Appendix B:

Module catalogue

for the master's degree study programme in
Industrial Engineering and Management (part-time combined studies)
of the Faculty of Engineering and Mathematics

As of: 28 June 19

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Please note: The German version of this document is the legally binding version. The English translation provided here is for information purposes only.

Module catalogue for the master's degree study programme in
Industrial Engineering and Management (part-time combined studies)

Applied Market Research					AM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5021	150 h	6	2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	51	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Upon completion of the module, students will be able to

- assess the current data collection methods with regard to their application quality and to modify them in case of design weaknesses.
- correctly evaluate a collected data set from a business application using different statistical methods (multivariate, multivariate) depending on the question and appropriately interpret the results in terms of content.
- present basic statistical methods and evaluate them with regard to their applicability in different practical situations.
- be able to check the scientific procedure from data collection to data evaluation by means of an assessment according to scientific quality criteria.

3 Contents:

Data collection:
Sampling theory random sample, lumped sample, quota method
Questionnaire, observation, experiment introduction to the construction of survey instruments; survey distortions (response tendencies, observation distortions, validity threats)

Evaluation procedure
Exploratory factor analysis methodology and theoretical principles; principal component vs. principal axis analysis; testing the suitability of the correlation matrix; carrying out the procedure; interpreting the results; limitations Analysis of variance methodology and theoretical principles; univariate vs. multivariate ANOVA, single- and multifactorial ANOVA, ANOVA with repeated measures; testing the validity of the procedures; carrying out the procedures; interpreting the results; assessing the quality
The Conjoint Analysis; Methodology and Theoretical Foundations; Implementation of the Procedure; interpretation of the results; assessment of the quality

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8 Application of the module (in the following study programmes)

Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

	Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: -

Drive Systems and Drive Controls					AA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5005	150 h	6	2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	51	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students will be able to derive and describe the dynamic behaviour of electrical machines in addition to the steady-state behaviour. The students can explain the principles of controlling three-phase electrical machines. In addition, the students have gained an understanding of the operating point selection for electrical machines and can specify and evaluate reference variables for drive control. In small groups, the students gained initial experience in the design and implementation of a current control system for a three-phase motor using standard simulation software.

3 Contents:

1. Control models
1.1. Synchronous machine
1.2. Asynchronous machine
2. Control models
2.1. Power converter circuits
2.1. Pulse width modulation
2.2. Regular Sampling
2.3. Dead time for digital controls
3. Control method for converter-fed synchronous machines
3.1. Field-oriented control
3.2. Operating point selection for SPMSM (Surface Permanent Magnet Synchronous Motor) and IPMSM (Interior Permanent Magnet Synchronous Motor)
4. Control method for converter-fed asynchronous machines
4.1. Field-oriented control
4.2. Direct torque control (DTC)

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass and course assessment

8 Application of the module (in the following study programmes)

Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

percentage based on the sum of credits of the graded modules according to RPO- MA §32

10	Module coordinator: Prof. Dr.-Ing. Michael Leuer
11	Other information: -

Occupational Science					EAS
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5018	150 h	6	2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the module, students will be able to paraphrase the basics of occupational safety and ergonomics. They can apply measures, means and methods to protect workers from work-related safety and health hazards.
They are able to perceive and classify specific operational processes under occupational health and safety aspects and to communicate these within the company. Students recognise responsibilities for occupational safety and are able to identify potential risks with regard to plant and occupational safety. They can carry out risk assessments and evaluate them.

3 Contents:

Fundamentals of labour science
Models of human perception, information processing and motor skills Discussion of basic communication models in their significance for the design of human-machine interaction using examples from the various fields of work in ergonomics
Discussion of approaches and tools for the evaluation of human-machine interaction and the measurement of quality and performance of human work on the basis of measurement theory
Occupational health and safety aspects in relation to specific operational requirements
Responsibilities in occupational safety and health
Risk potentials in the company

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination or term paper

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- MA §32

10 Module coordinator:

Prof. Dr.-Ing. Prof. h.c. Lothar Budde

11 Other information:

-

Controlling-Based Management					CM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5012	150 h	6	1st or 2nd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Learning outcomes:
Students who have successfully completed this module,

- have gained an overview of the prerequisites and fundamentals of modern controlling and the controlling systems in companies (operational and strategic controlling) and can present these,
- can describe the controlling systems and assign them to the management tasks or planning levels in the company,
- are familiar with the tasks and instruments of operational and strategic controlling and can reproduce them,
- have practised or reflected the use of the instruments on selected instruments / tasks,
- can characterise the tasks of controlling systems and classify their significance,
- can select and evaluate controlling instruments,
- are able to review and assess the tasks and instruments with regard to their use in operational practice,
- can transfer the instruments to the operational practice and adapt them if necessary and
- are thus in a position to integrate the rationality perspective of corporate management into their own professional actions (see Mission Statement).

3 Contents:

Mission Statement:
Controlling is a cross-functional task in the company that is based on accounting and is part of the corporate management process. Control ensures the rationality of the company's management. This module therefore focuses on ensuring rationality in management.

Fundamentals of modern controlling in the corporate management process
External and internal accounting as the basis of controlling
Instruments of external accounting: Balance sheet, income statement, cash flow statement
Decision-oriented cost accounting: Full, partial costing, coverage costing
Key figures and key figure systems / performance measurement systems
Planning levels in the company (strategic, tactical, operational)
Controlling systems: Operational and strategic controlling
Operational controlling as part of operational corporate management
Operational corporate management and operational controlling
Operational planning: Corporate planning, operational plans and their interaction, budgeting
Operational information function, reporting
Operational analysis and control: Variance analyses in the cost and sales/turnover area
Operational control
Strategic controlling as part of strategic corporate management

	Strategic corporate management and strategic controlling Strategic planning process and instruments Strategic information system of the enterprise / strategic early reconnaissance Strategic analysis and control Strategic control Exercises and case studies on operational and strategic controlling	
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment: Written examination (regular form) and/or combination examination (semester-long preparation)	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator: Prof. Dr. Stephan Kress, Westphalian University of Applied Sciences	
11	Other information: Literature (selection): Brizelmaier, B.: Controlling Grundlagen, Praxis, Handlungsfelder, Pearson, 2013 Fiedler, R.; Gräf, J.: Einführung in das Controlling Methoden, Instrumente und IT-Unterstützung, 3. Auflage, Oldenbourg Verlag, 2011 Graumann, Matthias: Controlling Begriff, Instrumente, Methoden und Schnittstellen. 4. Auflage NWB, Herne 2014 Horváth, Péter: Controlling, 12. Auflage, Vahlen, München, 2011 Jost, Helmuth: Kosten- und Leistungsrechnung, 5. Auflage, Gabler, Wiesbaden 1988 Reichmann, Thomas: Controlling mit Kennzahlen Die systemgestützte Controlling-Konzeption mit Analyse- und Reportinginstrumenten, 8. Auflage, Vahlen, München 2014 Schröder, Ernst, F.: Modernes Unternehmens-Controlling Handbuch für die Unternehmenspraxis, 8. Auflage, Kiehl, Ludwigshafen, 2003 Weber, Jürgen; Schäffer, Utz: Einführung in das Controlling, 15. Auflage, Schäffer Poeschel, Stuttgart 2016 Baum, Heinz-Georg; Coenenberg, Adolf, G.; Günter, Thomas: Strategisches Controlling, 5. Auflage, Schäffer-Poeschel, Stuttgart 2013 Dörner, Dietrich: Die Logik des Misslingens Strategisches Denken in komplexen Situationen, 5. Auflage, rororo, Hamburg 2006 Hungenberg, Harald: Strategisches Management in Unternehmen, 8. Auflage, Springer Gabler, Wiesbaden 2014 Berens, Wolfgang; Hoffjan, Andreas, Schmitting, Walter: Controlling in Fallstudien Von Erbsenzählerinnen und Zahlenzauberinnen, Schäffer-Poeschel, Stuttgart 2004 Graumann, M.: Fallstudien zum Controlling Strategisches und operatives Controlling, 3. Auflage, NWB, Herne 2014 Horvath, Peter; Gleich, Ronald; Voggenreiter, Dietmar: Controlling umsetzen: Fallstudien, Lösungen und Basiswissen, 5. Auflage, Schäffer-Poeschel, Stuttgart 2012 Stahl, Hans-Werner: Modernes Kostenmanagement und Controlling in 70 Fällen, Vahlen, 1999 Weber, Jürgen; Schäffer Utz, Binder, Christoph: Einführung in das Controlling Übungen mit Fallstudien und Lösungen, 2. Auflage Schäffer-Poeschel, Stuttgart 2014	

Data Management / Big Data Analytics					BDA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5011	150 h	6	1st, 2nd or 3rd sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students master the basic handling of NoSQL databases.
Students are able to access internal and external data sources.
Students will be able to describe numerical data by statistical parameters and visualise them in a common way.
Students are able to analyse large amounts of data both in a targeted and exploratory way, with a diverse range of methods from the field of statistics and machine learning at their disposal.
Students will be able to understand the basic procedure for analysing very large data sets on Hadoop clusters.

3 Contents:

Introduction and general overview (Small Data vs. Big Data)
NoSQL database systems
Opening up data sources
Basics of programming with Python (which is used in the exercises for practical data analysis)
Basics of descriptive statistics
Visualisation of data
Correlation analysis and regression
Time series analysis
Basics of machine learning
Pre-processing of data (e.g. dimension reduction)
Unsupervised learning (e.g. clustering)
Supervised learning I: Classification (e.g. via support vector machines)
Supervised learning II: Learning of arbitrary input-output correlations (e.g. with artificial neural networks)
Entry into large-scale data analysis with Hadoop

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- BA §32

10 Module coordinator:

	Prof. Dr.-Ing. Wolfram Schenck
11	Other information: -

Industrial Property and Competition Law					GRW
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5007	150 h	6	1st, 2nd or 3rd sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students will be able to understand and apply the basics of patent, utility model and trademark law. They know the origins, contents and legal effects of patents, designs and trademarks and can analyse individual practical cases. They can evaluate the (negative) prohibition rights in the case of patent, design and trademark infringements and the (positive) possibilities of exploitation of industrial property rights, in particular through licensing, and understand the supplementary protection against imitation under competition law.
They will be able to classify and evaluate various methods (IP right infringements) to counteract product and brand piracy.
In addition, they can develop protection concepts independently or as part of a team, and implement (apply) them in the company.

3 Contents:

Patent, utility model and employee invention law, trademark law, European and international agreements on intellectual property, unfair competition law (supplementary competition law protection against imitation), licensing contract law.
Effects of product piracy and protective measures,
Development of effective protection concepts and implementation in the company.

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination or term paper

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- MA §32

10 Module coordinator:

Prof. Dr. Brunhilde Steckler

11 Other information:

Benkard, Patentgesetz, 11th edition Munich 2015.
Berlit, Markenrecht, 10th edition Munich 2015.
Eckhardt/Klett (eds.), Wettbewerbsrecht, Gewerblicher Rechtsschutz und Urheberrecht (Vorschriftensammlung), current edition.
OR: Beck-Texte im dtv (PatentR, DesignR, MarkenR etc.).
Eisenmann/Jautz, Grundriss Gewerblicher Rechtsschutz und Urheberrecht, 10th ed. 2015.

	Gausemeier/Glatz/Lindemann, Präventiver Produktschutz, Munich 2012. Götting, Gewerblicher Rechtsschutz (Patent-, Gebrauchsmuster-, Design- und Markenrecht, 10th edition 2014. Hering, Gewerblicher Rechtsschutz für Ingenieure, 2014. Haedicke (ed.), Patentrecht, 3rd edition 2015. Nordemann, Wettbewerbsrecht, Markenrecht, 11th edition, Baden Baden 2012.

Industrial Bus Technology and Communication					IBK
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5008	150 h	6	1st, 2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	51	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

The students master the advanced basics of bus communication and bus protocols within a fieldbus system and can assign the requirements for determinism and reliability.
They can evaluate and select industrial bus systems with regard to their suitability under specified boundary conditions and set up and maintain bus systems.

3 Contents:

1. Principles
   - Significance of fieldbus systems (classification and overview, OSI model)
   - Bit transmission layer (medium, coding, topology, interfaces,...)
   - Data link layer (data protection, access procedures)
   - Transmission media (symmetrical, asymmetrical, fibre optics, radio, ...)
   - EMC considerations
   - Real-time requirements / determinism
   - Connection of networks (repeaters, bridges, routers, gateway)
2. Network hierarchies
   - Management / Process Control / Field / Sensor Actuator Level
   - IoT Architectures
3. Industrial bus systems
   - Overview, application and decision-making aids
   - Classic fieldbuses: Profibus, Interbus-S, AS-Interface, Sercos
   - Industrial Ethernet, focus on Ethercat
   - Industrial Wireless
4. Bus systems in the automotive sector
   - CAN
   - FlexRay
   - LIN
5. IoT
   - Pub/Sub instead of Client/Server
   - OPC/UA
   - TSN
   - IoT protocols (MQTT, AMQP)
   - Platforms
6. Security
7. Design of communication systems
   - Project planning
   - Design and system planning
   - Performance analysis
   - Test
   - Diagnosis/Maintenance

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment: Written exam or combination exam (term paper with presentation and oral exam)	
7	Prerequisite for the award of credit points: Module examination pass and course assessment	
8	Application of the module (in the following study programmes) Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator: N. N.	
11	Other information: Required literature (in addition to the basic literature) will be announced each semester.	

Colloquium					KLQ
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5024	100 h	4	4th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		actual Contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	100	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	In the colloquium, the student demonstrates that he or she is able to orally present the results of the master thesis, its subject-related foundations, its interdisciplinary connections and its extra-subject-related references and to justify them independently. Students can critically evaluate the results of their work and are able to assess their significance for practice.	
3	Contents:	
	The colloquium complements the master thesis and is to be assessed independently. Content of the thesis according to the topic Defence of the procedure used in writing the thesis and in the event of questions arising in the work environment.	
4	Forms of teaching:	
	Oral examination	
5	Participation requirements:	
	Formal:	All modules of the study programme must be successfully completed. The master thesis must be successfully completed.
	Content:	Treatment of the master thesis
6	Forms of assessment:	
	Oral examination for a maximum duration of 75 minutes	
7	Prerequisite for the award of credit points:	
	Passed colloquium	
8	Application of the module (in the following study programmes)	
	Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator:	
	N. N.	
11	Other information:	
	-	

Leadership Management					LSM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5016	150 h	6	1st or 2nd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: After successful completion of the course, students have theoretical and practical basic knowledge for a professional communication and leadership basis and can reproduce it. They are able to grasp the significance of corporate goals and different leadership cultures. They have learned to evaluate entrepreneurial decisions and measures from an economic, labour law and social perspective and to derive and represent alternative courses of action. Furthermore, the students have a basic understanding of how to lead, motivate and coach employees in a qualified manner and can transfer this to their everyday work. They show when which leadership styles and methods can be applied in a goal-oriented manner. They know how to motivate themselves and others to achieve success in teams.
3	Contents: Self- and time management, communication, giving and receiving feedback, goal pursuit and controlling, leadership techniques and instruments, values in management, intercultural management, change management, coping with crisis situations, risks and opportunities
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Oral examination or term paper or project with paper
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Industrial Engineering and Management (part-time combined studies) (M.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr.-Ing. Michael Fahrig
11	Other information: Recommended reading will be announced at the beginning of the course.

Management of Industrial Service Bundles					ML
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5020	150 h	6	2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the module, the students have a comprehensive understanding of the conception and management of industrial service bundles as sales objects and can confidently apply and check this understanding using examples. They work out the special features of services, also in teams, and are able to present them and compare them with each other.

3 Contents:

The increasing intensification of competition due, among other things, to constantly shortening product life cycles with longer development times, new competitors from Asia and ever-faster imitations has led to an increasing competitive importance of services: industrial goods producers are trying to sell their material goods combined with additional services as so-called industrial service bundles (also called hybrid service bundles) in order to be able to differentiate themselves from the competition through a benefit advantage.
Introduction: Object and special features of services (concept and systematisation of services, special features of the production of services, special features of the sale of services)
Forms and characteristics of industrial services as a component of industrial service bundles (approaches to the systematisation of industrial services, integrativity and immateriality as service characteristics and their consequences for management)
Sponsorship and organisational design of industrial service bundles (Make or Buy)
Initial analysis and strategy concepts for industrial service bundles Operational management of industrial service bundles
Lifecycle management of industrial service bundles Quality management of industrial service bundles
Controlling of industrial service bundles (service blueprinting, benchmarking, process value analysis, process costing, target pricing/costing)
Analysis of selected business models of industrial service bundle providers
Development trends

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: Literature will be announced at the beginning of the course.

Master Thesis					MAR
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5023	500 h	20	4th sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	0	SCH	0	h	500	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	0	SCH	0	h	0	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences:	
	After successful completion of the master thesis, the candidate is able to independently complete a practice-oriented task from his/her special subject area within a specified period of time, both in the subject-specific details and in the interdisciplinary contexts, using scientific methods.	
3	Contents:	
	The master thesis is an independent scientific work from the subject area of the respective study programme with a description and explanation of its solution. It can also be carried out through an empirical investigation or through conceptual or design tasks or through an evaluation of existing sources. A combination of these is possible.	
4	Forms of teaching:	
	Written composition with faculty tutoring	
5	Participation requirements:	
	Formal:	-
	Content:	Coordinated topic from the student's special subject area
6	Forms of assessment:	
	Master thesis	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator:	
	N. N.	
11	Other information:	
	Literature will be announced at the beginning of the course.	

Product Lifecycle Management and Systems Engineering					PLM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5013	150 h	6	1st, 2nd or 3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students are able to describe procedures in product development processes and explain their control as well as the use and structure of a product lifecycle management.
Students are able to methodically apply product development processes and to critically reflect on them. In addition, they are able to argue the importance of PLM and to use PDM systems in a suitable way to solve day-to-day problems in the development of products in accordance with the principles of engineering.

3 Contents:

Basics of PLM
Processes and methods of PLM: Product development process PEP
Further processes of PLM
Basics of data management
Requirements for PLM/PDM data management
Managing product data
PDM system architecture

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- MA §32

10 Module coordinator:

Prof. Dr.-Ing. Klaus Dürkopp

11 Other information:

A teaching note from the Institute for Composite Studies (IfV NRW) is available for this module. The learning units of Prof. Dr. Brenke Product Life-Cycle Management (September 2015) are used.

Process and Production Engineering					PPT
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5014	150 h	6	1st, 2nd or 3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: After successful completion of the courses, the students are able to present the basics of factory organisation and industrial engineering and to apply the acquired knowledge to typical problems with the help of practical examples. They can recognise connections and apply them in their field of work. Students are able to reproduce an overall view of the typical facets of a modern industrial operation.
3	Contents: Introduction to Production Production planning and control Labour science (e.g. REFA /MTM) Factory planning LEAN Management / Industrial Engineering Industry 4.0 Digitalisation and networking of industrial plants Supply chain management Digital factory Strategic Management / Organisation
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written or oral examination or project with paper
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Industrial Engineering and Management (part-time combined studies) (M.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr.-Ing. Jürgen Sauser
11	Other information: -

Simulation of Production and Logistics Systems					SPL
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5017	150 h	6	2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	51	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students are able to

- model event-oriented dynamic systems that are subject to stochastic influences and to analyse them by means of simulation.
- illustrate the fields of application and to understand the limits of simulation applications in production and logistics.
- analyse, abstract and formulate tasks for simulation studies.
- apply procedural models for the creation, implementation and evaluation and validation of simulation models/studies.
- evaluate simulation results and their validity.
- deal critically with the possibilities of innovative digital planning and simulation tools.

3 Contents:

Basic terms simulation, model, system
Method of discrete-event simulation
Procedure models for simulation studies
Typical decision-making situations in logistics planning in which mathematical modelling and simulation can be effectively applied
Overview of VDI Guideline 3633 Simulation in Production and Logistics Stochastic Decision Models:
Markov chains, Poisson processes, waiting queues, stochastic decision processes
Simulation: Generation of random numbers, Monte Carlo integration, discrete simulation, random numbers of discrete and continuous random variables, statistical analysis of simulated data.
Introduction to the use of a simulation system for production and logistics structures. In the practical course, the students receive a concrete simulation task, which they have to solve with a given simulation tool.
Process models and techniques for verification and validation

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written or oral examination or project with paper

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- MA §32

10	Module coordinator: Prof. Dr. rer. oec. Pascal Reusch
11	Other information: -

Supply Chain Management					SCM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5019	150 h	6	2nd or 3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, students are able to

- discuss the challenges and approaches to planning, controlling and modelling cross-company value creation networks.
- present a holistic, interdisciplinary overview of the diverse management tasks of entire value chains, from raw material procurement to the end user to disposal or recycling.
- reproduce the basics of modelling and the modelling paradigm of logistics and apply them. Based on this, they can structure the diverse design tasks, starting from the superordinate SCM task model, which is structured according to temporal (long to short term) and role-specific (supplier, company, customer) criteria, relate them to each other and apply them to operational problems.
- work on detailed questions and also comprehend complex and interlinked tasks of value chain management.
- evaluate design decisions and distinguish between the special controlling procedures and the key figures of supply chain management.
- understand and describe the relationship level within the framework of cross-company cooperation.

3 Contents:

The main contents of the course are:
Definitions and goals in SCM,
SCM key processes at a glance,
Typologies of supply chains and reference models to describe supply chains (e.g. SCOR model),
Potentials and obstacles in SCM,
Make-or-buy decisions including the associated cooperation options, information flow in the supply chain (web-based tools and e-business scenarios),
Use and consolidation of information on the manufacturer and retail side for distribution and marketing (Collaborative Planning, Forecasting and Replenishment),
Effective use of ERP vs. SCM systems or APS systems across company boundaries,
Purchasing and procurement as interface processes in the supply chain organisational processes, in particular information and material flows between suppliers and buyers up to the provision of goods for production, from the national and international search for suppliers to supplier selection, negotiations and conclusion of contracts up to supplier assessment, controlling and auditing,
Inventory management in supply chain partnership, Supply Network Planning (SNP), Vendor Managed Inventory (VMI) etc.,
SCM key figures/controlling.

4	Forms of teaching:	
	Learning units for self-study, classroom sessions in the form of exercises	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment:	
	Written or oral examination or project with paper	
7	Prerequisite for the award of credit points:	
	Module examination pass	
8	Application of the module (in the following study programmes)	
	Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade:	
	Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator:	
	Prof. Dr. rer. oec. Pascal Reusch	
11	Other information:	
	-	

Technology and Innovation Management					INM
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5004	150 h	6	1st, 2nd or 3rd sem.	each semester	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Upon completion of the course, students will be able to

- develop innovations with the help of known methods of technology and innovation management and to implement them in relation to the application.
- present the process from strategic orientation, through the generation of innovations, to the selection of suitable projects and finally to their implementation in products, processes or services, as well as to classify them in the company's structures and processes.
- recognise the different requirements of companies for innovations and technologies in the different countries and take them into account in the execution.
- transfer their acquired understanding of innovation management to processes of multinational corporations and internationally operating medium-sized companies.
- assess the differences and interdependencies of technology development, management and marketing, and define the prerequisites for intra-organisational design of change processes.

3 Contents:

Basics of the subject area (innovation and technology concepts, idea generation and evaluation, conditions for innovations, technology life cycles, etc.)
Instruments of strategic and operational innovation management (technology matrix, technology portfolio, merging market and technology portfolio, etc.)
Carrying out market-oriented technology analyses and developing market- and customer-oriented technology and product strategies
Deriving opportunities and risks from the environmental analysis (early technology recognition, technology forecasts, competitor analysis) and identifying the strengths and weaknesses of one's own company (R&D assessment, resources, technological capability)
Influence of technologies on new product development
Application of the tools to concrete company examples

Table of contents:

- Introduction	How does the new come into the world?
- Basic concepts	From technical invention to market-driven innovation
- Create orientation	Defining strategic fields of innovation
- Developing ideas	Collecting and generating ideas
- Evaluate + select ideas	Identifying big ideas and avoiding flops
- Implementing ideas	Applied change management
- Marketing ideas	Innovation is when the market rejoices
- Creating framework conditions	Balance between innovation and routine

4 Forms of teaching:

	Learning units for self-study, attendance events in the form of seminar-based teaching and exercises	
5	Participation requirements:	
	Formal:	-
	Content:	-
6	Forms of assessment: Written or oral examination or presentation with paper	
7	Prerequisite for the award of credit points: Module examination pass	
8	Application of the module (in the following study programmes) Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);	
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32	
10	Module coordinator: Prof. Dr.-Ing. Prof. h.c. Lothar Budde	
11	Other information: -	

Business Valuation					UB
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5015	150 h	6	1st, 2nd or 3rd sem.	Annual (Summer)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2	Learning outcomes/competences: After successful completion of the course, students are able to present the basics of business valuation and can identify occasions for business valuation. They are familiar with the theories of business valuation and can use the various methods of business valuation in a targeted manner, especially in the context of the so-called function theory. The students can describe the factors influencing the company value and determine target-oriented company values depending on the purpose of the valuation. Through the imparting of specialist knowledge for solving current special problems of business valuation, they are in the position to carry out professional assessments.
3	Contents: Occasions of business valuation Theories of business valuation Principles of proper business valuation Methods/procedures of business valuation Special problems of business valuation (especially consideration of uncertainty, monetary devaluation, taxation) Case study on business valuation
4	Forms of teaching: Learning units for self-study, classroom sessions in the form of exercises
5	Participation requirements: Formal: - Content: -
6	Forms of assessment: Written examination or oral examination
7	Prerequisite for the award of credit points: Module examination pass
8	Application of the module (in the following study programmes) Industrial Engineering and Management (part-time combined studies) (M.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr. rer. pol. Hubertus Wameling
11	Other information: -

Sales and Negotiation Methods					VV
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5022	150 h	6	2nd or 3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	2	SCH	16	h	59	h
	Practical or seminar	15 students	0	SCH	0	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

Upon successful completion of the module, students will be able to

- recapitulate the learning content independently and deepen their knowledge in self-study using selected learning materials.
- classify the importance of personal selling and customer relationship management in the distribution of industrial goods.
- combine their technical competences in the field of industrial goods with the sales and personal selling competences acquired in this module in order to successfully lead sales and negotiations to ensure the sustainability of the project.

3 Contents:

Sales management as a component of the basic strategic concept of a company
The position of sales within sales management
Sales organisation planning
Customer definition and customer benefits as the basis for market cultivation
Customer segmentation and customer value
The Sales and Negotiation Process, Part 1: Travelling sales budgeting
Sales district distribution
Route planning
Visit planning
Number of sales employees
Compensation
Staff management and recruitment
The Sales and Negotiation Process, Part 2: Key account manager, sales manager and managing director as salesperson
Sales and negotiation training
The sales and negotiation process as social interaction
Communication science basics
Psychological and sociological foundations
the practice of sales and negotiation management sales controlling
Customer relationship management: from individual transaction to business relationship
Special aspects of marketing in the supply, system and plant business

4 Forms of teaching:

Learning units for self-study, classroom sessions in the form of exercises

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8	Application of the module (in the following study programmes) Industrial Engineering and Management (part-time combined studies) (M.Eng.);
9	Importance of the grade for the final grade: Percentage based on the sum of credits of the graded modules according to RPO- MA §32
10	Module coordinator: Prof. Dr. rer. oec. Klaus Rüdiger
11	Other information: -

Distributed Automation Systems					VA
Identification number:	Workload:	Credits:	Study semester:	Frequency of the offer	Duration:
5003	150 h	6	1st, 2nd or 3rd sem.	Annual (Winter)	1 semester

1	Course:	Planned group sizes	Scope		Actual contact time / classroom teaching		Self-study	
	Lecture	60 students	2	SCH	0	h	75	h
	Tuition in seminars	30 students	0	SCH	0	h	0	h
	Exercise	20 students	1	SCH	8	h	51	h
	Practical or seminar	15 students	1	SCH	16	h	0	h
	Supervised self-study	60 students	0	SCH	0	h	0	h

2 Learning outcomes/competences:

After successful completion of the course, the students are able to independently optimise in-process data acquisition in the manufacturing process depending on the degree of cross-linking. They are familiar with suitable measures to discover and use time optimisation potentials in complex dependencies of a manufacturing process. A deep understanding of the interrelationships between goods transport systems (transfer systems) and automatic processing stations (e.g. robot islands) is conveyed so that students are able to connect complex data transfer systems (BDE or MDE). Knowledge of fault management enables them to minimise plant downtimes with diagnostic and prognostic means. Special emphasis is placed on decentralised and BUS-networked safety technology, which enables students to very effectively integrate UVV-compliant systems into complex safety systems.

3 Contents:

Linking decentralised automation components
Design methods for global automation systems
Higher-level integration of shared transfer systems and logistics units (stacking gantries; robots)
PDA and MDC in the production process; parts tracking in cycle lines with decentralised automation
Central error management with decentralised recording
Decentralised networked safety technology (safety bus systems)

4 Forms of teaching:

Learning units for self-study, classroom events in the form of exercises and practicals

5 Participation requirements:

Formal:	-
Content:	-

6 Forms of assessment:

Written examination or oral examination

7 Prerequisite for the award of credit points:

Module examination pass

8 Application of the module (in the following study programmes)

Applied Automation (part-time combined studies) (M.Eng.); Industrial Engineering and Management (part-time combined studies) (M.Eng.);

9 Importance of the grade for the final grade:

Percentage based on the sum of credits of the graded modules according to RPO- MA §32

10 Module coordinator:

Prof. Dr.-Ing. Thomas Freund