Module catalogue

for the collaborative study
programme

Mechanical Engineering (B. Eng.)

at Bielefeld University of Applied Sciences and South Westphalia University of Applied Sciences, Iserlohn Dept.

As of: 6 February 2014

Course Schedule

Module name						Semester								
		L	E	P	ECTS	1	2	3	4	5	6	7	8	9
M0I	Technical Documentation	2	1	1	5									
M02	Computer Science	2	2		5									
M03	Mathematics 1	2	2		5									
M04	Engineering Mechanics 1	2	2		5									
M05	Physics	2	1	1	5									
M06	Mathematics 2	2	2		5									
M07	Engineering Mechanics 2	2	2		5									
M08	CAD	2	1	1	5									
M09	Mathematics 3	2	2		5									
MI0	Engineering Mechanics 3	2	2		5									
MII	Construction Elements 1	2	1	1	5									
M12	Electrical Engineering 1	2	2		5									
M13	Construction Elements 2	2	1	1	5									
M14	Thermodynamics	2	2		5									
M15	Electrical Engineering 2	2	2		5									
M16	Materials Science 1 and Chemistry	2	1	1	5									
M17	Materials Science 2	2	1	1	5									
M18	Industrial Management	2	2		5									
M19	Fluid Mechanics	2	2		5									
M20	Production Engineering 1	2	2		5									
M21	Automation Technology 1	2	1	1	5									
M22	Applied Statistics	2	2		5									
M23	Fluid Power	2	2		5									
M24	Production Engineering 2	2	1	1	5									
M25	Automation Technology 2	2	1	1	5									
M26	Production Planning and Control	2	2		5									
M27	Cost Accounting	2	2		5									
M28	Thermal Power and Working Machines	2	1	1	5									
WPM	Elective 1	2	1	1	5									
WPM	Elective 2	2	2(1)	(1)	5									
WPM	Elective 3	2	2		5									
WPM	Elective 4	2	2		5									
M29	Project Management	2	1	1	5									
M30	Bachelor Thesis				12									
M31	Colloquium				3									
Total		66	53(52)	13(14)	**180**									

Compulsory Elective Blocks

In the seventh semester there is an information event on the four compulsory elective courses. The students determine their selection priorities within the subsequent decision period. Elective blocks can only take place if at least seven students have bindingly registered for participation in due time. In case of course non-occurrence at the own venue of study, students must switch to other compulsory electives or, if applicable, find another venue of study.

Product Development														
Module name						Semester								
		L	E	P	ECTS	1	2	3	4	5	6	7	8	9
WPM08	Design System	2	1	1	5									
WPM03	Accuracy and Reliability of Machines and Equipment	2	2		5									
WPM04	Transmission Technology	2	2		5									
WPM05	Industrial Property Protection/Patents	2	2		5									

Production Engineering														
Module name						Semester								
		L	E	P	ECTS	1	2	3	4	5	6	7	8	9
WPM14	Machining	2	1	1	5									
WPM12	Forming	2	1	1	5									
WPM01	Occupational Science	2	2		5									
WPM11	Quality Management	2	2		5									

Plastics Technology														
Module name						Semester								
		L	E	P	ECTS	1	2	3	4	5	6	7	8	9
WPM07	Designing With Plastics	2	1	1	5									
WPM02	Plastics Production Process	2	1	1	5									
WPM13	Material Science of Plastics	2	2		5									
WPM11	Quality Management	2	2		5									

Business Organisation														
Module name						Semester								
		L	E	P	ECTS	1	2	3	4	5	6	7	8	9
WPM09	Material Flow and Logistics	2	1	1	5									
WPM10	Operations Research	2	2		5									
WPM06	Investment and Financing	2	2		5									
WPM11	Quality Management	2	2		5									

Technical Documentation

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M01	125 h	5	1st sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 stud.

2 Learning outcomes / competences

Students are able to ...

... produce standardised technical drawings of simple components and assemblies.

... dimension the components in a manner suitable for production.

... specify tolerances of individual dimensions and tolerance.

... create parts lists of assemblies.

... select semi-finished products.

3 Contents

Basics of standard-compliant representation in machine, plant and equipment construction:

- Elements of a technical drawing: Formats, title block, scales, projections and views, lines, labels, sectional views
- Drawing and dimensioning suitable for production: Elements of dimensioning, arrangement of dimensions and special features in representation and dimensioning, types of dimensioning
- Special representations and dimensions: Thread and screw illustration, rolling bearing illustration and arrangement, gear illustration, construction and illustration of shafts, weld illustration
- Tolerances and fits: Tolerance specifications, ISO tolerance system, fitting systems: Standard bore, standard shaft, general tolerances (free size tolerances), form and position tolerances
- Surface details
- Materials, semi-finished products and heat treatment
- Designing for production and materials during casting

4 Forms of teaching

Teaching units for self-study, classroom attendance in the form of seminar-based teaching, exercises and practical training.

5 Participation requirements:

- Formal: -
- Content: -

6 Forms of assessment: usually written exam

7 Requirements for the award of credit points:

Certificate for successful participation in the internship and module examination pass

8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Engineering (B.Eng.) and Mechatronics (B.Eng.) of the South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences Prof. Dr.-Ing. Raimund Kisse, Bielefeld University of Applied Sciences
11	**Other information** • Practical course with several selected application examples (workpiece recording, drawing creation, parts list creation, tolerance analysis) to acquire and consolidate the skills for reading and creating technical drawings and for the production-oriented and tolerance-oriented design as well as the selection of semi-finished products. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Computer Science

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M02	125 h	5	1st sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students
2	**Learning outcomes / competences** students ... ... are familiar with the basic ideas of computer science as well as the practical use of computers and can quickly familiarise themselves with computer applications. ... are especially able to use the spreadsheet programme EXCEL to solve business and technical problems.			
3	**Contents** • Information processing with the computer: Information, data and their processing, basic structure and functioning of a computer • Basics of data processing: Binary coding, dual number arithmetic, algorithms • Boolean Algebra and Switching Systems: Boolean algebra, normal forms, circuit design • Structure of a computer: Processor, system bus, internal and external memory, input and output devices, interfaces • Computer networks: Classification, transmission media, communication protocols, network structures, access procedures • Operating systems: Boot process, tasks of an operating system, user and programming interfaces, resource management, classification of operating systems • Database systems: Databases, data models, introduction to database design • Spreadsheet calculation with EXCEL			
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.			
5	**Participation requirements** • Formal: • Content: -			
6	**Forms of assessment:** usually written examination			

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Engineering (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Mathematics 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M03	125 h	5	1st sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... transform terms and simple equations with confidence.

... determine the solution set of inequalities.

... calculate with complex numbers.

... use the methods of combinatorics to systematically count finite sets.

.. assess the accuracy of calculation results.

... deal with number sequences and infinite series.

... investigate real functions and their characteristic properties.

... differentiate real functions.

... carry out a curve discussion.

3 Contents

Students learn the basic mathematical methods for solving engineering problems and how to apply them.

- General principles:
  Statements and logical connections, sets, relations and mappings, equations and inequalities, combinatorics, numerical arithmetic and elementary error calculation
- Complex numbers:
  Imaginary unit, real and imaginary part, Gaussian number plane, polar and exponential form of a complex number, conversion of the forms of representation, calculating with complex numbers, exponentiation, root extraction and logarithmisation of complex numbers
- Sequences and rows:
  The concept of a number sequence, properties of sequences, limit value of a sequence, the concept of an infinite series, convergence criteria
- Real functions:
  Definition and representation of a real function, calculation with real functions, properties of real functions, limit and continuity of real functions
- Special functions:
  Integral functions, fractional functions, irrational functions, exponential functions, logarithmic functions, trigonometric functions
- Differential calculus:
  Differentiability, derivative rules, differentiation after logarithmising, derivative of the

	inverse function, higher derivatives, de L'Hospital's rules, monotonicity and curvature behaviour of real functions, extrema, curve discussion
4	**Forms of teaching** Teaching units for self-study, attendance-required events in the form of seminar-based teaching and exercises.
5	**Participation requirements** • Formal: - • Content: -
6	**Forms of assessment:** usually written examination
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences Dr. rer. nat. Christiane lhrig, South Westphalia University of Applied Sciences Dipl.-Math. Sybille Draxl, University of Applied Sciences Bielefeld
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Engineering Mechanics 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M04	125 h	5	1st sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16h c) Self-study and exam preparation: 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to ...

... apply the axioms of statics.

... create free-body images.

... carry out equilibrium investigations analytically on manageable planar or spatial technical examples.

... calculate focal points.

... analyse stability problems.

... analyse force systems with friction.

3 Contents

The students learn the basic interrelationships of statics as the study of the equilibrium of forces in and on mechanical structures at rest and how to apply their methods.

- Introduction: Delimitation of topics, conventions
- Basics of structural analysis: Concept of force, axioms of statics
- Central plane force system
- General plane force system
- Determine the bearing reactions for one-piece systems of rigid bodies in the plane
- Determining the bearing and intermediate reactions in multi-part systems of rigid bodies
- Focus: Body, volume, area, line centre of gravity, stability, Guldin's rules
- Friction: static and sliding friction, rope friction, rolling resistance
- The spatial force system

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: -

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences Prof. Dr.-Ing. Raimund Kisse, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Physics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M05	125 h	5	2nd sem.	Summer semester	1 semester

1	**Courses**	**Contact time**	**Self-study**	**Planned group size**
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

The students ...

... are familiar with the SI system and confidently transform physical quantities and units.

... understand the nature of a physical measurement process.

... recognise basic physical relationships.

... solve simple kinematic and dynamic problems using the basic equations.

... understand the meaning of physical conservation laws and are able to apply them.

... know the basic phenomena of acoustics and optics.

... carry out physical experiments and evaluate the results.

... write laboratory reports according to the general method.

3 Contents

- Basic concepts of physics:
  Systematics of physical quantities, SI units, definition of elementary physical quantities (e.g. length, time, mass, density, force, pressure, mechanical tension, temperature, heat capacity, viscosity)
- Physical measurement process:
  Measurement systems, graphical representations, measurement deviation and error propagation
- Kinematics :
  Basic kinematic variables in translation and rotation (location, angle of rotation, (angular) velocity, (angular) acceleration, displacement-time diagram, uniform (rotational) motion, uniformly accelerated (rotational) motion)
- Dynamics:
  Newton's axioms, inertial mass, moment of inertia, gravitation, mechanical forces, friction, apparent forces (centripetal force, Coriolis force)
- Physical work and energy:
  Definition of work, energy, power, efficiency and effectiveness; forms of energy, energy conservation law with applications
- Momentum and angular momentum:
  Definition of momentum and angular momentum, connection with forces and moments, law of conservation of momentum and angular momentum with applications

	• Elementary vibration theory: Periodic processes, kinematics and dynamics of harmonic oscillations, undamped and damped, free and forced oscillation • Elementary wave phenomena using the examples of acoustics and optics • Technical acoustics : Sound waves and superposition, sound propagation, sound pressure, sound level and A-weighting, sound attenuation and sound insulation • Optics: Wave optics (interference and diffraction), Reflection, Transmission, Refraction, Total refraction), Geometrical optics (optical imaging, simple optical instruments)
4	**Forms of teaching** Teaching units for self-study, classroom attendance in the form of seminar-based teaching, exercises and practical training.
5	**Participation requirements** • Formal: • Content: Mastery of the material from *Mathematics 1*
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Dr. rer. nat. Christiane Ihrig, South Westphalia University of Applied Sciences
11	**Other information** • In the practical course, students carry out a selection of experiments from the following catalogue: 1. Gravitational acceleration (free fall; mathematical pendulum) 2. Heat (specific heat capacity of solid bodies; experiment on phase transformation) 3. Density and buoyancy (density of liquid substances with hydrometer and immersion test; density of solid substances by Jolly's spring balance) 4. Optics (focal length of thin lenses; dispersion at the prism) 5. Heat II (linear expansion of metal rods; volume expansion of liquids) 6. Optics II (refraction and total reflection; diffraction at slit, grating and pinhole) 7. Torsion pendulum (G-modulus of torsion bars ; mass moments of inertia of different bodies) 8. Dynamic viscosity of liquids (falling ball test, test on temperature dependence) 9. Modulus of elasticity (extension test; bending test with different rods) 10. Spring pendulum (Hooke's law, calculation of the spring constant from the geometry and material properties of the spring; free oscillations of different springs) • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Mathematics 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M06	125 h	5	2nd sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... calculate the power series expansion of a function and use it in approximation and integration.

... integrate real functions using the techniques covered.

... deal with vectors and matrices, especially for applications in analytical geomatics.

... solve systems of linear equations using the Gauss algorithm.

... calculate the determinant of a matrix.

3 Contents

Students learn the basic mathematical methods for solving engineering problems and how to apply them.

- Power series:
  Definition and basics, convergence of power series, Taylor series , power series development of a function, integration of power series
- Integral calculus :
  The definite integral , the area problem, general definition of the definite integral, general integration rules and properties of the definite integral, the main theorem of differential and integral calculus, basic or root integrals, integration methods, partial integration, integration by substitution, integration of fractional rational functions, improper integrals
- Vector calculus:
  Scalar and vector quantities, vector as a mapping , three-dimensional vector space, vector addition and multiplication with a scalar, scalar product, n-dimensional vector space, linear dependence and independence, vector and spat product, analytic geometry
- Matrices and systems of linear equations:
  Definition of a matrix, Calculating with matrices, Matrices as linear representations, linear systems of equations, coefficient matrix of a linear system of equations, row normal form of a matrix,
  Gauss-Jordan method, solvability of linear systems of equations, calculation of the inverse matrix, determinants

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5	**Participation requirements** • Formal: - • Content: Mastery of the material from *Mathematics 1*
6	**Forms of assessment:** usually written examination
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences Dipl.-Math. Sybille Draxl, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Engineering Mechanics 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
MO?	125 h	5	2nd sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

The students are able to carry out strength checks for simple statically or dynamically stressed components using relevant material parameters.

3 Contents

The students learn fundamental relationships between the external loads and the resulting internal stresses and deformations.

- Introduction: Delimitation of topics, conventions
- Tensile/compressive stress
- Assessment of failure under static loading
- Deformation and thermal stresses
- Vibratory stress on notch-free components
- Stress on notched components
- First and second order moments of area, moments of resistance
- Internal forces on the beam
- Bending stress
- Torsional stress
- Shear force-induced shear stresses in bending beams
- Buckling stress
- Multi-axial stress states and equivalent stresses

4 Forms of teaching

Teaching units for self-study, classroom attendance in the form of seminar-based teaching, exercises and practical exercises.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Mathematics 1* and *Engineering Mechanics 1*

6 Forms of assessment: usually written examination

7 Prerequisites for the award of credit points: module examination pass

8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Significance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences Prof. Dr.-Ing. Raimund Kisse, University of Applied Sciences Bielefeld
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

CAD

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
MOB	125 h	5	2nd sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	**Contact time** 24 h	**Self-study** 101 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to ...

... describe the functions and possibilities of common 3D CAD systems in an overview.

... create and manipulate 3D models.

... create 3D assemblies.

... derive 2D drawings from 3D models.

3 Contents

The students get to know and apply systems and working techniques of computer-aided design.

- CAD systems:
  Definition and historical development, reasons for introduction and distribution, equipment technology, programmes for CAD, data exchange
- CAD working techniques:
  Input techniques, coordinate systems, operators and operands, construction methods for 2D geometry, 3D geometry models (corner, edge, surface, solid models), methods for structuring CAD data, variant construction through parameterisation, solid modelling through
  Solid element synthesis, solid modelling by rotating and extruding, levels of detail for 3D CAD models, application extensions

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Technical Documentation*

6 Forms of assessment: usually written exam

7 Requirements for the award of credit points

Certificate for successful participation in the internship and module examination pass

8 Use of the module (in other degree programmes)

Compulsory module in the part-time combined study programme Plastics Technology (B. Eng.) of South Westphalia University of Applied Sciences

9 Importance of the grade for the final grade: 5/180

10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Wilhelm Hannibal, South Westphalia University of Applied Sciences Dr. Peter Hoppe, South Westphalia University of Applied Sciences
11	**Other information** • Internship on an integrated CAE system (CATIA, Autocad inventory): a) Demonstration of the basic methods of computer-aided design, Individual application in particular the presented methods for modelling 3D models for individual parts and assemblies in mechanical engineering and for drawing derivation under guidance. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Mathematics 3

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M09	125 h	5	3rd sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... calculate the solution of various simple types of differential equations as well as systems of linear differential equations.

... determine partial derivatives, gradient and directional derivative of functions of several variables.

... determine relative extrema as well as extrema under constraints of functions of several variables.

... apply the discussed methods in the compensation and error calculation.

3 Contents

Students learn the basic mathematical methods for solving engineering problems and how to apply them.

- Ordinary differential equations:
  Introduction and definitions, 1st order differential equations, geometric interpretation, separable differential equations, integration of a differential equation by substitution, 1st order linear differential equations, variation of constants, nth order linear differential equations with constant coefficients, superposition theorem, product theorem, fundamental systems, exponential theorem, characteristic equation, oscillations, determination of the special solution of the inhomogenous equation, systems of linear differential equations with constant coefficients
- Differential calculus for functions of several variables :
  Introduction of functions of several variables, forms of representation, continuity, partial derivative, the total differential, !implicit differentiation, gradient and directional derivative, Taylor's theorem, relative extrema, extrema under constraints, applications in equilibrium and equilibrium theory
  Error calculation

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Mathematics 2*

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (**B.**Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences Dipl.-Math. Sybille Draxl, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Engineering Mechanics 3

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M10	125 h	5	3rd sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to apply the essential basic dynamic laws to points and rigid bodies.

3 Contents

Students are taught basic knowledge of the geometric and temporal processes of movements and their interactions with forces and moments in and on mechanical structures.

- Introduction to the topic delimitation
- Kinematics :
  Kinematics of the point, kinematics of the disc
- Kinetics :
  Kinetics of the mass point, pure translational motion; work, energy, power; momentum, momentum theorem, momentum conservation law for mass points; motion of a body in a medium; rotation of a body about a fixed axis; work, energy, power in rotational motion; momentum, momentum conservation law for rotational motion; general, plane motion of a rigid body

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Mathematics 2* and *Engineering Mechanics 2*

6 Forms of assessment: usually written examination

7 Prerequisites for the award of credit points: module examination pass

8 Use of the module (in other degree programmes)

Compulsory module in the joint degree programmes
Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer

Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences

Prof. Dr.-Ing. Raimund Kisse, University of Applied Sciences Bielefeld

11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Construction Elements 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M11	125 h	5	3rd sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... explain the function of the machine elements presented.

... name the advantages and disadvantages of technical alternatives.

... design the basic machine elements presented.

... draw on their knowledge from previous basic subjects in order to find solutions to simple design problems and to develop these solutions taking into account physical, economic and social factors, material, technological and economic aspects.

... document their own constructive solution proposals as far as possible in accordance with standards.

3 Contents

Students are taught about the function and structure of machine elements as well as their calculation and design.

- Basics of construction:
  Overview of the design development process, designing with design elements, force-appropriate design, production-appropriate design, stress on design elements, tolerances and fits
- Connecting elements :
  Classification system for connections, substantial connections (welded, soldered, bonded, cemented connections), Positive connections (embedded, riveted, flanged, folded, lapped, expanded, bolted, shaft-hub connections), force connections (press, pin, screw, wedge, clamp connections)
- Bearings:
  Friction behaviour of bearing arrangements, rolling bearings, plain bearings
- Guided tours:
  Definition and application examples , requirements, sliding guides, rolling guides, kinematic guides
- Axles and shafts:
  Definition and properties, strength calculation, deformation calculation, critical speed, design guidelines

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5	**Participation requirements** • Formal: • Content: Mastery of the material from *Technical Documentation* and *Technical Mechanics 2*
6	**Forms of assessment:** usually written examination
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with several selected design tasks from the sub-spectrum of the machine elements covered. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Electrical Engineering 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M12	125 h	5	3rd sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16h c) Self-study and exam preparation: 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to ...

... calculate the force effects of electric and magnetic fields.

... apply Ohm's law and Kirchhoff's equations.

... set up and solve systems of equations for calculating linear DC and AC circuits.

... apply the law of induction and the law of flow-through.

3 Contents

Students are taught basic and in-depth knowledge of the content, interrelationships and technical applications of electrical engineering. The module contents serve as a basis for understanding the application and development of electrotechnical systems in engineering activities.

- SI units, electrophysical basics
- Electrostatics:
  Coulomb's law, electric force field, electric work, voltage and potential, electric flux density and electric flux, polarisation, capacitor
- Electric flow:
  Electrical line current and current density, Ohm's law for homogeneous conditions , heat of current or Joul's heat, electrical power, direct current circuit, Kirchhoff's rules, parallel connection and series connection of ohmic resistors, resistance determination
- Unsteady electric flow (capacitor)
- Magnetostatics:
  Magnetic field strength, flux density, magnetic flux and magnetic voltage
- Electromagnetism and Electrodynamics:
  Interactions between electric and magnetic field, flow law, Ohm's law of magnetism, law of induction, inductance, eddy currents
- Unsteady electric flow (coil)
- Alternating current:
  Origin, designation and representation of alternating current quantities, alternating current circuit

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5	**Participation requirements** • Formal: - • Content: Mastery of the material from *mathematics 2* and *physics*
6	**Forms of assessment:** usually written examination
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Significance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Martin Skambraks, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Construction Elements 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M13	125 h	5	4th sem.	Summer semester	1 semester

1	**Courses**	**Contact time**	**Self-study**	**Planned group size**
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... explain the function of the machine elements presented.

... name the advantages and disadvantages of technical alternatives.

... design the basic machine elements presented.

... draw on their knowledge from previous basic subjects in order to find solutions to simple design problems and to develop these solutions taking into account physical, economic and social factors, material, technological and economic aspects.

... document their own constructive solution proposals as far as possible in accordance with standards.

3 Contents

Students are taught about the function and structure of machine elements as well as their calculation and design.

- Springs:
  Ordering criteria, spring characteristics, spring work, damping, interaction of springs, mould effective number, metal springs, elastomer springs, gas springs
- Clutches:
  Balanced clutches, shift clutches, hydraulic clutches
- Brakes:
  Outside shoe and inside shoe brake, disc brake, band brake, friction materials for brake linings
- Traction gear:
  Structure and properties of tension members, criteria for the selection of the tension member, calculation of belt drives, chain drives
- Gear drive:
  Theoretical principles of gearing, pinion gearing, helical gears,
  Bevel gears, worm drive, gear materials, strength calculation, permissible surface pressure, gearbox design

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5	**Participation requirements** • Formal: • Content: Mastery of the material from *Technical Mechanics 3* and *Construction Elements 1*
6	**Forms of assessment:** usually written examination
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics technology (B. Eng.) and Mechatronics (B. Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with several selected design tasks from the sub-spectrum of the machine elements covered. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Thermodynamics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M14	125 h	5	4th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... apply basic thermodynamic concepts safely and simplify thermodynamic problems.

... handle physical units safely.

... set up and solve mass and energy balances.

... assess energy conversions.

... apply and distinguish laws for ideal and real fluids.

... calculate and evaluate idealised circular processes.

… solve simple problems of heat transfer.

3 Contents

The thermodynamic and material fundamentals for technical energy conversions and transfers as well as the fundamentals for questions of rational energy conversion are taught.

- Thermodynamic basics: Open, closed, confined, homogeneous, heterogeneous and adiabatic systems, system boundary, thermal, especific and molar state variables, processes, ideal gas, thermal equation of state
- First law of thermodynamics: Heat, work, enthalpy, internal energy, power, specific heat capacity, law of conservation of energy
- Second law of thermodynamics: Irreversibility, dissipation, entropy, second law
- Reversible changes of state: Application of the thermal equation of state, application of the first and second law for reversible isobaric, isothermal, isochoric, isentropic and polytropic changes of state, np/v diagram
- Real fluids: p/v/T-, log p/h-, T/s- and h/s-diagram for real fluids, two-phase area, boiling line, dew line, saturated and superheated vapour, vapour content, vapour pressure, boiling temp. subcooled and boiling liquid
- Circular process: supercritical and subcritical process, ideal comparative process (Joule, Clausius Rankine), isentropic, Carnot and thermal efficiency, gas turbine process, combustion engines, steam power process, heat pump, refrigerating machine, course of processes in p/v, log p/h, T/s and h/s diagrams
- Heat transfer: Heat conduction, natural and forced convection, heat transfer, heat transmission, heat radiation, heat exchanger

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.
5	**Participation requirements** • Formal: • Content: Mastery of the material from *physics* and *mathematics 3*
6	**Forms of assessment:** usually written exam
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B. Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. Matthias Gruber, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Electrical Engineering 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M15	125 h	5	4th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to ...

... describe the construction and functioning of transformers and rotating electrical machines.

... apply the complex alternating current calculation.

... set up and solve systems of equations for calculating symmetrical three-phase circuits.

... determine the operating states of transformers.

... calculate the steady-state and quasi-steady-state operating behaviour of rotating electrical machines.

3 Contents

Students are taught basic and in-depth knowledge of the contents, correlations and technical applications of electrical engineering. The module contents serve as a basis for understanding the application and development of electrotechnical systems in engineering activities.

- Basics:
  Counting arrow systems, Kirchhoff equations, Lorentz equation, flow law, induction law
- Direct current machines:
  Design, function, operating behaviour, power losses and efficiency, Leonard converter
- General rotating field machine:
  Three-phase system and three-phase field, designations in the three-phase system, star and delta connection, power in the three-phase system
- Synchronous machines:
  Construction and types, mode of operation, equivalent circuit diagram and pointer diagram, stationary operation, synchronisation and start-up
- Transformer:
  Construction and mode of operation , transformer losses and efficiency, three-phase transformers, parallel connection of transformers
- Asynchronous machines, alternating current machines

4 Forms of teaching

Teaching units for self-study, Attendance events in the form of seminar-based teaching and exercises.

5	**Participation requirements** • Formal: • Content: Mastery of the material from *Electrical Engineering 1*
6	**Forms of assessment:** usually written exam
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Martin Skambraks, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Materials Science 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M16	125 h	5	4th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... nuclear construction, understand the interactions between atoms and thus the formation of bonds.

... Lattice structure defects should be seen as the basis for alloy formation and deformation behaviour and heat treatment processes.

... understand the solidification process of metallic melts.

... read and interpret state diagrams.

... understand diffusion processes.

... know lattice structure defects as a basis for the hardening behaviour of metallic materials.

... understand and apply the processes of solidification and forming to the properties of metals.

... ZTA and ZTU diagrams to be seen as the basis for heat treatment processes.

3 Contents

Students learn about the most important metallic and non-metallic materials, their properties and operating behaviour.

- Structure of metallic materials:
  Basics, atomic modes, lattice structure , lattice structure errors
- Phase transformations:
  homogeneous and heterogeneous nucleation, state diagrams, iron-carbon diagram
- Behaviour of metals during thermal activation and metallic stress:
  Thermally activated reactions, behaviour of metals under mechanical stress
- Primary and secondary forming of metallic materials
- Heat treatment of metals (1):
  Basic considerations, thermal processes (annealing, hardening, tempering , austenitising,) ferrite, pearlite, martensite and bainite formation, continuous and isothermal ZTA diagram, continuous and isothermal ZTU diagram, tempering, embrittlement ranges, thermal and thermochemical side effects
- Fundamentals of chemistry

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: • Content: -
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme in plastics engineering (B.Eng.) at South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Wolf-Berend Busch, Bielefeld University of Applied Sciences Prof. Dr.-Ing. Franz Wendl, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with several selected laboratory experiments, for example - Hardness test (Brinell, Vickers, Rockwell C) - Tensile test according to DIN EN ISO - Fe3C diagram - Microstructure assessment - Hardening mechanisms (work hardening, solid solution hardening, precipitation hardening) • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Materials Science 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M17	125 h	5	5th sem.	Winter semester	1 semester

		Contact time	Self-study	Planned group size
1	**Courses** a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... understand methods of boundary layer heating.

... understand thermochemical processes in carburising and nitriding processes.

... see precipitation processes as a way of increasing strength.

... define the different manufacturing techniques.

... derive the different areas of application of metallic materials on the basis of their chemical composition.

... estimate production-related influences on the component properties.

... infer processing problems.

3 Contents

Students learn about the most important metallic and non-metallic materials, their properties and operating behaviour.

- Heat treatment of metals (II):
  Ferrous metals (continuation of materials science 1), non-ferrous metals
- Production of metallic material:
  Steel production, steel designations, steel abbreviations, aluminium production, designation of aluminium materials , copper production, designation of copper materials
- Metallic materials:
  Structural steels, heat-treatable steels, nitriding steels, case-hardening steels, rolling bearing steels, tool steels, wear, corrosion-resistant steels, corrosion, copper materials, aluminium materials

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Materials science 1*

6 Forms of assessment: usually written examination

7	**Requirements for the award of credit points:** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Significance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Wolf-Berend Busch, Bielefeld University of Applied Sciences Prof. Dr.-Ing. Franz Wendl, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with a selection of laboratory experiments from the following catalogue: - Precipitation hardening - Erich deepening - Hole expansion - Cup train - Notched bar impact test -ZTU, ZTA - Forehead quenching attempt - Hardening and tempering - Ultrasonic testing (UT) - X-ray testing (RT or DR) - Surface crack testing: Penetrant testing (PT), Magnetic particle testing (MT) • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Industrial Management

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M18	125 h	5	5th sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... understand the business management interrelationships in industrial companies.

... make rational decisions to solve problems according to the operational objectives.

... assess the main legal forms in use today with regard to their relevance.

... recognise and assess the principles of operational organisation.

... deal with essential functions and solve problems in the corporate areas of materials management, production, sales and financing.

3 Contents

Students are taught the business management way of thinking and basic knowledge from the sub-areas of industrial management.

- Objective of the industrial operation
- Operational organisation:
  Process and organisational structure, project management
- Legal forms of the company:
  Alternative legal forms, sole proprietorships and partnerships
- Materials management:
  Materials, purchasing, materials planning/quantity planning, inventory management
- Production Management:
  Production planning and strategy, production programme planning, production execution planning, production types, performance improvement in production
- Sales-market orientation of the company
- Financing and investments

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: -

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Michael Fahrig, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Fluid Mechanics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M19	125 h	5	5th sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... calculate pressure forces exerted on bodies and walls by liquids at rest.

... calculate flow variables of incompressible flows by applying the law of conservation of energy.

... calculate pressure losses of liquid-carrying pipelines.

... determine the hydraulic power of pumps and turbines.

... calculate forces on bodies flowing around them by applying the conservation of momentum.

... describe the most important measurement methods used in fluid mechanics.

3 Contents

The students are taught basic contents of fluid mechanics. They will receive an overview of the fluid mechanical processes that frequently occur in the engineer's practice.

- Physical properties of fluids
- Hydrostatics:
  Definition of pressure, hydrostatic pressure, directional independence of pressure, pressure propagation, communicating vessels, compressive forces on flat and curved walls, hydrostatic drive
- Basic concepts of fluid dynamics
- Energy equation of the stationary, frictionless flow:
  Energy equation of the ideal fluid (Bernoulli equation,)static and dynamic pressure, energy equation of compressible fluids
- Frictional flow (real fluids):
  Flow forms of real fluids (laminar and turbulent flow), energy equation of real fluid flow, pressure loss in pipelines and in piping elements
- Resistance behaviour of flowed around bodies
- Force effects in flow processes, Impulse theorem:
  Derivation and application of the momentum theorem, jet impulse forces of free jets, recoil forces during outflow from vessels, flow forces on pipe elbows, Carnot shock loss
- Flow measurement technology:
  Pressure, velocity, flow, viscosity measurement

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.
5	**Participation requirements** • Formal: • Content: Mastery of the material from *physics*
6	**Forms of assessment:** usually written exam
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. Matthias Gruber, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Production Engineering 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M20	125 h	5	5th sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students
2	**Learning outcomes / competences** Students are able to select the most suitable manufacturing process for a manufacturing task in mechanical engineering.			
3	**Contents** The students are given an overview of the manufacturing processes as well as their main areas of application and limits in terms of dimensions, quality and performance, weight, material, accuracy, quantities and costs. • Overview of the manufacturing processes according to DIN 8586 • Fixed and variable costs of the processes, qualitative • Archetypes: Casting process, typical casting defects • Sintering: Sintering processes and typical sintered workpieces, selective laser sintering • Forming: Structuring aspects, achievable accuracies of different processes, material-technical basics, forming processes in detail • Joining: Joining by forming, thermal joining, bonding • Separating: Cutting, machining with geometrically defined cutting edge (procedures, cutting forces, cutting force calculation), machining with geometrically undefined cutting edge (achievable accuracies and surface qualities) • Removal • Thermal separation: Flame cutting, laser cutting			
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.			
5	**Participation requirements** • Formal: • Content: Mastery of the material from *Materials Science 1*			
6	**Forms of assessment:** usually written exam			
7	**Prerequisites for the award of credit points:** module examination pass			
8	**Use of the module** (in other degree programmes)			
9	**Importance of the grade for the final grade:** 5/180			
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Wolf-Berend Busch, Bielefeld University of Applied Sciences			

11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Automation Technology 1

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M21	125 h	5	6th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	**Contact time** 24 h	**Self-study** 101 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

The students know ...

... the basic structure of distributed automation systems.

... various sensors for measuring temperature and various mechanical variables.

3 Contents

- Measuring principle of various sensors
- Bus systems and their protocols
- Structure of a programmable logic controller (PLC)
- Software development according to IEC 61131
- Basic concepts of measurement, control and regulation technology

4 Forms of teaching

Teaching units for self-study, classroom attendance in the form of seminar-based teaching, exercises and practical training.

5 Participation requirements

- Formal: -
- Content: Mastery of the material from *Computer Science* and *Mathematics 3* and *Electrical Engineering 1*

6 Forms of assessment: usually written exam

7 Requirements for the award of credit points:
Certificate for successful participation in the internship and module examination pass

8 Use of the module (in other degree programmes)

Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer:

Prof. Dr.-Ing. Martin Skambraks, South Westphalia University of Applied Sciences

11	**Other information** • In the practical course, a selection of different laboratory experiments is carried out on the following topics: - Getting to know various sensors for measuring temperature and various mechanical variables - Commissioning of a programmable logic controller - Connection of various digital and analogue sensors to a PLC - Development of a programme in the functional design language according to IEC 61131 - Development of a programme in structured text according to IEC 61131 - Development of a sequence control according to IEC 61131 - Regulated control of a motor with a motion controller - Use of a machine vision sensor for optical quality control • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Applied Statistics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M22	125 h	5	6th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... apply the statistical methods dealt with appropriately to technical tasks, obtain and evaluate information from data material, prepare decisions under uncertain conditions, check technical processes for their suitability.

... present the results obtained from statistical investigations and assess them with regard to correctness and significance.

3 Contents

- Basic concepts of probability calculation
  Random experiments and events, probability space (relative frequency, the probability measure, Laplace experiments, statistical probability), conditional probability (definition of conditional probability, tree diagrams, total probability and Bayesian formula, independent events), Bernoulli experiments and Bernoulli chains
- Random variables and distribution functions:
  Concept of random variables, probability and distribution function of a discrete random variable, density and distribution function of a continuous random variable, multidimensional random variables (probability, density and distribution function for two-dimensional random variables, marginal and conditional probabilities), characteristics of random variables (expected value of a random variable, variance and standard deviation of a random variable, Chebyshev inequality, median and mode, expected value, variance and covariance for two-dimensional random variables), important probability distributions (binomial distribution, Poisson distribution, normal distribution, exponential distribution, chi-square distribution)
- Statistical methods:
  Descriptive statistics (basic terms, empirical frequency distribution, class formation for samples, characteristics of samples, frequency distribution of two-dimensional samples, variance and correlation coefficient, regression line), evaluative statistics (sample size and confidence interval, estimating parameters, testing hypotheses)

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Mathematics 1 to 3*

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Significance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences Dipl.-Math. Sybille Draxl, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Fluid Power

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M23	125 h	5	6th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... apply the basic physical laws of hydrostatics.

... calculate and assess flow resistances.

... read and assess hydraulic circuit diagrams.

... design hydraulic circuit diagrams using the appropriate hydraulic components.

... calculate and design hydraulic drives and controls (mainly in black and white hydraulics).

... assess the use of proportional valves in proportional technology.

3 Contents

The fundamentals and applications of fluid technology in drive technology and in the conveyance and distribution of liquid media are taught and insights are provided into the function, operating behaviour, design and use of fluid technology components and devices in mechanical engineering systems.

- Basics: Hydrostatics, Hydrodynamics, Hydraulic Networks
- Valves: Directional valves in general, types, switching transitions, directional valves for plate connection, development of pilot operated directional valves, directional valve with switching position monitoring, proportional directional valve, solenoids for directional valves
- Shut-off valves: Check valves, shuttle valve, pilot operated check valve
- Pressure valves: Pressure relief valves, pressure switching valves, pressure reducing valves
- Flow control valves: Orifice plates and throttles, 2-way flow control valve, 3-way flow control valve, power losses in throttle controls
- Pumps and motors: External gear pumps , gear motors, internal gear pumps, screw pumps, vane pumps, positive displacement pistons, radial piston motors according to the multi-stroke principle, hydraulic cylinders (linear motors)
- Control and regulating devices
- Basic circuits and applications : Pump shut-off, directional control with directional control valves, speed control, circuits with pilot-operated check valves, parallel circuits, series connection
- Proportional, control and servo valves, 2-way built-in valves, measurement technology in hydraulics

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.
5	**Participation requirements** • Formal: - • Content: Mastery of the material from *Fluid Mechanics*
6	**Forms of assessment:** usually written examination
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the joint degree programmes Plastics Technology (B.Eng.) and Mechatronics (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Bernhard Kirsch, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Production Engineering 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M24	125 h	5	6th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	**Contact time** 24 h	**Self-study** 101 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

Students are able to ...

... can evaluate different degrees of automation in terms of costs/benefits.

... can compare and evaluate different machine concepts.

... identify limits of machining from the dynamic and thermal behaviour of machine tools.

3 Contents

The students get to know the different machine tool types and assemblies.

- Importance of machine tools for German industry
- Machine tools as part of manufacturing systems
- Machine types, designs and components:
  Assemblies of the individual machine (guiding principles, drive systems, measuring systems, control of machine tools) , Requirements by HSC on the machine
- Machining centres
- Flexible manufacturing systems
- Design of machine tools: Frames, guides and bearings, main drives
- Machine tool accuracy
- Dynamic behaviour of machine tools
- Thermal behaviour of machine tools

4 Forms of teaching

Teaching units for self-study, Classroom attendance in the form of seminar-based teaching, Exercises and practical training.

5 Participation requirements

- Formal:
  Content: Mastery of the material from *Mechanics 3* and *Construction Elements 2* as well as *Production Engineering 1*

6 Forms of assessment: usually written exam

7	**Requirements for the award of credit points:** Certificate for successful participation in the practical and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Dragan Vucetic, Bielefeld University of Applied Sciences
11	**Other information** • Practical course with several selected laboratory experiments, for example - Consideration of the construction and mode of operation of an eccentric die cutter - Consideration of the construction and mode of operation of a fineblanking press (driven by hydraulics and toggle lever) - Consideration of the construction and mode of operation of a deep-drawing press (driven by hydraulics) • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Automation Technology 2

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M25	125 h	5	7th sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

Students will be able to define the requirements of an automation project in a specification booklet. They are familiar with development methods, programming principles and computer tools to carry out simple automation tasks themselves in a professional manner.

3 Contents

- Methods for specifying requirements for automation
- Fail-safe and fail-safe systems
- Machinery Directive
- Automation software development

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal:
- Content: Mastery of the material from *Automation Technology 1*

6 Forms of assessment: usually written exam

7 Requirements for the award of credit points

Certificate for successful participation in the internship and module examination pass

8 Use of the module (in other degree programmes)

Compulsory module in the part-time combined study programme Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer

Prof. Dr.-Ing. Martin Skambraks, South Westphalia University of Applied Sciences

11 Other information

- In the practical course, a selection of different laboratory experiments is carried out on the following topics:
  - Determination of the safety requirements for an automated manufacturing cell
  - Realisation of a fail-safe and error-proof system
  - Use of modelling languages to specify system behaviour in specifications
  - Conversion of a state model into a function block programme
  - Implementation of the object-oriented programming paradigm with an example
- Advice and faculty tutoring by telephone or e-mail as well as in personal

	meetings by appointment.

Production Planning and Control

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M26	125 h	5	7th sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students

2 Learning outcomes / competences

The students are able to understand the essential tasks in the planning and control of production in work preparation, as they have become familiar with the most important tasks and problems in the area of work preparation and have learned various problem-solving methods. This prepares them to work as engineers in the work preparation departments of production companies.

3 Contents

Students are provided with basic knowledge for solving the diverse planning tasks in production, especially in production control. One special focus is the application of PPS systems.

- Tasks of work preparation
- Tasks of production planning:
  Value analysis, preparation of parts lists, preparation of work plans (selection of production resources, determination of standard times)
- Programming of production equipment
- Production resource planning and equipment construction
- Cost planning , test planning, technical investment planning, method planning, material planning
- Production control

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: -

6 Forms of assessment: usually written exam

7 Prerequisites for the award of credit points: module examination pass

8 Use of the module (in other degree programmes)

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer

11 Other information

Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Cost Accounting

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M27	125 h	5	7th sem.	Winter semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students
2	**Learning outcomes / competences** Students are able to ... ... perform investment calculations for both simple static and dynamic methods. ... assess the relevance of key performance indicator systems for evaluating different areas of the company.			
3	**Contents** Students learn the most important business management calculations for engineers. They get an insight into the accounting of companies by learning the basics of balance sheets and profit and loss accounts as well as an insight into operational cost accounting. • Accounting – Overview • Balance sheet, profit and loss account • Stages of value movement in the enterprise • Accounting principles • Cost accounting (operational accounting) • Cost-type accounting • Cost accounting systems • Investment calculation • Static investment calculation methods • Dynamic investment calculation methods • Corporate management with key figures			
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.			
5	**Participation requirements** • Formal: • Content: Mastery of the material from *Applied Statistics*			
6	**Forms of assessment:** usually written examination			

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the combined part-time studies Plastics Technology (B.Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Michael Fahrig, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Thermal Power and Working Machines

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M28	125 h	5	7th sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students

2 Learning outcomes / competences

The students ...

... have gained an overview of heat engines and working machines.

... can understand how these machines work with the basic principles of fluid mechanics and thermal engineering.

... know the advantages and disadvantages of the alternative construction methods.

... understand the interaction in circular processes.

... know realistic approaches to efficiency distribution.

3 Contents

Students are taught the basics of the functioning and structure of heat engines and working machines as well as their interaction in circular processes.

- Introduction: Working machine, power machines, heat exchangers
- Thermodynamic basics
- Displacement machines:
  Changes of state and compressor work, intercooling, efficiencies, characteristics , designs, control
- Gyroscopic working machines:
  Calculation principles, multi-stage compression, power determination, characteristic diagram , design examples
- Positive displacement machines:
  Displacement machines, rotary displacement machines
- Gyroscopic engines:
  Changes of state and energy conversion, axial and radial turbines, constant and positive pressure turbines, energy conversion values, steam turbine designs, power setting and control of the turbine
- Heat exchanger:
  Fundamentals of heat transfer, apparatuses, steam generators
- Circular processes:
  Classification, comparative processes, steam energy cycle, combustion turbine, efficiency improvement , reciprocating internal combustion engines (internal combustion engines)

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: • Content: Mastery of the material from *Thermodynamics* and *Fluid Mechanics*
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Fred Schäfer, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with several selected laboratory experiments, for example: - Determining torque and power at full load as a function of the speed of an internal combustion engine - Determining the fuel consumption of an engine at selected operating points - Energy balance on a combustion engine - Characteristics of a radial blower - Recording and calculation of operating data of a centrifugal pump • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Project Management

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M29	125 h	5	9th sem.	Winter semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students

2 Learning outcomes / competences

Students are able to ...

... understand the basic tasks involved in project organisation and project management.

... describe the detailed procedure for working on projects.

... present the process-organisational forms of project organisation.

... master sequence planning and scheduling with network plans up to the solution of practical tasks.

... consider capacity and cost issues based on network plans.

... explain the special features of team building and project management.

... know the elementary technical vocabulary regarding project organisation and project management

3 Contents

The basics and practical application of project management are presented. The network planning technique is treated as an essential tool.

- Basic feature:
  Terms and definition, aspects of problem-solving and decision-making processes, project organisation and project management
- Project management as a methodology:
  Planning systems, project preparation, project planning, project implementation, project completion, project management as a management tool, project management in the organisational structure, project management tools
- Network planning technique:
  Introduction, structure of network plans, standard programme network planning technique, application of network planning technique to concrete problems

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal:
- Content: -

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Michael Fahrig, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Bachelor Thesis					
ID no.	**Workload**	**Credits**	**Study semester**	**Frequency of the offer**	**Duration**
M30	300 h	12	9th sem.	Continuous	12–18 weeks

1	**Courses**	**Contact time**	**Self-study**	**Planned group size**
	Self-study 300 h		300 h	usually 1 stud.

2	**Learning outcomes / competences** The students demonstrate that they are capable of working independently on a practice-oriented task from the field of mechanical engineering within the given time limit using the engineering-scientific and technical-practical methods that have been tried and tested in application.
3	**Contents** The topic of the bachelor thesis can be derived from current research projects at the university or from operational problems with an engineering character.
4	**Forms of teaching** The final thesis of the bachelor's degree study programme in Mechanical Engineering is an independent written work. It shall be written in German and may be written in English upon request. The bachelor thesis may also be admitted in the form of a group thesis if the contributions of the individual students to be assessed as an examination performance are clearly delimited on the basis of objective criteria .
5	**Participation requirements** • Formal: 160 ECTS in the modules of the first 8th semester and written admission by the Examination Committee/Officer • Content: Mastery of the technical and methodological competences relevant to mechanical engineering
6	**Forms of assessment:** written composition
7	**Prerequisites for the award of credit points:** timely submission of the written work (in duplicate and additionally in electronic form), which has been assessed by the first and second examiners as at least "sufficient"
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 12/180
10	**Module coordinator and main lecturer** Examiners appointed by the examination board/examination officer, if necessary on the suggestion of the student
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Colloquium

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
M31	75 h	3	9th sem.	Continuous	

1	**Courses** Self-study and exam preparation: 75 h	**Contact time**	**Self-study** 75 h	**Planned group size** usually 1 stud.

2	**Learning outcomes / competences** Students are able to ... ... present the problem, approach and main results of their bachelor thesis in an oral presentation, ... defend the procedure and results of the bachelor thesis in a professional discussion on the basis of the competences acquired in the course of study, ... answer questions from the narrower subject area of the bachelor thesis.
3	**Contents** See bachelor thesis.
4	**Forms of teaching** Self-study for preparation of the day before
5	**Participation requirements** • Formal: 177 ECTS (165 in the compulsory and elective modules and 12 in the bachelor thesis) • Content: Argumentation skills from acquired study competences
6	**Forms of assessment:** oral examination
7	**Prerequisites for the award of credit points:** At least the rating "sufficient" by the first and second examiners
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 3/180
10	**Module coordinator and main lecturer** Examiners (of the bachelor thesis) appointed by the examination board/examination officer
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Occupational Science

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM01	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... state the essential goals of labour science.

... describe work systems, distinguish between types of work and understand the concept of stress and strain as well as the basics of work analysis.

... apply constructive design rules to humanise and rationalise work.

.. take into account the requirements of occupational health and safety in organisational and technical terms.

... comprehend the methods of time management, remuneration, work and performance evaluation.

3 Contents

Students are given an introduction to occupational science including occupational safety.

- Fundamentals of labour science
- Informational work:
  Perception
- Energetic-effective work:
  Muscular system, metabolism, skeletal system, design rules
- People in the work process :
  Design features, disposition features, adaptation features
- Working environment:
  Hazardous substances, radiation, climate, noise, mechanical vibrations, lighting
- Occupational health and safety:
  Occupational health and safety institutions, occupational health and safety management, legal bases
- Ergonomic work design:
  Anthropometric, occupational physiology and information technology design
- Time management
- Remuneration, work and performance evaluation

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5	**Participation requirements** • Formal: Choice of compulsory elective block *Production Engineering* • Content: -
6	**Forms of assessment:** usually written exam
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer**
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Plastics Production Process

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM02	125 h	5	8th sem.	Summer semester	1 semester

1 Courses

	Contact time	Self-study	Planned group size
a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students min. 7 stud.

2 Learning outcomes / competences

The students ...

... are able to assess the essential processes of plastics processing in a practice-oriented manner and use them in an application-oriented manner.

... know the essential design criteria for tools used in plastics processing, especially for injection moulds.

3 Contents

Students are given an overview of the essential manufacturing techniques for the production of semi-finished and finished plastic parts as well as the tools for essential plastics processing methods injection moulding tools are dealt with in greater depth.

- Plastics Chemistry
- Properties of plastics:
  Thermal, electrical, mechanical, chemical, optical, acoustic properties, shrinkage and warpage, relaxation and retardation
- Plastics processing and supply
- Processing methods for plastics :
  Primary moulding and casting, injection moulding, pressing, calendering, extrusion, blow moulding, foaming, thermoforming
- Further processing and finishing:
  Conditioning, tempering, stretching, bonding, welding, painting, metallising
- Tools:
  Introduction and definition
- Injection moulds for thermoplastics:
  Design of injection moulds, mould design and concepts, mould measurements, injection moulding machine, mould cavity dimensions and arrangement, gating system, hot runner systems, rheological design, demoulding system, temperature control system , mould maintenance
- Sensors in the tool
- Extrusion tools:
  Design criteria, pipe head, profile tool, wide slot nozzle tool, blow heads, sheathing tool

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: Choice of the elective block *Plastics Technology* • Content: Mastery of the material from *Materials Science 1*
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module(s) in the part-time combined study programme in Plastics Engineering (B.Eng.) at South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Bruno Hüsgen, Bielefeld University of Applied Sciences
11	**Other information** • Practical course with several selected laboratory experiments serves to familiarise students with injection moulding and extrusion tools as well as tool sensor technology. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Accuracy and Reliability of Machines and Equipment

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM03	125 h	5	8th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... Identify potential faults in machines and equipment.

... Introduce measures to minimise the errors, to improve the failure behaviour at low cost.

3 Contents

Students are taught the procedure for recognising potential faults in machines and equipment and how to reduce them using practical examples.

- Technical function and error behaviour:
  Function-relevant input and output variables, external and internal disturbance variables, unit faults
- Accuracy and error behaviour:
  Recording the influencing variables, possibilities of increasing the accuracy
- Tolerance definition:
  Relationships between accuracy, tolerance and costs, dimensional and tolerance chains
- Low-error arrangements:
  Invariant arrangements , innocent arrangements, avoidance of overdeterminism, function separation and function integration, principle of shortest force flow
- Error compensation: Compensation, adjustment
- Reliability:
  Areas of influence on technical reliability, failure behaviour of machines and equipment,
  Measures to improve reliability and costs

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal: Choice of compulsory elective block *Product Development*
- Content: Mastery of the material from *Construction Elements 2*

6 Forms of assessment: usually written exam

7 Prerequisites for the award of credit points: module examination pass

8 Use of the module (in other degree programmes)

9 Importance of the grade for the final grade: 5/180

10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Transmission Technology

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM04	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students min. 7 stud.

2 Learning outcomes / competences

The students ...

... are familiar with the systematics, properties and use of mechanical gears.

... are able to solve limited synthesis and analysis tasks in gear technology using graphical or computational methods.

3 Contents

Students are taught the basics of analysis and synthesis of planar and spatial gears.

- Introduction:
  Delimitation of topics, areas of application, tools
- Gear system:
  Basic terms, structure of gears, degree of freedom of gears, structural systematics
- Geometric-kinematic analysis of planar gears: Kinematic basics, relative kinematics
- Numerical gear analysis:
  Analytical-vectorial method, module method
- Kinetostatic analysis of planar gears: Classification of forces, basics of kinetostatics
- Fundamentals of the synthesis of planar four-link articulated gears: Dead layer construction, layer synthesis
- Spatial gears:
  The spatial velocity state of a rigid body, the relative velocity state of three rigid bodies, vectorial iteration method, coordinate transformations

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal Choice of compulsory elective block *Product Development*
- Content: Mastery of the material from *Mechanics 3*

6 Forms of assessment: usually written exam

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Karsten Schöler, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Industrial Property Protection/Patents

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM05	125 h	5	8th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students min. 7 stud.

2 Learning outcomes / competences

Students ...

... know the possibilities and limits of industrial property protection in order to secure the economic exploitation of innovations.

... are able to initiate protective measures.

3 Contents

- Protection of new developments:
  Protection by a patent, protection by a utility model, protection by a design patent, filing tactics, basic expectations of a patent, patent structure
- The employee invention law:
  Employee inventor and invention, employee invention, innovative employee performance, naming of inventor, invention disclosure
- Patent expiry and time limits:
  Invention disclosure, request for grant of patent, employee and employer obligations, claiming the invention, inventor's compensation
- Patent search:
  International classification of patents, patent searches in different phases of the development cycle (basic, accompanying, examination search), planning and execution of searches, electronic information systems, own searches

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal: Choice of compulsory elective block *Product Development*
- Content: -

6 Forms of assessment: usually written exam

7 Prerequisites for the award of credit points: module examination pass

8 Use of the module (in other degree programmes)

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer

11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Investment and Financing

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM06	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation: 45 h	16 h	109 h	max. 30 students min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... understand the relationships between raising and using capital.

... understand the tasks, functions and objectives of investment and financial accounting.

... evaluate the advantages of individual investment projects by means of different investment procedures.

... determine the capital requirements to ensure sufficient liquidity.

... assess instruments for raising and structuring capital.

3 Contents

Students are taught basic knowledge of investment and financial management tasks. In particular, entrepreneurial and networked thinking is promoted, taking into account profitability-oriented criteria in all entrepreneurial activities and decision-making fields.

- Fundamentals of business investment decisions
- Static investment calculation methods
- Dynamic investment calculation methods
- Alternative investment calculation methods
- Shareholder value approach
- Principles of business finance decisions
- Determining the capital and liquidity requirements
- Financial and liquidity planning
- Internal financing
- Financing effects of the profit
- Financing effects of depreciation , pension provisions and capital releases
- External financing
- Self-financing
- Long-term and short-term debt financing
- Leasing and factoring
- Mixed forms of financing

	• Innovative financing instruments • Effects of Basel II on the financing of companies • Ranking • Start-up • Company succession
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.
5	**Participation requirements** • Formal: Choice of compulsory elective block *Business Organisation* • Content: Mastery of the material from *Industrial Operations/Management* and *Cost Accounting*
6	**Forms of assessment:** usually written examination
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module from the part-time combined study programme in Industrial Engineering and Management (Prof. Dr. Wolfgang Hufnagel, FH Münster)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer**
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Designing With Plastics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM07	125 h	5	8th sem.	Summer semester	1 semester

		Contact time	Self-study	Planned group size
1	**Courses** a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 stud. min. 7 stud.

2 Learning outcomes / competences

The students are able to design and create plastic components suitable for production.

3 Contents

Students are taught the design and construction guidelines of injection moulded parts as well as extrusion profiles.

- Introduction and definitions
- Moulded part development, process selection, material selection
- Strength calculation and dimensioning
  Characteristic value and characteristic function, mechanical behaviour of plastics, molecular orientations, failure case, uniaxial and multiaxial stress states, calculation of mechanical stresses
- Designing injection moulded parts from thermoplastics and thermosets
- Designing extrusion profiles
- Design of welded and bonded joints

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal: Choice of the elective block *Plastics Technology*
- Content: -

6 Forms of assessment: usually written exam

7 Requirements for the award of credit points

Certificate for successful participation in the practical and module examination pass

8 Use of the module (in other degree programmes)

9 Importance of the grade for the final grade: 5/180

10 Module coordinator and main lecturer

Prof. Dr.-Ing. Bruno Hüsgen, Bielefeld University of Applied Sciences

Prof. Dr.-Ing. Ulrich Lichius, South Westphalia University of Applied Sciences

11	**Other information** • Practical course with several selected design exercises offers students the opportunity to consolidate their knowledge by understanding and applying proven design rules for injection moulded parts, extruded profiles and plastic-compatible welded and bonded joints. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Design System

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM08	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 students min. 7 stud.

2 Learning outcomes / competences

The students ...

... know the structured overall process of design and development tasks.

... know the importance of and the ways to obtain information for **R&D.**

... know methods for task clarification for technical development projects.

... know selected engineering methods for finding and evaluating solutions.

... know the prerequisites and procedures for methodical design and can apply these techniques themselves to problems that are still manageable.

... are enabled to communicate more clearly and purposefully with R&D areas .

... are enabled to consistently apply drafting and design rules for products in mechanical engineering.

3 Contents

- Introduction:
  Information flow and position of design in the production process, types of tasks in development and design, objectives and potentials of methodical procedures in the development and design of technical products, the hierarchy of technical entities
- Work step sequences of methodical design according to VDI guideline 2222:
  Analyse, conceive, design, elaborate
- Methods and techniques for task specification
- Methods and techniques for systematic solution finding: methodical-intuitive, methodical-discursive, combined procedures
- Methods and techniques for solution evaluation
- Systematic approaches to design:
  Design elements and design parameters, basic rules of design (unambiguousness, simplicity, safety), design principles (lines of force, division of tasks, self-help , stability and bistability)
- Design and layout guidelines:
  stress-/strength-related, material-appropriate, tolerance-compliant, standard-conforming, manufacturable (drilling, casting, sintering, extrusion, forging), weldable (gluing, soldering, brazing, welding),
  handling- and assembly-friendly, cost-reducing, maintenance-friendly, recycling-friendly, ergonomic design

	• Developing different construction methods: Construction methods of components, construction methods of assemblies and machines, development of series and type groups
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: Choice of compulsory elective block *Product Development* • Content: -
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Andreas Asch, South Westphalia University of Applied Sciences
11	**Other information** • Practical course with teaching examples of mechanical engineering, apparatus engineering and appliance construction offers students the opportunity to consolidate their knowledge by comprehending and applying proven methodological procedures for the development of technical products. The design rules, principles and guidelines presented are applied to case studies by designing and developing technical solution concepts or by analysing executed design examples. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Material Flow and Logistics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM09	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Working independently through the course material and solving exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study portion and exam preparation: 45 h	24 h	101 h	max. 30 stud. min. 7 stud.

2 Learning outcomes / competences

The students ...

... know the basics of industrial logistics, e.g. in the automotive industry.

... can independently deal with and solve simple logistics problems.

3 Contents

- Introduction:
  Terms and objectives of logistics, types of logistics systems and strategic logistics management Logistics chains and networks
- Management Logistic Networks:
  Process management Supply chain design (network design and planning), supply chain planning (planning of requirements, resources and inventories)
- Procurement and distribution logistics:
  Strategic planning, structural analysis and planning, site selection, procurement strategies, demand planning
- Production logistics:
  Basics of production theory, basics of factory structure planning, basics of factory organisation, goals and procedures of production planning and control (PPC)
- Warehouse logistics and systems:
  Warehouse functions and types, warehouse processes, warehouse and conveyor technology, warehouse planning, inventory management, picking processes and procedures
- Transport logistics and systems:
  Factors influencing transport logistics, transport infrastructure and modes of transport , networking of modes of transport (multimodal transport), transport containers and systems
- Information systems for logistics management

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.

5 Participation requirements

- Formal: Choice of compulsory elective block *Business Organisation*
- Content: -

6	**Forms of assessment:** usually written examination
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Werner Tschuschke, South Westphalia University of Applied Sciences Prof. Dr. -Ing. Ralf Hörstmeier, Bielefeld University of Applied Sciences
11	**Other information** • Practical course deals with selected case studies and teaching examples to consolidate the knowledge of methods for solving simple logistics problems and to get to know information systems of logistics management. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Operations Research

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM10	125 h	5	8th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 students min. 7 stud.

2 Learning outcomes / competences

The students learn the essential mathematical model types and associated solution methods from the field of linear optimisation.
After successful attendance of the courses, the students are able to solve a concrete problem (e.g. blending problem, transport optimisation, production planning, investment planning, etc.) and to build a corresponding mathematical model and to apply this with a suitable method (e.g. the simplex method) by hand or with the help of the Excel solver.

3 Contents

Important mathematical model types and solution methods of operations research are explained. In particular, mathematical methods for solving production planning, transport and allocation problems are covered. The main focus of the lecture is the discussion of methods for solving linear optimisation problems (e.g. the variants of the simplex method.)

On the basis of numerous concrete problems, some of which are also solved with the help of the Excel solver, the material is deepened and the students are thereby enabled to solve optimisation problems that occur in practice.

Some of the required basics from the field of mathematics (especially the solution of linear systems of equations) are repeated at the beginning of the course.

The contents in detail are:

1. Tasks of operations research
2. Mathematical basics
3. Linear optimisation problems
   - Graphical solution
   - The variants of the simplex procedure
4. Transport problems
5. Parametric linear optimisation

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal: Choice of compulsory elective block *Business Organisation*
- Content: Mastery of the material from *Mathematics 1, 2, 3*

6 Forms of assessment: usually written examination

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr. rer. nat. Hardy Moock, South Westphalia University of Applied Sciences
11	**Other information** • Literature: Koop, Andreas; Moock, Hardy: Lineare Optimierung - eine anwendungsorientierte Einführung in Operations Research. Berlin/Heidelberg: Springer-Verlag, 2008. • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Quality Management

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM11	125 h	5	8th sem.	Summer semester	1 semester

1	**Courses** a) Independent work with course material and exercises: 64 h b) Classroom exercise: 16 h c) Self-study and exam preparation : 45 h	**Contact time** 16 h	**Self-study** 109 h	**Planned group size** max. 30 stud. min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... assess the differences between the various QM systems.

... introduce and audit QM systems.

... introduce a UM system.

... shape customer loyalty within the framework of a QM system.

... apply the continuous improvement process and benchmarking.

3 Contents

Students are taught the basics of quality management (QM) and its importance in the company for customer satisfaction.

- Basic concepts of quality management: Quality, audit, error, corrective action
- Standardisation of quality management systems:
  DIN EN ISO 9001:2000, ISO/TS 16949:2002, QS-9000, VDA 6.1
- Process-oriented quality management system:
  Measurement of processes with key figures, introduction of the QM system, documentation, electronic QM system, internal auditing of QM systems
- Environmental management systems
- Customer orientation
- Continuous improvement process
- Benchmarking

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal: Choice of compulsory elective block *Production Technology* or *Plastics Technology* or *Business Organisation*
- Content: -

6 Forms of assessment: usually written exam

7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Prof. h.c. Lothar Budde, Bielefeld University of Applied Sciences Prof. Dr.-Ing. Martin Skambraks, South Westphalia University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Forming

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM12	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 stud. Min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... establish the connection between metal structure/fault and forming technology.

... gain a basic understanding of the boundary forming of a metal.

... handle essential characteristic values of the forming technology (yield stresses, degree of deformation, forming work, etc.) and to interpret flow curves.

... master plastomechanical basics and apply them to forming processes.

... evaluate and calculate various solid and sheet metal forming processes in detail.

... classify the mechanisms of forming technology from a metallurgical point of view.

... define the advantages and disadvantages of alternative forming processes from the point of view of the products that can be manufactured.

... classify the advantages and disadvantages of cold/semi-hot/hot forming.

... recognise basic economic correlations with reference to unit costs for mass production.

... classify the characteristics and scope of use of different forming machines in relation to the products to be manufactured.

3 Contents

The students are taught in-depth theoretical and application knowledge of the forming production processes and, in addition, essential metallurgical and plastomechanical basics as well as essential processes and machines of solid and sheet metal forming and their application possibilities are presented in detail.

- Process delimitations :
  Machining/chipless manufacturing processes, cold, semi-hot and hot forming, solid and sheet metal forming, primary stress, productivity, flexibility and cost
- Metallurgical basics:
  Crystal structure and microstructure, lattice defects, shape change
- Flow curve, deformation capacity, mechanical characteristics
- Plastomechanical basics:
  Statics, flow conditions, kinematics, forming work and efficiency, stress and deformation states, elementary theory
- Massive forming process:
  Rolling, free-forming, extrusion, drawing, upsetting, impact extrusion, compression moulding, drop

	forging • Sheet metal forming process: Cutting, cutting/punching, (deep) drawing, widening, rolling, progressive technologies • Forming technology machines: work-bound machines (hammers, screw presses), path-bound machines (mechanical presses), power-bound machines (hydraulic presses)
4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: Choice of compulsory elective block *Production Engineering* • Content: Mastery of the material from *materials science 2* and *production engineering 2*
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Rainer Herbertz, South Westphalia University of Applied Sciences Prof. Dr.-Ing. Wolf-Berend Busch, Bielefeld University of Applied Sciences
11	**Other information** • Practical course with selected laboratory experiments, for example: - Plastomechanical material characterisation for hot forming at low and high forming speeds - Plastomechanical material characterisation for cold forming - Stress identification for different forming processes - Rollers: Tensions, forces, performances - Influence analysis on the unit costs of massive forming processes for different operational scenarios (e.g. full automation, change of location, multi-shift operation) • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Materials Science of Plastics

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM13	125 h	5	8th sem.	Summer semester	1 semester

1 Courses

a) Independent work with course material and exercises: 64 h

b) Classroom exercise: 16 h

c) Self-study and exam preparation: 45 h

Contact time	Self-study	Planned group size
16 h	109 h	max. 30 stud. min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... assess the properties and areas of application of plastics.

... using plastics in an engineering-friendly way.

3 Contents

Students are taught the basics of the materials science of plastics.

- Plastics in practice:
  What is plastic? Production and history, processing
- The structure of matter:
  Periodic table of the elements, the chemical bond, from monomer to macromolecule
- Polymeric materials:
  Thermoplastics, duromers, conventional elastomers (rubber,) thermoplastic elastomers, nomenclature and abbreviations for polymers, overview of the selected classes of materials, economic and technological considerations
- Molecular weight distribution:
  Molar mass distributions and mean values of the molar mass
- The synthesis of polymers:
  Types of polymer build-up reactions, stepwise reactions, chain reactions, process engineering of polymerisation
- Phase transitions:
  Glass transition, crystallinity, amorphous and semi-crystalline plastics
- Rheology of plastics:
  The behaviour of liquids, structural viscosity, non-Newtonian flow, the flow behaviour of polymer melts, energy and entropy elasticity
- Additive :
  Antioxidants, light stabilisers, antistatic agents, flame retardants, slip/separating agents and related additives, blowing agents, fillers and fibres, nucleating agents

4 Forms of teaching

Teaching units for self-study, attendance events in the form of seminar-based teaching and exercises.

5 Participation requirements

- Formal: Choice of compulsory elective block *Plastics Technology*
- Content : Mastery of the material from *Materials Science 1*

6	**Forms of assessment:** usually written exam
7	**Prerequisites for the award of credit points:** module examination pass
8	**Use of the module** (in other degree programmes) Compulsory module in the part-time combined study programme Plastics Technology (B. Eng.) of South Westphalia University of Applied Sciences
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Bruno Hüsgen, Bielefeld University of Applied Sciences
11	**Other information** Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.

Machining

ID no.	Workload	Credits	Study semester	Frequency of the offer	Duration
WPM14	125 h	5	8th sem.	Summer semester	1 semester

1	Courses	Contact time	Self-study	Planned group size
	a) Independent work with course material and exercises: 56 h b) Practical training: 16 h c) Classroom exercise: 8 h d) Self-study and exam preparation: 45 h	24 h	101 h	max. 30 stud. min. 7 stud.

2 Learning outcomes / competences

Students are able to ...

... determine the optimum machining process for a product.

... evaluate the technical-economic work result as a function of machine setting values.

3 Contents

Students are taught in-depth knowledge of machining processes and machines and the parameters influencing the technical and economic work result.

- Machining processes:
  Accuracy requirements, fundamentals of metal-cutting shaping, tool wear
- Cutting materials, cooling lubricants
- Choice of economical cutting conditions
- Method with geometrically defined cutting edge:
  Method with rotatory main movement, method with translatory main movement
- Method with geometrically indeterminate cutting edge: Grinding, honing, lapping
- Ablative process:
  Electrical discharge machining , Chemical machining, Electrochemical machining , Electro-beam machining, Laser machining
- Assessment of machine tools and design requirements:
  Definition and classification of machine tools , manufacturing processes and types of machine tools, requirements for machine tools, accuracy parameters and causes of errors
- Design and assemblies of machine tools :
  Frames, guides, main spindle
- Main drives:
  Requirements and design, motors, gearboxes, clutches
- Feed drives:
  mechanical, hydraulic and electric feed drives, feed spindles , dynamics of feed drives
- Control technology and information processing: Position control loop, control types

4	**Forms of teaching** Teaching units for self-study, attendance events in the form of seminar-based teaching, exercises and practicals.
5	**Participation requirements** • Formal: Choice of compulsory elective block *Production Engineering* • Content: Mastery of the material from *Materials Science 2* and *Production Engineering 2*
6	**Forms of assessment:** usually written exam
7	**Requirements for the award of credit points** Certificate for successful participation in the internship and module examination pass
8	**Use of the module** (in other degree programmes)
9	**Importance of the grade for the final grade:** 5/180
10	**Module coordinator and main lecturer** Prof. Dr.-Ing. Dragan Vucetic, Bielefeld University of Applied Sciences
11	**Other information** • Practical course with several selected laboratory experiments, for example from the following topics: - Cutting force measurement - CNC programming - Turning and milling - Simulation of machine tool controls - Model milling and free surfaces • Advice and faculty tutoring by telephone or e-mail as well as in personal meetings by appointment.