TECHNISCHE HOCHSCHULE LÜBECK

Modulhandbuch

Angewandte Informationstechnik, Master

Stand: 13.03.2025

Inhaltsverzeichnis

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

1. Semester (SoSe)

Pflichtmodule

TECHNISCHE HOCHSCHULE LÜBECK

Modul: Angewandte Mathematik

Niveau	Master	**Kürzel**	AnMa
Modulname englisch	Applied Mathematics		
Modulverantwortliche	Werth, Sören; Schiffer, Ralf		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Pflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90

Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Prüfungsleistung	Klausur	**Prüfsprache**	Deutsch
Dauer PL in Minuten	120	**Bewertungssystem PL**	Drittelnoten

Lernergebnisse	Nach erfolgreichem Abschluss der Lehrveranstaltung können die Studierenden: • die Konzepte und Methoden der Wahrscheinlichkeitsrechnung und Statistik in typischen Problemstellungen der Praxis anwenden, wie sie beispielsweise im Modul „Digitale Verarbeitung stochastischer Signale“ behandelt werden; • lineare und nichtlineare Ausgleichsprobleme mit der Methode des „Least Squares Fit“ lösen, wie sie beispielsweise im Modul „Digitale Regelungssysteme“ auftreten; • anspruchsvolle Aufgabenstellungen aus dem Bereich der Linearen Algebra analysieren und lösen; • numerische Verfahren zur Behandlung von den genannten Problemstellungen erfolgreich einsetzen; • eine Fehleranalyse von numerischen Algorithmen durchführen: Liefert ein mathematisch korrekter Algorithmus ungenaue Ergebnisse, können die Studierenden feststellen, worin die Ursache liegt: in der schlechten Konditionierung des Problems oder in der Instabilität des Algorithmus. Sie haben die Fähigkeit erworben, Instabilitäten von Algorithmen zu identifizieren und zu beseitigen.
Teilnahmevoraussetzungen	Solide Kenntnisse in Ingenieursmathematik

Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✔ Zielgruppengerechte Anpassung der didaktischen Methoden ✘ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)

Verwendbarkeit	
Bemerkungen	

Lehrveranstaltung: Angewandte Mathematik (Vorlesung)

(zu Modul: Angewandte Mathematik)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Applied Mathematics (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	3
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	90
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			

Lehrinhalte

Statistik und Fehlerfortpflanzung

- Statistik von physikalischen Messungen: Häufige Verteilungsfunktionen, Erwartungswert, Varianz;
- Schätzung von Verteilungsparametern aus Stichproben: „Maximum-Likelihood“-Methode, statistische Eigenschaften von Stichproben, Vertrauensintervalle;
- Fehlerfortpflanzung.

Kurvenanpassung, Least Square Fit (LSF)

- LSF für lineare Parameter: Schätzung von Parametern, Genauigkeit der Schätzwerte, Normalgleichungen, Pseudoinverse;
- Kovarianz, Korrelationskoeffizient;
- LSF für nichtlineare Parameter.

Lineare Algebra

- Grundlagen: Vektorräume, lineare Unabhängigkeit, Basen, Matrizen als lineare Abbildungen, symmetrische und orthogonale Matrizen, inverse Matrizen, Determinanten, Hauptachsentransformation, Singulärwertzerlegung;
- Lineare Gleichungssysteme: Quadratische Systeme, über-/ unterbestimmte Systeme, Lösbarkeit, Gauß-Verfahren;

Fehleranalyse in der Numerik

	• Numerische Fehler: Maschinenzahlen, Rundungsfehler und ihre Fortpflanzung, Stabilität von Problemstellungen bzw. Algorithmen, Konditionszahlen; • Anwendung auf lineare Gleichungssysteme: Rundungsfehler beim Gauß-Verfahren, Pivotstrategien, Konditionierung von Matrizen.
Literatur	• Helge Toutenburg, Christian Heumann: „Induktive Statistik“, Springer • Hans Rudolf Schwarz, Norbert Köckler: "Numerische Mathematik", Vieweg+Teubner • Josef Stoer, Roland Bulirsch: "Numerische Mathematik I/II", Springer • Martin Hermann: "Numerische Mathematik", Oldenbourg • Alfio Quarteroni, Riccardo Sacco, Fausto Saleri: "Numerical Mathematics", Springer
Bemerkungen	

Lehrveranstaltung: Angewandte Mathematik (Übung)

(zu Modul: Angewandte Mathematik)

Lehrveranstaltungsart	Übung	**Lernform**	Präsenz
LV-Name englisch	Applied Mathematics (Exercises)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	2
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße		**Arbeitsaufwand in Stunden**	60
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung		**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	• Statistik und Fehlerfortpflanzung • Kurvenanpassung, Least Square Fit (LSF) • Lineare Algebra • Fehleranalyse in der Numerik		
Literatur	Siehe Vorlesung		
Bemerkungen			

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

1. Semester (SoSe)

Wahlpflichtmodule

TECHNISCHE HOCHSCHULE LÜBECK

Module: Analog Integrated Circuits

Level	Master	**Short Name**	AIS
Responsible Lecturers	Milady, Saeed, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	1	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	SuSe	**Presence Hours**	60
Teaching Language	German/English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes	• The students know the real characteristics of MOS transistors. • Students can analyze and design the basic CMOS amplifier circuits (CS, CD, CG, etc.). • The students are familiar with the CMOS current sources and their corresponding biasing circuits. They can analyze and design them. • Students know the CMOS current sources analyze and design. • Students are familiar with CMOS differential amplifiers and can analyze and design them. • Students are familiar with various operational amplifier circuits (Miller OpAmp, Folded Cascode, RailtoRail Opamp, Constant gm, etc.) analyze them. • Students will be able to design a simple operational amplifier, simulate its important parameters and optimize them. • Students will be familiar with other typical integrated analog circuits (such as Bandgap reference, LDO, etc.) and their applications. • The students can verify their own circuit designs and their dimensioning in simulation. • Students will be able to layout simple analog circuits.
Participation Prerequisites	Analoge Elektronik, Grundlagen der Bauelemente und Elektronik

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)

Applicability	
Remarks	

Module Course: Analog Integrated Circuits (Lecture)

(of Module: Analog Integrated Circuits)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	1. Introduction to MOS device physics 2. Single stage amplifiers (CS, CG, CD, cascade amplifiers) 3. Differential amplifiers 4. Current mirror 5. Frequency response of amplifiers and analog circuits (stability and frequency compensation) 6. Multistage operational amplifiers 7. Output stages (class AB/push pull, etc.) 8. Analog layout 9. Noise in analog circuits
Literature	1. Razavi, B., Design of Analog CMOS Integrated Circuits, McGrawHill, 2nd Edition, 2017. 2. Sedra, Adel S, et. al, Microelectronic circuits, 8th edition. New York, NY, Oxford: Oxford University Press, 2020. 3. Baker, J., CMOS: Circuit Design, Layout, and Simulation (IEEE Press Series on Microelectronic Systems), 2010
Remarks	

Module Course: Analog Integrated Circuits (Practical Training)

(of Module: Analog Integrated Circuits)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	German/English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The following circuits are simulated using a professional circuit simulator using realistic submicron CMOS transitor models: 1. Basic CMOS transistor amplifier 2. Current sources, differential amplifiers 3. Operational amplifier
Literature	See lecture and script
Remarks	

Modul: Datenbanken und Informationsmanagement

Niveau	Master	**Kürzel**	DBuIM
Modulname englisch	Databases and Information Management		
Modulverantwortliche	Töbermann, J.-Christian, Prof. Dr.-Ing.		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90

Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Prüfungsleistung	Klausur	**Prüfsprache**	Deutsch
Dauer PL in Minuten	120	**Bewertungssystem PL**	Drittelnoten

Lernergebnisse	Die Studierenden: • kennen Grundkonzepte von relationalen Datenbanksystemen, NoSQL-Datenbanken und Informationssystemen und können Systeme entsprechend der jeweiligen Aufgabenstellung sachgerecht auswählen. • können mit Fokus auf technischen Anwendungen selbständig eine einfache Datenbank von der fachlichen Modellierung bis zur Implementierung systematisch erstellen und in ein Informationssystem einbinden. • formulieren zielgerichtet Datenbankoperationen, bspw. in SQL, für gegebene Aufgabestellungen. • können Datenbanktransaktionen entwerfen und implementieren.
Teilnahmevoraussetzungen	

Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✔ Zielgruppengerechte Anpassung der didaktischen Methoden ✘ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)
Verwendbarkeit	
Bemerkungen	

Lehrveranstaltung: Datenbanken und Informationsmanagement (Vorlesung)

(zu Modul: Datenbanken und Informationsmanagement)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Databases and Information Management (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	3
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	90
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	• Grundkonzepte von Relationalen Datenbanksystemen, NoSQL-Datenbanken und Informationssystemen • Entwurf und Normalisierung relationaler Datenbanken • wesentliche Sprachelemente von SQL und NoSQL • weitere Datenbankkonzepte wie Transaktionen, Trigger und Stored Procedures • Programmierung von Datenbankanwendungen • Objekt-relationales Mapping		
Literatur	• Elmasri, R. A. et al.: Grundlagen von Datenbanksystemen, Pearson, aktuellste Auflage • Jukic, N. et al.: Database Systems, Prospect Press, aktuellste Auflage • Kemper, A. et al.: Datenbanksysteme – eine Einführung, Oldenbourg, aktuellste Auflage • weitere Literatur wird in der Veranstaltung benannt		
Bemerkungen			

Lehrveranstaltung: Datenbanken und Informationsmanagement (Praktikum)

(zu Modul: Datenbanken und Informationsmanagement)

Lehrveranstaltungsart	Praktikum	**Lernform**	Präsenz
LV-Name englisch	Databases and Information Management (Practical Training)		
Anwesenheitspflicht	ja	**ECTS-Leistungspunkte**	2
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße	12	**Arbeitsaufwand in Stunden**	60
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung	Praktikum	**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	Bestehen

Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			

Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Lehrinhalte	In den semesterbegleitenden Praktika wenden die Studierenden das in der Vorlesung Gelernte selbstständig und mit Nutzung üblicher Softwaresysteme auf vorgegebene Aufgabenstellungen und Anwendungsszenarien an.
Literatur	Siehe zugehörige Vorlesung
Bemerkungen	

Modul: Digitale Regelungssysteme

Niveau	Master	**Kürzel**	DR
Modulname englisch	Digital Control Systems		
Modulverantwortliche	Korff, Alexander, Prof. Dr.		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90
Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Prüfungsleistung	Projektarbeit	**Prüfsprache**	Deutsch
Dauer PL in Minuten		**Bewertungssystem PL**	Drittelnoten
Lernergebnisse	Die Studierenden: • kennen die gebräuchlichen Designmethoden von digitalen Reglern. • können einen digitalen Regler auf einer geeigneten Plattform umsetzen. • kennen und anwenden von Entwicklungsmethoden für komplexe digitale Regelungssysteme wie bspw. Hardware in the Loop, Software in the Loop, Prozessor in the Loop, Function Bypassing und Virtuelle Absicherung		
Teilnahmevoraussetzungen	Kenntnisse aus der Vorlesung Grundlagen der Regelungstechnik, Laplace Transformation, Reglerauslegung nach dem Frequenzgangkennlinienverfahren, Umgang mit Signalflussplänen, Umgang mit einer höheren Programmiersprache		
Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✔ Zielgruppengerechte Anpassung der didaktischen Methoden ✘ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)		
Verwendbarkeit			
Bemerkungen			

Lehrveranstaltung: Digitale Regelungssysteme (Vorlesung)

(zu Modul: Digitale Regelungssysteme)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Digital Control Systems (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	4
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	120
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	75
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	• Entwurf Digitaler Regler • Umsetzung digitaler Regler auf eingebetteten Plattformen • Entwicklungsmethoden digitale Regler		
Literatur	1. Rapid Control Prototyping, Methoden und Anwendungen, Dirk Abel (Springer Link) 2. Regelungstechnik für Ingenieure - Analyse, Simulation und Entwurf von Regelkreisen, Serge Zacher, Manfred Reuter (Springer Link)		
Bemerkungen			

Lehrveranstaltung: Digitale Regelungssysteme (Praktikum)

(zu Modul: Digitale Regelungssysteme)

Lehrveranstaltungsart	Praktikum	**Lernform**	Präsenz
LV-Name englisch	Digital Control Systems (Practical Training)		
Anwesenheitspflicht	ja	**ECTS-Leistungspunkte**	1
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße	12	**Arbeitsaufwand in Stunden**	30
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung	Praktikum	**Selbststudiumsstunden**	15
Dauer SL in Minuten		**Bewertungssystem SL**	Bestehen
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	Praktische Durchführung wesentlicher Vorlesungsinhalte im Labor mittels Microcontroller und Rapid Control Prototyping Systems		
Literatur	Siehe Vorlesung		
Bemerkungen			

Module: Digital Processing of Stochastic Signals

Level	Master	**Short Name**	DPSS
Responsible Lecturers	Prof. Dr. Ralph Hänsel		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	SuSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Written Exam	**Exam Language**	German/English
Exam Length (minutes)	120	**Exam Grading System**	One-third Grades
Learning Outcomes	After successful completion of this course, the students will be able to: • Describe stochastic signals mathematically using expectations like the first and second moments of a stochastic process. • Represent stochastic signals in the time domain and the frequency domain and to classify them. • Apply the structure of digital systems for processing stochastic signals including two different predictor structures. • Describe and apply different adaptation strategies and be familiar to the design of adaptive filters. • Name typical applications of the presented systems. • Design predictors and quantizers for a given training sequence. • Make use of stochastic features of a given signal for data compression. • Describe the basic structures of different systems for source coding.		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Digital Processing of Stochastic Signals (Lecture)

(of Module: Digital Processing of Stochastic Signals)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Cha. 1: IntroductionContent and organization of the course, features of stochastic signals, basic model of information transmission. • Cha. 2: Introduction to ProbabilityEvents, random variables and probability, discrete and continuous random variables, stochastic processes, autocorrelation function. • Cha. 3: PredictionBasic idea, structure of the predictor, derivation of the optimal prediction, the prediction gain, the Levinson Durbin-Algorithm, prediction with lattice filters. • Cha. 4: Adaptive FiltersWiener-filter , LMS-Algorithm, Kalman-Filter. • Cha. 5: QuantizationScalar quantization, companding, block quantization, Karhunen-Loeve-transform, vector quantization, the LBG-Algorithm. • Cha. 6: Principles of AdaptationForward adaption, backward adaptation, main and side information, constant and variable data rates. • Cha. 7: ApplicationsSource coding: RELP, DPCM, G.726(ADPCM), G.722 (SB-ADPCM),G.728 (LD-CELP), ETSI/ GSM Standard 06.10 (RPE-LTP), MP3, feature extraction, signal enhancement, echo cancellation, adaptive channel equalization, adaptive beam forming
Literature	In English:

	• P.S.R. Diniz, Adaptive Filtering, Kluwer Academic Publishers, 2002, ISBN 1-4020-7125-6 • Papoulis, Probability, Random Variables and Stochastic Processes, McGraw-Hill, 2002, ISBN 0- 0711-9981-0 In German: • F.Jondral, A.Wiesler, Wahrscheinlichkeitsrechnung und stochastische Prozesse, Teubner Verlag, 2002, ISBN 3-5191-6263-6 • E.Hänsler, Statistische Signale Grundlagen und Anwendungen, Springer Verlag, 2001, ISBN 3-5404- 1644-7 • W.Hess, U.Heute, P.Vary Digitale Sprachsignalverarbeitung Teubner Verlag, Stuttgart, 1998, ISBN 3-519-06165-1, ISBN-13 978-3519061656 • J.F. Böhme, Stochastische Signale, Teubner Verlag, 1998, ISBN 3-5191-6160-5
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Module Course: Digital Processing of Stochastic Signals (Practical Training)

(of Module: Digital Processing of Stochastic Signals)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	To deepen and expand the practical knowledge the students will solve three problems out of a set of given problems using MATLAB on a PC.Topics are: Signal analysis and measurement of the autocorrelation function, adaptive gain control using the probability density function, design of a linear predictor for speech signals, programming an adaptive lattice predictor, implementation of the LMS-Algorithm.
Literature	See lecture
Remarks	

Modul: Industrielle Automatisierungstechnik

Niveau	Master	**Kürzel**	IndAut
Modulname englisch	Industrial Automation		
Modulverantwortliche	Pelka, Mathias, Prof.Dr.-Ing.		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90

Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Prüfungsleistung	Mündliche Prüfung	**Prüfsprache**	Deutsch
Dauer PL in Minuten	30	**Bewertungssystem PL**	Drittelnoten

Lernergebnisse	Studierende erstellen einfache Automatisierungslösungen für typische industrielle Anwendungen. Dazu gehören: • Interpretation von Beschreibungssprachen der Automatisierungstechnik • Klassifizieren von Fertigungsverfahren • Extraktion von Aufgaben und Herausforderungen mittels Kommunikationsmodellen • Diskussion der Vor- und Nachteile von genormten Bussystemen • Synthese von SPS-Programmen nach IEC 61131-3 zur Lösung von Automatisierungsproblemen
Teilnahmevoraussetzungen	

Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.

Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✔ Zielgruppengerechte Anpassung der didaktischen Methoden ✔ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)
Verwendbarkeit	
Bemerkungen	

Lehrveranstaltung: Industrielle Automatisierungstechnik (Vorlesung)

(zu Modul: Industrielle Automatisierungstechnik)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Industrial Automation (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	3
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	90
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	

Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			

Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Lehrinhalte	• Beschreibungssprachen der Automatisierungstechnik wie z.B. Wahrheitstabelle, Schaltfolgetabelle, Wege-Schritt Diagramm und Zustandsdiagramm • Diskussion von Fertigungsverfahren wie Urformen, Umformen, Trennen usw. • Verständnis der Automatisierungspyramide und deren Verwendungen im Kontext der Automation. • Diskussion von Bussysteme wie AS-Bus, Profibus und Profinet sowie OPC UA • Einführung in IEC 61131-3 • Diskussion der Erkenntnisse im Rahmen der elektrischen Netze
Literatur	• Plenk - Grundlagen der Automatisierungstechnik kompakt. • Förster - Einführung in die Fertigungstechnik. • Schnell - Bussysteme in der Automatisierungs- und Prozesstechnik: Grundlagen, • Systeme und Anwendungen der industriellen Kommunikation. • Veneri - Hands-on industrial Internet of Things: create a powerful industrial IoT infrastructure using industry 4.0. • John - SPS-Programmierung mit IEC 61131-3. • Schulz - Elektrische Energieversorgung - Erzeugung, Übertragung und Verteilung elektrischer Energie für Studium und Praxis.

	• OPC 10000-X - UA Specification
Bemerkungen	

Lehrveranstaltung: Industrielle Automatisierungstechnik (Praktikum)

(zu Modul: Industrielle Automatisierungstechnik)

Lehrveranstaltungsart	Praktikum	**Lernform**	Präsenz
LV-Name englisch	Industrial Automation (Practical Training)		
Anwesenheitspflicht	ja	**ECTS-Leistungspunkte**	2
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße		**Arbeitsaufwand in Stunden**	60
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung	Praktikum	**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	Bestehen

Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			

Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Lehrinhalte	In den semesterbegleitenden Praktika wenden die Studierenden das in der Vorlesung Gelernte auf gegebene oder selbst gewählte Anwendungsszenarien an. Dazu gehören unter anderen: • Automatisierung von 3D-Drucker • Einsatz von mobilen Robotern • Einsatz von Sensorik (z.B. UWB, LiDAR) • Vernetzung von Automatisierungskomponenten mittels OPC UA und MQTT
Literatur	Siehe Vorlesung
Bemerkungen	

Modul: Mikroprozessor-Design

Niveau	Master	**Kürzel**	uPD
Modulname englisch	Microprocessor Design		
Modulverantwortliche	Oliver Stecklina, Prof. Dr.		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90
Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Prüfungsleistung	Projektarbeit	**Prüfsprache**	Deutsch/Englisch
Dauer PL in Minuten		**Bewertungssystem PL**	Drittelnoten
Lernergebnisse	Nach erfolgreichem Abschluss der Veranstaltung können die Studierenden • Prozessordesigns vergleichen und bewerten, • den RISC-V Prozessor in VHDL umsetzen, • Prozessoroptimierungen differenzieren und umsetzen, • Probleme und Lösungen eines Pipeline-Prozessors erkennen und bewerten • VHDL Design-Entscheidungen für Mikroprozessoren auswählen und umsetzen.		
Teilnahmevoraussetzungen	VHDL-Kenntnisse		
Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✘ Zielgruppengerechte Anpassung der didaktischen Methoden ✔ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)		
Verwendbarkeit	Das Modul kann als Wahlfach im Studiengang Master Informatik genutzt werden.		
Bemerkungen			

Lehrveranstaltung: Mikroprozessor-Design (Vorlesung)

(zu Modul: Mikroprozessor-Design)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Microprocessor Design (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	3
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	90
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			

Lehrinhalte

Die Automatisierung und die Autonomisierung von Systemen erhöht den Bedarf nach anwendungsspezifischer Rechenleistung. Der Einsatz von General-Purpose Mikroprozessoren wird aufgrund ihres Energiebedarfs oder ihrer Kosten in Anwendungsgebieten zunehmend an Bedeutung verlieren. Auf deren Seite biete moderne programmierbare Standard-ICs bereits heutzutage die Voraussetzung, um ein kundenspezifisches System effizient einzusetzen. Somit werden anwendungsspezifische Prozessoren für die Zukunft immer wichtiger.

Im Rahmen des Moduls soll anhand eines praktischen Anwendungsbeispiels das Design eines Microprozessors auf der Register-Transfer-Ebene vollzogen werden. Als Basis für das Design eines Prozessors wird der RISC-V verwendet. Hierbei handelt es sich um eine freie RISC-Architektur, die unter anderem Bestandteil der Europäischen Prozessorinitiative ist.

Teil 1 - Einführung Prozessor-Architekturen
- Klassifizieren nach Flynn
- Harvard und von-Neumann Rechner
- RISC und CISC

Teil 2 - RISC-V Prozessor
- Befehlssatz und Struktur
- Modellierung in VHDL

	Teil 3 – Prozessor Optimierung • Pipeline • Cache-Speicher • Low Power Design
Literatur	1. Andrew S. Tanenbaum: Computerarchitekturen; Pearson Education; 2005 2. David Patterson und John Hennessy: Computer Architecture: A Quantitative Approach; Morgan Kaufmann; 2017 3. David Patterson und John Hennessy: Computer Organization and Design RISC-V Edition; 2017 4. Jürgen Reichardt, Bernd Schwarz; VHDL-Synthese; Oldenbourg Verlag 5. Peter J. Ashenden; The Designer's Guide to VHDL; Morgan Kaufmann
Bemerkungen	

Lehrveranstaltung: Mikroprozessor-Design (Praktikum)

(zu Modul: Mikroprozessor-Design)

Lehrveranstaltungsart	Praktikum	**Lernform**	Präsenz
LV-Name englisch	Microprocessor Design (Practical Training)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	2
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße	12	**Arbeitsaufwand in Stunden**	60
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung	Praktikum	**Selbststudiumsstunden**	45
Dauer SL in Minuten		**Bewertungssystem SL**	Bestehen
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	Im vorlesungsbegleitenden Praktikum werden im Rahmen einer semesterbegleitenden Projektarbeit Erweiterungen oder zusätzliche Komponenten für den RISCV@THL, einer 32-bit RISC-V Mikroprozessor Architektur der TH Lübeck, umgesetzt. Die Umsetzung der Designs erfolgt in VHDL und wird in Präsenzveranstaltungen begleitet. Zwischenergebnisse werden in kurzen Präsentationen vorgestellt und mit den anderen Kursteilnehmer:innen diskutiert. Die Bearbeitung der Projektarbeit erfolgt in kleinen Teams von 2-3 Studierenden.		
Literatur	Siehe Vorlesung		
Bemerkungen			

Modul: Rechnungswesen und Controlling

Niveau	Master	**Kürzel**	ReCo
Modulname englisch	Accounting and Controlling		
Modulverantwortliche	Elsner, Andree, Prof. Dr.		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	1	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90
Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Prüfungsleistung	Klausur	**Prüfsprache**	Deutsch
Dauer PL in Minuten	120	**Bewertungssystem PL**	Drittelnoten
Lernergebnisse	Die Studierenden verstehen betriebswirtschaftliche Zusammenhänge, die für die Entwicklung, Einführung und Analyse von Informationssystemen erforderlich sind.		
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✔ Zielgruppengerechte Anpassung der didaktischen Methoden ✔ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)		
Verwendbarkeit	Geschäftsprozessmanagement, Integrierte Systeme (SAP)		
Bemerkungen			

Lehrveranstaltung: Rechnungswesen und Controlling (Vorlesung)

(zu Modul: Rechnungswesen und Controlling)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Accounting and Controlling (Lecture)		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	4
Teilnahmebeschränkung		**Semesterwochenstunden**	3
Gruppengröße		**Arbeitsaufwand in Stunden**	120
Lehrsprache	Deutsch	**Präsenzstunden**	45
Studienleistung		**Selbststudiumsstunden**	75
Dauer SL in Minuten		**Bewertungssystem SL**	

Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			

Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Lehrinhalte	• Grundlegende betriebswirtschaftliche Konzepte (Produktionsfaktoren, Organisationsmodell, Logistik, Supply Chain Management, …) • Externes Rechnungswesen (Bilanz, FiBu, …) • Internes Rechnungswesen (BAB, Produktkalkulation, Interne Leistungsverrechnung, Target Costing, …) • Investitionsrechnung (statische Verfahren, Kapitalwertmethode) • Controlling (Kennzahlensysteme, Kennzahlen, Datawarehouse, …)
Literatur	• Thommen, Achleitner, Allgemeine Betriebswirtschaftslehre, SpringerGabler, aktuelle Auflage; • Ermann, Krupp, Betriebswirtschaftslehre, Pearson, aktuelle Auflage.
Bemerkungen	

Lehrveranstaltung: Rechnungswesen und Controlling (Praktikum)

(zu Modul: Rechnungswesen und Controlling)

Lehrveranstaltungsart	Praktikum	**Lernform**	Präsenz
LV-Name englisch	Accounting and Controlling (Practical Training)		
Anwesenheitspflicht	ja	**ECTS-Leistungspunkte**	1
Teilnahmebeschränkung		**Semesterwochenstunden**	1
Gruppengröße		**Arbeitsaufwand in Stunden**	30
Lehrsprache	Deutsch	**Präsenzstunden**	15
Studienleistung	Praktikum	**Selbststudiumsstunden**	15
Dauer SL in Minuten		**Bewertungssystem SL**	Bestehen

Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			

Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.

Lehrinhalte	Das Praktikum vermittelt ausgewählte Inhalte der Vorlesung in Form von praktischen Aufgaben in Team- oder Einzelarbeit. Die Studierenden können die Konzepte und Verfahren des Rechnungswesens und Controlling praktisch anwenden
Literatur	Siehe Vorlesung
Bemerkungen	

Modul: Teststandsautomatisierung

Niveau	Master	**Kürzel**	TA
Modulname englisch	Teststand automation		
Modulverantwortliche	Prof. Dr.-Ing. Thomas Wich		
Fachbereich	Elektrotechnik und Informatik		
Studiengang	Angewandte Informationstechnik, Master		
Verpflichtungsgrad	Wahlpflicht	**ECTS-Leistungspunkte**	5
Fachsemester	(Nicht festgelegt)	**Semesterwochenstunden**	4
Dauer in Semestern	1	**Arbeitsaufwand in Stunden**	150
Angebotshäufigkeit	SoSe	**Präsenzstunden**	60
Lehrsprache	Deutsch	**Selbststudiumsstunden**	90
Der folgende Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Prüfungsleistung	Portfolio-Prüfung	**Prüfsprache**	Deutsch
Dauer PL in Minuten		**Bewertungssystem PL**	Drittelnoten
Lernergebnisse	Nach der aktiven Teilnahme an diesem Modul sind die Studierenden in der Lage, • Funktionstests für mechatronische Systeme zu planen und auszulegen • Die dafür notwendige Hard-/Software-Plattformen anhand der Anforderungen auszuwählen, • Die entsprechenden Teststände zu konzipieren und zu implementieren, • Die Funktionstest durchzuführen und zu automatisieren und Die Ergebnisse aufzubereiten, zu analysieren und zu bewerten.		
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es **genau eine** modulabschließende Prüfung gibt.			
Berücksichtigung von Gender- und Diversity-Aspekten	✔ Verwendung geschlechtergerechter Sprache (THL-Standard) ✘ Zielgruppengerechte Anpassung der didaktischen Methoden ✘ Sichtbarmachen von Vielfalt im Fach (Forscherinnen, Kulturen etc.)		
Verwendbarkeit			
Bemerkungen			

Lehrveranstaltung: Teststandsautomatisierung (Vorlesung)

(zu Modul: Teststandsautomatisierung)

Lehrveranstaltungsart	Vorlesung	**Lernform**	Präsenz
LV-Name englisch	Teststand automation		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	3
Teilnahmebeschränkung		**Semesterwochenstunden**	2
Gruppengröße		**Arbeitsaufwand in Stunden**	90
Lehrsprache		**Präsenzstunden**	30
Studienleistung		**Selbststudiumsstunden**	60
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	Die Veranstaltung vermittelt wesentliche Fach- und Methodenkompetenzen im Bereich der automatisierten Tests mechatronischer Systeme. • Grundlagen • Analyse und Design von Tests • Konzeption und Implementierung • Integration von Subsystemen und Anbindung an übergeordnete Systeme Testausführung und -auswertung		
Literatur	• Georg, W., Metin, E.: „Einführung in LabVIEW“, Hanser 2015 • Walter Geiger, Willi Kotte: „Handbuch Qualität - Grundlagen und Elemente des Qualitätsmanagements: Systeme – Perspektiven“, Vieweg Verlag, 5. Auflage 2008 • Daniel Schöni: „Schaltungs- und Leiterplattendesign im Detail – Von der Idee zum fertigen Gerät“, Books on Demand Norderstedt, 2017		
Bemerkungen			

Lehrveranstaltung: Teststandsautomatisierung (Projekt)

(zu Modul: Teststandsautomatisierung)

Lehrveranstaltungsart	Projekt	**Lernform**	Online betreut mit Präsenzphase
LV-Name englisch	Teststand automation		
Anwesenheitspflicht	nein	**ECTS-Leistungspunkte**	2
Teilnahmebeschränkung		**Semesterwochenstunden**	2
Gruppengröße		**Arbeitsaufwand in Stunden**	60
Lehrsprache	Deutsch	**Präsenzstunden**	30
Studienleistung		**Selbststudiumsstunden**	30
Dauer SL in Minuten		**Bewertungssystem SL**	
Der folgende Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Prüfungsleistung		**Prüfsprache**	
Dauer PL in Minuten		**Bewertungssystem PL**	
Lernergebnisse			
Teilnahmevoraussetzungen			
Der vorige Abschnitt ist nur ausgefüllt, wenn es eine lehrveranstaltungsspezifische Prüfung gibt.			
Lehrinhalte	Bearbeitung von kleinen Projektaufgaben aus dem Bereich der Teststandsautomatisierung in Kleingruppen.		
Literatur			
Bemerkungen			

Module: Wireless Localization

Level	Master	**Short Name**	WiLoc
Responsible Lecturers	Bartels – v. Mensenkampff, Stefan, Prof. Dr.; Hellbrück, Horst, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	1	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	SuSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Oral Exam	**Exam Language**	German/English
Exam Length (minutes)	30	**Exam Grading System**	One-third Grades
Learning Outcomes	After successful completion of this course, the students will be able to: • design antennas for radar applications. They are familiar with various radar techniques and the design of related RF-components and -systems. • apply, evaluate and benchmark localization methods, algorithms and related realizations		
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Radar

(of Module: Wireless Localization)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2,5
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	75
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

1. Introduction

2. Basics
   - Radar Equation
   - Coherent and Non-Coherent Pulse Radar
   - Distance to Target
   - Angular Position of Target
   - Wave Propagation
   - Reflection and Transmission at Interfaces

3. Radar Antennas
   - Radiators
     - Offset Reflector Antennas
     - Cassegrain Reflector Antennas
     - Multibeam Antennas
     - Lens Antennas
     - Dielectric Antennas
   - Antenna Arrays
   - Radomes

4. Radar Cross Section

5. Radar Techniques
   - CW Radar

	• Doppler Radar • FMCW Radar • MTI Radar • Pulse Doppler Radar • Tracking Radar • Sequential Lobing • Conical Scan • Monopulse • Amplitude Monopulse • Phase Monopulse • SAR (Synthetic Aperture Radar)
Literature	Skolnik, M. I. Introduction to Radar Systems, McGraw-Hill, 2003
Remarks	

Module Course: Localization

(of Module: Wireless Localization)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2,5
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	75
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Basics Wireless Communication
	  • Frequency ranges
	  • Modulation types, waveforms, cells
	• Algorithms
	  • Synchronization
	  • Time-Of-Flight (Measurements)
	  • Distance measurements
	  • Angle measurements
	  • Trilateration
	  • Triangulation
	• Positioning systems
	  • Cellular systems (telecommunication)
	  • Satellites (GPS)
	  • Indoor positioning
	• Applications
	• Performance evaluation
	• Summary and outlook

Literature	• Ground-Based Wireless Positioning by Kegen Yu • Beiträge zur Ultra-Wideband Ortung (Hannoversche Beiträge zur Nachrichtentechnik) Taschenbuch von Stefan Galler • Wireless Positioning: Principles and Practice, Ian Sharp, Kegen Yu, Springer • Bensky, Alan. Wireless Positioning Technologies and Applications

Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

2. Semester (WiSe)

Pflichtmodule

Module: Scientific Project

Level	Master	**Short Name**	SciPr
Responsible Lecturers	Director of Studies, Master AIT		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory	**ECTS Credit Points**	10
Semester of Studies	2	**Semester Hours per Week**	1
Length (semesters)	1	**Workload (hours)**	300
Frequency	WiSe	**Presence Hours**	15
Teaching Language	English	**Self-Study Hours**	285

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes	The learning goal of the module is to enable students to work on scientific topics (e.g., a master thesis) autonomously/independently. Additionally, students will acquire the skills necessary to write scientific publications and give scientific presentations. Following the successful completion of this course, the students will have acquired the following competencies: • Writing of a scientific article of approximately 4 to 8 pages in length that covers state of the art, approach and result of the project. • Document and present the scientific approach used for solving the selected task. • Graphical representation and presentation of the results. • Retrieval and evaluation of information using literature and online resources. • Giving an overview of a complex scientific area in a presentation to a professional audience. • Participate in scientific discussions typical for scientific presentations.
Participation Prerequisites	

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	

Remarks	Exemplarily, the project work may consist of following parts: • Scientific article (appr. four to eight pages) • Presentation slides and poster of the project • Oral presentation of slides and poster

Module Course: Scientific Project (Seminar)

(of Module: Scientific Project)

Course Type	Seminar	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	10
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	300
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	285
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Introduction to Scientific Writing • Introduction to Version Management, e.g. GIT or SVN • Structure and outline of a scientific article • Structured approach for writing a scientific article • Presentation and poster • Writing workshops
Literature	(individual depending on project)
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

2. Semester (WiSe)

Wahlpflichtmodule

Module: Advanced Machine Vision

Level	Master	**Short Name**	AMV
Responsible Lecturers	Prof. Dr. Ralph Hänsel		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	(Unspecified)	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	German/English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes	• Students can describe the main functionalities of the robot operating system 2 (ROS2) • Students can integrate new functional blocks into ROS2 • Students can describe basic deep learning architectures for object detection and other tasks in machine vision • Students can perform the training of a given object detector model on a custom dataset and evaluate the performance • Students can describe the properties of the environment model • Students can apply different depth estimation technologies to estimate the position of a detected object • Students can describe technologies for ego-motion estimation and joint map generation (SLAM) • Students can state the physical description of light
Participation Prerequisites	

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	Robotics
Remarks	

Module Course: Advanced Machine Vision (Lecture)

(of Module: Advanced Machine Vision)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The course is focused on autonomous driving and how vision can play an important role as a sensor in an autonomous robot Processing Environment (ROS2) Image and Light Deep Learning in Machine Vision Environment Model Functional Safety Aspects
Literature	Literature will be given in the lecture
Remarks	

Module Course: Advanced Machine Vision (Lab)

(of Module: Advanced Machine Vision)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	German/English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	See lecture
Literature	See lecture
Remarks	

Module: Applied FPGA and VLSI Design

Level	Master	**Short Name**	AFPGA
Responsible Lecturers	Peter Bartmann, M.Sc.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes	After successful completion of the course, students are able to: • Describe and explain conventional and non-conventional number systems • Calculate in non-conventional number systems (add/sub, mult, div) incl. rounding and overflow handling • Implement advanced/optimized adder and multiplication structures in VLSI design • Implement and test digital signal processing pipelines (like polyphase filter) • Compose and analyze timing constraints • Analyze existing arithmetic / logic units, differentiate against other solutions and optimize them according to a given measurement function
Participation Prerequisites	Following knowledge is helpful, but not required to participate. • Experience in hardware description language VHDL or Verilog • Good understanding of linear algebra and number representations • Confidence use/handling of Boolean logic • Basic knowledge in discrete signals and systems

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)
Applicability	

Remarks	

Module Course: Applied FPGA and VLSI Design (Lecture)

(of Module: Applied FPGA and VLSI Design)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Number representation / number systems
	  • recap on conventional systems
	  • non-conventional/redundant number systems
	  • rounding and overflow in non-conventional systems
	• Addition
	  • Carry based adder
	  • carry-free redundant adder
	  • multi-operand and sequential adder
	• Multiplication/Division
	  • Advanced structures like Braun-Array-Multiplier
	  • Pezarris-Array-Multiplier and Booth-Wallace-Multiplier
	  • division by multiplication
	• Optimization for FPGAs
	  • Timing description
	  • FPGA-optimized VHDL-coding
	• Applications
	  • Transformation of algorithms
	  • Retiming
	  • Multi-rate and polyphase digital filters

Literature	• Amos R. Omondi, Computer Arithmetic Systems Algorithms, Architecture and Implemetations, Prentice-Hall, 1994, ISBN:0-13-334301-4

	• Steve Kilts, Advanced FPGA Design, Architecture, Implementation, and Optimization, Wiley-Interscience, 2007, ISBN: 978-0-470-05437-6 • Israel Koren, Computer Arithmetic Algorithms, http://www.ecs.umass.edu/ece/koren/arith/ • Peter Pirsch, Architekturen der digitalen Signalverarbeitung, B.G. Teubner, Stuttgart, 1996 • Jean-Michel Muller, Elementary Functions, Algorithms and Implementation, Birkhäuser Boston, 2006, http://perso.ens-lyon.fr/jean-michel.muller/SecondEdition.html • Reto Zimmermann, Computer Arithmetic: Principles, Architectures, and VLSI Design, Lecture notes, Integrated Systems Laboratory, ETH Zürich, 1997, http://www.iis.ee.ethz.ch/~zimmi
Remarks	

Module Course: Applied FPGA and VLSI Design (Practical Training)

(of Module: Applied FPGA and VLSI Design)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Implementation of a multiplication-addition structure (e.g. FIR filter, color space transformation) in VHDL • Testing and evaluation of own implementation • Optimizing VHDL code for a given FPGA • Optimization according to an objective function (combination of error, max. speed, min. size, ...)
Literature	• Same as lecture • Documentation of used development kits
Remarks	

Module: Autonomous Robots

Level	Master	**Short Name**	AuRob
Responsible Lecturers	Korff, Alexander, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	German/English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes	• The students know the characteristics of an autonomous system. • They can analyze existing autonomous systems and are able to discuss their abilities. • Furthermore, the students are able to design an autonomous system, choose appropriate sensors, actuators and algorithms to enable the AS to perform a certain task autonomously. • The students know the limitations of certain sensors, actuators and robotic algorithms.
Participation Prerequisites	Dealing with a higher programming language and/or dealing with Matlab/ Simulink,ideally knowledge of ROS (Robotic Operating System) and/or mobile systems

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Autonomous Robots (Lecture)

(of Module: Autonomous Robots)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	1. Introduction to Autonomous Systems 2. Robotics Operating System 2 3. Sensors, actuators and their use 4. Orientation and Mapping and Path Planning (3D) 5. Reasoning and System Integration
Literature	Roland Siegwart et al., Introduction to Autonomous Mobile Robots
Remarks	

Module Course: Autonomous Robots (Practical Training)

(of Module: Autonomous Robots)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	2
Group Size	18	**Workload (hours)**	60
Teaching Language	German/English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	30
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	Introduction to the Turtlebot4 Robot Plattform Start of Project Work
Literature	Roland Siegwart et al., Introduction to Autonomous Mobile Robots
Remarks	

Module: Business Process Management

Level	Master	**Short Name**	BPM
Responsible Lecturers	Lohmann, Rüdiger, Prof. Dr.-Ing.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Oral Exam	**Exam Language**	German/English
Exam Length (minutes)	30	**Exam Grading System**	One-third Grades
Learning Outcomes	Students will understand organizational structures and processes within enterprises. They will have learned techniques and rules of process design necessary for analysis and design of information systems.		
Participation Prerequisites	Financials and Controlling		
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Business Process Management (Lecture)

(of Module: Business Process Management)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	4
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	120
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	75
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Fundamentals of Organizations
	• IT Applications in Business
	  • Book keeping, MRP, MRPII, PPS u. ERP
	  • BOM, routing, scheduling
	• Business Process Management
	  • Goals, techniques
	• Order Processing
	  • OTC, P2P, planning and manufacturing, production order, scheduling, order confirmation

Literature	• Essentials of Business Processes and Information Systems (Magal, Word), current edition • Eversheim, W., Schuh, G., Integrierte Produkt- und Prozessgestaltung, Springer, Berlin. • Eversheim, W., Organisation in der Produktionstechnik - Band 1, Grundlagen, VDI-Verlag, Düsseldorf
Remarks	

Module Course: Business Process Management (Exercises)

(of Module: Business Process Management)

Course Type	Exercise	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	1
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	30
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	15
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The exercises train students in applying knowledge and methods of business models in several practical tasks.
Literature	See lecture
Remarks	

Module: Human-Computer Interaction

Level	Master	**Short Name**	HCI
Responsible Lecturers	Prof. Dr. Monique Janneck, Prof. Dr. Denys Matthies		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades

Learning Outcomes

By the end of this module, students will be able to:

- **Understand key concepts in Human-Computer Interaction (HCI):** Define and apply foundational terminology in UI and UX, recognizing how these concepts influence user needs and behaviors in interactive systems.
- **Analyze and apply HCI models:** Use models such as Fitts' Law, Hick's Law, and Norman's Seven Stages of Action to predict and improve user interactions within a system.
- **Design human-centered interfaces:** Apply human-centered design principles, including mental models, metaphors, and usability principles, to create intuitive and effective user interfaces.
- **Evaluate human factors in design:** Analyze human capabilities like perception, cognition, and motor functions to inform interface design decisions, optimizing for both usability and accessibility.
- **Implement prototyping techniques:** Develop and utilize low-functional prototypes, including the Wizard of Oz method, to test and iterate interface designs in the early stages of development.
- **Apply design principles in practice:** Use design elements such as color, composition, and form, alongside interaction design methods, to create aesthetically and functionally sound interfaces.
- **Conduct usability evaluations:** Perform usability tests, cognitive walkthroughs, and heuristic evaluations to identify and address usability issues in interface designs.
- **Engage in empirical research:** Design and conduct experiments using empirical methods to validate interface designs, employing techniques such as hypothesis testing and grounded theory.

	These outcomes will equip students with the skills and knowledge needed to design, prototype, and evaluate user interfaces that align with human cognitive and physical capabilities, ensuring optimal user experience.
Participation Prerequisites	

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	The module can be used within the Master of Computer Science/Software Engineering for Distributed Systems
Remarks	The project work (examination) includes, e.g., the implementation of a self-chosen HCI project, a written report, and an oral presentation of the project.

Module Course: Human-Computer Interaction (Lecture)

(of Module: Human-Computer Interaction)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	30
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

- **Introduction:** introduces the fundamental concepts of user interfaces (UIs) and the role they play in Human-Computer Interaction (HCI). You will learn about the core terminologies in both general UI design and specifically within the context of User Experience (UX). Understanding these terms helps establish a solid foundation for identifying and addressing user needs when designing interfaces. The discussion will extend to Ubiquitous Human-Computer Interaction, where interaction happens seamlessly across devices and environments, reflecting the ever-growing pervasiveness of technology in our daily lives.
- **Models in HCI:** are key to understanding and predicting how users interact with systems. This module begins with an introduction to the role of models in HCI and covers important foundational models, such as Fitts' Law, which explains the relationship between the distance to a target and the time required to reach it. Applications of Fitts' Law in interface design will be explored, followed by the concept of "steering through tunnels," which describes navigation in constrained environments. Hick's Law and the Keystroke-Level Model (KLM) will help us understand decision-making time and task execution at a granular level. We will also delve into the GOMS (Goals, Operators, Methods, and Selection rules) model for task analysis and Norman's Seven Stages of Action, which outline user interaction from goal formulation to system feedback. Finally, we'll explore additional models and their applications in HCI.

- **Basics and Principles:** examines user illusions and how UIs can shape user perception. A key emphasis will be placed on focusing on the human side of the interaction, particularly through mental models and metaphors, which help users make sense of unfamiliar systems. Human-centered design (HCD) principles will be introduced, emphasizing usability and user satisfaction. We'll discuss strategies to better know your users and their tasks, and dive into established principles like the Eight Golden Rules of interface design. This module will also cover the potential for human error in interaction and how proper design can mitigate these risks. Style guides, UI guidelines, and the concepts of constraints and mappings will offer practical approaches to achieving consistency and usability in design.
- **Human:** has capabilities and limitations in perception, cognition, and interaction. We begin with visual perception, understanding how the brain processes visual stimuli, and move on to cognition, focusing on how people process information, solve problems, and make decisions. We'll look at Gestalt laws and how they influence perception, alongside human hearing, haptics, attention, and memory. Cognitive models will offer insights into how users think and act, and we'll also address the emotional aspect of interaction and how it affects user experience. Finally, this module will examine the motor system and its role in physical interaction with interfaces.
- **Input and Output**: starts with an exploration of the ultimate user interface, questioning what constitutes a perfect interface. We will then discuss the design space and taxonomy of input devices, focusing on their types, affordances, and limitations. Pointing devices and their associated transfer functions will be examined, followed by an exploration of various output methods, including visual, auditory, and physical (printing and tactile) outputs. We'll also cover emerging technologies such as olfactory and taste outputs and dive into advanced interaction techniques like eye gaze interaction.
- **Prototyping**: is a crucial part of the design process. Here, we introduce the various types of prototypes and methods for systemizing them based on their functionality and fidelity. You'll learn about low-functional prototypes, which are used for early testing and iteration, and how to employ the Wizard of Oz technique, where users interact with a system they believe to be autonomous but is controlled behind the scenes by a human. These methods allow designers to simulate functionalities without full implementation, saving time and resources.
- **Design**: covers the essentials in HCI. We begin with an introduction to design, discussing its purpose and importance in creating effective user interfaces. You will then explore various design methods, including user-centered and participatory approaches. The discussion will continue into advanced design techniques, including the use of color, composition, and form to create aesthetically pleasing and functional interfaces. Additionally, we will cover interaction design, focusing on how users engage with and navigate through interfaces.
- **Evaluation & Experiments**: focuses on evaluating designs and conducting experiments to ensure usability. We will cover cognitive walkthroughs, where experts evaluate an interface by stepping through user tasks, and heuristic evaluation, which identifies usability problems through expert review. You will

	also learn about usability testing, where real users interact with a system to provide feedback. The module concludes with an introduction to empirical research methods, including grounded theory and hypothesis testing, essential for validating design decisions with data.
Literature	• B. Shneiderman (2002). Leonardo's Laptop: Human Needs and the New Computing Technologies. http://mitpress.mit.edu/main/feature/leonardoslaptop/index.html • B. Buxton (2010). Sketching user experiences: getting the design right and the right design. Morgan Kaufmann. • Harry Brignull (2006). Bad usability is like a leaky pipe. https://90percentofeverything.com/2006/11/13/bad-usability-is-like-a-leaky-pipe/ • Thomas T. Hewett, Ronald Baecker, Stuart Card, Tom Carey, Jean Gasen, Marilyn Mantei, Gary Perlman, Gary Strong, and William Verplank. 1992. ACM SIGCHI Curricula for Human-Computer Interaction. Technical Report. Association for Computing Machinery, New York, NY, USA. • Standard, ISO 9241:210 https://www.iso.org/obp/ui/#iso:std:iso:9241:-210:ed- 2:v1:en • https://www.interaction-design.org/literature/article/what-is-interaction-design by Yu Siang Teo • Jakob Nielsen's Alertbox, August 25, 2003: Usability 101: Introduction to Usability https://www.nngroup.com/articles/usability-101-introduction-to-usability/ • Jakob Nielsen. 2009. Powers of 10: Time Scales in User Experience. https://www.nngroup.com/articles/powers-of-10-time-scales-in-ux/ • Jennifer Preece, Yvonne Rogers, Helen Sharp (2002) Interaction Design, ISBN: 0471492787, http://www.id-book.com/, Chapter 9 • Winograd, T. (1997). From computing machinery to interaction design. In Denning, P., & Metcalfe, R. (Eds.), Beyond calculation: The next fifty years of computing, 149-162. Springer-Verlag. http://hci.stanford.edu/~winograd/acm97.html. • Foreword “What is Interaction Design?”. Interview with Gillian Crampton Smith. Moggridge, Bill, and Bill Atkinson. Designing interactions. Vol. 17. Cambridge, MA: MIT press, 2007. page xvii • https://www.interaction-design.org/literature/article/what-is-interaction-design by Yu Siang Teo • Pine, B. Joseph, and James H. Gilmore. "Welcome to the experience economy." Harvard business review 76 (1998): 97-105. https://hbr.org/1998/07/welcome-to-the-experience-economy • Hassenzahl, Marc (2013): User Experience and Experience Design. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human- Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. http://www.interaction- design.org/encyclopedia/user_experience_and_experience_design.html • Effie Lai-Chong Law, Virpi Roto, Marc Hassenzahl, Arnold P.O.S. Vermeeren, and Joke Kort. 2009. Understanding, scoping and defining user experience: a survey approach. In Proceedings of the 27th international conference on Human factors in computing systems(CHI '09). ACM, New York, NY, USA, 719-728. DOI=10.1145/1518701.1518813 http://doi.acm.org/10.1145/1518701.1518813

	• Maslow, A. H. (1943): A theory of human motivation. Psychological Review, 50(4), 370-396. https://doi.org/10.1037/h0054346 • John M. Carroll. (1990): Infinite detail and emulation in an ontologically minimized HCI. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '90). Association for Computing Machinery, New York, NY, USA, 321–328. DOI:https://doi.org/10.1145/97243.97303 • John M. Carroll.(2013): Human Computer Interaction - brief intro. In: Soegaard, Mads and Dam, Rikke Friis (eds.). "The Encyclopedia of Human-Computer Interaction, 2nd Ed.". Aarhus, Denmark: The Interaction Design Foundation. http://www.interaction-design.org/encyclopedia/human_computer_interaction_hci.html • Alan Cooper, Robert Reimann, and Hugh Dubberly (2003): About face 2.0: The essentials of interaction design. John Wiley & Sons, Inc.
Remarks	(add. literature incl. current research papers presented in script)

Module Course: Human-Computer Interaction (Practical Training)

(of Module: Human-Computer Interaction)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size	12	**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The student will develop an individual or team project.
Literature	See lecture
Remarks	

Module: Medical AI

Level	Master	**Short Name**	MedAI
Responsible Lecturers	Prof. Dr. Marian Himstedt		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	(Unspecified)	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	• Students can explain common deep learning architectures with a focus on medical computer vision. • Students can describe challenges in medical applications of AI. • Students can apply models for classification, segmentation, and registration to existing and new medical applications. • Students can employ deep learning methods effectively for specific medical applications. • Students can confidently develop, evaluate, and deploy their own deep learning-based applications using Python. • Students can independently assess the relevance of scientific articles and adapt the presented methods for use in both existing and new medical applications.		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Medical AI (Lecture)

(of Module: Medical AI)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

Introduction
- Motivation for AI in healthcare
- Recent trends and challenges

Neural Networks
- Neurons and layers
- (Multi-layer) perceptron
- Backpropagation
- Training networks using PyTorch

Neural networks architectures:
- CNN
- Transformer

Medical data domains
- CT, MRI
- Ultrasound
- Endoscopy

Learning methods
- Supervised/unsupervised/weakly supervised approaches
- Contrastive learning
- Self-supervised learning

Fundamental tasks for medical domain
- Classification
- Segmentation

	• Registration • Explainable models **Recent approaches** • Foundation models • Multimodal learning **Selected clinical applications** • ECG signal classification • Organ and tumor localization and segmentation • Image guidance • Tumor/tissue tracking
Literature	Ian Goodfellow, Yoshua Bengio und Aaron Courville: Deep Learning - The MIT Press
Remarks	

Module Course: Medical AI (Lab)

(of Module: Medical AI)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	2
Group Size	12	**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	30
SL Length (minutes)		**SL Grading System**	Participation

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	See lecture
Literature	See lecture
Remarks	

Module: Mobile Human-Computer Interfaces

Level	Master	**Short Name**	MoHCI
Responsible Lecturers	Matthies, Denys, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	German/English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	After successfully completing the course, participants acquired theoretical and practical knowledge on the design, implementation, and evaluation of mobile applications. Course participants learned that a “good” mobile application is more than user interface eye candy. In particular, students will: • know a variety of application scenarios for mobile applications • can apply different technologies to develop mobile applications • are capable of appropriately evaluating mobile applications, such as by applying basic usability & UX evaluation techniques • know gestalt laws, typography rules, and UI guidelines for mobile applications • understand the design process and HCD life-cycle • be able to apply low-fidelity prototyping while taking into account user-centered design strategies • have improved analytical, teamwork, and presentation skills		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	The module can be used within the Master of Computer Science/Software Engineering for Distributed Systems
Remarks	

Module Course: Mobile Human-Computer Interfaces (Lecture)

(of Module: Mobile Human-Computer Interfaces)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	30
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

The course features in-person lectures and online lectures. The following contents are taught in-person:

- **Introduction to mobile applications**, discussing different device categories and their properties. It gives an overview of various development platforms for mobile apps and outlines common application scenarios where mobile apps are utilized.
- **Basics in sketching a mobile UI:**focuses on the use of layers and shapes, visual design principles, and grid systems to create structured and aesthetic interfaces.
- **Conceptualization of Design Principles**: covers the key elements such as design patterns, wireframes, and layout. It also addresses grids, iconography, color theory, and Gestalt laws, providing a comprehensive fundamentals for designing mobile UIs.
- **Typography:** explains the fundamentals, including different font types, and the concepts of kerning, tracking, and leading. It also discusses how line length and spacing impact readability and overall text design.
- **Low fidelityPrototyping:**discusses paper prototyping and wireframing, which are used to quickly visualize and test design concepts before moving to more detailed development stages.
- **User-centered Design fundamentals:** covers the mockup of mood boards and personas to guide design decisions. It emphasizes user, human, or humanity-centered design

	approaches and explores the principles of design thinking to ensure solutions are tailored to user needs. • **Usability heuristics & User Experience guidelines:** focusing on general best practices for designing intuitive, consistent, and predictable user interfaces. These principles help ensure a smooth and user-friendly experience across mobile and other platforms and digital products. • **Evaluation**: detailing the study design and methods for data acquisition. It discusses the use of both new and established questionnaires to quantify usability and user experience, and explains data analysis techniques, including statistical analysis and machine learning/pattern recognition methods. The course is complemented through online lectures comprising of: • **Android:** covers an introduction to Android Studio, Android UI Guidelines, integrating APIs, managing local data with SQLite, and applying Material UI principles to enhance app design and functionality. • **iOS:** focuses on using Xcode and Swift, with an emphasis on Swift UI for designing intuitive interfaces. Further the broader iOS ecosystem and the integration of Firebase is explored for backend functionalities. • **Unity:** starting with an introduction to the platform while highlighting media enrichment capabilities, such as sound, videos, and animations. Further input controls, including buttons and gestures as well Unity's augmented reality capabilities are covered. • **Flutter:** introduction to the cross-platform framework and its basic features. It is explained how Flutter integrates with Firebase for authentication and database access. The use of widgets and animations to enhance app functionality is demonstrated. • **React Native:** and its JSX syntax is introduced guiding users on how to get started with developing cross-platform apps. It also covers integration with Firebase and its APIs for functionalities like authentication and data management.
Literature	• Allan, A. (2011). Basic sensors in IOS: Programming the accelerometer, gyroscope, and more. " O'Reilly Media, Inc.". • Banks, A., & Porcello, E. (2017). Learning React: functional web development with React and Redux. " O'Reilly Media, Inc.". • Brooke, John. "SUS-A quick and dirty usability scale." Usability evaluation in industry 189, no. 194 (1996): 4-7. • Deutsche Gesetzliche Unfallversicherung e.V. (2021). DGUV Information 215–450. Softwareergonomie. • DIN, E. (2020). Ergonomie der Mensch-System-Interaktion–Teil 110: Interaktionsprinzipien (ISO 9241-110: 2020) [Ergonomics of human-system interaction-Part 110: Interaction principles]. *Deutsche Fassung EN ISO*, 9241-110. • Eisenman, B. (2015). Learning react native: Building native mobile apps with JavaScript. " O'Reilly Media, Inc.". • Gargenta, M. (2011). Learning android. " O'Reilly Media, Inc.". • Hart, S. G. & Staveland, L. E. (1988) Development of NASA-TLX (Task Load Index): Results of empirical and theoretical research. In P. A. Hancock and N. Meshkati (Eds.) Human Mental Workload. Amsterdam: North Holland Press. • Jackson, W. (2014). Pro Android UI. Apress.

- Love, S. (2005). Understanding mobile human-computer interaction. Elsevier.
- Lukosek, G. (2016). Learning C# by Developing Games with Unity 5. x. Packt Publishing Ltd.
- Matthies, D.J.C., Kothandan, J., Sun, W., Dittmar, A. (2023). User Generated Inverted Item Evaluation (UGIIE). In Proceedings of 25th HCI International Conference (HCII 2023), July 23-28, 2023, Copenhagen, Denmark. Springer.
- Morson, S. (2014). Learn design for iOS development. Apress.
- Mostefaoui, G., Tariq, F (2018) Mobile Apps Engineering: Design, Development, Security, and Testing, Chapman and Hall.
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- Richter, M., & Flückiger, M. D. (2016). *Usability und UX kompakt: Produkte für Menschen*. Springer-Verlag.
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- Suh, H., Shahriaree, N., Hekler, E. B., & Kientz, J. A. (2016). Developing and validating the user burden scale: A tool for assessing user burden in computing systems. In Proceedings of the 2016 CHI conference on human factors in computing systems (pp. 3988-3999).
- Windmill, E. (2020). Flutter in action. Simon and Schuster.

Remarks	

Module Course: Mobile Human-Computer Interfaces (Practical Training)

(of Module: Mobile Human-Computer Interfaces)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size	12	**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The practical course serves to apply the teaching content presented in the lecture and to deepen a specific current topic centering around designing usable mobile applications.
Literature	See lecture
Remarks	

Module: Process Integration

Level	Master	**Short Name**	PINT
Responsible Lecturers	Pelka, Mathias, Prof. Dr-Ing		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	The students: • Interpret the impact of industrial revolutions leading to Industry 4.0 and the advent of the smart factory • analyse the concepts of integrated operation management systems for the smart factory and the industrial internet-of-things and the implications for the integration of the industrial processes • understand different systems, system concepts, system architectures and the reasons for each choice of the smart factory and other cyber-physical systems • classify functionalities of an MES system such as production data acquisition, asset management, quality management, detailed production planning and control and can describe and evaluate them in an overall task context • have gained first experiences in designing automated industrial processes		
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Process Integration (Lecture)

(of Module: Process Integration)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Discussion of the four industrial revolutions • Aims for the Smart Factory • Concepts and variants of integrated operations management in the Smart Factory using the Industrial Internet-of-Things (I-IoT) • Integration of applications in the I-IoT Edge using OPC UA and other fieldbus technologies as an example for a cyber-physical system • Cyber-Security related hardening of integrated industrial systems • Interface description, design and implementation between automation process level and higher operating levels using workflow engines • Synthesis of a complex hard and software project using state-of-the-art technology
Literature	• Veneri, Giacomo, and Antonio Capasso. Hands-on industrial Internet of Things: create a powerful industrial IoT infrastructure using industry 4.0. Packt Publishing Ltd, 2018. • Buchmann, Johannes, et al. Introduction to Public Key Infrastructures. Berlin: Springer, 2013. • Reuckert, Bernd. Practical Process Automation: Orchestration and Integration in Microservices and Cloud Native Architectures. O'Reilly UK Ltd, 2021. • Kletti, Jürgen. MES Manufacturing Executing System, Springer 2015

	• Kurbel, Karl E. Enterprise resource planning and supply chain management. Functions, Business Processes and Software for Manufacturing Companies. Progress in IS. Springer, Dordrecht (2013).
Remarks	

Module Course: Process Integration (Practical Training)

(of Module: Process Integration)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	In the practical trainings during the semester, the students apply what they have learned in the lecture to given or self-study topics for selected application scenarios
Literature	See lecture
Remarks	

Module: Process Optimization

Level	Master	**Short Name**	POPT
Responsible Lecturers	Töbermann, J.-Christian, Prof. Dr.-Ing		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Project Work	**Exam Language**	English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	The Students: • can apply various mathematical and heuristic optimization methods and know their fields of application and limitations. • can apply basic approaches of AI-based optimization. • can systematically plan and describe requirements for higher decision and optimization functions in automation systems or superimposed operating systems (e.g. Manufacturing Execution Systems). • can implement such functions using suitable optimization methods and integrate them into the overall system.		
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Process Optimization (Lecture)

(of Module: Process Optimization)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Mathematical and heuristic optimization methods. • Basics of AI-based optimization methods. • Modelling of process tasks for higher decision and optimization functions and selection of suitable methods, approaches, and algorithms. • Design, implementation, simulation and testing of higher decision and optimization functions. • Integration into existing Automation Systems or Manufacturing Execution Systems.
Literature	Literature will be named in the lecture.
Remarks	

Module Course: Process Optimization (Practical Training)

(of Module: Process Optimization)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	In the practical trainings during the semester, the students apply what they have learned in the lecture to given or self-study topics for selected application scenarios.
Literature	See lecture.
Remarks	

Module: Real-Time Systems

Level	Master	**Short Name**	RTS
Responsible Lecturers	Blaurock, Ole, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Written Exam	**Exam Language**	German/English
Exam Length (minutes)	90	**Exam Grading System**	One-third Grades
Learning Outcomes	After successful completion of this course, the students will have acquired the following competences: • Understanding of requirements specific to real-time systems. • Analysis and design of hard- and software of systems with real-time capabilities. • Modelling and implementation of real-time systems. • The students are able to model and apply specific techniques to implement a real-time system.		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✘ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Real-Time Systems (Lecture)

(of Module: Real-Time Systems)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Presentation of selected real-time systems, classification of real-time systems. • Safety in real-time systems: Dependability, reliability, methods for analysis, fault models, redundant design. • Security in real-time systems. • Communication in systems with real-time capabilities. • Implementation of real-time systems: models of time, energy concerns, fields of applications, target platforms. • Real-time operating systems: Architecture, scheduling, resource management, synchronization, comparison with • operating systems for systems without real-time capabilities, selected examples.
Literature	• Giorgio Buttazzo, Giuseppe Lipari, Luca Abeni und Marco Caccamo: Soft Real-Time Systems Predictability vs. Efficiency, Springer, 2005. • Giorgio Buttazzo: Hard Real-Time Computing Systems Predictable Scheduling Algorithms and Applications, Springer, 2011. • Abraham Silberschatz, Peter B. Galvin, Greg Gagne: Operating System Concepts, 8th ed., Wiley, 2010. • Andrew S. Tanenbaum, Herbert Bos: Modern Operating Systems, Pearson Education Limited, 2014. • Hermann Kopetz: Real-Time Systems, Springer, 2011.

Remarks	

Module Course: Real-Time Systems (Practical Training)

(of Module: Real-Time Systems)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The topics of the module are applied to a scenario with characteristic requirements and constraints, e.g., implementation of an online scheduler for real-time systems.
Literature	See lecture
Remarks	

Module: Supply Chain Management

Level	Master	**Short Name**	SCM
Responsible Lecturers	Köhler, André, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	2
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	30
Teaching Language	English	**Self-Study Hours**	120

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	After successful completion of this course, the students will be able to: • Take cultural aspects of the participants of a supply chain into account. • Prepare strategic and operational supply chain management decisions in various enterprises • Understand, analyze and evaluate major SCM tools and concepts • Apply SCM concepts in practice		
Participation Prerequisites			

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Supply Chain Management (Lecture)

(of Module: Supply Chain Management)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	5
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	150
Teaching Language	English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	120
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

- Introduction to SCM
  - From logistics to SCM
  - Goals and principles of SCM
- Supply Chain Design and Operations
  - Best practice examples
  - Special SCM tools (VMI, ECR, JIT, 3 and 4 PL)
  - Selected quantitative models
  - Change management
- SCM information systems
  - E-Business
- Case study/Exercise
- Business Game SCM
- Usage of cultural diversity

Literature

1. Chopra, S.; Meindl, P. ; Supply Chain Management. Pearson Education Limited; Auflage: 6th Global ed Mai 2016
2. Corsten, D.; Gabriel, Chr.: Supply Chain Management erfolgreich umsetzen. Berlin u.a.: Springer 2002
3. Corsten, D.; Gössinger, R.: Einführung in das Supply Chain Management. München, Wien: Oldenbourg 2001
4. Eißig, M. (Hrsg.): Perspektiven des Supply Chain Managements. Berlin et al: Springer 2005
5. Kuhn, A.; Hellingrath, H.: Supply Chain Management. Berlin u.a.: Springer 2002

	6. Schönsleben, P.: Integrated Logistics Management. Boca Raton et al: St. Lucie 2000 7. Simchi-Levi, D.; Kaminsky, P.; Simchi-Levi, E. Designing and Managing the Supply Chain; Mcgraw-Hill Education - Europe; Auflage: 4 Rev ed. 2016
Remarks	

Module: Wireless Networks for Cyber Physical Systems

Level	Master	**Short Name**	WiNet
Responsible Lecturers	Hellbrück, Horst, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	2	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	WiSe	**Presence Hours**	60
Teaching Language	English	**Self-Study Hours**	90

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	After successfully completing the course, students will be able to: • present the specialties of wireless sensor systems and the challenges and concepts of these systems. • interpret and follow actual research activities and technology trends. • design and analyze systematically protocols for sensor systems. • design, implement deploy and operate real-time applications based on wireless networks. • choose components for automation systems based on technical requirements and economic reasons. • perform diagnose, tests and optimizations of wireless networked systems.		
Participation Prerequisites	Knowledge of modules: Principles of Electrical Engineering, Digital Technology, Communication Technologies, Digital Transmission Systems, Communication Networks		

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Wireless Networks for Cyber Physical Systems (Lecture)

(of Module: Wireless Networks for Cyber Physical Systems)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents

Introduction to Communication Systems (Workload 10h)
- Principles of networks (ISO-OSI-Schichtenmodell)
- Overview of state-of-the-art technologies incl. field buses and their classification
- Quality of service requirements for networks (real-time)

Wireless Data Transmission (Workload 10h)

Wireless Data Link Layer (Workload 10h)
- Medium access control
- Error control
- Real-time aspects

Wireless Network Layer (Workload 15h)
- Addressing
- Routing
- Path finding
- Real-time Aspects

Wireless Technologies (Workload 30h)
- 802.15.4
- WLAN
- GSM, 4G, 5G
- Bluetooth
- RFID
- LowPowerWANs

	• (Broadcast, Satellite Systems) Security in wireless Networks (Workload 10h) Applications (Workload 15h)
Literature	• Jochen Schiller: Mobile Communications, Addison-Wesley • Andrew S. Tanenbaum: Computer Networks, Prentice-Hall • Holger Karl, Andreas Willig: Protocols and Architectures of Wireless Sensor Networks, Wiley • Fheng Zhao, Leonidas Guibas: Wireless Sensor Networks, Morgan Kaufmann • Andreas F. Molisch: „Wireless Communications“, John Wiley & Sons • Kurose, Ross: „Computer Networks“, Pearson
Remarks	

Module Course: Wireless Network for Cyber Physical Systems (Practical Training)

(of Module: Wireless Networks for Cyber Physical Systems)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	• Concept, implementation of real-time networking with wireless components • Data acquisition, processing and transfer from the field to management systems
Literature	See lecture
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

3. Semester (SoSe oder WiSe)

Pflichtmodule

TECHNISCHE HOCHSCHULE LÜBECK

Module: Master Thesis and Colloquium

Level	Master	**Short Name**	MA
Responsible Lecturers	Professors of the Department, Field Electrical Engineering		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory	**ECTS Credit Points**	25
Semester of Studies	3	**Semester Hours per Week**	
Length (semesters)	1	**Workload (hours)**	750
Frequency	(Flexible)	**Presence Hours**	1
Teaching Language	German/English	**Self-Study Hours**	749
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Master Thesis

(of Module: Master Thesis and Colloquium)

Course Type	Project Work	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	20
Participation Limit		**Semester Hours per Week**	0
Group Size		**Workload (hours)**	600
Teaching Language	German/English	**Presence Hours**	0
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	600
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type	Thesis	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	Students apply the technical, methodological, systems and social skills acquired during their studies to a concrete problem in their final thesis, thereby demonstrating their ability to work independently in a scientific manner.		
Participation Prerequisites	Regulated by Studien- und Prüfungsordnung (SPO) as well as Prüfungsverfahrensordnung (PVO) in their respective valid version		

The previous section is filled only if there is a course-specific exam.

Contents	The course content corresponds to the specified topic of the Master Thesis.
Literature	According to the task
Remarks	

Module Course: Master Colloquium

(of Module: Master Thesis and Colloquium)

Course Type	Seminar	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	5
Participation Limit		**Semester Hours per Week**	0
Group Size		**Workload (hours)**	150
Teaching Language	German/English	**Presence Hours**	1
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	149
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type	Colloquium	**Exam Language**	German/English
Exam Length (minutes)	60	**Exam Grading System**	One-third Grades
Learning Outcomes	The students present the experience and scientific results gained during the processing of their thesis and represent these in a subsequent discussion.		
Participation Prerequisites	Regulated by Studien- und Prüfungsordnung (SPO) as well as Prüfungsverfahrensordnung (PVO) in their respective valid version		

The previous section is filled only if there is a course-specific exam.

Contents	The course content corresponds to the specified topic of the Master Thesis.
Literature	According to the task
Remarks	

TECHNISCHE HOCHSCHULE LÜBECK

Angewandte Informationstechnik, Master

3. Semester (SoSe oder WiSe)

Wahlpflichtmodule

Module: Masterthesis Seminar

Level	Master	**Short Name**	MtSem
Responsible Lecturers	Korff, Alexander, Prof. Dr.		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	3	**Semester Hours per Week**	1
Length (semesters)	1	**Workload (hours)**	150
Frequency	(Flexible)	**Presence Hours**	15
Teaching Language	German/English	**Self-Study Hours**	135

The following section is filled only if there is **exactly one** module-concluding exam.

Exam Type	Project Work	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	Ability to work independently on a master's thesis or other comparable scientific work.		
Participation Prerequisites	All compulsory courses in semesters 1 to 2 are recommended		

The previous section is filled only if there is **exactly one** module-concluding exam.

Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✘ Making subject diversity visible (female researchers, cultures etc.)
Applicability	
Remarks	

Module Course: Masterthesis Seminar

(of Module: Masterthesis Seminar)

Course Type	Seminar	**Form of Learning**	Online supported with presence hours
Mandatory Attendance	no	**ECTS Credit Points**	5
Participation Limit		**Semester Hours per Week**	1
Group Size		**Workload (hours)**	150
Teaching Language	German/English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	135
SL Length (minutes)		**SL Grading System**	

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	Students are to be given methodical tools to support them in preparing a master thesis: • Organizational aspects • Topic identification and description • Literature research
Literature	According to the task
Remarks	

Module: Special Topics in Information Technology I

Level	Master	**Short Name**	STIT I
Responsible Lecturers	Professors and lecturers of the department		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	(Unspecified)	**Semester Hours per Week**	4
Length (semesters)	1	**Workload (hours)**	150
Frequency	(Flexible)	**Presence Hours**	60
Teaching Language	German/English	**Self-Study Hours**	90
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	Students can report on a current topic in information technology. Students can classify and evaluate an advanced technology or development presented and apply it to specific issues.		
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Special Topics in Information Technology I (Lecture)

(of Module: Special Topics in Information Technology I)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	3
Group Size		**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	45
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	
The following section is filled only if there is a course-specific exam.			
Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			
The previous section is filled only if there is a course-specific exam.			
Contents	The current content is determined by the lecturer.		
Literature	Literature will be presented in the lecture.		
Remarks			

Module Course: Special Topics in Information Technology I (Practical Training)

(of Module: Special Topics in Information Technology I)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	German/English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass

The following section is filled only if there is a course-specific exam.

Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			

The previous section is filled only if there is a course-specific exam.

Contents	The current content is determined by the lecturer.
Literature	Literature will be presented in the practical training.
Remarks	

Module: Special Topics in Information Technology II

Level	Master	**Short Name**	STIT II
Responsible Lecturers	Professors and lecturers of the department		
Department, Facility	Electrical Engineering and Computer Science		
Course of Studies	Applied Information Technology, Master		
Compulsory/elective	Compulsory elective	**ECTS Credit Points**	5
Semester of Studies	(Unspecified)	**Semester Hours per Week**	3
Length (semesters)	1	**Workload (hours)**	150
Frequency	(Flexible)	**Presence Hours**	45
Teaching Language	German/English	**Self-Study Hours**	105
The following section is filled only if there is **exactly one** module-concluding exam.			
Exam Type	Portfolio Exam	**Exam Language**	German/English
Exam Length (minutes)		**Exam Grading System**	One-third Grades
Learning Outcomes	Students can report on a current topic in information technology. Students can classify and evaluate an advanced technology or development presented and apply it to specific issues.		
Participation Prerequisites			
The previous section is filled only if there is **exactly one** module-concluding exam.			
Consideration of Gender and Diversity Issues	✔ Use of gender-neutral language (THL standard) ✔ Target group specific adjustment of didactic methods ✔ Making subject diversity visible (female researchers, cultures etc.)		
Applicability			
Remarks			

Module Course: Special Topics in Information Technology II (Lecture)

(of Module: Special Topics in Information Technology II)

Course Type	Lecture	**Form of Learning**	Presence
Mandatory Attendance	no	**ECTS Credit Points**	3
Participation Limit		**Semester Hours per Week**	2
Group Size		**Workload (hours)**	90
Teaching Language	German/English	**Presence Hours**	30
Study Achievements ("Studienleistung", SL)		**Self-Study Hours**	60
SL Length (minutes)		**SL Grading System**	
The following section is filled only if there is a course-specific exam.			
Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			
The previous section is filled only if there is a course-specific exam.			
Contents	The current content is determined by the lecturer.		
Literature	Literature will be presented in the lecture.		
Remarks			

Module Course: Special Topics in Information Technology II (Practical Training)

(of Module: Special Topics in Information Technology II)

Course Type	Practical Training	**Form of Learning**	Presence
Mandatory Attendance	yes	**ECTS Credit Points**	2
Participation Limit		**Semester Hours per Week**	1
Group Size	12	**Workload (hours)**	60
Teaching Language	German/English	**Presence Hours**	15
Study Achievements ("Studienleistung", SL)	Practical Training	**Self-Study Hours**	45
SL Length (minutes)		**SL Grading System**	Pass
The following section is filled only if there is a course-specific exam.			
Exam Type		**Exam Language**	
Exam Length (minutes)		**Exam Grading System**	
Learning Outcomes			
Participation Prerequisites			
The previous section is filled only if there is a course-specific exam.			
Contents	The current content is determined by the lecturer.		
Literature	Literature will be presented in the practical training.		
Remarks			