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

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<tr>
<td>Automotive Drives</td>
</tr>
<tr>
<td>Piston Machines</td>
</tr>
</tbody>
</table>
### Module code
- Mathematics

### 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, 1st + 2nd semester

### Module coordinator
- cf. German version

### Prerequisites
- None

### Learning outcomes
- The students
  - 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
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)

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A contact hours</th>
<th>B preparation/revision, module-component examination</th>
<th>C examination incl. preparation</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Mathematics 1</td>
<td>60</td>
<td>30</td>
<td>15</td>
<td>120</td>
</tr>
<tr>
<td>T Tutorials 1</td>
<td>30</td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>L Mathematics 2</td>
<td>60</td>
<td>30</td>
<td>15</td>
<td>120</td>
</tr>
<tr>
<td>T Tutorials 2</td>
<td>30</td>
<td></td>
<td></td>
<td>60</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>180</strong></td>
<td><strong>120</strong></td>
<td><strong>30</strong></td>
<td><strong>360</strong></td>
</tr>
</tbody>
</table>

### Workload in hours
- Total workload: 360 hours = 12 ECTS credits (1 ECTS = 30 hours)

### Module examination
- **Prerequisite(s) for examination**
  1. Regular and active participation in courses
  2. Successful completion of homework

### Form(s) of assessment (scope) module-component
1. Examination of lecture 1 (90 min.)
2. Examination of lecture 2 (90 min.)

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).
<table>
<thead>
<tr>
<th>Contribution to final mark</th>
<th>50% examination 1 and 50% examination 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retake examination</td>
<td>Examination (90 min.)</td>
</tr>
<tr>
<td>Frequency</td>
<td>Every semester duration: 2 semesters</td>
</tr>
<tr>
<td>Intake capacity</td>
<td>Lecture: unlimited (capacity of lecture hall), tutorials: 35 per tutorial</td>
</tr>
<tr>
<td>Language of instruction</td>
<td>German</td>
</tr>
<tr>
<td>Additional information</td>
<td>Guidance on module and required literature: see notice board/date: see course catalogue</td>
</tr>
<tr>
<td>Module code</td>
<td>Technical Mechanics</td>
</tr>
<tr>
<td>-------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>Bachelor</td>
<td>Professional and Business Education</td>
</tr>
</tbody>
</table>

### Module

**Technical Mechanics 1 and 2**

#### Associated degree course/Semester taken
Bachelor PBE, 1st + 2nd semester

#### Module coordinator
cf. German version

#### Prerequisites
None

#### Learning outcomes
- The students
  - 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
- 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

<table>
<thead>
<tr>
<th>Type and title of course</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination incl. preparation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total workload</td>
<td>300 hours = 10 ECTS credits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Module-component examination</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| 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 | 1. Examination for lecture 1 (90 min.)  
2. Examination for lecture 2 (90 min.)  
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 |</p>
<table>
<thead>
<tr>
<th>Module code</th>
<th>TD/CAD</th>
<th>2nd sem.</th>
<th>4 CP</th>
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<tbody>
<tr>
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<td>Professional and Business Education</td>
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<table>
<thead>
<tr>
<th>Module</th>
<th>TD/CAD</th>
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</thead>
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<table>
<thead>
<tr>
<th>Faculty/Subject/Department</th>
<th>University of applied sciences: Faculty 03/MMEW</th>
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<table>
<thead>
<tr>
<th>Associated degree course/Semester taken</th>
<th>Bachelor PBE, 2nd semester</th>
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<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>cf. German version</th>
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</thead>
</table>

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>None</th>
</tr>
</thead>
</table>

### Learning outcomes

The students shall have the ability to:

- 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

- Rules concerning the realization of technical drawings
- Functions and potentials of a design software
- Composition of geometrical model structures
- Interfaces, data transfer

### Form(s) of instruction

<table>
<thead>
<tr>
<th>Module examination</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 lecture 40% 1 tutorial 60%</td>
<td></td>
</tr>
</tbody>
</table>

### Total workload

120 hours = 4 ECTS credits

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses (hours)</th>
<th>B autonomous preparation/revision (hours)</th>
<th>C examination (incl. preparation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture TD/CAD</td>
<td>30</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Laboratory tutorials</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final design assignment</td>
<td>5</td>
<td>30</td>
<td></td>
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</tbody>
</table>

**Sum**: 120 hours

### Workload in hours

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses (hours)</th>
<th>B autonomous preparation/revision (hours)</th>
<th>C examination (incl. preparation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture TD/CAD</td>
<td>30</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Laboratory tutorials</td>
<td>45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final design assignment</td>
<td>5</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**Sum**: 120 hours

### Module examination

- **Prerequisite(s) for examination**: Regular and active participation in courses
- **Form(s) of assessment (scope)**:
  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/dates: see course catalogue
### Module code

**Machine Elements**

<table>
<thead>
<tr>
<th>Bachelor</th>
<th>Professional and Business Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td><strong>Machine Elements 1 and 2</strong></td>
</tr>
<tr>
<td>Faculty/Subject/Department</td>
<td>University of applied sciences: Faculty 03/MMEW</td>
</tr>
<tr>
<td>Associated degree course/Semester taken</td>
<td>Bachelor PBE, 2nd + 3rd semester</td>
</tr>
<tr>
<td>Module coordinator</td>
<td>cf. German version</td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
</tr>
</tbody>
</table>

#### Learning outcomes

- The students
  - 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

- 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%

#### Time requirements

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>Contact hours</th>
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<th>Autonomous work</th>
<th>Examination inclusive preparation</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Lecture Machine Elements 1</td>
<td>45</td>
<td>40</td>
<td>15</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>T Calculation tutorials 1</td>
<td>15</td>
<td>15</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>D Design assignment 1</td>
<td>20</td>
<td>30</td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>L Lecture Machine Elements 2</td>
<td>45</td>
<td>40</td>
<td>15</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>T Calculation tutorials 2</td>
<td>15</td>
<td>15</td>
<td></td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>D Design assignment 2</td>
<td>20</td>
<td>30</td>
<td></td>
<td>50</td>
<td></td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td><strong>160</strong></td>
<td><strong>170</strong></td>
<td><strong>30</strong></td>
<td><strong>360</strong></td>
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</tr>
</tbody>
</table>

#### Workload in hours

- Total workload: 360 hours = 12 ECTS credits

#### Contribution to final mark

- 50% examination 1 and 50% examination 2

Prerequisite(s) for examination: Regular and active participation in courses

Form(s) of assessment (scope)

1. Examination of Machine Elements 1 lecture (90 min.)
2. Examination of Machine Elements 2 lecture (90 min.)

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).
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<table>
<thead>
<tr>
<th>Retake examination</th>
<th>Written examination (90 min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Every semester duration: 2 semesters</td>
</tr>
<tr>
<td>Intake capacity</td>
<td>Lecture and tutorial: unlimited (capacity of lecture hall)</td>
</tr>
<tr>
<td>Language of instruction</td>
<td>German</td>
</tr>
<tr>
<td>Additional information</td>
<td>Guidance on module and required literature:: see notice board/date: see course catalogue</td>
</tr>
<tr>
<td>Module code</td>
<td>Materials Engineering</td>
</tr>
<tr>
<td>-------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td>Bachelor</td>
<td>Professional and Business Education</td>
</tr>
</tbody>
</table>

**Module**

Materials Engineering

**Faculty/Subject/Department**

MMEW

**Associated degree course/Semester taken**

Bachelor PBE, 1st semester

**Module coordinator**

cf. German version

**Prerequisites**

None

**Learning outcomes**

- 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**

- 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%

**Total workload**

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact hours</td>
<td>45</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Preparation/revision, module-component examination</td>
<td>15</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>60</td>
<td>45</td>
<td>15</td>
</tr>
</tbody>
</table>

**Workload in hours**

Total workload: 120 hours = 4 ECTS credits (1 ECTS = 30 hours)

**Prerequisite(s) for examination**

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
<table>
<thead>
<tr>
<th>Module code</th>
<th>Technical Thermodynamics</th>
<th>Bachelor Professional and Business Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>Technical Thermodynamics</td>
<td>Faculty/Subject/Department University of applied sciences: Faculty 03/MMEW</td>
</tr>
<tr>
<td>Associated degree course/Semester taken</td>
<td>Bachelor PBE, 3rd semester</td>
<td></td>
</tr>
<tr>
<td>Module coordinator</td>
<td>cf. German version</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**Learning outcomes**
- 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**
- 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**

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>Contact hours</th>
<th>Preparation/revision, module-component examination</th>
<th>Examination incl. preparation</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Lecture Thermodynamics</td>
<td>45</td>
<td>15</td>
<td>15</td>
<td>75</td>
</tr>
<tr>
<td>LT Laboratory tutorials</td>
<td>30</td>
<td>15</td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>Sum</td>
<td>75</td>
<td>30</td>
<td>15</td>
<td>120</td>
</tr>
</tbody>
</table>

**Total workload**
120 hours = 4 ECTS credits (1 ECTS = 30 hours)

**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
<table>
<thead>
<tr>
<th>Module code</th>
<th>Electrical Engineering</th>
<th>Bachelor Professional and Business Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty/Subject/Department</td>
<td>Electrical Engineering 2</td>
<td>University of applied sciences: Faculty 03/MMEW</td>
</tr>
<tr>
<td>Associated degree course/Semester taken</td>
<td>Bachelor PBE, 1st semester</td>
<td></td>
</tr>
<tr>
<td>Module coordinator</td>
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<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

**Learning outcomes**
- The students 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**
- 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**

<table>
<thead>
<tr>
<th>Type and title of course</th>
<th>A courses</th>
<th>B autonomous work</th>
<th>C examination incl. preparation</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lecture Electrical Engineering</td>
<td>30</td>
<td>15</td>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>Calculation tutorial</td>
<td>30</td>
<td>30</td>
<td></td>
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</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>45</td>
<td>15</td>
<td>120</td>
</tr>
</tbody>
</table>

**Prerequisite(s) for examination**
Regular and active participation in courses

**Module examination**
- Form(s) of assessment (scope) Examination of lecture (90 min.)
- 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
<table>
<thead>
<tr>
<th>Module code</th>
<th>Manufacturing Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor</td>
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<table>
<thead>
<tr>
<th>Module</th>
<th>Manufacturing Technology</th>
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<table>
<thead>
<tr>
<th>Associated degree course/Semester taken</th>
<th>Bachelor PBE, 2nd semester</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>cf. German version</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>None</th>
</tr>
</thead>
</table>

**Learning outcomes**

- The students
  - 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**

- 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**

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>Lecture Manufacturing Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>A courses</td>
<td>60 hours</td>
</tr>
<tr>
<td>B preparation/revision</td>
<td>30 hours</td>
</tr>
<tr>
<td>C examination</td>
<td>15 hours</td>
</tr>
<tr>
<td>Sum</td>
<td>120 hours = 4 ECTS credits (1 ECTS = 30 hours)</td>
</tr>
</tbody>
</table>

| Percentage share of instruction form(s) | Lecture 100% |

**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
### Module code
Measurement Engineering

### 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, 4th semester

### Module coordinator
cf. German version

### Prerequisites
None

#### Learning outcomes
- 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
- 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

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</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>

#### Module examination
- Prerequisite(s) for examination: Regular and active participation in courses
- Form(s) of assessment (scope): 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
Module code: Production and Quality Assurance
Degree Programme: Vocational Education and Training
Attachment: 2.1.2 Module Descriptions Metals Technology
Version 1 of June 24, 2009

**Module: Production and Quality Assurance**

**Faculty/Subject/Department:**
University of applied sciences: Faculty 03/MMEW

**Associated degree course/Semester taken:**
Bachelor PBE, 5th semester

**Module coordinator:**
cf. German version

**Prerequisites:**
Manufacturing Technology

### Learning outcomes

- The students are familiar with
  - 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

- 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

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>Contact hours</th>
<th>Preparation/revision hours</th>
<th>Autonomous work</th>
<th>Module-component examination</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L Lecture</strong></td>
<td>45</td>
<td>30</td>
<td>10</td>
<td>15</td>
<td>100</td>
</tr>
<tr>
<td><strong>LT Laboratory tutorials</strong></td>
<td>10</td>
<td>10</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td><strong>Si Seminar</strong></td>
<td>15</td>
<td>15</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>70</td>
<td>55</td>
<td>10</td>
<td>15</td>
<td>150</td>
</tr>
</tbody>
</table>

**Total workload:** 150 hours = 5 ECTS credits (1 ECTS = 30 hours)

**Percentage of workload:**
- Lecture: 75%
- Seminar: 15%
- Tutorial: 10%

### Module examination

**Prerequisite(s) for examination:**
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:**
- 100% examination
- Written examination (90 min.)

**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
Module code | Control Engineering | 5\textsuperscript{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\textsuperscript{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.

- 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

Laboratory:
- All elements of the lecture will be put into practice through the use of a teaching software that will be made available to students.

**Module contents**

- stead 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

Laboratory:
- All elements of the lecture will be put into practice through the use of a teaching software that will be made available to students.

**Prerequisite(s) for examination**

Regular and active participation in courses

**Form(s) of assessment (scope)**

- 1. Se: written or oral examination of all content covered in module
- 2. L: 3 laboratory reports
- 3. FD: Final design assignment

**Module examination**

Contribution to final mark

- 80% examination or technical discussion, 20% reports

---

Please note that only the German version of the modules is official and legally binding. The English version is for informative purposes only.
<table>
<thead>
<tr>
<th>Retake examination</th>
<th>Every module-component examination must be passed. Individual module-component examinations can be retaken.</th>
</tr>
</thead>
</table>
| 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 |
### Module code
Sensor and Actuator Engineering

### 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, 5th semester

### Module coordinator
cf. German version

### Prerequisites
Fundamental modules, Metrology

<table>
<thead>
<tr>
<th>Learning outcomes</th>
<th>The students are familiar with</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>•  sensor technologies, operating principles and characteristics</td>
</tr>
<tr>
<td></td>
<td>•  fundamentals and technological principles of motors/actuators, small motors, piezo actuators, magnetic actuators, magnetoelastic actuators, micro motors, memory metals, thermal propulsion systems, nanotechnology</td>
</tr>
</tbody>
</table>

| Module contents | •  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

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a contact</td>
<td>b preparation/revision</td>
<td>incl. preparation</td>
</tr>
<tr>
<td>Lecture</td>
<td>45</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Laboratory tutorials</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Total workload</td>
<td>150</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Module examination

<table>
<thead>
<tr>
<th>Form(s) of assessment (scope)</th>
<th>Examination of lecture (90 min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module examination</td>
<td></td>
</tr>
<tr>
<td>Contribution to final mark</td>
<td>100% examination</td>
</tr>
<tr>
<td>Retake examination</td>
<td>Written examination (90 min.)</td>
</tr>
</tbody>
</table>

### 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
<table>
<thead>
<tr>
<th>Module code</th>
<th>Machine Tools</th>
<th>Bachelor Professional and Business Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faculty/Subject/Department</td>
<td>Machine Tools, 3Se/1P</td>
<td>MMEW</td>
</tr>
<tr>
<td>Associated degree course/Semester taken</td>
<td>Bachelor PBE, 5th/6th semester</td>
<td></td>
</tr>
<tr>
<td>Module coordinator</td>
<td>cf. German version</td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td>None</td>
<td></td>
</tr>
</tbody>
</table>

### Learning outcomes
- have the ability to describe, name and classify machine tools
- are aware of the fundamentals 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
- 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

<table>
<thead>
<tr>
<th>Type and title of course</th>
<th>hours A</th>
<th>b preparation/revision, work</th>
<th>c examination incl. preparation</th>
<th>module-component examination</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laboratory</td>
<td>15</td>
<td>30</td>
<td></td>
<td></td>
<td>45</td>
</tr>
<tr>
<td>Seminar</td>
<td>45</td>
<td>30</td>
<td>30</td>
<td>105</td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>60</td>
<td>60</td>
<td>30</td>
<td>150</td>
<td></td>
</tr>
</tbody>
</table>

### Prerequisite(s) for examination
- Regular and active participation in courses

### Form(s) of assessment (scope)
- 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
### Module code
Vibration Technology

### 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, 5th/6th semester

### Module coordinator
cf. German version

### Prerequisites
None

### Learning outcomes
The students
- 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
- 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

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A contacts</th>
<th>b preparation/ revision, nomous work</th>
<th>C examination incl. preparation</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Vibration Technology</td>
<td>60</td>
<td>30</td>
<td>20</td>
<td>110</td>
</tr>
<tr>
<td>T Calculation tutorial</td>
<td>30</td>
<td>10</td>
<td>40</td>
<td>150</td>
</tr>
</tbody>
</table>

### Module examination

<table>
<thead>
<tr>
<th>Prerequisite(s) for examination</th>
<th>Regular and active participation in courses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Form(s) of assessment (scope)</td>
<td>1. L: examination of lecture (90 min.)</td>
</tr>
<tr>
<td>Module examination</td>
<td></td>
</tr>
<tr>
<td>Contribution to final mark</td>
<td>100% examination</td>
</tr>
<tr>
<td>Retake examination</td>
<td>Examination (90 min.)</td>
</tr>
</tbody>
</table>

### 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
Module code | Mining and Extraction | Bachelor Professional and Business Education
---|---|---
Module | Mining and Extraction | Bachelor PBE, 5th semester
Faculty/Subject/Department | University of applied sciences: Faculty 03/MMEW | cf. German version
Associated degree course/Semester taken | Bachelor PBE, 5th semester | None
Prerequisites | None | None

### Learning outcomes
- 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
- 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%

### Total workload
150 hours = 5 ECTS credits (1 ECTS = 30 hours)

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>L Materials-handling Technology</td>
<td>45</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>T Calculation tutorial</td>
<td>45</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Sum</td>
<td>90</td>
<td>45</td>
<td>15</td>
</tr>
</tbody>
</table>

### Module examination
Prerequisite(s) for examination: Regular and active participation in courses
Form(s) of assessment (scope): Examination of lecture (90 min.)
Contribution to final mark: 100% examination
<table>
<thead>
<tr>
<th>Retake examination</th>
<th>Examination (90 min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>Every semester duration: 1 semester</td>
</tr>
<tr>
<td>Intake capacity</td>
<td>Lecture: unlimited (capacity of lecture hall)</td>
</tr>
<tr>
<td>Language of instruction</td>
<td>German</td>
</tr>
<tr>
<td>Additional information</td>
<td>Guidance on module and required literature: see notice board/date: see course catalogue</td>
</tr>
</tbody>
</table>
### Module code

Microsystems Engineering

### Bachelor Program

Professional and Business Education

### Module

Microsystems Engineering

### Faculty/Subject/Department

University of applied sciences: Faculty 03/MMEW

### Associated degree

Bachelor PBE, 5th semester

### Module coordinator

cf. German version

### Prerequisites

None

---

### Learning outcomes

The students are familiar with
- the fundamentals of miniaturization,
- microstructures and their manufacture,
- the materials of microtechnology,
- micro-technical components,
- lithographic methods

### Module contents

- Microstructures and their manufacture,
- materials of microtechnology,
- micro-technical components,
- lithographic methods

### Percentage share of instruction form(s)

Seminar 100%

### Workload in hours

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si Seminar</td>
<td>60</td>
<td>60</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>150</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Total workload

150 hours = 5 ECTS credits (1 ECTS = 30 hours)

### 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
### Module code
- **Technical Optics**

### 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, 5th semester

### Module coordinator
- cf. German version

### Prerequisites
- None

### Learning outcomes
- The students
  - 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
- 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

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>a contact hours</td>
<td>45</td>
<td>30</td>
<td>30</td>
<td>105</td>
</tr>
<tr>
<td>b preparation/revision, module-component examination</td>
<td>15</td>
<td>30</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

| Sum | 60 | 60 | 30 | 150 |

### Module examination
- **Frequency**: Every semester duration: 1 semester
- **Prerequisite(s) for examination**: Regular and active participation in courses
- **Form(s) of assessment (scope)**: Examination of lecture (90 min.)
- **Module examination**: 100% examination
- **Retake examination**: Examination (90 min.)

### 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
## Module Description: Electrical Drives

**Module Code:** Electrical Drives  
**Semester:** 5th sem.  
**ECTS Credits:** 5 CP

### Bachelor Professional and Business Education

**Faculty/Subject/Department:** University of applied sciences: Faculty 03/MMEW  
**Associated degree course/Semester taken:** Bachelor PBE, 5th semester  
**Module coordinator:** cf. German version  
**Prerequisites:** None

### Learning Outcomes

- 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

- 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

<table>
<thead>
<tr>
<th>Course Type and Title</th>
<th>A: Courses</th>
<th>B: Autonomous Preparation</th>
<th>C: Examination</th>
<th>Sum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact Hours</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>80</td>
</tr>
<tr>
<td>Preparation/Revision</td>
<td></td>
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<tr>
<td>Examination</td>
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</tbody>
</table>

### Module Examination

- **Prerequisite(s) for examination:** Regular and active participation in courses
- **Form(s) of assessment (scope):** Examination of lecture (60 min.)
- **Module examination:** 100% examination
- **Retake examination:** Examination (60 min.)

### Frequency

- Every 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, *Elektrische Maschinen*, Hanser-Verlag 2005
Special regulation of the Degree Programme Vocational Education and Training
Attachment: 2.1.2 Module Descriptions Metals Technology
Version 1 of June 24, 2009

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

<table>
<thead>
<tr>
<th>Module code</th>
<th>Automotive Engineering</th>
<th>Bachelor</th>
<th>Professional and Business Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Module</td>
<td>Bachelor Professional and Business Education</td>
<td></td>
<td></td>
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<tr>
<td>Module contents</td>
<td>Automotive Engineering</td>
<td></td>
<td></td>
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<tr>
<td>Associated degree course/Semester taken</td>
<td>Bachelor PBE, 5th semester</td>
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<tr>
<td>Module coordinator</td>
<td>cf. German version</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prerequisites</td>
<td>Knowledge of statics and dynamics</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Learning outcomes**
- The students
- 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**
- 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%

**Total workload**
150 hours = 5 ECTS credits (1 ECTS = 30 hours)

<table>
<thead>
<tr>
<th>Type and title of course</th>
<th>A courses</th>
<th>B autonomous</th>
<th>C examination</th>
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</thead>
<tbody>
<tr>
<td>L Lecture Auto. Eng.</td>
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<tr>
<td>LT Laboratory tutorials</td>
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<tr>
<td>Sum</td>
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<td>45</td>
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</tbody>
</table>

**Prerequisite(s) for examination**
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
<table>
<thead>
<tr>
<th>Module code</th>
<th>Automotive Drives</th>
<th>Bachelor Professional and Business Education</th>
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</thead>
<tbody>
<tr>
<td>Faculty/Subject/Department</td>
<td>University of applied sciences: Faculty 03/MMEW</td>
<td>Bachelor PBE, 5th semester</td>
</tr>
<tr>
<td>Module coordinator</td>
<td>cf. German version</td>
<td>Knowledge of statics and dynamics</td>
</tr>
<tr>
<td>Prerequisites</td>
<td></td>
<td>Knowledge of statics and dynamics</td>
</tr>
</tbody>
</table>

**Learning outcomes**
- 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**
- 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)

<table>
<thead>
<tr>
<th>Type and title of course</th>
<th>A courses</th>
<th>B autonomous work</th>
<th>C examination</th>
<th>Sum</th>
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</thead>
<tbody>
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<td>Lecture Auto. Drives</td>
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<tr>
<td>Laboratory tutorials</td>
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<td></td>
<td></td>
<td>15</td>
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<tr>
<td>Sum</td>
<td>60</td>
<td>45</td>
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</table>

**Module examination**

<table>
<thead>
<tr>
<th>Form(s) of assessment (scope)</th>
<th>Examination of lecture (90 min.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prerequisite(s) for examination</td>
<td>1. Regular and active participation in courses</td>
</tr>
<tr>
<td></td>
<td>2. Tests on three experiments in the laboratory tutorials</td>
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<td>Module examination</td>
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</tr>
<tr>
<td>Contribution to final mark</td>
<td>100% examination</td>
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<tr>
<td>Retake examination</td>
<td>Examination (90 min.)</td>
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**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
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<th>Piston Machines</th>
<th>5th sem.</th>
<th>5 CP</th>
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<td>Professional and Business Education</td>
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<td>Module</td>
<td>Piston Machines</td>
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<td>Module coordinator</td>
<td>cf. German version</td>
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<tr>
<td>Prerequisites</td>
<td>Knowledge of thermodynamics</td>
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</tbody>
</table>

**Learning outcomes**
- 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**
- 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**

<table>
<thead>
<tr>
<th>Course type and title</th>
<th>Contact hours</th>
<th>Preparation/revision hours</th>
<th>Nomous work incl. preparation</th>
<th>Module-component examination</th>
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<tr>
<td>Sum</td>
<td>60</td>
<td>45</td>
<td>45</td>
<td></td>
<td>150</td>
</tr>
</tbody>
</table>

**Module examination**
- **Prerequisite(s) for examination**
  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.)
- **Contribution to final mark**
  100% examination
- **Retake examination**
  Written examination (90 min.)

**Frequency**
- Every 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