (90 min.) <p>Students must pass both examinations. If the module-component examination is not passed, a retake examination will take place. The student may partake in the retake examination if less than 5 credits were awarded in the first examination (max. 90 minutes). If more than one part of the module-component examination is not passed, the student is required to participate in a retake examination in each of the module-components not passed (max. 90 minutes).</p>

Special regulation of the Degree Programme Vocational Education and Training Attachment: 2.1.2 Module Descriptions Metals Technology Version 1 of June 24, 2009	7.35.06 No. 6	p. 3
---	---------------	------

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

	Contribution to final mark	50% examination 1 and 50% examination 2
	Retake examination	Examination (90 min.)
Frequency	Every semester duration: 2 semesters	
Intake capacity	Lecture: unlimited (capacity of lecture hall), tutorials: 35 per tutorial	
Language of instruction	German	
Additional information:	Guidance on module and required literature: see notice board/date: see course catalogue	

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Technical Mechanics	1st + 2nd sem.	10 CP	
Bachelor	Professional and Business Education			
Module	Technical Mechanics 1 and 2			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 1 st + 2 nd semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the fundamental laws of stress analysis and dimensioning as well as of load capacity analysis and have the ability to apply these, are proficient in the use of the linear beam theory, are familiar with the fundamental laws of torsion and buckling and have the ability to apply these, understand the basic method of structural analysis of mechanical engineering constructions 			
Module contents	<ul style="list-style-type: none"> Forces and torques in equilibrium systems Calculation of the centre of gravity Stress resultants in slender components Member forces in constructions Friction Stresses and distortions Tensile stress, bending stress and torsional loading Pressure loading and buckling Plane state of stress Strength hypotheses Three-dimensional state of stress Contact loading 			
Percentage share of instruction form(s)	2 lectures 67%/2 tutorials 33%			
Workload in hours	Total workload	300 hours = 10 ECTS credits		
	Type and title of course	A courses a contact hours	B auto-nomous work b preparation/revision module-component examination	C examination incl. preparation Sum
	L Engineering Mechanics 1	60	40	100
	T Calculation tutorial	30	20	50
	L Engineering Mechanics 2	60	40	100
	T Calculation tutorial	30	20	50
	Sum	180	120	300
Prerequisite(s) for examination	Regular and active participation in courses			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Form(s) of assessment (scope) module-component	<ol style="list-style-type: none"> 1. Examination for lecture 1 (90 min.) 2. Examination for lecture 2 (90 min.) <p>Students must pass both examinations. If the module-component examination is not passed, a retake examination will take place. The student may partake in the retake examination if less than 5 credits were awarded in the first examination (max. 90 minutes). If more than one part of the module-component examination is not passed, the student is required to participate in a retake examination in each of the module-components not passed (max. 90 minutes).</p>	
	Contribution to final mark	50% examination 1 and 50% examination 2
	Retake examination	Examination (90 min.)
Frequency	Every semester duration: 2 semesters	
Intake capacity	Lecture and tutorial: unlimited (capacity of lecture hall)	
Language of instruction	German	
Additional information:	Guidance on module and required literature: see notice board/date: see course catalogue	

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	TD/CAD	2 nd sem.	4 CP	
Bachelor	Professional and Business Education			
Module	TD/CAD			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 2 nd semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students shall have the ability to</p> <ul style="list-style-type: none"> design methodologically with the help of computer aided tools, use technical drawings as a communication method for technical information, use digitalized component information from various sources of data 			
Contents of module	<ul style="list-style-type: none"> Rules concerning the realization of technical drawings Functions and potentialities of a design software Composition of geometrical model structures Interfaces, data transfer 			
Form(s) of instruction Percentage	1 lecture 40%/1 tutorial 60%			
Workload in hours	Total workload	120 hours = 4 ECTS credits		
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture TD/CAD	30		10 40
	LT Laboratory tutorials	45		45
	FD Final design assignment	5	30	35
		Sum	80	30
Module examination	Prerequisite(s) for examination	Regular and active participation in courses		
	Form(s) of assessment (scope) module-component	1. L: Technical discussion (oral examination) concerning all branches 2. LT: 5 drawings 3. FD: Final design assignment		
	Contribution to final mark	33.3% technical discussion, 33.3% drawings, 33.3% final design assignment		
	Retake examination	Each module-component examination must be passed. Individual assessment items can be retaken.		
Frequency	Every semester duration: 1 semester winter semester: lecture + lab tutorial summer semester: lecture + lab tutorial			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 70 students each			
Language of instruction	German			
Additional information	Guidance on module and required literature:: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Machine Elements	2 nd + 3 rd sem.	12 CP	
Bachelor	Professional and Business Education			
Module	Machine Elements 1 and 2			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 2 nd + 3 rd semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the principles and correlations of engineering mechanics and have the ability to apply these, are proficient in technical drawing and CAD, are familiar with materials engineering and manufacturing technology and should have the ability to transfer and apply the acquired knowledge from Machine Elements 1. 			
Contents of module	<ul style="list-style-type: none"> Calculation and design of: Welds, bonds, brazed joints, pins, screws, bolts, rivets, compression moulds, shaft-hub connections, axes/shafts, springs. Static and dynamic loads: Force, torque, strain, deformation, vibration, notch effect. Load, fatigue strength, critical speed of rotation, Lubricants, friction bearings, antifriction bearings, gears, Gaskets, clutches, chain drives, belt drives 			
Percentage share of instruction form(s)	2 lectures: 50%/2 tutorials: 25%/design assignment 1 and 2: 25%			
Workload in hours	Total workload	360 hours = 12 ECTS credits		
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture Machine Elements 1	45	40	15 100
	T Calculation tutorials 1	15	15	30
	D Design assignment 1	20	30	50
	L Lecture Machine Elements 2	45	40	15 100
	T Calculation tutorials 2	15	15	30
	D Design assignment 2	20	30	50
	Sum	160	170	30 360
Module examination	Prerequisite(s) for examination	Regular and active participation in courses		
	Form(s) of assessment (scope) module-component	<ol style="list-style-type: none"> Examination of Machine Elements 1 lecture (90 min.) Examination of Machine Elements 2 lecture (90 min.) <p>Students must pass both examinations. If the module-component examination is not passed, a retake examination will take place. The student may partake in the retake examination if less than 5 credits were awarded in the first examination (max. 90 minutes). If more than one part of the module-component examination is not passed, the student is required to participate in a retake examination in each of the module-components not passed (max. 90 minutes).</p>		
	Contribution to final mark	50% examination 1 and 50% examination 2		

Special regulation of the Degree Programme Vocational Education and Training Attachment: 2.1.2 Module Descriptions Metals Technology Version 1 of June 24, 2009	7.35.06 No. 6	p. 8
---	---------------	------

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

	Retake examination	Written examination (90 min.)
Frequency		Every semester duration: 2 semesters
Intake capacity		Lecture and tutorial: unlimited (capacity of lecture hall)
Language of instruction		German
Additional information		Guidance on module and required literature:: see notice board/date: see course catalogue

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Materials Engineering	1 st sem.	4 CP	
Bachelor	Professional and Business Education			
Module	Materials Engineering			
Faculty/Subject/Department	MMEW			
Associated degree course/Semester taken	Bachelor PBE, 1 st semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • have the ability to evaluate the mechanical material behaviour of metallic materials under static and dynamic loading, • can determine material parameters under static and dynamic loading, • can recognize and correlate fracture surfaces of metallic component with the respective failure mechanisms. • Ultrasonic testing of components 			
Contents of module	<ul style="list-style-type: none"> • Stress-strain behaviour of materials • Hardness testing • Technological testing of materials • Behaviour of materials under dynamic loading • Non-destructive material testing 			
Percentage share of instruction form(s)	Lecture 75%/tutorial 25%			
Workload in hours	Total workload	120 hours = 4 ECTS credits (1 ECTS = 30 hours)		
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture Materials Engineering	45	15	15 75
	LT Laboratory tutorials	15	30	45
	Sum	60	45	15 120
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> 1. Regular and active participation in courses 2. Tests on three experiments in the laboratory tutorials 3. Technical report of three experiments in the laboratory tutorials 		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Examination (90 min.)		
Frequency	Every semester duration: 1 semester			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial: 15 students			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Technical Thermodynamics	3 rd sem.	4 CP
Bachelor	Professional and Business Education		
Module	Technical Thermodynamics		
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW		
Associated degree course/Semester taken	Bachelor PBE, 3 rd semester		
Module coordinator	cf. German version		
Prerequisites	None		

Learning outcomes	The students
	<ul style="list-style-type: none"> • can apply the principles and fundamentals to practical problems related to energy , • are familiar with the various operating and cycle processes and have the ability to assess these.

Contents of module	<ul style="list-style-type: none"> • Thermodynamic material data • First and second laws of thermodynamics • Operating and cycle processes • Gas mixtures and humid air
--------------------	---

Percentage share of instruction form(s)	1 lecture 60%/1 tutorial 40%
---	------------------------------

Workload in hours	Total workload	120 hours = 4 ECTS credits (1 ECTS = 30 hours)			
		A courses	B auto-	C examination	
	Course type and title	a contact hours	b preparation/revision, module-component examination	nomous work	incl. preparation
					Sum
	L Lecture Thermodynamics	45	15		15 75
LT Laboratory tutorials	30	15		45	
	Sum	75	30	15	120

Module examination	Prerequisite(s) for examination	Regular and active participation in courses
	Form(s) of assessment (scope)	Examination of lecture (90 min.)
	Module examination	
	Contribution to final mark	100% examination
	Retake examination	Examination (90 min.)

Frequency	Every semester duration: 1 semester
-----------	-------------------------------------

Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 60 students each
-----------------	--

Language of instruction	German
-------------------------	--------

Additional information	Guidance on module and required literature: see notice board/date: see course catalogue
------------------------	---

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Electrical Engineering	1 st sem.	4 CP	
Bachelor	Professional and Business Education			
Module	Electrical Engineering 2			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 1 st semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the fundamental laws for describing direct current circuits and networks and have the ability to apply these, are familiar with electric and magnetic fields, are familiar with the fundamental laws for describing alternating current circuits and networks and have the ability to apply these, understand the principal functionality of selected semiconductor devices 			
Contents of module	<ul style="list-style-type: none"> Fundamental laws of electrical engineering Direct current circuits, resistor networks Electric and magnetic fields Inductors and capacitors Law of induction Alternating current circuits Three-phase current Fundamentals of semiconductor technology (diodes, transistors) 			
Percentage share of instruction form(s)	Lecture 50%/tutorial 50%			
Workload in hours	Total workload	120 hours = 4 ECTS credits		
	Type and title of course	A courses a contact hours	B auto- nomous preparation/ revision, work	C examination incl. preparation
		module-component examination		Sum
	L Lecture Electrical Engineering	30	15	15 60
	T Calculation tutorial	30	30	60
	Sum	60	45	15 120
Module examination	Prerequisite(s) for examination	Regular and active participation in courses		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Examination (90 min.)		
Frequency	Every semester duration: 1 semester			
Intake capacity	Lecture and tutorial: unlimited (capacity of lecture hall)			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Manufacturing Technology	2 nd sem.	4 CP			
Bachelor	Professional and Business Education					
Module	Manufacturing Technology					
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW					
Associated degree course/Semester taken	Bachelor PBE, 2 nd semester					
Module coordinator	cf. German version					
Prerequisites	None					
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the production route of sintered parts and with the advantages and disadvantages of this technology, are able to assess in which cases this technology is to be applied, understand the most important welding methods and the required relevant information; are aware of the fields of application of these methods and their advantages and disadvantages, are familiar with the fundamental design of welding systems. 					
Contents of module	<ul style="list-style-type: none"> Powder metallurgy, technical description of this process, applications, particular cases, sintered bearings Technical metals, casting, forming, joining and separation processes Welding technology, technical description of selected welding methods, fields of application, important information 					
Percentage share of instruction form(s)	Lecture 100%					
Workload in hours	Total workload	120 hours = 4 ECTS credits (1 ECTS = 30 hours)				
		A courses	B auto-nomous work	C examination incl. preparation		
	Course type and title	a contact hours	b preparation/revision, module-component examination	Sum		
	L Lect. Manufacturing Technology	60	30	15	15	120
	Sum	60	30	15	15	120
Module examination	Prerequisite(s) for examination	Regular and active participation in courses				
	Form(s) of assessment (scope)	Examination of lecture (90 min.)				
	Module examination					
	Contribution to final mark	50% examination 1 and 50% examination 2				
	Retake examination	Examination (90 min.)				
Frequency	Every semester duration: 1 semester					
Intake capacity	Lecture: unlimited (capacity of lecture hall)					
Language of instruction	German					
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue					

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Measurement Engineering	4 th sem.	6 CP																					
Bachelor	Professional and Business Education																							
Module	Measurement Engineering																							
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW																							
Associated degree course/Semester taken	Bachelor PBE, 4 th semester																							
Module coordinator	cf. German version																							
Prerequisites	None																							
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the fundamentals of applying of measurement equipment in an industrial environment are aware possible causes of causes and have the ability to assess these are familiar with the methods for analysing and assessing measured data and are have the ability to apply these to typical data series understand the principal functionality of selected measurement equipment and methods 																							
Contents of module	<ul style="list-style-type: none"> General fundamentals, measurement principles Measurement errors, causes, analysis and mathematical description Measurement of mechanical values Electrical metrology Selected sensors Processing of measured data Production measurement technology 																							
Percentage share of instruction form(s)	Lecture 67%/tutorial 33%																							
Workload in hours	Total workload	180 hours = 6 ECTS credits (1 ECTS = 30 hours)																						
		<table border="1"> <thead> <tr> <th></th> <th>A courses a contact hours</th> <th>B auto- nomous work</th> <th>C examination incl. preparation</th> <th>Sum</th> </tr> </thead> <tbody> <tr> <td>L Lecture Metrology</td> <td>60</td> <td>30</td> <td>30</td> <td>120</td> </tr> <tr> <td>LT Laboratory tutorials</td> <td>30</td> <td>30</td> <td></td> <td>60</td> </tr> <tr> <td>Sum</td> <td>90</td> <td>60</td> <td>30</td> <td>180</td> </tr> </tbody> </table>				A courses a contact hours	B auto- nomous work	C examination incl. preparation	Sum	L Lecture Metrology	60	30	30	120	LT Laboratory tutorials	30	30		60	Sum	90	60	30	180
		A courses a contact hours	B auto- nomous work	C examination incl. preparation	Sum																			
	L Lecture Metrology	60	30	30	120																			
	LT Laboratory tutorials	30	30		60																			
Sum	90	60	30	180																				
Module examination	Prerequisite(s) for examination	Regular and active participation in courses																						
	Form(s) of assessment (scope) Module examination	Examination of lecture (90 min.)																						
	Contribution to final mark	100% examination																						
	Retake examination	Examination (90 min.)																						
Frequency	Every semester duration: 1 semester winter semester: lecture summer semester: lecture																							
Intake capacity	Lecture: unlimited (capacity of lecture hall)																							
Language of instruction	German																							
Additional information	Guidance on module and required literature: in first lecture																							

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Production and Quality Assurance	5 th sem.	5 CP	
Bachelor	Professional and Business Education			
Module	Production and Quality Assurance			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th semester			
Module coordinator	cf. German version			
Prerequisites	Manufacturing Technology			
Learning outcomes	<p>The students are familiar with</p> <ul style="list-style-type: none"> trends in manufacturing technology, standards and guidelines, methods of quality assurance, methods of integrating quality data into the operational flow of information 			
Contents of module	<ul style="list-style-type: none"> Trends in manufacturing technology, risks and advice for users, standards and guidelines, methods of quality assurance, integration of quality data into the operational flow of information 			
Percentage share of instruction form(s)	Lecture 75%/seminar 15%/tutorial 10%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture	45	30	10 15 100
	LT Laboratory tutorials	10	10	20
	Si Seminar	15	15	30
	Sum	70	55	10 15 150
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> Regular and active participation in courses Tests on three experiments in the laboratory tutorials 		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Written examination (90 min.)		
Frequency	Every semester duration: 1 semester summer semester: seminar			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 60 students each			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Control Engineering	5 th sem.	5 CP		
Bachelor	Professional and Business Education				
Module	Control Engineering				
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW				
Associated to degree course/Semester taken	Bachelor PBE, 5 th semester				
Module coordinator	cf. German version				
Prerequisites	Common sense				
Learning outcomes	Methodological fundamentals of control engineering: the lecture covers the most important fundamentals and functional elements of technical systems which contain control systems. The content of the course will be illustrated with the help of numerous examples taken from the area of supply engineering, energy process engineering and environmental process engineering, and from the area of the application of renewable energies. All elements of the lecture will be put into practice in the laboratory sessions, in which students will autonomously use simulation software with system data as input.				
Module contents	<ul style="list-style-type: none"> Steady state behaviour and time response of control system units Mathematical modelling on the basis of energy and material balances Simulation of system behaviour on the basis of difference equations Adjustment of modelling approaches by comparison of simulation results with system data Fundamental control methods Discontinuous controls (on-off control and multiple discontinuous controls) Simple continuous controls (proportional behaviour, standard controls with PID behaviour) Investigation of the control system behaviour (stability) with frequency characteristic methods Selection of the appropriate controller behaviour and determination of the setting values for the controller Simulation of closed control systems with standardized system models Overview of digital automation systems <p>Laboratory:</p> <ul style="list-style-type: none"> All elements of the lecture will be put into practice through the use of a teaching software that will be made available to students. 				
Percentage share of instruction form(s)	1 seminar 60%/laboratory 40%				
Total workload	150 hours = 5 ECTS credits				
Workload in hours	Course type and title				
		A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination		
			C examination incl. preparation		
			Sum		
	Se Seminar CE	45		45	
L Laboratory	15	15	30		
FD Final design assignment		10	55	65	
	Sum	60	25	55	140
Module examination	Prerequisite(s) for examination	Regular and active participation in courses			
	Form(s) of assessment (scope) module-component	1. Se: written or oral examination of all content covered in module 2. L: 3 laboratory reports 3. FD: Final design assignment			
	Contribution to final mark	80% examination or technical discussion, 20% reports			

Special regulation of the Degree Programme Vocational Education and Training Attachment: 2.1.2 Module Descriptions Metals Technology Version 1 of June 24, 2009	7.35.06 No. 6	p. 16
---	---------------	-------

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

	Retake examination	Every module-component examination must be passed. Individual module-component examinations can be retaken.
Frequency		Every semester duration: 1 semester Se: lecture in seminar form L: laboratory
Intake capacity		Lecture: unlimited (capacity of lecture hall), laboratory and seminar: 70 students each
Language of instruction		German
Additional information		Guidance on module and required literature: see notice board/date: see course catalogue

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Sensor and Actuator Engineering	5 th sem.	5 CP	
Bachelor	Professional and Business Education			
Module	Sensor and Actuator Engineering			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th semester			
Module coordinator	cf. German version			
Prerequisites	Fundamental modules, Metrology			
Learning outcomes	<p>The students are familiar with</p> <ul style="list-style-type: none"> • sensor technologies, operating principles and characteristics • fundamentals and technological principles of motors/actuators, small motors, piezo actuators, magnetic actuators, magnetoelastic actuators, micro motors, memory metals, thermal propulsion systems, nanotechnology 			
Module contents	<ul style="list-style-type: none"> • Operating principles for determining rotational speed, distance, velocity, acceleration, vibration, torque, pressure, force, fill level, flow rate • Motors/actuators, fundamentals/technological principles, small motors, piezo actuators, magnetic actuators, magnetoelastic actuators, micro motors, memory metals, thermal propulsion systems, nanotechnology 			
Percentage share of instruction form(s)	Lecture 75%/tutorial 25%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture	45	30	30 105
	LT Laboratory tutorials	15	15	15 45
	Sum	60	45	15 30 150
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> 1. Regular and active participation in courses 2. Tests on three experiments in the laboratory tutorials 		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Written examination (90 min.)		
Frequency	Every semester duration: 1 semester summer semester: seminar			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 60 students each			
Language of instruction	German			
Additional information	Guidance module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Machine Tools	5 th /6 th sem.	5 CP	
Bachelor	Professional and Business Education			
Module	Machine Tools, 3Se/1P			
Faculty/Subject/Department	MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th /6 th semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • have the ability to describe, name and classify machine tools • are aware of the fundamental demands on machine tools • can select and dimension machine tools • are familiar with the fundamental components of machine tools and can select and dimension these 			
Module contents	<ul style="list-style-type: none"> • Types and designs of machine tools for selected manufacturing processes, e.g. cutting and forming • Selected machine tool components, e.g. drives, guideways, spindles, beds, control systems, ... • Characteristics of machine tools from a static, dynamic and thermal point of view • Selected methods for assessing machine tools, e.g. modal analysis, geometrical loss, ... • Current trends in machine tools 			
Percentage share of instruction form(s)	Seminar 75%/laboratory 25%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
	Type and title of course	A courses a contact hours	B auto-nomous work b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Laboratory	15	30	45
	Se Seminar	45	30	30 105
	Sum	60	60	30 150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses		
	Form(s) of assessment (scope) module-component	<ol style="list-style-type: none"> 1. Examination of seminar and laboratory (90 min.) 2. 3 laboratory reports 		
	Contribution to final mark	90% examination, 10% laboratory reports If a module-component examination is not passed, a retake examination will take place (90 min.). The total of 5 points (mark of 4.0) must be achieved in order to pass the examination. If the student does not pass the laboratory reports section of the assessment, the reports can be revised within three weeks. If more than one part of the module-component examination is not passed, the module-component retake examination consists of the participation in the retake test (90 min.)		
	Retake examination	Retake of examination (90 min.) and re-submission of laboratory reports		
Frequency	Every year duration: 1 semester			
Intake capacity	Seminar and laboratory: 60 students each			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Vibration Technology	5 th /6 th sem.	5 CP		
Bachelor	Professional and Business Education				
Module	Vibration Technology				
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW				
Associated degree course/Semester taken	Bachelor PBE, 5 th /6 th semester				
Module coordinator	cf. German version				
Prerequisites	None				
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the fundamental laws for analysing oscillating systems and have the ability to apply these, are familiar with oscillation and wave propagation in a continuum, are aware of the fundamental methods of experimental and numerical vibration analysis and have the ability to apply these understand the principal analysis methods of mechanical constructions with regards to vibration and acoustics 				
Module contents	<ul style="list-style-type: none"> Single-mass oscillator, damping, harmonic excitation General periodic excitation, impact excitation, Fourier analysis Continuous oscillators Experimental vibration analysis, numerical methods Technical acoustics 				
Percentage share of instruction form(s)	Lecture 67%/tutorial 33%				
Total workload	150 hours = 5 ECTS credits				
Workload in hours	Course type and title	A courses a contact hours	B auto-nomous b preparation/revision, module-component examination	C examination incl. preparation	Sum
	L Vibration Technology	60	30	20	110
	T Calculation tutorial	30	10		40
	Sum	90	40	20	150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses			
	Form(s) of assessment (scope)	1. L: examination of lecture (90 min.)			
	Module examination				
	Contribution to final mark	100% examination			
Retake examination	Examination (90 min.)				
Frequency	Every semester duration: 1 semester				
Intake capacity	Lecture and tutorial: unlimited (capacity of lecture hall)				
Language of instruction	German				
Additional information	Guidance on module and required literature:: see notice board/date: see course catalogue				

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Mining and Extraction	5 th sem.	5 CP		
Bachelor	Professional and Business Education				
Module	Mining and Extraction				
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW				
Associated degree course/Semester taken	Bachelor PBE, 5 th semester				
Module coordinator	cf. German version				
Prerequisites	None				
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • have a fundamental knowledge of materials handling technology, • are familiar with continuous and discontinuous conveyors, • have the ability to analytically determine conveyor capabilities, • have the ability to constructively assess material handling plants. 				
Module contents	<ul style="list-style-type: none"> • Classification of conveyors • Determination of the conveyor capability • Calculation of the load torque • Rope drives • Chain drives • Running wheels and rails • Brakes • Load handling device • Link conveyors • Belt conveyors • Circular conveyors • Bucket conveyors • Gravity conveyors • Powered roller conveyors • Screw conveyors • Oscillating conveyors • Pneumatic conveyors • System reliability 				
Percentage share of instruction form(s)	Lecture 50%/tutorial 50%				
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)			
		A courses	B auto-nomous	C examination	
	Course type and title	a contact hours	b preparation/revision, module-component examination	incl. preparation	
				Sum	
	L Materials-handling Technology	45	15	15	75
T Calculation tutorial	45	30		75	
	Sum	90	45	15	150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses			
	Form(s) of assessment (scope)	Examination of lecture (90 min.)			
	Module examination				
	Contribution to final mark	100% examination			

Special regulation of the Degree Programme Vocational Education and Training Attachment: 2.1.2 Module Descriptions Metals Technology Version 1 of June 24, 2009	7.35.06 No. 6	p. 21
---	---------------	-------

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

	Retake examination	Examination (90 min.)
Frequency		Every semester duration: 1 semester
Intake capacity		Lecture: unlimited (capacity of lecture hall)
Language of instruction		German
Additional information		Guidance on module and required literature: see notice board/date: see course catalogue

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Microsystems Engineering	5 th sem.	5 CP	
Bachelor	Professional and Business Education			
Module	Microsystems Engineering			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th semester			
Module coordinator	cf. German version			
Prerequisites	None			
Learning outcomes	<p>The students are familiar with</p> <ul style="list-style-type: none"> the fundamentals of miniaturization, microstructures and their manufacture, the materials of microtechnology, micro-technical components, lithographic methods 			
Module contents	<ul style="list-style-type: none"> Microstructures and their manufacture, materials of microtechnology, micro-technical components, lithographic methods 			
Percentage share of instruction form(s)	Seminar 100%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
		A courses a contact hours	B auto-nomous b preparation/ revision, module-component examination	C examination incl. preparation
	Course type and title			Sum
	Si Seminar	60	60	15 15 150
	Sum	60	60	15 15 150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses		
	Form(s) of assessment (scope)	Examination of seminar (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Examination (90 min.)		
Frequency	Every semester duration: 1 semester summer semester: seminar			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 60 students each			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Technical Optics	5 th sem.	5 CP		
Bachelor	Professional and Business Education				
Module	Technical Optics				
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW				
Associated degree course/Semester taken	Bachelor PBE, 5 th semester				
Module coordinator	cf. German version				
Prerequisites	None				
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> understand the fundamentals of light and comprehend the principle of the formation of light are familiar with the laws of geometrical optics and the fundamentals of calculating optical components understand the principle of interference and the principle of interferometry and their most important applications are familiar with the fundamental mathematical and graphical solutions of optical systems 				
Module contents	<ul style="list-style-type: none"> Definition of light (of optical radiation), formation of light, light propagation Geometrical optics, optical components Physical optics, interferometry Optical systems 				
Percentage share of instruction form(s)	Lecture 75%/tutorial 25%				
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)			
		A courses	B auto-nomous	C examination	
	Course type and title	a contact hours	b preparation/revision, module-component examination	incl. preparation	
				Sum	
	L Lecture Technical Optics	45	30	30	105
T Tutorials	15	30		45	
	Sum	60	60	30	150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses			
	Form(s) of assessment (scope)	Examination of lecture (90 min.)			
	Module examination				
	Contribution to final mark	100% examination			
	Retake examination	Examination (90 min.)			
Frequency	Every semester duration: 1 semester				
Intake capacity	Lecture: unlimited (capacity of lecture hall)				
Language of instruction	German				
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue				

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Electrical Drives	5 th sem.	5 CP			
Bachelor	Professional and Business Education					
Module	Electrical Drives					
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW					
Associated degree course/Semester taken	Bachelor PBE, 5 th semester					
Module coordinator	cf. German version					
Prerequisites	None					
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • have a fundamental knowledge of electrical drive technology, • comprehend the application of electrical machines, • are familiar with various drive concepts, • are familiar with the optimal use of motors. 					
Module contents	<ul style="list-style-type: none"> • electromagnetism, • construction, operation, characteristic curves and types of loading of electrical machines • DC motors, • three-phase AC motors, • non-standard and small motors, • use of electrical drives with converters. 					
Percentage share of instruction form(s)	Lecture 50%/tutorial 50%					
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)				
	Course type and title	A courses a contact hours	B auto-nomous work b preparation/ revision, module-component examination	C examination incl. preparation		
	L Lecture Electrical Drives	30	20	30	20	100
	T Calculation tutorials	30	20			
	Sum	60	40	30	20	150
Module examination	Prerequisite(s) for examination	Regular and active participation in courses				
	Form(s) of assessment (scope)	Examination of lecture (60 min.)				
	Module examination					
	Contribution to final mark	100% examination				
	Retake examination	Examination (60 min.)				
Frequency	Every semester duration: 1 semester winter semester: lecture and laboratory tutorial summer semester: seminar					
Intake capacity	Lecture: unlimited (capacity of lecture hall)					
Language of instruction	German					
Additional information	Guidance on module and required literature: lecture notes as well as Fischer, <i>Elektrische Maschinen</i> , Hanser-Verlag 2005					

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Automotive Engineering	5 th sem.	5 CP																					
Bachelor	Professional and Business Education																							
Module	Automotive Engineering																							
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW																							
Associated degree course/Semester taken	Bachelor PBE, 5 th semester																							
Module coordinator	cf. German version																							
Prerequisites	Knowledge of statics and dynamics																							
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> are familiar with the calculation of driving resistance can determine tyre forces in dependence of wheelspin, skew and wheel load can calculate brake power are familiar with the concepts of steering are familiar with automotive data bus systems 																							
Module contents	<ul style="list-style-type: none"> Wheels and tyres Driving resistances Brakes Steering Wheel suspensions Automobile electronics and bus systems 																							
Percentage share of instruction form(s)	Lecture 75%/laboratory tutorial 25%																							
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)																						
		<table border="1"> <thead> <tr> <th></th> <th>A courses a contact hours</th> <th>B auto- nomous work b preparation/ revision, module-component examination</th> <th>C examination incl. preparation</th> <th>Sum</th> </tr> </thead> <tbody> <tr> <td>L Lecture Auto. Eng.</td> <td>45</td> <td>30</td> <td>45</td> <td>120</td> </tr> <tr> <td>LT Laboratory tutorials</td> <td>15</td> <td>15</td> <td></td> <td>30</td> </tr> <tr> <td>Sum</td> <td>60</td> <td>45</td> <td>45</td> <td>150</td> </tr> </tbody> </table>				A courses a contact hours	B auto- nomous work b preparation/ revision, module-component examination	C examination incl. preparation	Sum	L Lecture Auto. Eng.	45	30	45	120	LT Laboratory tutorials	15	15		30	Sum	60	45	45	150
		A courses a contact hours	B auto- nomous work b preparation/ revision, module-component examination	C examination incl. preparation	Sum																			
	L Lecture Auto. Eng.	45	30	45	120																			
	LT Laboratory tutorials	15	15		30																			
Sum	60	45	45	150																				
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> Regular and active participation in courses Tests on three experiments in the laboratory tutorials 																						
	Form(s) of assessment (scope)	Examination of lecture (90 min.)																						
	Module examination																							
	Contribution to final mark	100% examination																						
	Retake examination	Examination (90 min.)																						
Frequency	Every semester duration: 1 semester winter semester: lecture + lab tutorial summer semester.: lecture + lab tutorial																							
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 4 students each																							
Language of instruction	German																							
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue																							

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Automotive Drives	5 th sem.	5 CP	
Bachelor	Professional and Business Education			
Module	Automotive Drives			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th semester			
Module coordinator	cf. German version			
Prerequisites	Knowledge of statics and dynamics			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • can calculate vehicle consumption, • can assess the primary energy demand of various drive concepts, • can calculate the driving performance, • are familiar with motor dimensioning, motor installation and vibration insulation, • are familiar with the designing of gears and drives. 			
Module contents	<ul style="list-style-type: none"> • World energy resources • Energy demand and energy conversion • Piston engines • Gears and converters • Electric motors and hybrid drives 			
Percentage share of instruction form(s)	Lecture 75%/laboratory tutorial 25%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
	Type and title of course	A courses a contact hours	B auto-nomous b preparation/revision, module-component examination	C examination incl. preparation Sum
	L Lecture Auto. Drives	45	30	45 120
	LT Laboratory tutorials	15	15	30
	Sum	60	45	45 150
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> 1. Regular and active participation in courses 2. Tests on three experiments in the laboratory tutorials 		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Examination (90 min.)		
Frequency	Every semester duration: 1 semester winter semester: lecture + lab tutorial summer semester: lecture + lab tutorial			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 4 students each			
Language of instruction	German			
Additional information	Guidance on module and required literature: see notice board/date: see course catalogue			

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.

Module code	Piston Machines		5 th sem.	5 CP
Bachelor	Professional and Business Education			
Module	Piston Machines			
Faculty/Subject/Department	University of applied sciences: Faculty 03/MMEW			
Associated degree course/Semester taken	Bachelor PBE, 5 th semester			
Module coordinator	cf. German version			
Prerequisites	Knowledge of thermodynamics			
Learning outcomes	<p>The students</p> <ul style="list-style-type: none"> • can assess different construction types for various cases of application • can calculate thermodynamic cycles • can calculate inertia forces and mass balance • can calibrate combustion engines 			
Module contents	<ul style="list-style-type: none"> • Classification and construction types of reciprocating engines • Thermodynamic fundamentals • Parameters and characteristic diagrams of combustion engines • Kinematics and mass balance of reciprocating engines • Mixture preparation and charge exchange of combustion engines • Machine elements of combustion engines 			
Percentage share of instruction form(s)	Lecture 75%/laboratory tutorial 25%			
Workload in hours	Total workload	150 hours = 5 ECTS credits (1 ECTS = 30 hours)		
		A courses	B auto-	C examination
	Course type and title	a contact hours	b preparation/revision, module-component examination	nomous work incl. preparation
				Sum
	L Lecture Rec. Engines	45	30	45 120
LT Laboratory tutorials	15	15	30	
	Sum	60	45 45 150	
Module examination	Prerequisite(s) for examination	<ol style="list-style-type: none"> 1. Regular and active participation in courses 2. Test on three experiments in the laboratory tutorials 		
	Form(s) of assessment (scope)	Examination of lecture (90 min.)		
	Module examination			
	Contribution to final mark	100% examination		
	Retake examination	Written examination (90 min.)		
Frequency	Every semester duration: 1 semester winter semester: lecture + lab tutorial summer semester: lecture + lab tutorial			
Intake capacity	Lecture: unlimited (capacity of lecture hall), laboratory tutorial and seminar: 4 students			
Language of instruction	German			
Additional information	Guidance on module and literature: see notice board/date: see course catalogue			