Reutlingen University
School of Engineering

Engineering Courses in English for Exchange Students

International Project Engineering, Bachelor

Project Leadership	
Study Program **Study level and semester**	International Project Engineering Bachelor, 1st Semester
ECTS Credits	2
Hours per week / **total contact hours**	2 / 30
Total hours of study	90
Type/Teaching Method	Seminar-style lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Jochen Brune, MBA E-Mail: Jochen.brune@reutlingen-university.de
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Prerequisites:	None
Course learning objectives:	Professional competencies The students are able… • to describe the fundamental principles of project leadership and project management. Methodological competencies The students are able… • to describe and apply the fundamental methods and techniques of project leadership. • to practically apply important methods and techniques of project management to successfully plan a project. • to plan a project regarding scope, schedule, cost and quality. • to analyze a given project in detail and to optimize it regarding scope, schedule, cost and quality. Social competencies The students are able… • to analyze communication failures and create communication strategies in leadership situations. • to actively manage conflicts and negotiation situations.

	• to understand and practically apply the fundamentals of human motivation, personal preferences and team behavior to lead a project to success Personal competencies The students are able… • develop an understanding of the requirements towards a project leader. • to solve complex leadership problems individually as well as in a team setup. • to understand why structuring and planning are prerequisites for successful execution of complex projects.
Contents:	Fundamental methods and techniques for project leadership: Creativity techniques, problem solving techniques, communication and communication failures, communication in leadership situations, conflicts and conflict management, Negotiation, personality & preferences, influencing others, motivation, team management, virtual teams
Textbooks:	Fundamentals: - Meredith, Jack; Mantel, Samuel: 'Project Management – A Managerial Approach', 11th ed. (International Student Version), Wiley, aktuelle Auflage - Jenny, Bruno: 'Projektmanagement – Das Wissen für eine erfolgreiche Karriere', aktuelle Auflage, vdf Hochschulverlag, Zürich Additional: - Kerzner, Harold: 'count: A Systems Approach to Planning, Scheduling, and Controlling ', John Wiley & Sons; aktuelle Auflage Jenny, Bruno: Projektmanagement – Das Wissen für den Profi, aktuelle Auflage, vdf Hochschulverlag, Zürich
Assessment	Graded: Case Study and Written Exam Fall Semester: Exam takes place the week before Christmas break. Students who wish to take the exam must be in Reutlingen for the exam.

Project Planning	
Study Program **Study level and semester**	International Project Engineering Bachelor, 2nd Semester
ECTS Credits	3
Hours per week / **total contact hours**	2 / 30
Total hours of study	120

Type/Teaching Method	Seminar-style lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Jochen Brune, MBA E-Mail: Jochen.brune@reutlingen-university.de
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Prerequisites:	None
Course learning objectives:	Professional competencies The students are able… • to describe the fundamental principles of project leadership and project management. Methodological competencies The students are able… • to describe and apply the fundamental methods and techniques of project leadership. • to practically apply important methods and techniques of project management to successfully plan a project. • to plan a project regarding scope, schedule, cost and quality. • to analyze a given project in detail and to optimize it regarding scope, schedule, cost and quality. Social competencies The students are able… • to analyze communication failures and create communication strategies in leadership situations. • to actively manage conflicts and negotiation situations. • to understand and practically apply the fundamentals of human motivation, personal preferences and team behavior to lead a project to success Personal competencies The students are able… • develop an understanding of the requirements towards a project leader. • to solve complex leadership problems individually as well as in a team setup. • to understand why structuring and planning are prerequisites for successful execution of complex projects.
Contents:	Introduction to classical project management methods and techniques, with the focus on structured project planning and optimization. Fundamental principles of project management: Projects, triple constraint, differences between working in projects and working in operations, project success and failure, tasks of a project manager, project organisation forms, forms

	of project lifecycle, activities at project start, project management core processes (planning, project start, project execution, project controlling, project closing), supporting and facilitating processes. Methods of classical project management: Project proposal, Product Breakdown Structure (PBS), Work Breakdown Structure (WBS), Work Package Descriptions (WPD), Project Network Diagram (PND) (activity sequencing), Project schedule, effort and duration estimation, Organisational Breakdown Structure (OBS), Responsibility Assignment Matrix (RAM), resources plan, resources optimization, cost structure plan, project budget plan, introduction to Discounted Cash Flow (DCF) techniques (Net Present Value (NPV), Internal Return Rate (IRR)) Methods of agile project management: Predictive vs. New Product Development, The Agile Manifesto, waterfall vs. agile project success, user stories, agile effort estimation, planning poker, Definition of Done, Introduction to Scrum, Scrum process, Scrum roles, Scrum artefacts, Scrum limitations
Textbooks:	Fundamentals - Meredith, Jack; Mantel, Samuel: 'Project Management – A Managerial Approach', 9th ed. (International Student Version), Wiley, 2015 - Jenny, Bruno: 'Projektmanagement', vdf Hochschulverlag, Zürich 2005 Additional: - Kerzner, Harold: 'Project Management: A Systems Approach to Planning, Scheduling, and Controlling ', John Wiley & Sons; 12th Ed. (2017) Basiszertifikat im Projektmanagement (GPM) GPM Deutsch Gesellschaft für Projektmanagement / Michael Gessler (Hrsg.)GPM Deutsche Gesellschaft für Projektmanagement e.V., 2010, ISBN: 9783942660136, 854 Seiten 3. Auflage
Assessment	Graded: Written exam Fall Semester: Students who wish to take the exam must be in Reutlingen for the exam.

Finance and Investment	
Study Program **Study level and semester**	International Project Engineering Bachelor, 3nd Semester
ECTS Credits	3
Hours per week / **total contact hours**	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, case studies, group tasks
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Antje Brüsch E-Mail: Antje.Bruesch@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Course learning objectives:	At the end of the course students should: <u>Professional competencies</u> • be able to make decisions related to investments / evaluate, which alternatives are the best from an economic perspective (regarding investment). • be able to discuss and evaluate the pros and cons of different financing alternatives and decide which one is the best, regarding the specific financial circumstances of a company. • have understood basic concepts of investment appraisal and corporate finance and apply them in real-life situations. <u>Methodological competencies</u> • be trained in analytical and methodical competences, related to investment decisions based on the circumstances a company is facing. • be qualified to define targets, plan investments and the associated financing and therefore select appropriate methods, measures and tools. <u>Social competencies</u> • learned to deal with each other and develop respect for one another through group discussions and practical exercises in teams. <u>International competencies</u> • Improved their English language skills in the area of investment and finance.
Contents:	For their operations, a company needs assets, which have to be financed. Financial resources could be given by equity and/or debt investors.

	The course deals with the challenge of a company to meet the expectations of investors. Therefore, the planning and calculation of financial resources of a company is key in the investment field. The funding of these needs is the basis for the finance part of the course. The focus in this area is on the possibilities of internal and external financing as well as equity and debt financing.
Textbooks:	Brealey, R, Myers, S, Allen, F, current edition. Principles of Corporate Finance, McGraw Hill. Zantow, R., aktuelle Auflage. Finanzierung: Die Grundlagen modernen Finanzmanagements, Pearson Studium. various articles
Assessment	Graded: Oral exam 15 min

Accounting	
Study Program **Study level and semester**	International Project Engineering Bachelor, 2nd Semester
ECTS Credits	3
Hours per week / **total contact hours**	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, case studies
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Antje Brüsch E-Mail: Antje.Bruesch@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Prerequisites:	Fundamentals of business administration
Course learning objectives:	At the end of the course students should: Professional competencies • have understood the holistic accounting system and should be able to explain the reasons / needs for the different segments of accounting. • be able to use the appropriate measure or method in specific circumstances and can explain the impact on the financial figures of a company. Methodological competencies • be trained in analytical, methodical and economical competences, related to accounting in general. • be qualified to define the required financial information in specific situations and should be able to evaluate the financial health of a company and deduce a clear statement. Social competencies • learned to deal with each other and develop respect for one another through group discussions and practical exercises in teams. International competencies • Improved their English language skills in the area of managerial accounting.
Contents:	Today, accounting is called 'language of business'. The course deals with the challenge of a company to record and report the appropriate information depending on different information addressees (Shareholder, Stakeholder, Manager, etc.). Therefore, the course deals with four segments of accounting:

	• double entry accounting • cost accounting • planning and shows relationships between these aspects.
Textbooks:	Taschner, A., Charifzadeh, M., aktuelle Auflage. Management and Cost Accounting, Wiley. Olfert, K., aktuelle Auflage. Kostenrechnung, Kiehl. various articles
Assessment	Graded: Oral exam 15 min

Project Budgeting and Controlling	
Study Program **Study level and semester**	International Project Engineering Bachelor, 4th Semester
Total ECTS credits	7
Total hours per week	5
Hours per week / **total contact hours**	5 / 75
Total hours of study	210
Type/Teaching Method	Lecture, case studies, group tasks, e-learning, Laboratory internship (Taught as compact course on 3-4 selected dates)
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Antje Brüsch E-Mail: Antje.Bruesch@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Course learning objectives:	After course completion, students: Professional competencies ▪ can deduce a cost baseline. ▪ are able to use and adapt techniques for cost and risk analysis. ▪ are able to develop a budget. ▪ are able to define recovery measures. ▪ are able to define the structure of a multi project. Methodological competencies ▪ are able to understand the needs of multi project and single project control. ▪ are able to apply the methods used in multi and single project control. ▪ are able to forecast future trends. ▪ are able to structure and plan projects. ▪ are able to estimate the effort to reach project targets. Social competencies ▪ are able to report (interim) results, according to the needs of information addressees. International competencies ▪ improved their English writing skills with group tasks and case studies.
Assessment	Graded: Written Exam 2 hours; Computer Lab Assignments, Testat/ Attestation
Contents:	Empirical surveys show, that: ▪ 20% of all IT-Projects will be cancelled ▪ Every second project will overrun time and / or will be more expensive

	▪ Probability of failures rise with duration time and complexity! The course deals with the challenge, to define a proper baseline for a project and deduce (based on that baseline) a realistic budget as benchmark for the following controlling process. Therefore, students should reach the capability to define a proper baseline (plan), control complex projects and provide appropriate information to decision makers during the project. Overall, students should understand the necessity of project budgeting and controlling and learn to consider the management accountant as their "partner" in order to support the decision making throughout the project on all hierarchical levels
Textbooks:	Fiedler, R., aktuelle Auflage. Controlling von Projekten, Vieweg Verlag. Horngren, C.T. et al., current edition. Introduction to Management Accounting, Pearson. Kerzner, H., current edition. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, John Wiley & Sons. Various articles
IPE Project Lab	
Course Coordinator/Instructor	Dr. Schmid, Elisabeth Elisabeth.Schmid@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Course learning objectives:	After the completion of the course, students: <u>Professional competencies</u> - are able to estimate the “duration, cost and degree of completion” of practical oriented case studies. - are able to take advantage of project-based learning and modern project management software in the planning, organisation, budgeting and resource assignment of complex projects. - are able to perform project monitoring, project control and project optimization. - are able to execute independently activities in the project management of complex Projects <u>Methodological competencies</u> - are able to generate technical reports. - Social competencies/International competencies - are able to use business English in project management. - Personal competencies - are able to set their own deadlines and to evaluate the progress towards the given goals.
Contents:	Principles and limitations of professional project planning software. Computer-based project plan, budgeting, resource assignment. Computer-based project monitoring, project control and project optimization. Reporting in the engineering and in the project management: Gantt Chart and Project Network Diagrams Milestone plans, timelines and tables of activities technical reporting

Textbooks:	HOLERT, H. (2011). Microsoft Project 2010 – Das Profibuch. Microsoft Press Deutschland. ISBN: 978-3866454484. CHATFIELD, C., JOHNSON, T. (2010). Step by Step – Microsoft Project 2010. Microsoft Press. ISBN: 978-0735626959. The mouse training company. Microsoft Project 2010 Training – Project quick reference card. Available from the company site. Last retrieved: 04.09.2012. http://www.mousetraining.co.uk/training-manuals/Project_2010_QRG.pdf

Plant Engineering	
Study Program **Study level and semester**	International Project Engineering Bachelor, 4th Semester
ECTS Credits	5
Hours per week / total contact hours	3/ 45
Total hours of study	150
Type/Teaching Method	Lecture (70%) with integrated exercises (30%)
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Georg Samland E-Mail: Georg.Samland@Reutlingen-University.DE
Course learning objectives:	After the completion of the course, students: Professional competencies - know the components used in typical plants. - are able to read and interpret P&ID-diagrams - are able to discuss plant-engineering problems. - are aware of HAZOP-studies and SIL-categories. - are able to calculate and size typical piping configurations. Methodological competencies - have fundamental knowledge in plant engineering and they are able to discuss safety issues. - They have the competency to lead a discussion and to make decisions in a plant engineering project. Personal competencies - are able to make decisions on their own and they can set up appropriate documents.
Contents:	Scaling and cost estimation of plants Safety Issues and HAZOP-Studies Block-diagram, flow-diagram, P&ID Diagram, Main components (Motor, compressors, pumps, piping, heat exchanger, instrumentation…) Measurement devices for e.g. mass flow, temperature, velocity, vibration… Sizing of pipes
Assessment	Written final exam (2 hours)

Project Management Certification	
Study Program **Study level and semester**	International Project Engineering Bachelor, 6th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Seminar-style Lecture. Taught as compact course on 3-4 selected dates!
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Erik Lehmann
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Prerequisites:	
Course learning objectives:	Professional competence The students... - can operationalize goals - can manage risks, opportunities & stakeholders - know how to calculate and optimize the process and deadlines in the network plan - can create a traceable target system using a project structure and reporting system - can use MS Project (critical path and chain) and create result variables for project controlling. - can plan and track project resources and project costs. Methodological competence The students... - know how to apply communication psychology models in the implementation of project content. - know methods for organizing and carrying out tasks. Social competence The students... - can deal more consciously with questioning techniques for leadership and negotiation. - can analyze, anticipate and carry out team development. Self-competence The students... - reflect on themselves and the learning outcomes of group work and can improve the work result as a result.

	- can realistically assess their own abilities. know how to ensure trust, integrity and a good relationship level so that crises and conflicts can be handled confidently or resolved professionally.
Contents:	ICB 3.0 Competence Elements: 1.01 project management success 1.02 interested parties 1.03 project requirements & objectives 1.04 Risk & opportunity 1.05 quality 1.06 project organisation 1.07 teamwork 1.08 problem resolution 1.09 project structures – 1.10 scope & deliverables 1.11 time & project phases 1.12 resources 1.13 cost & finance 1.14 procurement & contract 1.15 changes 1.16 control & reports – 1.17 information & documentation 1.18 communication 1.19 start-up 1.20 close-out – PM behavioural competencies
Textbooks:	Lecture notes in English
Assessment	Graded: Written exam

Intercultural Communication	
Study Program **Study level and semester**	International Project Engineering Bachelor, 7th Semester
ECTS Credits	5
Hours per week / total contact hours	4 / 60
Total hours of study	150
Type/Teaching Method	Presentation, case studies, discussions, group film
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Kerstin Reich E-Mail: kerstin.reich@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Prerequisites:	
Course learning objectives:	After successful completion, students: Professional competencies - have understood the scope of different cultural models and have the ability to transfer and - apply theoretical knowledge to real-life settings. - have achieved a deeper understanding of cultural differences (e.g. national, regional but - also on group level). - have achieved the competences in leading international teams, negotiating strategies and - business behavior. Methodological competencies - can analyse case studies and critical incidents in an intercultural context. - can apply cultural dimensions and theoretical background to real-life settings. Social competencies/ International competencies - have awareness of different values and cultural imprinting. - have a set of tools in order to react in a flexible way in cultural situations. - improved oral and written communication skills. - can give and receive feedback from fellow students in a structured and constructive manner. Personal competencies

	- have awareness of one's own personality and its relation to other cultures, understand one's own personality and its implications to teamwork.
Contents:	Overview of main intercultural management concepts and approaches Verbal and non-verbal communication concepts Training individual intercultural competences Self-assessment
Textbooks:	Browaeys, M.-J., Price, R. Understanding Cross-Cultural Management, FT Press, newest edition. Hall, E.T., Hall M. R. (1990) Understanding Cultural Differences, Yarmouth: Intercultural Press. Hofstede, G., Hofstede, G. J. Cultures and Organisations – Software of the Mind, Mcgraw-Hill Professional, newest edition. Rothlauf, J., A Global View on Intercultural Management: Challenges in a Globalized World. Verlag De Gruyter Studium, newest edition. Trompenaars, F., Hampden-Turner, C. Riding the Waves of Culture: Understanding Cultural Diversity in Business, Nicholas Brealey Publishing, newest edition.
Assessment	Graded: Written seminar paper (70%), group presentations (30%)

Scientific Approaches and Methods	
Study Program **Study level and semester**	International Project Engineering Bachelor, 5th semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	E-Learning course
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Silvia Casellato Silvia.Casellato@Reutlingen-University.DE
Restrictions	
Prerequisites:	This course requires a weekly continuous active participation throughout the whole semester! Participation is continuously assessed.
Course learning objectives:	After successful completion of the course the students will have developed the following competences: Professional competencies • Working, writing and citing according to the scientific methodology Methodological competencies • Critically evaluating existing scientific work and literature • Presenting results scientifically Social competencies • Life-long learning competencies, by following the e-Learning part of the course during the international practical internship International competencies • Integrating into the international scientific community
Contents:	Principles of research Contributing to the body of knowledge

	The scientific method Research questions Research design & methodology Documenting a research process Writing an introduction Scoping studies vs. literature review Organizing literature Referencing and citation styles Results vs. Discussion How to phrase a paragraph Research ethics Presenting scientific results Time- and self-management The course is designed as a synchronous e-learning course accessible in Relax. e-learning means you can take this course anywhere where you have a computer and internet access, i.e. during your practical semester, from home or at university. Synchronous means the course is timed and every week you will be required to work through new material, research, read, write and submit a certain piece of writing. Despite the flexibility in location, you will extensively work with your peers by reviewing their work and discussing improvements. The examination method is continuous assessment; hence, you will only pass this course if you have made enough successful weekly submissions. Apart from professional and methodological competences, you will acquire life-long learning competencies with this course.
Textbooks:	
Assessment	Graded: Continuous Assessment (CA)

Smart Systems	
Study Program **Study level and semester**	International Project Engineering Bachelor, 6th semester
ECTS Credits	7
Hours per week / total contact hours	5 / 75
Total hours of study	210
Type/Teaching Method	Lecture, case studies, project assignment, group work and discussions, presentations, project documentation
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Markus Wachter, Antonio Notholt markus.wachter@reutlingen-university.de, antonio.notholt@reutlingen-university.de
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Prerequisites:	This is an **advanced course** requiring: University Level Math (Algebra, Analysis, Trigonometry); Physics basics; Electrical Engineering basics; Computer Science (basic knowledge how to design, test and implement software in any language); Electrical drives; Control Engineering basics.
Course learning objectives:	At the end of the course students: **Professional competencies** • are able to choose technical components for a smart system • can define the system architecture with their mechanical, electronical, software and communication interfaces • understand and are able to fine tune and enhance existing image processing algorithms, communication infrastructures, graphical user interfaces and machine learning algorithms • have integrated a smart system and understand its limitations and challenges • can evaluate possible applications for smart systems **Methodological competencies** • can discuss the advantages and disadvantages of the application of new "smart" technology in various fields • can identify needed project positions and set up a team for system development • can present the project status of the current smart system **Social/Personal competencies** • are able to identify needed capabilities of different positions in a development team

	• can assign persons from a team to the needed positions in the project • can cooperate within a heterogenous team and solve conflicts regarding different interests • can design and implement a challenging technical system in a team • have created a project documentation consisting of technical artefacts
Contents:	**Technology:** Digital control and integration of microsystems, IoT principles its practical implementation, machine learning, AI, neural networks, predictive analysis, self-X-systems (learning, organizing, optimizing, repairing) **Applications:** Smart cities, IoT, smart traffic, smart society, digital business management, smart health **Beyond:** Business models, ecosystems for smart solutions
Textbooks:	Deep learning / Ian Goodfellow, Yoshua Bengio and Aaron Courville, The MIT Press, [2016] Artificial intelligence : a modern approach / Stuart Russell; Peter Norvig, 2016 The Internet of things : how smart TVs, smart cars, smart homes, and smart cities are changing the world / Michael Miller, 2015 IoT System Design : Project Based Approach / by Alice James, Avishkar Seth, Subhas Chandra Mukhopadhyay, 2022
Assessment	Graded: Project Work (PA)

Business Transformation	
Study Program **Study level and semester**	International Project Engineering Bachelor, 6th Semester
Total ECTS credits	3
Total hours per week	2/ 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Martin Sattler E-Mail: martin.sattler@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Course learning objectives:	Professional competencies Students… • can identify and formulate basic legal issues that apply to the facts of a given case • are able to apply the law in special cases, e.g. to recognize, define, and explain the legal context of projects. • know the fundamentals of national and international contracts, including the types of contracts. • are able to analyze cases, to create short contracts and they know details about claim-management. • can explain and evaluate the elements of company culture and its impact on entrepreneurial success. • have the ability to implement and carry out business transformations and define suitable controlling approaches for successful execution Methodological competencies Students… • are able to describe and apply the fundamental methods and techniques for law.

	• have a basic understanding of the steps of finding legal decisions; basic knowledge of legal research. • are able to analyse existing business cultures using different models. • can specify target cultures and transform an existing business culture into the selected target culture. • know that there will be resistance from various stakeholder groups and know ways to overcome it. Social competencies Students… • are capable to collaborate with other students (presentation skills, role play experience). • are able to identify different behaviour patterns of employees and colleagues during a change. Personal competencies Students… • develop an understanding of the system of law. They solve legal problems individually. • recognize that transformation implies personal involvement and intrinsic motivation.
Contents:	Key characteristics of business transformation include (acc. to PwC): Change Management (Become fit for growth): Effective change management is crucial, as it involves getting involvement from employees and stakeholders, managing resistance to change, and ensuring a smooth transition. Cultural Shift: Transformation requires a shift in the organizational culture to foster innovation, adaptability, and a customer-centric mindset. Technology Integration (Integrate technology for advantage): Businesses may adopt new technologies, software, or systems to automate processes, improve data analytics, or enable new business models. Strategic Alignment (Shape clear value strategy): Business transformation is driven by a clear strategic vision and objectives. It's essential for aligning the transformation efforts with the long-term goals of the organization. Skill Development (Engage people to accelerate): Employees may need training or further

	education to adapt to new roles or technologies. Measurement and Evaluation: Key performance indicators (KPIs) and feedback schemes are established to track progress and evaluate the success of the transformation
Textbooks:	Balogun, Julia; Hope Hailey, Veronica, 'Exploring Strategic Change', Prentice Hall; Kotter, John P., Cohen, Dan S.: The Heart of Change: Real-Life Stories of How People Change Their Organizations, Maximilian; Kotter, John, Duck, Daniel, Jeanie: Change Management - Strategies for Realizing change, Harvard Business School Publishing, (each as newest edition); Harvard Business Manager, special edition 2016: Change Management.
Assessment	Graded: Written exam

Strategic Leadership	
Study Program **Study level and semester**	International Project Engineering Bachelor, 6th Semester
Total ECTS credits	7
Total hours per week	6 / 90
Total hours of study	300
Type/Teaching Method	Lecture, group work, presentations, role play, case study
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Kerstin Reich E-Mail: kerstin.reich@Reutlingen-University.DE Anthony J Churchill MA E-Mail: anthony_john.churchill@reutlingen-university.de
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Course learning objectives:	After course completion, students: Professional competencies • have dealt with complexities of global business issues. • have developed a critical understanding of the key concepts and principles of strategy, formulation and competitive analysis.be able to apply different leadership styles most fitting to the situation • be familiar with and have the ability to apply important tools and techniques of personal planning.

	• know how to deal with HR-related responsibilities in managerial positions and to conduct a selection process. Methodological competencies • be able to manage plan and control key HR activities. • be able to contribute to a company strategy • can critically evaluate models and approaches in order to select the most appropriate strategy. Social competencies • be able to apply effective written and oral communication skills. • be able to work in diverse teams. • be able to give and receive feedback. • have understood dynamics in social systems such as organisations or teams. Personal competencies • have the awareness of one's personality and its relation to job requirements. • have developed decision making skills and understand one's own leadership style Can adopt to online or in-person leadership challenges
Assessment	Graded: Written exam
Strategic Management	
Contents:	Management Theory Corporate and business level strategy Leadership Motivation and Performance Manipulative Statistics Conflict Management Communication
Textbooks:	Glasl, F. Konfliktmanagement, Haupt, newest edition Johnson, G., Scholes, K., Whittington, R. Fundamentals of Strategy, Pearson, newest edition Jones, G. R., George, J. M. Contemporary Management, McGraw Hill, newest edition Katzenbach, J. R., Smith, D. K. The Wisdom of Teams: Creating the High-performance Organization, Harvard Business School newest Koontz, H., Weihrich H. Essentials of Management, Tata McGraw-Hill, newest edition Mullins, L. Management and Organisational Behaviour, Prentice Hall, newest edition
Human Resources Management	
Contents:	HRM: Past and Future War of talents, employer branding Selection process Performance appraisal Compensation policies Retention and resignation

Textbooks:	Cascio, W. F., Boudreau, J. W. Short Introduction to Strategic Human Resource Management, University Press newest edition Dessler, G.) Human Resource Management, Pearson, newest edition Torrington, D., Hall, L., Taylor, S. , Human Resource Management, Prentice Hall, newest edition

Information Management	
Study Program **Study level and semester**	International Project Engineering Bachelor, 7th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, case studies, group tasks, e-learning
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Antje Brüsch E-Mail: Antje.Bruesch@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Prerequisites:	
Course learning objectives:	At the end of the course students should: Professional competencies ▪ have understood the challenge of information needs of managers in a global world. ▪ be able to describe the theoretical basics of information management. ▪ be able to analyze the specific situation of a company by using the appropriate Techniques and methods. ▪ be able to discuss the pros and cons of current state of the art technology associated with ▪ Information Management (IM) / Information Technology (IT). ▪ Methodological competencies ▪ are able to use tools of digital collaboration and to present online ▪ Social and personal competencies ▪ have refined oral communication skills ▪ have improved the ability to work in teams in order to propose strategies for a digital world. International competencies ▪ have improved their English discussion and writing skills with group tasks.
Contents:	The students learn in this class what the main challenges of digitalisation are from a business perspective and how to prepare for these challenges.
Textbooks:	Rainer, R. K, Prince, B, current edition. Introduction to Information Systems – Supporting and transforming business, Wiley. Krcmar, H., aktuelle Auflage. Informationsmanagement, SpringerGabler.

	various articles
Assessment	Graded: Oral exam 15 min

Supply Chain Management	
Study Program **Study level and semester**	International Project Engineering Bachelor
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Project work, simulation game
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Antje Brüsch E-Mail: Antje.Bruesch@Reutlingen-University.DE
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course.
Course learning objectives:	Professional Competencies: At the end of the course, students should: • be able to align supply chain activities with overall business goals • be able to understand and coordinate supply chain end-to-end processes • be able to distinguish between the activities in source-make-deliver and to understand the key challenges • be able to understand the Toyota Production System • be able to identify waste (muda) and make suitable proposals for improvements of the supply chain Methodological Competencies: At the end of the course, students should: • be able to do value stream mapping (including identification of inefficiencies and improvement ideas) • be able to use a few quantitative and qualitative techniques to optimize supply chain processes • be able to assess and mitigate risks in supply chain operations. Social Competencies:

	At the end of the course, students should: • have improved their presentation skills • be able to address social and environmental concerns in the area of supply chain management • be able to transform very operational issues from the shopfloor into an efficient proposal for decision-making on a management level Self/Personal Competencies: At the end of the course, students should: • be able to effectively convey information to diverse audiences (shopfloor and upper management) be able to analyze complex issues and find practical solutions
Contents:	This course will introduce you to the overall topic of supply chain management. The laboratory is mainly based on the ideas of the lean principles and the Toyota Production System (TPS). The goal is to support the students in building their proper "lean mindset" for working in production, in presenting appropriately indicators from the production environment and in working on further problems dealing with supply chains. These are required competencies for many internships as well as a future professional career in operations. The course is suitable for students of any semester. The pillars of the lecture are the following focal areas of supply chain management: • source / extralogistics • make / intralogistics • deliver /extralogistics • lean mindset and Toyota Production System
Textbooks:	Ohno, T. (current edition). Toyota Production System: Beyond Large Scale Production. Productivity Press, Portland. Waters, D. (current edition). Supply Chain Management: An Introduction to Logistics, Palgrave McMillan, New York. Various current press releases / articles.
Assessment	Graded: Project report, participation in simulation game (lab)

Marketing Project	
Study Program	International Project Engineering
Study level and semester	Bachelor, 3rd Semester
ECTS Credits	5

Hours per week / total contact hours	4 / 90
Total hours of study	120
Type/Teaching Method	Lectures and practical marketing project
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Kerstin Reich E-Mail: kerstin.reich@Reutlingen-University.DE
Course learning objetives	After successful completion of the course the students will have developed the following competences: Professional competencies • Ability to critically discuss the scope of different marketing approaches. • Can apply basic marketing concepts in (international) business situations. • Understand the importance of in-depth customer knowledge as well as being able to formulate marketing messages based on different needs, taking into consideration cultural differences. • Gained an insight into analytical methods and are able to apply the fundamentals of empirical research (e.g. define research questions and design data gathering method) Methodological competencies • Can develop marketing strategies based on the 4 Ps; transfer and apply theoretical marketing knowledge to real-life (international) business cases. • Can prepare a marketing plan, and display a basic level of competence in the empirical research process. • Are able to run a digital marketing project Social competencies • Refined oral communication skills. • Improved the ability to work in teams in order to solve a given complex marketing situation. • Are able to give and receive feedback from fellow students in a structured manner. Self competencies • Confidence to approach people for interviews • Openness to understand other people's point of view
Assessment	Graded: Compulsory attendance of lectures and successful completion of marketing project.

Marketing Project	
Contents	• Overview of different marketing ideas and concepts • Marketing Mix (4Ps) • Difference between B2B and B2C marketing • Market Research • Communication • Positioning • Marketing Plan • Customer Value • Branding • Trends in digital marketing
Textbooks	Armstrong, G., Kotler, P. Marketing: An Introduction, Pearson, newest edition Chaffey, D., Ellis-Chadwick, F. Digital Marketing, newest edition Hollensen, S. Global Marketing, Pearson, newest edition Jobber, D. Fahy, J. Foundations of Marketing, McGraw Hill, newest edition
Media Project	
Contents	Project work in the area of: Market research Internet Social Media Production of films Marketing strategy
Textbooks	Lammenett, E. Praxiswissen Online-Marketing, Springer Fachmedien Wiesbaden, newest edition

Management Simulation	
Study Program **Study level and semester**	International Project Engineering Bachelor, 6th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Intensive Course which takes place after the semester
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Kerstin Reich E-Mail: kerstin.reich@Reutlingen-University.DE
Course learning objectives:	After successful completion, students: **Professional competencies** • have applied methods and knowledge of how to evaluate a company's performance and understand its operations. • can make decisions under resource and competitive constraints and be able to revise decisions if requirements are changing. **Methodological competencies** • have applied theoretical strategy and marketing models and evaluate their effectiveness in a business environment • can use financial data to analyse the company performance and develop measurement and decision support systems. **Social competencies** • can Self-organize and work result-oriented under time pressure and deadlines • can identify and distribute work packages among team members • can integrate results back into group decision. **Personal competencies**

	• have awareness of own personality and how time constraints as well as insufficient information is influencing one's behavior as well as the group dynamics.
Contents:	• Introduction to the computer-based business game in which several groups of students compete against each other. • Financial planning • Production planning • Human resource planning • Strategy planning • Marketing plan • Preparation of a share-holder meeting
Textbooks:	Business game manual (will be made available before the course commences)
Assessment	Graded: Online Test (first day), active participation

Mechanical Engineering Bachelor

Heat Transfer	
Study Program **Study level and semester**	Mechanical Engineering Bachelor
ECTS Credits	6
Hours per week / total contact hours	4 / 60
Total hours of study	180
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Bernd Thomas E-Mail: bernd.thomas@reutlingen-university.de
Restrictions	The course is designed for students from the following partner universities: Valparaiso University, Kettering University, NC State University. **A minimum number of 5 international students** is required for offering the course in English. As tailored for students from the aforesaid Universities, the language of instruction is English until the exam for the international students in mid-December (Chapter 1-5). For the remaining lessons thereafter, which are assigned to Chapter 6, the language of instruction will be German.
Prerequisites:	Basic Math skills
Course learning objectives:	The objective of this course is to provide an insight into heat transfer problems. Topics covered include heat transfer by conduction, both multi-dimensional and non-stationary; convection and radiation; the design of heat exchangers. The focus is on the transformation of the physical problems into appropriate mathematical equations, in order to achieve the desired results.
Contents:	1. Fundamentals 2. Thermal Conduction 2.1 Steady-state, 1-dimensional conduction, Integral approach 2.2 Transient, 1-dimensional conduction 3. Convection 3.1 Thermal boundary layer and heat transfer coefficient 3.2 Heat transfer correlations in case of forced convection 3.4 Heat transfer correlations in case of free (natural) convection 4. Thermal radiation 5. Overall heat transfer, heat exchangers 5.1 The overall heat transfer coefficient 5.2 Heat exchangers

	5.3 Fined surfaces 6. Thermal conduction, differential approach 6.1 Steady-state, 1-dimensional conduction 6.2 Steady-state, 1-dimensional conduction incl. internal heat generation 6.3 Steady-state, 2 and 3-dimensional conduction 6.4 The transient differential equation
Textbooks:	F.P. Incropera, D.P. DeWitt, T.L. Bergmann, A.S. Lavine Introduction to Heat Transfer John Wiley & Sons, 6th ed., 2011 T.L. Bergmann Fundamentals of Heat and Mass Transfer John Wiley & Sons Inc, 8th ed., 2016
Assessment	Graded: Written exam, 2 hours

Design Methodology	
Study Program **Study level and semester**	Mechanical Engineering Bachelor, 4th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Steffen Ritter E-Mail: Steffen.Ritter@Reutlingen-University.DE
Restrictions	None
Prerequisites:	Engineering Design Basics (~ 400 class)
Course learning objectives:	Methodology of technical problem solution esp. product development, analysis, evaluation and selection of design alternatives
Contents:	The course covers the methodology for engineering development projects- Students will learn “tool” by “tool” the essentials of a correct and ideal product development process on a base of systematic solution finding. A. Introduction B. General Tools C. Design Process VDI 2221 D. Product Specification E. Systematic Idea Finding F Problem Abstraction G. Physical Working Principles H. Concept Selection I. Design Objectives K. Eco Design
Textbooks:	All handouts will be provided by the professor
Assessment	Graded: Assignments

Finite Element Method	
Study Program **Study level and semester**	Mechanical Engineering Bachelor 6th Semester
ECTS Credits	3 ECTS Credits
Hours per week / total contact hours	3 / 45
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Simon Peter
Restrictions	None
Prerequisites:	Strength Analysis
Course learning objectives:	Strength Analysis of simple mechanical designs with the help of Creo Simulate (FEM Code)
Contents:	FEM deals with the analysis of structures subject to mechanical and thermal loads. Starting from CAD-Models we learn how to perform a static or dynamic FEM analysis, use the most often available tools and try to interpret the results. Topics such as boundary conditions and singularities, sensitivity and optimization analysis, screw and welded joints are covered. There are lectures where short presentations introduce the problems and labs where the students work on these problems.
Textbooks:	Creo Simulate 3.0 Tutorial, Roger Toogood
Assessment	Graded: Students are supposed to give presentations in the lectures and perform a group project.

Applied Acoustics	
Study Program **Study level and semester**	Mechanical Engineering, Mechatronics, International Project Engineering Bachelor
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, experiments, project task
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Stephan Pitsch E-Mail: Stephan.Pitsch@Reutlingen-University.DE
Restrictions	None
Prerequisites:	Mathematics (analysis, differential equations, Fourier series, complex numbers) Physics (mechanics, oscillations) Programming experience (MATLAB)
Course learning objectives:	In this course, participants learn about fundamentals of acoustics, perform sound and frequency band analysis, use professional acoustic measurement equipment in order to determine acoustical quantities or design a reflection absorber (muffler).
Contents:	Fundamentals of acoustics (1st half of the term, obligatory) ▪ Sound and its properties ▪ Acoustical quantities (sound pressure, particle velocity, sound power, etc.) ▪ Level calculation ▪ Perception of sound ▪ Sound sources and resonators ▪ Sound propagation ▪ Sound measurement and analysis Project tasks (2nd half of the term, elective) (participants choose one of the following projects) ▪ Project 1: Sound power measurement (DIN 3744) ▪ Project 2: Room acoustical planning (DIN 18041) ▪ Project 3: Reflection absorber design
Textbooks:	Lawrence Kinsler, A. F. (2000). Fundamentals of Acoustics. John Wiley & Sons.
Assessment	Graded: Written exam, Group project, Presentation

Data Science	
Study Program **Study level and semester**	Mechanical Engineering Bachelor
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. rer-nat. Barbara Priwitzer E-Mail: barbara.priwitzer@reutlingen-university.de
Restrictions	**A minimum number of 3 international students** is required for offering the course in English.
Prerequisites:	
Course learning objectives:	Professional competence Students... - understand how data can be used in an engineering context with the help of various analysis methods. Methodological competence Students... - can analyse data with the help of software; - can successfully apply and evaluate various data analysis methods. Social competence Students... - know how to collect, analyse and interpret data responsibly without violating the privacy or rights of others; - can communicate complex data analyses and their results clearly and comprehensibly. Self-competence The students... - can work independently, accurately and persistently; - are able to critically evaluate their own results.
Contents:	Exploratory data analysis: Graphical methods, central tendency of variables and their dispersion, outlier analysis, treatment of missing values Regression analysis:

	Fundamentals of regression, evaluation measures and applications, multilinear and generalised linear models Classification: Definition of a classification problem, evaluation, methods for classification from machine learning, feature selection and normalisation
Textbooks:	Joel Grus: Data Science from Scratch: First Principles with Python, O'Reilly 2015 Matthias Plaue: Data Science: An Introduction to Statistics an Machine Learning, Springer 2023 Laura Igual, Santi Seguí: Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, 2nd edition, Springer 2024
Assessment	Continuous Assessment

Mechanical Engineering Master

Applied Mathematics	
Study Program Study level and semester	Mechanical Engineering Master, 1st Semester
ECTS Credits	6
Hours per week / total contact hours	4 / 60
Total hours of study	180
Type/Teaching Method	Lecture and practice sessions
Language of instruction	English or German (depending on the demands of the participants)
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. Ing. Simon Peter Simon.peter@reutlingen-university.de Prof. Dr. rer. nat. Barbara Priwitzer barbara.priwitzer@reutlingen-university.de
Restrictions	None
Prerequisites:	Basic courses in Mathematics, especially: ▪ basic analysis of functions of one and several variables ▪ theory of ordinary differential equations (ODEs) ▪ linear algebra MATLAB: basic knowledge
Course learning objectives:	▪ Awareness of the problems that can arise when solving mathematical problems numerically. ▪ Knowledge of basic algorithms for the classical tasks in numerical analysis (solving equations, integration, …). ▪ Assessing the quality of numerical solutions. ▪ Improving programming skills.
Contents:	Topics are chosen from ▪ Floating point arithmetic ▪ Conditioning of numerical problems ▪ Direct and iterative methods for solving systems of linear equations ▪ Numerical Integration ▪ Numerical solution of ordinary differential equations ▪ Solving nonlinear equations ▪ Polynomial and Spline interpolation
Textbooks:	▪ Gisela Engeln-Müllges/ Klaus Niederdrenk/ Reinhard Wodicka: Numerik-Algorithmen, 10. Auflage, Springer 2010 ▪ Steven Chapra/ Raymond Canale: Numerical methods for engineers, 8th ed., McGraw Hill 2021 ▪ Masayuki Yano/ James Douglas Penn/ George Konidaris/ Anthony T Patera: Maths, Numerics and Programming for Mechanical Engineers, MIT Open Course Ware 2013
Assessment	Graded: problem sheets + written exam (120 min)

Numerical Structural Mechanics	
Study Program **Study level and semester**	Mechanical Engineering Master, 2nd Semester
ECTS Credits	7
Hours per week / total contact hours	6 / 90
Total hours of study	210
Type/Teaching Method	Lecture and laboratory assignments
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Michael Lauxmann E-Mail: michael.lauxmann@reutlingen-university.de
Restrictions	Only taught in English if demanded by 3 international students at the minimum
Prerequisites:	Numeric, Partial Differential Equations
Course learning objectives:	Getting to know the basics of the multibody and finite element method in terms of their theoretical principles and their practical use.-
Contents:	The course starts with an introduction on different modelling technics. It considers various aspects of multibody system dynamics including the theoretical basics of kinematics and kinetics as well as principles of mechanics. Later on an introduction in finite element systems follows, focusing on static and basic transient stress analysis applications. By means of examples out of the field of mechanical engineering, special focus is given on dynamical phenomena. Lectures and exercises alternate in an adequate manner to complete the understanding of the topics. The exercises comprise both manual exercises on a piece of paper as well as computer–aided exercises in the simulation laboratories with the help of Ansys and Matlab.
Textbooks:	Technische Dynamik, Schiehlen, W. und Eberhard, P. ;
Assessment	Finite element procedures, Bathe, K.-J.

Basic Principles of Energy Conversion	
Study Program **Study level and semester**	Mechanical Engineering Master, 1st semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Frank Truckenmüller E-Mail: Frank.Truckenmueller@Reutlingen-University.DE
Restrictions	Only taught in English if demanded by 3 international students at the minimum
Prerequisites:	Understanding of fundamentals of thermodynamics
Course learning objectives:	Understanding of the fundamentals of conversion of energy applied to different processes and option for improvement
Contents:	1.) Global energy consumption and future global development 2.) forms of energy and energy concepts and the theoretical foundations 3.) Energetic evaluation criteria; efficiency, energy-harvesting factor etc 4.) Apply the thermodynamic assessment criteria on combustion and associated cycles in thermal power plants; Steam turbine, gas turbine, combustion engines 5.) Energy Conversion at the examples of the pumped storage power plant and wind power 6.) Energy Conversion at the examples of the fuel cell and photovoltaic 7.) Energy Conversion examples of biogenic energy conversion 8.) Energy Conversion at the example of solar thermal Criteria for assessment of energy storage
Textbooks:	
Assessment	Graded: Project, presentation and exam

Mechatronics Bachelor

Electrical Drives	
Study Program **Study level and semester**	Mechatronics Bachelor, 6th Semester
ECTS Credits	4
Hours per week / total contact hours	3 / 45
Total hours of study	120
Type/Teaching Method	Introductory lecture session. All following sessions will be taking place as tutorials and practical trainings in the laboratory
Language of instruction	Course materials, exam and lab assignments will be provided in English.
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Gernot Schullerus E-Mail: gernot.schullerus@reutlingen-university.de
Restrictions	None
Prerequisites:	Mathematics Fundamentals of electrical engineering Principles of mechanics
Course learning objectives:	Students are familiar with the structure, the operating principles and the behaviour during operation of the following drive types: dc-machine induction machine permanent magnet synchronous machine brushless dc-motor stepper motor Students are able to choose and do the dimensioning for an electrical drive for a given application
Contents:	- Materials, standards and basic definitions - DC-machine - Rotating field machines - Brushless-DC motors - Stepper motors - Dimensioning of electrical drives

Textbooks:	Lecture notes are provided
Assessment	Graded: Written exam (1h)

Interactive Robots in Motion	
Study Program **Study level and semester**	Mechatronics Bachelor, 7th semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Lectures, Practical Training and Projects
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Matthias Rätsch E-Mail: matthias.raetsch@reutlingen-university.de
Restrictions	
Prerequisites:	
Course learning objectives:	The students know the fundamentals of the interaction and collaboration of intelligent robots with humans in the times of industry 4.0 and the change from industrial robots to intelligent, autonomous and collaborative systems, which are one day hardly distinguishable from humans. Students appreciate that robots are getting faster, stronger and more intelligent and therefore why they are better at playing chess, Go and StarCraft II. Students will acquire knowledge and will be able to answer questions about AI and robotics, in areas such as: How and when is the Turing Test "applied"? Secrets of non-verbal interaction? Avatars in computer games and virtual worlds? How do Google Glass + Siri work and what can they be used for? Will robots be the better humans? Will they replace us in my future career? What means super intelligence, singularity and transhumanism? The students are familiar with current developments in the field of collaborative, intelligent robots, have initial experience in the practical use of these systems and can assess the effects on the areas of our life. An optional follow-up project can be selected to consolidate the learning objectives.
Contents:	- Basics of modern 3D sensor technology in mobile robotics. - Artificial intelligence for autonomous and collaborative robots. - Autonomous localization and navigation using monocular SLAM techniques. - Verbal and non-verbal interaction between robots and humans. - The use, impact and vision of the new generation of intelligence and robots.

	- Practical approach to interactive, mobile and collaborative robots, as well as SDKs. - Design and development of concepts, modules and prototypes for leading collaborative robots in industrial projects or for RC@Home. - if applicable, continuation of the successes of the world champion team.
Textbooks:	Lit. on Pattern Recognition and Machine Learning: e.g. by Christopher M. Bishop (ISBN-10: 0387310738, ISBN-13: 978-0387310732) Lit. on Swarm Intelligence/Image and Video Processing: e.g. publications by Prof. Matthias Rätsch at https://www.visir.org/people/ Lit. on Computer Vision and Robotics: e.g. "Robotics, Vision and Control" by Peter Corke (ISBN-10: 3642201431, ISBN-13: 978-3642201431) Lit. with philosophical background and visions about virtual and mixed reality future worlds: e.g. "Der futurologische Kongreß" by Stanislaw Lem, "Brave New World" by Aldous Huxley, "The Matrix" Triology by Andy and Larry Wachowski, "i,ROBOT" by Alex Proyas, "Bicentennial Man" by Chris Columbus, "Gottes Gehirn" by Jens Johler and Olaf-Axel Burow Lit. on SCITOS with MIRA support and sources, e.g.: Comparison MIRA vs. ROS: http://www.mira-project.org/MIRA-doc/ComparisonWithROSPage.html Projects from students (s. RELAX and http://projekte.rt-lions.de/SCITOS)
Assessment	Graded: Project work, documentation, presentation

Power Electronics Laboratory	
Study Program **Study level and semester**	Mechatronics Bachelor/6th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Laboratory
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Burkhard Ulrich E-Mail: Burkhard.Ulrich@Reutlingen-University.DE
Restrictions	
Prerequisites:	Fundamentals of electrical engineering and basic power electronics (dc/dc converter)
Course learning objectives:	• The students learn the basics of the design and testing of power electronics circuits using the example of a dc/dc converter.
Contents:	• In a hands-on project-based laboratory, the students design their own small dc/dc converter based on a given specification. They select the components, design a PCB layout, and manufacture (solder) a prototype circuit to test it against the specification.
Textbooks:	
Assessment	**Ungraded: Documentation of laboratory work**

Semiconductor Devices	
Study Program **Study level and semester**	Mechatronics Bachelor, 6th semester
ECTS Credits	5 ECTS Credits
Hours per week / total contact hours	6 / 60
Total hours of study	150
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Ertugrul Sönmez E-Mail: ertugrul.soenmez@reutlingen-university.de
Restrictions (if applicable)	None
Prerequisites:	Fundamentals of electrical engineering and mathematics
Course learning objectives:	The students know the functionality of semiconductor devices based on the physical semiconductor properties. They are also familiar with models of semiconductor devices.

Contents:	• Semiconductor Physics
	  ○ Semiconductor materials
	  ○ Bond model
	  ○ Band Theory
	  ○ Charge carrier transport
	
	• Semiconductor diode
	  ○ Abrupt PN junction
	  ○ Metal junctions
	  ○ Zener diode
	
	• Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET)
	  ○ Structure
	  ○ Inversion charge Q_i and Threshold voltage V_th
	  ○ Pinch-Off Voltage V_off
	  ○ Characteristics: constant mobility µ_e
	  ○ Characteristics: constant drift velocity v_sat
	  ○ Parasitic capacities
	
	• Bipolar transistor

	○ Structure ○ Operating modes ○ Load transport - flow lines in active forward mode ○ Minority charge carrier concentrations in active forward mode ○ Current components in active forward mode ○ Transistor parameter PNP in active forward mode ○ Band diagram in active forward mode
Textbooks:	Semiconductor Devices by Mauro Zambuto
Assessment	Graded: oral exam 20min. + project report

Communication Systems	
Study Program **Study level and semester**	Mechatronics Bachelor, 6th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	
Prerequisites:	**One exam in electrical engineering or informatics (e. g. programming, SW-design)**
Course learning objectives:	Students will understand the main concepts in technical communication. They will know about state of the art technologies. They will be able to evaluate different communication technologies according to specific applications.
Contents:	Basics of communication technologies, ISO/OSI- Reference-model, TCP/IP reference model. Physical layer: Bandwidth, Nyquist-theorem, Shannon-theorem, serial communication, coding, Modulation, multiplexing. Link layer: Medium access, error detection, error correction TCP/IP Fieldbus: Profibus, CAN, Modbus Realtime-Ethernet: Ethercats
Textbooks:	Lecture notes in German are provided, Andrew Tanenbaum u. a.: Computer Networks, 5. Auflage, Pearson Education Limited, (2014)
Assessment	Graded: Written exam

Communication Systems Laboratory	
Study Program **Study level and semester**	Mechatronics Bachelor, 6th Semester
ECTS Credits	1
Hours per week / total contact hours	1 / 15
Total hours of study	30
Type/Teaching Method	Laboratory
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	Only in combination with lecture
Prerequisites:	
Course learning objectives:	Students will work in small groups on solutions for limited projects
Contents:	Lab assignments pertaining to the Communication Systems lecture
Textbooks:	Lecture notes in German are provided, Andrew Tanenbaum u. a.: Computer Networks, 5. Auflage, Pearson Education Limited, (2014)
Assessment	Ungraded: Documentation of laboratory work

PLC Control Systems	
Study Program **Study level and semester**	Mechatronics Bachelor , 4th Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	One successful exam in a lecture in programming
Prerequisites:	
Course learning objectives:	Students will learn to develop PLC-programs according the standard IEC61131. They will understand the main difference of operation of a PLC compared to other computer systems. They will be introduced to the basic concepts of object-oriented design and how to apply these to PLC-programming
Contents:	Definition of PLC IEC 61131, Elements of PLC-Programming, programming languages (IL, ST, FBS, LD and SFC), Use-cases, activity-charts, state-charts, Implementation of State-diagrams or Activity-Diagrams, Usage of standard libraries (Logic, Set/Rest-Function, Timer, Trigger, Counter, the Model-View-Control-Pattern,
Textbooks:	Lecture notes are only available in German
Assessment	Graded: Written exam

PLC Control Systems Laboratory	
Study Program **Study level and semester**	Mechatronics Bachelor , 4th Semester
ECTS Credits	2
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Laboratory
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	Only in combination with lecture
Prerequisites:	None
Course learning objectives:	Students will work in small groups on solutions for limited projects in the area of Automation
Contents:	Lab assignments pertaining to the PLC Control Systems lecture
Textbooks:	
Assessment	Ungraded: Documentation of laboratory work

Mechatronics Master

Distributed Control in Power Grids	
Study Program **Study level and semester**	Mechatronics Master, 2nd semester
ECTS Credits	3 ECTS Credits
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, use of specific software and project
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Debora Coll-Mayor, Prof. Dr.-Ing. Antonio Notholt E-Mail: Debora.coll-mayor@reutlingen-university.de Antonio.Notholt@Reutlingen-University.DE
Restrictions	None
Prerequisites:	Knowledge of Energy markets and energy economy
Course learning objectives:	– The students know the basics of Blockchain based Technologies; – The students learn about the regulatory framework of these new technologies – The students can develop simple use cases using blockchain based solutions – The students can develop new business cases based on those solutions – The students learn about basics and new tendencies in transactive control
Contents:	– Distributed ledger technologies; – Use of cryptocurrencies in the energy economy; – Smart contracts and distributed registers; – Analysis of new System Use Cases; – Analysis of new Business Use Cases; – Standardisation and regulatory barriers; – A step forward: The concept of transactive control.
Textbooks:	The literature will be given during the lecture.
Assessment	Graded: project

Software-System Architecture	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Jens Weiland, Jens.Weiland@Reutlingen-University.de
Restrictions	Only taught in English if demanded by 3 international students at the minimum
Prerequisites:	
Course learning objectives:	In the area of technical software systems different “quasi” standards have been established within the last years. In the automobile industrie specifications for the Classic and Adaptive AUTOSAR-platform have been developed; within robotics the specification and implementation of the Robot Operating System (ROS) are available. These embedded platforms are based on different software architectural concepts. Within this course students learn architectural and middleware concepts of these common state-of-the-art software system architectures. At the end of the module students Professional expertise - know the structure and behavior of these architectures - are able to apply selected architectural and middleware concepts for realizing embedded software system architectures Methodological expertise - know the methodologies to develop embedded systems based on “Classic and Adaptive AUTOSAR” as well as the Robot Operating System (ROS) and how to apply these methodologies - are able to trade against pros and cons of alternatives in developing software solutions based on the discussed embedded software system architectures
Contents:	- Overview of relevant process models, software development phases and programming

	paradigms for developing embedded software - Essential architecture principles and concepts for developing embedded software systems - Design principles and patterns - Architectural patterns like Product Line Architecture, Layered Architecture, Client/Server Architecture, Message-oriented Architecture, Service-oriented Architecture - Selected industrial-relevant reference architectures in the embedded domain and their realization of middleware concepts: - Classic AUTOSAR - Structure and behavior of the Classic AUTOSAR architecture - Software integration package and AUTOSAR tooling - Selected Classic AUTOSAR modules and concepts, e.g. SW-C, RTE, OS, Com - Adaptive AUTOSAR - Structure and behavior of the Adaptive AUTOSAR architecture - Selected Adaptive AUTOSAR modules and concepts, e.g. service-oriented communication, OS, execution management - Robot Operating System - Structure and behavior of ROS - Selected ROS concepts, e.g. nodes, DDS-based communication
Textbooks:	- AUTOSAR: Classic and Adaptive AUTOSAR Specification, www.autosar.org - O. Scheid: AUTOSAR Compendium, Part 1 – Application & RTE. ar-compendium.com, 2015 - ROS: Robot Operating System, www.ros.org - L. Joseph, A. Johny: Robot Operating System (ROS) for Absolute Beginners, Apress, 2022.
Assessment	Graded: Oral Exam 20 Minutes

EMC and Signal Integrity	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. habil. David Pouhè E-Mail: David.Pouhe@Reutlingen-University.DE
Restrictions	Only taught in English if demanded by 5 international students at the minimum
Prerequisites:	Electrodynamics
Course learning objectives:	Students know and understand problems in Electromagnetic Compatibility. They are able to identify EMC problems and elaborate an appropriate solution.
Contents:	In accordance with the given objectives
Textbooks:	
Assessment	Graded: Written Exam

EMC and Signal Integrity Laboratory	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90

Type/Teaching Method	Laboratory
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. habil. David Pouhè E-Mail: David.Pouhe@Reutlingen-University.DE
Restrictions	Cannot be chosen separately from EMC and Signal Integrity Lecture
Prerequisites:	Electrodynamics
Course learning objectives:	
Contents:	Lab assignments pertaining to the Electromagnetic Compatibility lecture
Textbooks:	
Assessment	Ungraded: Documentation of laboratory work

Human-Robot Collaboration - Introdution	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Matthias Rätsch E-Mail: matthias.raetsch@reutlingen-university.de
Restrictions	None
Prerequisites:	None
Course learning objectives:	The students know the fundamentals of the interaction and collaboration of intelligent robots with humans in the times of industry 4.0 and the change from industrial robots to the Personal Assistant, which is hardly distinguishable from humans. Students appreciate that robots are getting faster, stronger and more intelligent and therefore why they are better at playing chess, Go and StarCraft II. Students will acquire knowledge and will be able to answer questions about AI and robotics, in areas such as “How and when is the Turing Test" applied"? Secrets of non-verbal interaction? Avatars in computer games and virtual worlds? How do Google Glass + Siri work and what can they be used for? Will robots be the better people? Will they replace people in my future career? What is singularity and transhumanism? The students are familiar with current developments in the field of collaborative, intelligent robots, have initial experience in the practical use of these systems and can assess the effects on the areas of life of those involved. An optional follow-up project can be selected to consolidate the learning objectives.
Contents:	- Basics of modern 3D sensor technology in mobile robotics. - Artificial intelligence for autonomous and collaborative robots. - Autonomous localization and navigation using monocular SLAM techniques. - Verbal and non-verbal interaction between robots and humans. - The use, impact and vision of the new generation of intelligence and robots.

	- Practical approach to interactive, mobile and collaborative robots, as well as SDKs. - Design and development of concepts, modules and prototypes for leading collaborative robots in industrial projects or for RC@Home. - if applicable, continuation of the successes of the world champion team.
Textbooks:	Lit. on Pattern Recognition and Machine Learning: e.g. by Christopher M. Bishop (ISBN-10: 0387310738, ISBN-13: 978-0387310732) Lit. on Swarm Intelligence/Image and Video Processing: e.g. publications by M. Rätsch et al., s. publications by Prof. Matthias Rätsch https://www.visir.org/people/ Lit. on Computer Vision and Robotics: e.g. "Robotics, Vision and Control" by Peter Corke (ISBN-10: 3642201431, ISBN-13: 978-3642201431) Lit. with philosophical background and visions about virtual and mixed reality future worlds: e.g. "Der futurologische Kongreß" by Stanislaw Lem, "Brave New World" by Aldous Huxley, "The Matrix" Triology by Andy and Larry Wachowski, "i,ROBOT" by Alex Proyas, "Bicentennial Man" by Chris Columbus, "Gottes Gehirn" by Jens Johler and Olaf-Axel Burow Lit. on SCITOS with MIRA support and sources, e.g.: - MIRA Homepage: http://www.mira-project.org/joomla-mira/ et al. in RELAX - Comparison MIRA vs. ROS: http://www.mira-project.org/MIRA-doc/ComparisonWithROSPage.html - MIRA VBox and projects from students (s. RELAX and http://projekte.rt-lions.de/SCITOS)
Assessment	Graded: Project work, seminar paper, presentation

Human-Robot Collaboration - Applications	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Practical Training and Projects
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Matthias Rätsch E-Mail: matthias.raetsch@reutlingen-university.de
Restrictions	None
Prerequisites:	None
Course learning objectives:	The students know the fundamentals of the interaction and collaboration of intelligent robots with humans in the times of industry 4.0 and the change from industrial robots to the Personal Assistant, which is hardly distinguishable from humans. Students appreciate that robots are getting faster, stronger and more intelligent and therefore why they are better at playing chess, Go and StarCraft II. Students will acquire knowledge and will be able to answer questions about AI and robotics, in areas such as “How and when is the Turing Test" applied"? Secrets of non-verbal interaction? Avatars in computer games and virtual worlds? How do Google Glass + Siri work and what can they be used for? Will robots be the better people? Will they replace people in my future career? What is singularity and transhumanism? The students are familiar with current developments in the field of collaborative, intelligent robots, have initial experience in the practical use of these systems and can assess the effects on the areas of life of those involved. An optional follow-up project can be selected to consolidate the learning objectives.
Contents:	- Basics of modern 3D sensor technology in mobile robotics. - Artificial intelligence for autonomous and collaborative robots. - Autonomous localization and navigation using monocular SLAM techniques. - Verbal and non-verbal interaction between robots and humans. - The use, impact and vision of the new generation of intelligence and robots.

	- Practical approach to interactive, mobile and collaborative robots, as well as SDKs. - Design and development of concepts, modules and prototypes for leading collaborative robots in industrial projects or for RC@Home. - if applicable, continuation of the successes of the world champion team.
Textbooks:	Lit. on Pattern Recognition and Machine Learning: e.g. by Christopher M. Bishop (ISBN-10: 0387310738, ISBN-13: 978-0387310732) Lit. on Swarm Intelligence/Image and Video Processing: e.g. publications by M. Rätsch et al., s. publications by Prof. Matthias Rätsch https://www.visir.org/people/ Lit. on Computer Vision and Robotics: e.g. "Robotics, Vision and Control" by Peter Corke (ISBN-10: 3642201431, ISBN-13: 978-3642201431) Lit. with philosophical background and visions about virtual and mixed reality future worlds: e.g. "Der futurologische Kongreß" by Stanislaw Lem, "Brave New World" by Aldous Huxley, "The Matrix" Triology by Andy and Larry Wachowski, "i,ROBOT" by Alex Proyas, "Bicentennial Man" by Chris Columbus, "Gottes Gehirn" by Jens Johler and Olaf-Axel Burow Lit. on SCITOS with MIRA support and sources, e.g.: - MIRA Homepage: http://www.mira-project.org/joomla-mira/ et al. in RELAX - Comparison MIRA vs. ROS: http://www.mira-project.org/MIRA-doc/ComparisonWithROSPage.html - MIRA VBox and projects from students (s. RELAX and http://projekte.rt-lions.de/SCITOS)
Assessment	Graded: Project work, seminar paper, presentation

Machine Vision and Artificial Intelligence Lecture with Laboratory	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	6
Hours per week / total contact hours	5 / 75
Total hours of study	180
Type/Teaching Method	Lectures and Presentations
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr. rer. nat. Matthias Rätsch E-Mail: matthias.raetsch@reutlingen-university.de
Restrictions	Only 5-6 international Students at the maximum can be admitted to this course
Prerequisites:	
Course learning objectives:	The students are familiar with the basics of machine learning (artificial intelligence) and the use of image processing in industrial environments and especially in the robotics and automotive industries. They will be able to create algorithms for simple application examples, which will then be implemented and tested in practical courses and projects. The students are capable of putting together an intelligent image processing system from available components which they can then use to complete simple tasks. The students are proficient in 3D sensors as well as 3D image and video processing, which they will then apply hands-on in projects with interactive mobile robots and assistance and service systems. The students will discuss and be familiar with the social challenges and opportunities of AI as well as questions of social ethics and acceptance research
Contents:	- Basics: Components of a Learning Machine Vision System - Data recording: camera technology, pre-processing, colour display, optics, lighting technology - Data processing (feature extraction, image analysis, feature extraction, classification/segmentation, error analysis) - Feature extraction: convolution, low pass, high pass, morphological filter feature space transformation: Chain rule, contour slider, applications - error analysis: FAR/FRR, lin. separable, error class analysis, efficiency - AI basics: Boolean and Fuzzy logic, classification, definition KI, Turing test, world knowledge theory ML: learning styles, DTree, Random Forests, NN, Perceptron, SVM (Lin/Non-lin, Kernel Trick)

	- 3D Image Processing (3D Sensors; RGB-D, TOF, Stereo; Shape from Shading/Motion, SLAM)- Video Processing (4D): Detection (Sliding Window, Image Pyramids, Sampling Theorem, Frequency Analysis, Compression, Blending), Tracking (Condensation, Motion Detection) - Model based machine learning: face modelling (representation of 3D data, data procurement for 3D data, morphable face model) PCA (data/corr/loading matrix, SVD, dim reduction, eigenvalue problem, eigenfaces) - Deep Learning - CNNs: Meaning, Difference NN to CNN, Layer Types, Convolution, Pooling, ReLu, Applications- History and visions of AI: Exp. Growth, Singularity, Transhumanity, Society. Challenges/opportunities for action, social ethics, acceptance
Textbooks:	Script based on the lecture slides. Corke, P.: Robotics, Vision and Control. Springer, Berlin. Jähne, B.: Digitale Bildverarbeitung. Springer, Berlin. Demant, C.; Streicher-Abel, B.; Springhoff, A.: Industrielle Bildverarbeitung: Wie optische Qualitätskontrolle wirklich funktioniert. Springer, Berlin. Bishop, C.M.: Pattern Recognition and Machine Learning
Assessment	Graded: Project work, seminar paper, presentation

Renewable Energies	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture with integrated exercises
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Antonio Notholt E-Mail: antonio.notholt@Reutlingen-University.DE
Restrictions	
Prerequisites:	
Course learning objectives:	The students are familiar with technologies and processes of the production of electrical energy from renewable sources. They are able to perform a simple layout of installations. They know the key indicators and know how to apply them for assessing and comparing different installations. They are familiar with systemic components, common communication and information technologies as well as the potential of selected future innovations.
Contents:	Energy and climate protection Solar radiation Photovoltaics wind power Hydroelectric power Geothermal energy Use of biomass Hydrogen generation, fuel cells and methanation Economic efficiency calculations Simulation Communication and Information Technologies Integration of renewable energies in electrical grids
Textbooks:	Volker Quaschning, Regenerative Energiesysteme: Technologie - Berechnung - Simulation. ISBN 978-3-446-44267-2
Assessment	Graded: Presentation, seminar paper

Control Systems	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	3
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	
Prerequisites:	Basic knowledge of communication technologies as presented in lecture "communication systems" **At least one exam in electrical engineering, informatics or communication systems**
Course learning objectives:	Students will have a deeper understanding of state of the art communication technologies like radio communication, IEEE802.x (Ethernet, WLAN, Bluetooth LE), ethernet based fieldbusses and security. They will be able to evaluate different communication technologies according to specific performance indexes like throughput, realtime, security, etc.
Contents:	Physical and technical basics of radio communication. IEE802.x communication (Ethernet, WLAN, Bluetooth) and 6LOWPAN (RFC 6282), Security (Encryption, hash-functions, digital signature, certificates), Functional Safety, ethernetbased fieldbusses (Ethercat, Powerlink, Profinet IRT)
Textbooks:	Lecture notes are provided in German, Andrew Tanenbaum u. a.: Computer Networks, 5. Auflage, Pearson Education Limited, (2014)
Assessment	Graded: oral exam

Control Systems Laboratory	
Study Program **Study level and semester**	Mechatronics Master, 2nd Semester
ECTS Credits	2
Hours per week / total contact hours	2 / 30
Total hours of study	60
Type/Teaching Method	Laboratory
Language of instruction	English
Frequency	Winter Semester
Course Coordinator/Instructor	Prof. Dr. Thorsten Zenner E-Mail: thorsten.zenner@reutlingen-university.de
Restrictions	Only in combination with Control Systems lecture
Prerequisites:	Basic knowledge of communication technologies as presented in lecture “communication systems”
Course learning objectives:	
Contents:	Lab assignments pertaining to the Control Systems lecture. Realtime and Performance testing using the following systems: - EnOcean (without battery), - Texas Instruments (Protokoll SimpliciTI) - Nordic Semiconductor (Bluetooth Low Energy).
Textbooks:	
Assessment	Ungraded: Documentation of laboratory work

Distributed Energy Systems and Energy Efficiency, Master

Distributed Economy in the Energy Sector	
Study Program **Study level and semester**	Distributed Energy Systems and Energy Efficiency Master, 2nd semester
ECTS Credits	3 ECTS Credits
Hours per week / total contact hours	2 / 30
Total hours of study	90
Type/Teaching Method	Lecture, use of specific software and project
Language of instruction	English
Frequency	Every Semester
Course Coordinator/Instructor	Prof. Dr.-Ing. Debora Coll-Mayor E-Mail: Debora.coll-mayor@reutlingen-university.de
Restrictions	None
Prerequisites:	Knowledge of Energy markets and energy economy
Course learning objectives:	– The students know the basics of Blockchain based Technologies; – The students learn about the regulatory framework of these new technologies – The students can develop simple use cases using blockchain based solutions – The students can develop new business cases based on those solutions – The students learn about basics and new tendencies in transactive control
Contents:	– Distributed ledger technologies; – Use of cryptocurrencies in the energy economy; – Smart contracts and distributed registers; – Analysis of new System Use Cases; – Analysis of new Business Use Cases; – Standardisation and regulatory barriers; – A step forward: The concept of transactive control.
Textbooks:	The literature will be given during the lecture.
Assessment	Graded: 1 hour written exam and a project with oral presentation

Interdisciplinary courses

Career Management	
Study Program **Study level and semester**	Bachelor, Master
ECTS Credits	2
Hours per week / **total contact hours**	2 / 30
Total hours of study	60
Type/Teaching Method	Intensive Course which takes place after the semester
Language of instruction	English
Frequency	Every semester / yearly (dependent on demand)
Course Coordinator/Instructor	Prof. Dr.-Ing. Helmut Nebeling
Restrictions	No restrictions, at least 6 participants, max. 25 participants
Prerequisites:	None
Course learning objectives:	Learning to adapt self-view and public-image in professional and personal surroundings, training of patterns of personality, practical aspects of getting into the job, career orientation
Contents:	• Goal setting workshop • Features of mentality and character • Patterns of personality • Patterns of communication • Application training • Analysis of job advertisements • Assessment center • Self-discovery: How do I find what fits me? • Elevator pitch • Analysis of salaries, salary negotiations
Textbooks:	
Assessment	Presentation Ungraded

Projects for Bachelor and Master Students

Semester Engineering Project					
Study Program **Study level and semester**	Mechatronics, Mechanical Engineering, Distributed Energy Systems and Energy Efficiency, Microelectronics and Power Electronics Bachelor and Master				
Type of project	Project I	Project II	Project III	Project IV	Project V
ECTS Credits	6	8	10	15	30
Hours per week	10	12	15	20	40
Total hours of study	180	240	300	450	900
Type/Teaching Method	Project				
Language of instruction	English				
Frequency	Every Semester				
Course Coordinator/Instructor	Prof. Dr.-Ing. Ertugrul Sönmez E-Mail: ertugrul.soenmez@reutlingen-university.de				
Restrictions and procedure	Offered on demand for a limited number of students and only if a professor agrees to act as project supervisor. 2. Send an updated CV including three preferred research areas/supervisors as well as information on theoretical and practical knowledge in the relevant areas to the international coordinator (Dr. Nadja Lobensteiner) who will check the availability of projects. 3. Students will be notified after a supervising professor has been confirmed. Exact project topics will be defined afterwards.				
Prerequisites:	**Commitment to work on the project in accordance with the above stated hours per week during the whole semester is mandatory**				
Course learning objectives:	Students will work independently on a given engineering topic. Students will develop and apply a suitable approach to solve the problem				
Contents:	Depending on project topic.				
Textbooks:					
Assessment	Graded: Documentation of research work according to scientific standards, final report or presentation including poster summarizing research results				