

# Modulkatalog SoSe 25 und WiSe 25/26

## M.Sc. Wirtschaftsinformatik



**Änderungen vorbehalten**

**Änderungen werden ggf. zunächst nur auf der Fakultätswebsite kommuniziert und nicht  
umgehend in den Katalog eingetragen**

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## Modulzuordnung

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### Methoden

34950	Entscheidung unter Unsicherheit	SoSe
34951	Kombinatorische Optimierung	SoSe
34954	Network Optimization	irregular
34955	Heuristics and Approximation Methods	irregular
35500	Multivariate Verfahren	WiSe
35550	Topics in Applied Econometrics	SoSe
35610	Paneldatenanalyse	SoSe
35621	Computational Statistics – Regression in R	WiSe (+SoSe)
35622	Computational Statistics – Statistical Learning in R	SoSe (+WiSe)
35777	Econometric Methods	WiSe
35780	Advanced Data Analytics	WiSe
37507	Data Analysis in R for Information Systems Research	SoSe
39734	Approximate Dynamic Programming (Reinforcement Learning)	WiSe

### Wirtschaftswissenschaftliche Grundlagen

30000	Steuerplanung und Steuerwirkung	SoSe
30913	Corporate Finance und Kapitalmärkte	SoSe
31360	Wertorientiertes Controlling/Value-based Management	SoSe
31362	Unternehmensbewertung/Corporate Valuation	WiSe
31803	Finanzcontrolling I	SoSe
31814	Finanzcontrolling II	WiSe
32820	Organizations and Innovation Strategy	irregular
32900	Strategy for High-Tech Startups	SoSe
33160	Organizational Behavior – Unternehmensführung und Verhalten in Organisationen	SoSe
33820	Produkt-, Marken- und Kommunikationsmanagement	unregelmäßig
34540	Kundenmanagement	WiSe
34730	Konsumentenverhalten	SoSe

**Wirtschaftsinformatik/ Information Systems**

34953	Artificial Intelligence and Optimization	WiSe
34956	Masterseminar in Business Analytics	SoSe + WiSe
35002	Business Intelligence & Analytics Systems	SoSe
35005	Masterseminar AI-Based Information Systems	SoSe / WiSe
35006	Artificial Intelligence (AI)-Based Business Information Systems	WiSe
35621	Computational Statistics – Regression in R	WiSe (+SoSe)
35622	Computational Statistics – Statistical Learning in R	SoSe (+WiSe)
37500	Strategic IT Management	WiSe
37502	IT Architecture Management	SoSe
37504	IT-Services und IT-Servicemanagement	WiSe (nicht in 25/26)
37506	Master Seminar Business Information Systems	irregular
37507	Data Analysis in R for Information Systems Research	SoSe
37509	Cloud Anwendungsentwicklung und Applikationstest	WiSe
39606	Master Seminar Telecommunications and Internet Business	SoSe + WiSe
39607	Master Colloquium in Internet and Telecommunications Business	SoSe + WiSe
39612	Digital Markets and Online Platforms	WiSe
39614	Governance of Platforms and Ecosystems	unregelmäßig
39724	Masterseminar in Data Science und Optimierung	unregelmäßig
39732	Master-Seminar: Seminar in Management Science	unregelmäßig
39733	Colloquium: Master-Colloquium im Fach Management Science/ Operations and Supply Chain Management	WiSe + SoSe
39734	Approximate Dynamic Programming (Reinforcement Learning)	WiSe
39802	Masterseminar Wirtschaftsinformatik Daten- und Informationsmanagement	WiSe
39803	Strategies in the Software Industry	WiSe
39807	Management of Information Security and Privacy	WiSe
39908	Scientific Computing and Digital Reporting with Python	SoSe
39910	Financial Data Analytics and Machine Learning	SoSe
39915	Deep Learning and Text Analysis in Finance	WiSe
5622V	Software-Sicherheit / System Security	SoSe
5724V	Safety and Security of Critical Infrastructures	unregelmäßig
5771V	Multimedia-Datenbanken	SoSe
5772	Data Modelling and Data Processing in the Internet of Things	SoSe

5777 Technologien zur Wahrung der Privatsphäre in Informationssystemen / Privacy-Preservation Technologies in Information Systems	unregelmäßig
5820 Advanced IT-Security	WiSe
5845 Search-Based Software Engineering	WiSe
5881 Privacy Enhancing Techniques	WiSe
5942 Network Science	unregelmäßig
5945 Advanced Topics in Data Science	irregular
5970V Scaling Database Systems	WiSe
5973 SQL for Data Science	irregular
6061 Introduction to Deep Learning	unregelmäßig
6064 Responsible Machine Learning	SoSe
6090 Security of Computer and Embedded Systems / Sicherheit von Rechnern und eingebetteten Systemen	WiSe
6120 Principles of AI Engineering	unregelmäßig
6123 Deep Learning for Natural Language and Code	unregelmäßig
6206 Data on the Web	unregelmäßig
6210 Semantic Data Integration	unregelmäßig

### Interdisziplinäres Vertiefungsangebot

Zur persönlichen Profilbildung können in diesem Gebiet bei bestehender Fachnähe ergänzende Lehrveranstaltungen aus weiteren Studiengängen gewählt werden. Die unten aufgelisteten Lehrveranstaltungen sind grundsätzlich wählbar und sind zur Anmeldung im Campusportal freigeschaltet. Für weitere Veranstaltungen stellen Sie bitte einen formlosen schriftlichen Antrag an die Vorsitzende oder den Vorsitzenden der Prüfungskommission für den Masterstudiengang Wirtschaftsinformatik.

Beachten Sie dazu die Hinweise unter <https://www.winfo.uni-passau.de/faq-masterstudium>.

5874V IT-Sicherheitsrecht	WiSe
39720 Fundamentals of Business Analytics	WiSe + SoSe

## **Begriffsbestimmungen**

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In den kommenden Bestimmungen werden folgende Abkürzungen verwendet:

<b>FFA</b>	=	<b>Fachspezifische Fremdsprachenausbildung</b>
<b>FFP</b>	=	<b>Fachspezifische Fremdsprachenprüfung</b>
<b>H</b>	=	<b>Stunden</b>
<b>LP</b>	=	<b>Leistungspunkte nach dem European Credit Transfer System</b>
<b>SE</b>	=	<b>Seminar</b>
<b>SWS</b>	=	<b>Semesterwochenstunden</b>
<b>Ü</b>	=	<b>Übung</b>
<b>V</b>	=	<b>Vorlesung</b>
<b>WÜ</b>	=	<b>Wissenschaftliche Übung</b>

## Präambel

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### **Workload-Berechnung:**

Die Zuordnung von Leistungspunkten geht von der Arbeitsbelastung eines oder einer durchschnittlichen Studierenden aus. Ein Leistungspunkt entspricht in diesem Rahmen ca. 30 Arbeitsstunden. Dieser Durchschnitt wird im vorliegenden Studiengang einheitlich für alle Fächer und Lehrveranstaltungstypen angenommen.

Da die hochschulpolitische und die allgemeinpolitische Diskussion um den Bologna-Prozess gezeigt hat, dass die modularisierten Studiengänge im Allgemeinen als verschult und unwissenschaftlich wahrgenommen werden, haben wir uns im Rahmen dieses Modells für eine relativ hohe Bepunktung entschieden, im Vertrauen auf die Fähigkeit unserer Studierenden, die Freiheit zum selbständigen Lernen gut zu nutzen.

Die konzeptionelle Philosophie der Wirtschaftswissenschaftlichen Fakultät der Universität Passau hat zwei Schwerpunkte: Klar und möglichst einfach strukturierte Studiengänge und große Freiheit zur selbständigen Arbeit. Das bedeutet ein einfach nachvollziehbares Punkte-Schema für alle Lehrveranstaltungstypen, je nach deren Semesterwochenstunden und insgesamten Workload (5 ECTS-LP für V+Ü, 7 ECTS-LP für Masterseminare). Die Veranstaltungen an der Wirtschaftswissenschaftlichen Fakultät sind so konzipiert, dass der größere Teil des Workloads auf die Eigenarbeit der Studierenden entfällt. Diese Eigenarbeit ist bei der Vor- und Nachbereitung von Lehrveranstaltungen zu erbringen.

### **Prüfende:**

Die in diesem Modulkatalog genannten Modulverantwortlichen sind auch Prüferinnen und Prüfer der von ihnen verantworteten Module.

### **Anwesenheitspflicht:**

Grundsätzlich besteht keine Anwesenheitspflicht. Bei Seminaren und Workshops gilt dagegen in der Regel regelmäßige Anwesenheitspflicht. Abweichungen entnehmen Sie bitte den Angaben in Stud-IP.

### **Wiederholungsmöglichkeit:**

Prüfungsmodule können gem. der Prüfungs- und Studienordnung des Masterstudiengangs Wirtschaftsinformatik wiederholt werden.

### **Seminare:**

Grundsätzlich bieten Lehrstühle regelmäßig Seminare an. Allerdings gibt es auch Ausnahmen. Bitte beachten Sie dazu die Seminar-Ankündigungen auf den Webseiten der Lehrstühle.

## Module

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**3000 Steuerplanung und Steuerwirkung / Tax effects**

<b>Module number</b>
30000
<b>Course name</b>
Tax effects
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Markus Diller

Examination number	Credit points (ECTS)	Hours per week (SWS)
262600	5	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hours of attendance and 45 hours of individual work) Exercise 2 SWS (30 hours of attendance and 45 hours of individual work).
15 semester weeks are counted (14 lecture weeks + 1 examination week) and each SWS is counted at 60 minutes.
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>LPO I applicability</b>
<b>Recommended prerequisites</b>
Bachelor's degree in economics or business-related studies. Basic tax knowledge in the area of income taxes (EStG, KStG) is recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The module deals with the impact of taxes on business decisions. In particular, the module discusses the impact of taxation on after-tax net present value in different scenarios and, based on this, investment-neutral tax systems (cash flow tax, economic profit) and their interrelationship with forward-looking effective tax rates.
<b>Intended learning outcomes (ILOs)</b>
After successfully completing the module:

- Students explain multi-period tax effects using the after-tax NPV and quantify complex, investment-theoretic tax effects.

<ul style="list-style-type: none"><li>• understand the concept of tax neutrality and its relationship to forward-looking effective tax rates.</li><li>• </li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Lecture with seminar character and interactive elements such as discussions and group work</li><li>• Working on exercises and suitable case studies.</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam 60 min, 100%
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
In the event of failure, all courses may be repeated in accordance with § 6 of the Study and Examination Regulations.
<b>Recommended reading</b>
The recommended literature will be announced by the respective lecturer in the course.
<b>Additional notes</b>

### 30913 Corporate Finance und Kapitalmärkte

<b>Module number</b>
30913
<b>Course name</b>
Corporate Finance und Kapitalmärkte / Corporate Finance and Capital Markets
<b>Module coordinator</b>
Prof. Dr. Oliver Entrop

Examination number	Credit points (ECTS)	Hours per week (SWS)
262230	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	1-3

<b>Workload</b>
Lecture 2 SWS (30 h presence and 45 h individual working hours) Exercise session (30 h presence and 45 h individual working hours)
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Introductory module in Finance
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>• Advanced methods of company valuation (APV, entity, equity approach, autonomous vs. value-based financing, annuity vs. two-phase model, equity costs and beta leverage, capital structure, taxes, multiplier method)</li> <li>• Determinants of stock price performance (basic performance measures, multifactor models, size and value factors, advanced factors such as liquidity)</li> <li>• Risk-oriented corporate management concepts (RORAC, RAROC, optimal capital allocation for different target values)</li> <li>• Optimal risk policy and hedging (basics, foreign currency risks, hedging of currency risks, risk policy for perfect and unperfect markets, risk policy and optimal capital structure, empirical evidence: company value and risk policy for currency risks)</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<p>Students who have successfully completed the module,</p> <ul style="list-style-type: none"> <li>• identify and interpret in-depth methods of company valuation and characterize the possibilities and limitations of different methods. They apply these methods to specific problems.</li> </ul>

<ul style="list-style-type: none"><li>• identify and interpret the influence of various value determinants on the share price performance of companies and apply methods of external performance measurement.</li><li>• identify and interpret capital market-oriented methods for internal corporate management and capital allocation and characterize the possibilities and limitations of the methods.</li><li>• identify and interpret the theoretical foundations of optimal corporate risk policy and implement specific risk reduction decisions using the appropriate financial instruments.</li></ul>
<b>Teaching methods</b>
Interactive lecture
Excercises
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam 60 minutes (100%)
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
According to the examination and study regulations for the Master's degree program.
<b>Recommended reading</b>
Given in class
<b>Additional notes</b>

### 31360 Wertorientiertes Controlling / Value-based Management

<b>Module number</b>
31360
<b>Course name</b>
Value-based Management
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Robert Obermaier

Examination number	Credit points (ECTS)	Hours per week (SWS)
262670	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
Lecture: 2 SWS (30 hours attendance time; 45 hours individual work time) Tutorial: 2 SWS (30 hours attendance time; 45 hours individual work time)
We calculate with 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>LPO I applicability</b>
<b>Recommended prerequisites</b>
Basic knowledge of controlling, reporting, financing and investment accounting.
<b>Requirements</b>
<b>Language of instruction</b>
English or German

<b>Content</b>
Value-based management is a fundamental and widely adopted management accounting practice, guiding organizations toward long-term maximization of shareholder value. The course covers key concepts and frameworks of shareholder value and value-based management to support value-based decision-making in organizations. Topics include economic profit and residual income as foundations for value-based performance measurement, regulatory requirements in the context of corporate governance, and value-based compensation systems for aligning management incentives. Beyond economic considerations, social and environmental aspects of management decision-making are discussed.
<b>Intended learning outcomes (ILOs)</b>
Students who have taken part in the module Value-based Management, <ul style="list-style-type: none"> <li>• analyze and critically evaluate corporate objectives from an economic perspective, considering both theoretical frameworks and practical implications within the context of corporate governance;</li> </ul>

- demonstrate a profound understanding of the design, implementation and inherent complexities of value-based controlling systems aligned with shareholder value principles, while critically assessing their limitations and potential trade-offs;
- evaluate the complexities of performance measurement systems that align with shareholder value principles, addressing methodological challenges and their impact on managerial decision-making;
- critically assess and develop recommendations for incentive-compatible management compensation schemes, considering their strategic alignment, incentive structure and implications for management retention and shareholder cost.

**Teaching methods**

- Interactive lecture
- Exercises and case studies

**Required attendance**

**Examination (type of examination, scope)**

- a) Written exam, 60 minutes, or
- b) Written exam, 60 minutes + optional semester-long performance (subject to change)

**Overall grade relevance**

**Exam resit opportunities**

In the event of failure (grade worse than 4.0), all courses can be repeated in accordance with § 9 of AStuPO.

**Recommended reading**

**Additional notes**

International students are welcome!

The exam can be written in English or German.

The language of lectures and tutorials will be determined in the first lecture.

## 31362 Unternehmensbewertung

<b>Module number</b>
31362
<b>Course name</b>
Corporate Valuation
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Robert Obermaier

Examination number	Credit points (ECTS)	Hours per week (SWS)
262710	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture: 2 SWS (30h present time, 45h own working time) Exercise: 2 SWS (30h present time, 45h own working time)
The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is counted as 60 minutes.
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>LPO I applicability</b>
<b>Recommended prerequisites</b>
Basic knowledge of accounting and capital budgeting is recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English or German

<b>Content</b>
The lecture "Corporate Valuation" deals with one of the most interesting and complex areas of business administration. After a systematization of the reasons and purposes for the valuation of entire companies or parts of companies, an overview of the theoretical foundations and relevant components of corporate valuation is provided. The lecture focuses on the theoretically and methodically sound application of Discounted Cash-Flow (DCF) approaches and the corresponding determination of adequate cost of capital rates. Finally, advanced research topics in the field of corporate valuation and practitioner standards (IDW S1) are discussed.
<b>Intended learning outcomes (ILOs)</b>
After successful participation in the course "Corporate Valuation", students <ul style="list-style-type: none"> <li>• know the different occasions and purposes for which companies or parts of companies are valued.</li> <li>• understand the theoretical underpinnings and the formal relationships between the Discounted Cash-Flow (DCF) approaches.</li> </ul>

- apply their conceptual and methodological knowledge to determine appropriate valuation-relevant cash-flows and cost of capital rates.
- combine their theoretical, conceptual, and methodical knowledge by applying different DCF approaches in a reflective and suitable manner.
- analyze, critically evaluate, and prepare company valuations, whether as controllers, auditors or investment bankers.
- transfer their knowledge of valuation theory to the areas of investment controlling, mergers & acquisitions, and value-based management of companies and business units.

**Teaching methods**

Interactive lecture

Completion of exercises and case studies

**Required attendance**

**Examination (type of examination, scope)**

- a) Written exam 100% or
- b) Written exam 90% + 10% through optional semester-accompanying performance (subject to reservation; if the number of participants is suitable, the chair can offer a voluntary semester-accompanying assignment, through which up to 6 bonus points (10% of the final exam) can be acquired. These are added to the points achieved in the final exam).

**Overall grade relevance**

**Exam resit opportunities**

In the event of failure (grade worse than 4.0), all courses can be repeated in accordance with § 9 of AStuPO.

**Recommended reading**

**Additional notes**

International students are welcome!

The exam can be written in English or German.

The language of lectures and tutorials will be determined in the first lecture.

Guest lectures by practitioners are planned.

The chair reserves the right to offer a voluntary graded assignment during the semester.

### 31803 Finanzcontrolling I

<b>Modulnummer</b>
31803
<b>Veranstaltungstitel</b>
Finanzcontrolling I
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Niklas Wagner

Prüfungsnummer	ECTS	SWS
200414	5	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Jedes Sommersemester, Fortführung in Finanzcontrolling II	1 Semester	

<b>Workload</b>
Zusammensetzung / Aufteilung des Workload: Veranstaltungen Vorlesung 2 SWS, Übungen 1 SWS = Summe 3 SWS, 5 ECTS
Aufteilung des Workload (zu berechnen in Stunden à 60 Minuten auf 15 Semesterwochen, d.h. 14 Vorlesungs- + 1 Prüfungswoche)
Präsenzzeit: Vorlesung 30, Übung 15, Eigenarbeitszeit: Vorlesung 70, Übung 35
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Verwendbarkeit</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsinformatik. Inhalte des Moduls Corporate Finance sowie solide Grundkenntnisse in Statistik und Wahrscheinlichkeitstheorie werden empfohlen.
<b>Verpflichtende Voraussetzungen</b>
Bachelor-Abschluss in einem wirtschaftswissenschaftlichen oder den Wirtschaftswissenschaften nahen Studiengang
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
Die aus dem Grundmodul Corporate Finance bekannten Konzepte Kapitalstruktur, Barwert und Risiko-Return Profil werden in stochastische Kapitalmarktmodelle eingebettet, um auf dieser Basis die fortgeschrittenen Konzepte des Risikomanagements wie Hedging, Einsatz von Derivaten und Value at Risk in ihrer Funktionsweise zu erschließen. Dabei werden anhand folgender spezieller

Inhalte Charakteristika einzelner Instrumente sowie die Dynamik der Ausdifferenzierung der Instrumentenvielfalt dargelegt: <ul style="list-style-type: none"><li>• Anleihebewertung und Asset-Liability Management mittels Duration und Konvexität</li><li>• Begriffe der Finanzmarktstochastik: Arbitrage, Hedging-Strategien, stochastische Prozesse, Risikoneutrale Bewertung</li><li>• Bewertung von Derivaten im Black-Scholes-Merton Modell</li><li>• Risikomanagement auf der Basis von Value at Risk</li><li>• Prinzipien der Bonitätsbeurteilung und Kreditrisikomessung</li><li>• Analyse von Rating-Methoden</li></ul>
<b>Lernergebnisse Lernziele</b>
Studierende, die erfolgreich an dem Modell „Finanzcontrolling I“ teilgenommen haben,
<ul style="list-style-type: none"><li>• wissen, dass die fundierte Risiko-Return Analyse im Zentrum vieler praktischer Entscheidungen steht.</li><li>• kennen die zwingende sachliche Kontinuität zwischen den traditionellen Konzepten der Finanzierung und deren moderner Ausdifferenzierung.</li><li>• erlernen die Ambivalenz von Arbitrage- und Hedgingstrategien, die in die Struktur des Risiko-Return trade-offs eingelassen ist und können deren Zielsetzung beurteilen.</li><li>• verstehen, dass das Bewertungsproblem für Derivate sich auch unabhängig von der Entwicklung innovativer Kapitalmarktprodukte stellt, da viele Aspekte der Finanzierungsentscheidung synthetisch durch Auszahlungsprofile von Derivaten replizierbar sind.</li><li>• erläutern in fundierter Weise, wie die Komplexität von Instrumenten mit Bewertungsaufwand, Bewertungsunsicherheit und Marktdatenbedarf zusammenhängt.</li><li>• bearbeiten selbstständig Problemstellungen im Bereich des Finanzcontrollings, insbesondere im Rahmen einer Master-Arbeit.</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht, Bearbeitung von Übungsaufgaben, Lösung und Präsentation von Übungsaufgaben
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Endklausur 60 Minuten, Endklausur: 100%
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<b>Weitere Hinweise</b>
Das Modul wird durch Finanzcontrolling II fortgesetzt. Dieses Modul kann von Studierenden in den Methoden bzw. den Grundlagen oder in der Vertiefung Accounting, Finance and Taxation eingebracht werden.

## 31814 Finanzcontrolling II

<b>Modulnummer</b>
31814
<b>Veranstaltungstitel</b>
Finanzcontrolling II
<b>Modulverantwortliche*r / Prüfer*innen</b>
PD Dr. Harald Kinateder, Prof. Dr. Niklas Wagner

Prüfungsnummer	ECTS	SWS
262140	5	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Jedes Wintersemester	1 Semester	

<b>Workload</b>
Aufteilung des Workload (zu berechnen in Stunden à 60 Minuten auf 15 Semesterwochen, d.h. 14 Vorlesungs- + 1 Prüfungswoche) Vorlesung 2 SWS (30 Std. Präsenzzeit und 70 Std. Eigenarbeitszeit) Übung 1 SWS (15 Std. Präsenzzeit und 35 Std. Eigenarbeitszeit)
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Verwendbarkeit</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsinformatik. Solide Grundkenntnisse in Statistik und Wahrscheinlichkeitstheorie werden empfohlen.
<b>Verpflichtende Voraussetzungen</b>
Bachelor-Abschluss in einem wirtschaftswissenschaftlichen oder den Wirtschaftswissenschaften nahen Studiengang
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
Zielsetzung des Moduls „Finanzcontrolling II“ ist den Studierenden mit den Methoden des Managements von finanziellen Risiken vertraut zu machen.
Insbesondere werden die neusten Modelle im Bereich des Marktrisiko und -liquiditätsmanagements sowie der Adressierung von systemischen Risiken behandelt. Der Schwerpunkt der Veranstaltung liegt dabei auf der Anwendung der entsprechenden Methoden sowie den zugrundeliegenden statistischen und ökonometrischen Modellen. Zu den behandelten Themen gehören unter anderem:
<ul style="list-style-type: none"> <li>• Ermittlung des regulatorisches Kapital gemäß des Basel Akkords</li> <li>• Fundamentale Eigenschaften von Risikomaßen: Kohärenz und Elicitability</li> <li>• Value-at-Risk</li> </ul>

<ul style="list-style-type: none"><li>• Expected Shortfall</li><li>• Marktliquiditätsmessung mittels quantitativer Ansätze</li><li>• Prognose finanzieller Risiken</li><li>• Entscheidungstheorie unter Unsicherheit</li><li>• Grundlagen der Portfoliooptimierung</li></ul>
<b>Lernergebnisse Lernziele</b>
Studierende, die erfolgreich an dem Modul „Finanzcontrolling II“ teilgenommen haben,
<ul style="list-style-type: none"><li>• kennen die verschiedenen Arten von finanziellen Risiken.</li><li>• wissen welche Eigenschaften quantitative Risikomaße haben müssen, damit sie für das Risikomanagement geeignet sind.</li><li>• erlernen die gängigen Methoden des Managements finanzieller Risiken.</li><li>• wenden quantitative Risikomaße an, um Prognosen des zukünftigen Marktrisikos zu erhalten.</li><li>• erläutern wie finanzielle Entscheidungen unter Berücksichtigung von Untersicherheit getroffen werden.</li><li>• bearbeiten selbstständig Problemstellungen im Bereich des Finanzcontrollings, insbesondere im Rahmen einer Master-Arbeit.</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht. Bearbeitung von Übungsaufgaben. Lösung und Präsentation von Übungsaufgaben.
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Endklausur 60 Minuten Endklausur: 100%
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<b>Weitere Hinweise</b>
Implementierung der theoretischen Modelle anhand von Fallbeispielen mit realen Daten. Kann unabhängig von Finanzcontrolling I gehört werden.

## 32820 Organizations and Innovation Strategy

<b>Module number</b>
32820
<b>Course name</b>
Organizations and Innovation Strategy
<b>Module coordinator</b>
Prof. Dr. Carolin Häussler, Dr. Patrick Figge

Examination number	Credit points (ECTS)	Hours per week (SWS)
264190	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
Lecture: 2 SWS (30 hrs. class instruction, 65 hrs. self-study) Exercise Class: 2 SWS (15 hrs. class instruction, 40 hrs. self-study)
Calculation is based on: every hr. per semester week corresponds to 60 minutes. One semester presumably consists of 15 weeks, i.e., 14 course and 1 exam week
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
This course focuses on the organizational and strategic challenges companies face in order to obtain a sustainable competitive advantage. It engages in an application-oriented analysis of intercompany interaction along the value chain. The course discusses how companies organize to innovate and decide for strategic moves in order to attain competitive advantage. Amongst others, topics covered by this course will be pricing decisions, market entry decisions, intellectual property protection, network effects, and vertical relations within the value chain.
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully participated in the module "Organizations and Innovation Strategy", <ul style="list-style-type: none"> <li>• explain key theoretical concepts of management, competition and strategy science.</li> <li>• combine and compare knowledge of theoretical concepts with the understanding of emerging trends. In so doing, students discuss resulting consequences for strategic</li> </ul>

decision-making in organizations, e.g., the strategic implications of network effects on the management of platform ecosystems.
<ul style="list-style-type: none"><li>• perform analyses to quantify abstract decision-making scenarios through game theoretic and economic models (e.g., simultaneous and sequential decision-making games).</li><li>• assess corporate strategies through analyzing competitive environments surrounding organizations.</li><li>• develop adequate recommendations for organizations.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive lecture</li><li>• Discussion of contents</li><li>• Discussion of questions and case studies linked to the organizational and innovation strategy of companies</li><li>• Interactive surveys and classroom experiments</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Written exam at the end of the course (60 Minutes)
<b>Overall grade relevance</b>
Exam (100%)
<b>Exam resit opportunities</b>
Gem. der Prüfungs- und Studienordnung für den Masterstudiengang
<b>Recommended reading</b>
<b>Additional notes</b>
<ul style="list-style-type: none"><li>• This lecture replaces the lecture "Organizational and Competitive Strategy" (you cannot include both courses in your degree program)</li><li>• Guest lectures, integration of videos, case studies</li><li>• A weekly exercise class (#32825) will supplement the lecture by repeating and intensifying core concepts.</li><li>• The module is applicable to the Certificate Program in Digital Technology and Entrepreneurship: Entrepreneurial Pathfinder.</li></ul>

### **32900 Strategy for High-Tech Startups**

<b>Module number</b>
32900
<b>Course name</b>
Strategy for High-Tech Startups
<b>Module coordinator</b>
Prof. Dr. Carolin Häussler, Dr. Patrick Figge

<b>Examination number</b>	<b>Credit points (ECTS)</b>	<b>Hours per week (SWS)</b>
264509	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
Lecture: 2 SWS (30 hrs. class instruction, 65 hrs. self-study) Exercise Class: 2 SWS (15 hrs. class instruction, 40 hrs. self-study)
Calculation based on: every hr. per semester week corresponds to 60 minutes. One semester presumably consists of 15 weeks, i.e., 14 course and 1 exam week.
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
In accordance with § 3 of the study and examination regulation for the master degree program Business Administration.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
Founding one's own company requires not only a promising business idea but also a successful management of upcoming strategic and organizational challenges. Successfully performing these management tasks is a substantial part of being a successful entrepreneur.
This course focuses on these management tasks concerning the founding of a company, especially with regard to high-technology startups. Inspired by the real founding process, the course starts with an introduction to venture opportunities, concepts, and strategies. Following this introduction, concepts on venture formation, organizational planning, as well as technology development strategy are discussed in the context of high-technology start-ups. The course closes with answers to the question how to finance and how to build the venture.

<b>Intended learning outcomes (ILOs)</b>
Students who have successfully participated in the module "Strategy for High-Tech Startups", <ul style="list-style-type: none"><li>• explain and apply the key concepts and theories in entrepreneurship.</li><li>• outline core findings of most influential and recent scientific studies in the field of entrepreneurship.</li><li>• transfer knowledge of entrepreneurship theories into in-class discussions so that they can interpret recent developments in entrepreneurship with a particular focus on the influences of digitalization, new technologies, and strategic implications for high-tech startups.</li><li>• analyze different entrepreneurial strategies and assess their implications, e.g., for the economy.</li><li>• develop adequate suggestions for entrepreneurial high-tech organizations.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive lecture</li><li>• Discussion of Contents</li><li>• Discussion of case studies</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Written exam at the end of the course (60 Minutes)
<b>Overall grade relevance</b>
Exam (100%)
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<ul style="list-style-type: none"><li>• Byers, T.H./Dorf, R. /Nelson, A.J. (2010): Technology Ventures – From Idea to Enterprise, McGraw-Hill.</li><li>• Selection of essays, articles, and case-studies</li></ul>
<b>Additional notes</b>
<ul style="list-style-type: none"><li>• Guest lectures, integration of videos, case studies.</li><li>• A weekly exercise class (#32905) will supplement the lecture by repeating and intensifying core concepts.</li><li>• The module is applicable to the Certificate Program in Digital Technology and Entrepreneurship: Entrepreneurial Pathfinder.</li></ul>

**33160 Organizational Behavior – Unternehmensführung und Verhalten in Organisationen**

<b>Modulnummer</b>
33160
<b>Veranstaltungstitel</b>
Organizational Behavior – Unternehmensführung und Verhalten in Organisationen
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Marina Fiedler

Prüfungsnummer	ECTS	SWS
264170	5	2 (+2 für Übung)
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
jedes Sommersemester	1 Semester	1.-4. Semester

<b>Workload</b>
Aufteilung des Workload (zu berechnen in Stunden à 60 Minuten auf 15 Semesterwochen, d.h. 14 Vorlesungs- + 1 Prüfungswoche)
<b>Verwendbarkeit</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsinformatik. Bachelor-Abschluss in einem wirtschaftswissenschaftlichen oder einem den Wirtschaftswissenschaften nahen Studiengang.
<b>Verpflichtende Voraussetzungen</b>
Keine
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
Zahlreiche Untersuchungen zeigen, dass das Verhalten von Mitarbeitenden Einfluss auf so zentrale unternehmerische Kenngrößen wie Mitarbeitenden-Fluktuation, Gewinn und Umsatz hat und so nachhaltige Wettbewerbsvorteile für das Unternehmen schaffen kann.
Ziel der Veranstaltung ist die Hervorhebung der Bedeutung und Wichtigkeit von Unternehmensführung und Verhalten in Organisationen mit besonderem Bezug auf Wandel in Organisationen.
Hierzu werden im Wesentlichen folgende Aspekte behandelt:
<ul style="list-style-type: none"> <li>• Führungsstile</li> <li>• Kommunikation und Feedback</li> <li>• Verhandlungsmanagement</li> <li>• Konfliktmanagement</li> <li>• Teamwork und Diversität</li> </ul>
Nähere Informationen zum Modul finden sich jeweils zum Start der Veranstaltung in Stud.IP.

<b>Lernergebnisse Lernziele</b>
Nach erfolgreicher Teilnahme am Modul sind die Studierenden in der Lage: <ul style="list-style-type: none"><li>• Einflussfaktoren für das Verhalten von Führungskräften zu bestimmen</li><li>• Zusammenhänge und Wichtigkeit von Führungsverhalten in Organisationen zu verstehen</li><li>• Dynamiken des Verhaltens in Organisationen anhand aktueller Trends zu beurteilen</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht Gastvorträge von Expertinnen und Experten aus der Praxis Erarbeitung von eigenen Tools zu den verschiedenen Themenbereichen
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Bei dieser Veranstaltung handelt es sich um eine Portfolio-Veranstaltung. Die Gesamtnote setzt sich aus zwei Teilleistungen zusammen: Teilleistung 1: Erstellung einer Gruppenarbeit, 25 Punkte Teilleistung 2: 60-minütige schriftliche Klausur, 60 Punkte Gesamtnote: Insgesamt (Teilleistung und Klausur) sind maximal 85 Punkte zu erreichen, woraus sich die Gesamtnote berechnet. Beachten Sie hierfür bitte die aktuellen Hinweise in der Veranstaltung sowie in Stud.IP.
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<b>Weitere Hinweise</b>
<b>Starke Unternehmensführungskompetenzen und ein fundiertes Verständnis für organisationales Verhalten sind entscheidend für den beruflichen Erfolg – sowohl in Führungspositionen als auch in der Teamarbeit.</b> Diese Vorlesung verfolgt einen wissenschaftsorientierten Ansatz, um die <b>Bedeutung und Implikationen von Unternehmensführung und Verhalten in Organisationen</b> insbesondere vor dem Hintergrund der <b>digitalen Transformation</b> zu analysieren.
Die Veranstaltung vermittelt <b>fachliche Kompetenzen</b> im Bereich <b>organisationales Verhalten und Unternehmensführung</b> . Dazu gehören <b>Modelle der Führungsstilforschung, Kommunikationsmodelle und -theorien, Feedbackmechanismen, Verhandlungsmanagement sowie Konfliktlösungstechniken</b> . Studierende erarbeiten sich ein fundiertes Verständnis dieser Konzepte und lernen, sie <b>evidenzbasiert auf reale Unternehmenssituationen anzuwenden</b> .
Neben dem Erwerb fachlicher Grundlagen stehen <b>methodische Kompetenzen</b> im Fokus. Dazu zählen <b>kritische Reflexion, analytische Problemlösung und datenbasierte Entscheidungsfindung</b> , die dazu beitragen, Managementherausforderungen systematisch zu bewerten und fundierte Strategien zu entwickeln. Zudem wird die <b>Fähigkeit zur wissenschaftlichen Analyse und zur Anwendung empirischer Forschungsergebnisse auf praxisrelevante Fragestellungen</b> gefördert.
Durch <b>interaktive Vorlesungen und eine Übung</b> wird nicht nur ein umfassendes Verständnis für Unternehmensführung und organisationales Verhalten geschaffen, sondern auch die Entwicklung <b>sozialer Kompetenzen</b> unterstützt. Studierende verbessern gezielt ihre <b>Kommunikationsfähigkeit, Teamarbeit und interkulturelle Sensibilität</b> , indem sie Theorien und Methoden in Gruppen diskutieren und auf praktische Fallbeispiele anwenden.

Im Rahmen des Gruppenprojekts wird zudem **generative KI gezielt eingesetzt** – sei es zur **Unterstützung von Kommunikationsstrategien, zur Optimierung von Verhandlungsprozessen oder zur Analyse von Konfliktlösungen**. Gleichzeitig erfolgt eine **kritische Reflexion der Grenzen und Potenziale von KI** in diesen Bereichen. Dies stärkt nicht nur die **digitale Kompetenz**, sondern auch die **Innovationsfähigkeit und den verantwortungsbewussten Umgang mit KI-gestützten Technologien**.

Besonderer Wert wird auf **kritische Reflexion und Selbstständigkeit** gelegt. Die Studierenden werden dazu ermutigt, **eigenständig fundierte Entscheidungen zu treffen, Unsicherheiten in der Führungspraxis zu bewältigen und sich mit ethischen Fragestellungen auseinanderzusetzen**.

Die Gesamtnote setzt sich aus einer **Gruppenleistung (30 %)** und einer **schriftlichen Klausur (70 %)** zusammen. Die Klausur kann auf **Deutsch oder Englisch** geschrieben werden.

**Internationale Studierende sind willkommen!** Die Vorlesung wird auf **Deutsch** gehalten, jedoch stehen **KI-generierte englische Audioübersetzungen** zur Verfügung. Beiträge in **deutscher und englischer Sprache** sind ausdrücklich erwünscht. Bitte beachten Sie die aktuellen Hinweise in der Veranstaltung sowie in Stud.IP.

## 33820 Produkt-, Marken und Kommunikationsmanagement

<b>Modulnummer</b>
33820
<b>Veranstaltungstitel</b>
Produkt-, Marken und Kommunikationsmanagement
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Dirk Totzek

Prüfungsnummer	ECTS	SWS
264950	5	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Dreisemesterturnus	1 Semester	

<b>Workload</b>
Vorlesung 2 SWS (30 Std. Präsenz- und 120 Std. Eigenarbeitszeit)
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- und 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Verwendbarkeit</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Grundlegende Kenntnisse in Marketing und Modulen des Gebiets Methoden (z.B. „Multivariate Verfahren“) werden empfohlen.
<b>Verpflichtende Voraussetzungen</b>
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalte</b>
<ul style="list-style-type: none"> <li>• Präferenztheoretische Grundlagen des Konsumentenverhaltens</li> <li>• Zentrale Entscheidungsfelder der Ausgestaltung und Führung von Produktprogrammen</li> <li>• Zentrale Entscheidungsfelder der Gestaltung und Führung von Marken</li> <li>• Zentrale Entscheidungsfelder und Instrumente des Kommunikationsmanagements</li> <li>• Instrumente zur Budgetierung von Kommunikationsausgaben</li> <li>• Modellierung und Messung der Kommunikationswirkung</li> </ul>
<b>Lernergebnisse Lernziele</b>
<p>Studierende, die am Modul „Produkt-, Marken und Kommunikationsmanagement“ teilgenommen haben,</p> <ul style="list-style-type: none"> <li>• erläutern zentrale Konzepte und Methoden zur Führung von Produktprogrammen und Marken.</li> <li>• wenden Methoden zur Bewertung und Steuerung von Marken an.</li> <li>• führen Messungen zur Wirkung von Kommunikationsmaßnahmen durch.</li> <li>• entwickeln optimale Verteilungen von Kommunikationsbudgets.</li> </ul>

<ul style="list-style-type: none"><li>• beurteilen zentrale Vor- und Nachteile unterschiedlicher Kommunikationsinstrumente.</li><li>• entwickeln ein integriertes und kritisches Verständnis von Markenführung und effektiver Marketingkommunikation vor dem Hintergrund des aktuellen Forschungsstands.</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht ergänzt durch Praxisvorträge
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang)</b>
Schriftliche Klausur (Dauer 60 Minuten) Gewichtung: 100%
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
jeweils im folgenden Semester; Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
Basisliteratur: Homburg, Ch. (2020), Marketingmanagement, 7. Aufl., Wiesbaden Spezielle Literatur zu den einzelnen Kapiteln wird in der Vorlesung bekannt gegeben. Ausgewählte Artikel als Pflichtlektüre.
<b>Weitere Hinweise</b>

**34540 Kundemanagement / Customer Relationship Management**

<b>Module number</b>
34540
<b>Course name</b>
Kundenmanagement / Customer Relationship Management
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Jan Hendrik Schumann

Examination number	Credit points (ECTS)	Hours per week (SWS)
264940	5	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hours attendance time and 120 hours individual work time)
<b>Module applicability</b>
Wirtschaftswissenschaftliche Grundlagen
<b>LPO I applicability (only for Teacher Education Programmes)</b>
<b>Recommended prerequisites</b>
Bachelor's degree in an economics or business-related degree program. Basic knowledge of marketing is advantageous.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The lecture covers the basics of (data-based) customer management. As part of the lecture, students learn about typical customer management problems and how to solve them. Basic methods and concepts (e.g. customer acquisition, cross-selling, customer loyalty, complaint management and churn) and their implementation in practice are discussed.
<b>Intended learning outcomes (ILOs)</b>
Students who have participated in the course "Customer Relationship Management" ...

- ... understand the CRM approach and concepts of value-oriented customer management.
- ... internalize the difference between past-based customer evaluation and forecasted customer evaluation as well as their respective strengths and weaknesses.
- ... know important customer management strategies and key figures.
- ... understand the specific challenges that the introduction of value-oriented customer management and know suitable approaches to meet them.

- ... take a critical look at typical customer management scenarios.
- ... derive suitable customer management strategies based on the key variables of customer lifetime value and customer equity.
<b>Teaching methods</b>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Written exam at the end of the semester (duration: 60 minutes) Weighting of the individual performances in the module grade: Final exam 100%
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<b>Additional notes</b>

**34730 Konsumentenverhalten**

<b>Modulnummer</b>
34730
<b>Veranstaltungstitel</b>
Konsumentenverhalten
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Jan Schumann

Prüfungsnummer	ECTS	SWS
264840	5	2
Modulangebot	Zeitdauer des Moduls	Empfohlenes Studiensemester
Jedes Sommersemester	1 Semester	

<b>Workload</b>
Vorlesung = 2 SWS (30 Std. Präsenzzeit + 120 Std. Eigenarbeitszeit)
<b>Verwendbarkeit</b>
Wirtschaftswissenschaftliche Grundlagen
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnung für den Masterstudiengang Business Administration. Grundkenntnisse in "Marketing" werden empfohlen.
<b>Verpflichtende Voraussetzungen</b>
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalte</b>
Das Modul gibt einen Überblick über konsumrelevante Wahrnehmungs-, Bewertungs- und Entscheidungsprozesse im Rahmen der individuellen Informationsverarbeitung. Hierbei werden aktuelle Erkenntnisse aus der Motivations-, Emotions-, Wahrnehmungs- und Sozialpsychologie berücksichtigt und aus einer problem- und managementorientierten Perspektive dargestellt. Zahlreiche Beispiele illustrieren, wie diese grundlegenden theoretischen Prinzipien in der Unternehmenspraxis zur Anwendung kommen können.
<b>Lernergebnisse Lernziele</b>
Studierende, die an dem Modul „Konsumentenverhalten“ teilgenommen haben, ...
<ul style="list-style-type: none"> <li>- ... verinnerlichen wesentliche Aussagen der zentralen verhaltenswissenschaftlichen Theorien.</li> <li>- ... wenden verhaltenswissenschaftliche Theorien auf Erkenntnisse und praktische Problemstellungen des Marketings an.</li> <li>- ... sind vertraut mit der optimalen Gestaltung der Instrumente des Marketing-Mix im Hinblick auf den Konsumenten.</li> </ul>

- ... beurteilen Anwendungsfälle im Kaufverhalten und in der Unternehmenspraxis im Rahmen des Konsumentenverhalten.
- ... bewerten Erkenntnisse aus der Motivations-, Emotions-, Wahrnehmungs- und Sozialpsychologie im Marketingkontext.
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang)</b>
Schriftliche Klausur am Ende des Semesters, 60 min., 100 %
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<ul style="list-style-type: none"><li>• Koeber-Riel, W. Weinberg, P. / Gröppel-Klein, A. (2008): Konsumentenverhalten (9. Aufl.), München: Vahlen.</li><li>• Homburg, Christian (2017). Marketingmanagement. Strategie, Instrumente, Umsetzung, Unternehmensführung. Wiesbaden, Springer-Gabler.</li><li>• Hoyer, W.D./MacInnis, D.J. (2009): Consumer Behavior, International Edition (5 th ed.), Cengage Learning Services.</li><li>• Trommsdorff, H. (2004): Konsumentenverhalten (6. Aufl.), Stuttgart.</li></ul>
<b>Weitere Hinweise</b>
Die Lehrveranstaltung soll durch Gastvorträge ergänzt werden.

### 34950 Decision Making Under Uncertainty

<b>Module number</b>
34950
<b>Course name</b>
Entscheidung unter Unsicherheit
<b>Module coordinator</b>
Prof Dr Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
271034	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	any

<b>Workload</b>
Lecture classes 2 SWS (30h presence, 45h unsupervised work) Tutorial classes 2 SWS (30h presence, 45h unsupervised work)
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Mathematical maturity and previous work with optimization problems
<b>Requirements</b>
Module "Fundamentals of Management Science"
<b>Language of instruction</b>
English

<b>Content</b>
We study decision-making problems under uncertainty using optimization tools, including
<ul style="list-style-type: none"> <li>- robust optimization, in particular</li> <li>- min-max, min-max regret, and ordered weighted averaging</li> <li>- one- and two-stage problems</li> <li>- different types of uncertainty sets (discrete, polyhedral, budgeted, ellipsoidal)</li> <li>- complexity, approximation and solution methods</li> <li>- the application to combinatorial problems</li> <li>- stochastic optimization</li> <li>- other approaches, such as fuzzy sets</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
Upon completion of the module, students are able to
<ul style="list-style-type: none"> <li>- recognize and model uncertain data, taking into account resulting complexity consequences</li> <li>- apply suitable techniques to model and solve uncertainty in decision-making</li> <li>- differentiate between hard and easy uncertain problems</li> </ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"> <li>- lecture with seminar character</li> </ul>

<ul style="list-style-type: none"><li>- interactive lectures</li><li>- group work in tutorial classes</li><li>- online forums and discussions</li><li>- take-home mock exam and its discussion</li><li>- blended learning</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Oral exam (Duration 45 minutes), OR written exam (90 minutes) The type of exam will be communicated within the first two weeks of teaching.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<b>Additional notes</b>

### 34951 Combinatorial Optimization

<b>Module number</b>
34951
<b>Course name</b>
Kombinatorische Optimierung
<b>Module coordinator</b>
Prof Dr Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
271036	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	any

<b>Workload</b>
Lecture classes 2 SWS (30h presence, 45h unsupervised work) Tutorial classes 2 SWS (30h presence, 45h unsupervised work)
<b>Module applicability</b>
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Mathematical maturity and previous work with optimization problems
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
We study fundamentals of combinatorial decision making problems. These include
<ul style="list-style-type: none"> <li>- graph theory</li> <li>- complexity classes</li> <li>- approximation methods</li> <li>- spanning tree problems</li> <li>- path problems</li> <li>- matching problems</li> <li>- knapsack problems</li> <li>- traveling salesperson problems</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
Upon completion of the module, students are able to
<ul style="list-style-type: none"> <li>- identify fundamental problems of combinatorial optimization, also in the context of more complex decision-making situations</li> <li>- choose appropriate heuristic and exact solution methods and apply them to solve such problems</li> <li>- classify problems by their complexity, and demonstrate hardness using different proof techniques, including polynomial reductions</li> </ul>

<b>Teaching methods</b> <ul style="list-style-type: none"><li>- lecture with seminar character</li><li>- interactive lectures</li><li>- group work in tutorial classes</li><li>- online forums and discussions</li><li>- take-home mock exam and its discussion</li><li>- blended learning</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Oral exam (Duration 45 minutes), OR written exam (90 minutes) The type of exam will be communicated within the first two weeks of teaching.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Related literature: Korte, B. H., Vygen, J. (2011). <i>Combinatorial optimization</i> . Berlin: Springer.
<b>Additional notes</b>

**34953 Artificial Intelligence and Optimization**

<b>Module number</b>
34953
<b>Course name</b>
Artificial Intelligence and Optimization
<b>Module coordinator</b>
Prof Dr Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture classes 2 SWS (30h presence, 45h unsupervised work) Tutorial classes 2 SWS (30h presence, 45h unsupervised work)
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Basic knowledge of optimization and/or AI helpful
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
We study the relationship between problems and methods in artificial intelligence (in particular, machine learning) and optimization. Concepts that are discussed include:
- classification and regression trees
- neural networks
- nearest neighbors classification
- support vector machines
- clustering
- robustness, interpretability, explainability
Each aspect is discussed from both the AI and optimization perspective, including issues of complexity. Methods are tested computationally.
<b>Intended learning outcomes (ILOs)</b>
Upon completion of the module, students are able to
- identify typical tasks in machine learning,
- formulate them as optimization models,
- distinguish between problems of different complexity classes,
- identify and apply the most suitable optimization strategy, and
- evaluate the quality of these methods

<b>Teaching methods</b>
- interactive lectures
- group work in tutorial classes, including programming of AI and optimization methods
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Oral exam (Duration 45 minutes), OR written exam (90 minutes) The type of exam will be communicated within the first two weeks of teaching.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Related literature includes:
- D. Bertsimas, J. Dunn: "Machine Learning under a Modern Optimization Lens", Dynamic Ideas LLC, Belmont, Massachusetts, 2019
- M. Mohri, A. Rostamizadeh, A. Talwalkar: "Foundations of Machine Learning", second edition, MIT Press, Cambridge, Massachusetts, 2018
- W. Ertel: "Grundkurs Künstliche Intelligenz", fifth edition, Springer Vieweg, Wiesbaden, 2021
<b>Additional notes</b>

## 34954 Network Optimization

<b>Module number</b>
34954
<b>Course name</b>
Network Optimization
<b>Module coordinator</b>
Prof Dr Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
Lecture classes 2 SWS (30h presence, 45h unsupervised work)
Tutorial classes 2 SWS (30h presence, 45h unsupervised work)
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Basic knowledge of combinatorial optimization or linear programming is helpful
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
We study optimization problems on graphs. We develop an understanding of different problem types and discuss corresponding solution methods. Problem applications include:
- shortest path problems
- minimum spanning tree problems
- maximum flow problems
- minimum cost flow problems
- assignments and matchings
- multicommodity flow problems
<b>Intended learning outcomes (ILOs)</b>
Upon completion of the module, students are able to
- identify network optimization problems,
- differentiate between polynomially solvable and hard types of problems,
- choose and apply an appropriate solution method,
- assess the impact of using different data structures for the implementation of algorithms, and
- model real-world problems using networks.

<b>Teaching methods</b>
- interactive lectures
- group work in tutorial classes
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Oral exam (Duration 45 minutes), OR written exam (90 minutes) The type of exam will be communicated within the first two weeks of teaching.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Recommended literature includes: - R. K. Ahuja, T. L. Magnanti, J. B. Orlin: "Network Flows – Theory, Algorithms, and Applications", Pearson, Harlow, 2014
<b>Additional notes</b>

### 34955 Heuristics and Approximation Methods

<b>Module number</b>
34955
<b>Course name</b>
Heuristics and Approximation Methods
<b>Module coordinator</b>
Prof Dr Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
Lecture classes 2 SWS (30h presence, 45h unsupervised work) Tutorial classes 2 SWS (30h presence, 45h unsupervised work)
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Basic knowledge of combinatorial optimization is helpful
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
We discuss optimization algorithms for problems that are too difficult to solve exactly. They either provide no guarantee (heuristics in general) or do provide a guarantee (approximation methods) on the quality of the resulting solution. Types of methods we study include
- greedy algorithms - local search - meta-heuristics and matheuristics - dynamic programming - deterministic and randomized rounding - primal-dual methods - approximation schemes
<b>Intended learning outcomes (ILOs)</b>
Upon completion of the module, students are able to - differentiate between approximable and inapproximable problems, - apply techniques to analyze the approximation guarantee of solution methods, - develop effective heuristic strategies for complex economical problems, and - find solutions of good quality for difficult decision problems

<b>Teaching methods</b>
- interactive lectures
- group work in tutorial classes
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Oral exam (Duration 45 minutes), OR written exam (90 minutes) The type of exam will be communicated within the first two weeks of teaching.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Recommended literature includes: - D. P. Williamson, D.B. Shmoys: "The Design of Approximation Algorithms", Cambridge University Press, New York, 2011
<b>Additional notes</b>

### **34956 Masterseminar in Business Analytics**

<b>Modulnummer</b>
34956
<b>Veranstaltungstitel</b>
Masterseminar
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Marc Goerigk

Prüfungsnummer	ECTS	SWS
	7	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
jedes Semester	1 Semester	2.-4.

<b>Workload</b>
Seminar 2 SWS (30h Präsenzzeit, 180h Eigenarbeitszeit)
<b>Verwendbarkeit</b>
Wirtschaftsinformatik/ Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Teilnahme an mindestens einer dieser Veranstaltungen hilfreich: Decision Making Under Uncertainty, Combinatorial Optimization, Artificial Intelligence and Optimization, Network Optimization, Heuristics and Approximation Methods
<b>Verpflichtende Voraussetzungen</b>
<b>Unterrichtssprache</b>
Deutsch und Englisch

<b>Inhalt</b>
Es werden aktuelle Themen aus dem Forschungsbereich Business Analytics behandelt und von den Studierenden eigenständig bearbeitet, schriftlich dokumentiert und analysiert sowie vorgestellt.
<b>Lernergebnisse Lernziele</b>
Studierende erlernen die Fähigkeiten:
<ul style="list-style-type: none"> <li>- an einem ausgewählten, vertiefenden und aktuellen Thema in Business Analytics selbstständig und methodisch wissenschaftlich zu arbeiten</li> <li>- durch modulübergreifend gestellte Seminarthemen sich kritisch fachlich mit aktuellen Themenstellungen auseinander zu setzen</li> <li>- wissenschaftliche Methoden der empirischen Forschung bzw. Methoden der Lösung von praxisorientierten Problemstellungen anzuwenden Sie erwerben darüber hinaus kommunikative Kompetenz und fachbezogene Methodenkompetenz</li> </ul>
<b>Lehr- und Lernformen</b>
Selbständige Textarbeiten, Präsentationen, Gruppendiskussionen
<b>Anwesenheitspflicht</b>

<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Vortrag (30 Minuten, 50%) und Hausarbeit (20 Seiten, 50%)
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Weitere Hinweise</b>

## 35002 Business Intelligence & Analytics Systems

<b>Module number</b>
35002
<b>Course name</b>
Data Mining and Data Warehousing
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Ulrich Gnewuch Gastvorlesung in engl. Sprache von Prof. Dr. Saji K. Mathew

Examination number	Credit points (ECTS)	Hours per week (SWS)
266140	5	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Summer semester 2025	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 h attendance, 60 h self-study) Exercise 2 SWS (60 h self-study)
Calculation basis: 15 weeks in a semester, including an examination week; each SWS corresponds to 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>LPO I applicability</b>
<b>Recommended prerequisites</b>
<p><b>SOFTWARE</b></p> <ul style="list-style-type: none"> <li>• Python (in Jupyter Notebook)</li> <li>• R, RStudio</li> <li>• MySQL with Workbench</li> <li>• MS Excel</li> </ul> <p>Please refer to Appendix to get started with the software</p>
<b>DATA SOURCES</b>
<ul style="list-style-type: none"> <li>▪ “Adventure Works Cycles”, SQL Server sample database</li> <li>▪ “Retail Sense transaction data”, real life data of a fashion retailer</li> <li>▪ UCI Machine Learning Repository, <a href="http://archive.ics.uci.edu/ml/">http://archive.ics.uci.edu/ml/</a></li> <li>▪ Financial/capital market data: Yahoo! Finance</li> <li>▪ TEXT DATA: <a href="http://www.twitter.com">www.twitter.com</a></li> <li>▪ ISL RESOURCES: <a href="http://www-bcf.usc.edu/~gareth/isl/">http://www-bcf.usc.edu/~gareth/isl/</a></li> <li>▪ Kaggle: www.kaggle.com</li> </ul>
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>		
<b>COURSE PHILOSOPHY</b>		
<p>Data-driven decisions have become a distinctive factor defining the success mantra of high performance firms. When used wisely, analytical capabilities have enormous power to enhance the competitiveness of almost any company or enterprise. It is therefore imperative that tomorrow's business managers learn to apply data mining techniques to enterprise data and draw management insights in decision making pertaining to their business domains.</p>		
<p>This course equips students with necessary knowledge and skills on the thought process, modeling approach and tools required to use data from the enterprise and other sources for business decisions. Thus, the course will enable you to prepare for a career in consulting, business analytics and market research. Students who are seeking positions as functional managers would also benefit from the course as future users of data for decisions. Functional managers will gain insights to set directions for research, and also to commission and evaluate business research projects.</p>		
<p>The business context of the course is set in the backdrop of decision problems surrounding market customization: segmentation, profiling and targeting and prediction covering sectors such as retail, manufacturing, and stock markets. This course will introduce the context of data mining, and cover prominent modeling techniques such as regression, decision trees, clustering, ANN and text mining.</p>		
<b>SESSION PLAN</b>		
<b>Session</b>	<b>Topics</b>	<b>Readings</b>
1-2	Introduction, expectations, QA, vocabulary of business analytics, business value of analytics, BI architecture, fundamentals of data management, databases	1a. Course outline 1b. Text 1: Han et al. (2012) Chapter 1, Introduction 2a. Case: Bizocity scoring at AT&T 2b. Text 1: Han et al. (2012) Chapter 4, Data Warehouse and OLAP Technology for Data Mining
3-4	Data warehousing, OLAP Data mining process, statistical learning, data pre-processing, data quality,	3a. SQL tutorial on MySQL 3b. Case: Retail operations at Smartsense 4a. Kumar & Bohling (2002) 4b. Text 2: James et al. (2013) Chapter 1, Statistical learning, <i>ISL</i>
5-6	Overview of data mining techniques, regression analysis, Classification, techniques, classifier performance, scoring models	5a. Pilgrim Bank (A): Customer profitability, HBS (assignment) 5b. Text 2: James et al. (2013) Chapter 2, Linear regression, <i>ISL</i> 6a. Malthouse (2001), Scoring models 6b. Text 1: Han et al. (2012) Chapter 8 (3rd ed); chapter 6, 4th ed), Classification: Basic concepts
7-8	Classification using decision trees; implementation in Python (scikit-learn library upon Google collab); problem of targeted mailing, Cluster analysis, clustering techniques, implementation in Python: clustering for segmentation and profiling	7a. Text 2: James et al. (2013) Chapter 8, Tree-based models 7b: Cases and Solutions: Python and R scripts with notes 8a. Text 2: James et al. (2013) Chapter 10, Unsupervised learning (pp. 385-400)

	9-10	Machine learning, artificial neural networks, Financial time series modeling using ANN, implementation in Python (scikit-learn and PyTorch libraries upon Google Collab), mining the web: text mining, process, key concepts, sentiment scoring, text mining using R- the case of a movie discussion forum, summary	9a. Kaastra & Boyd (1996) Designing a neural network for forecasting financial and economic time series, JNC 9b. Borant L. (2004) Financial Time Series Forecasting 9c. PyTorch tutorial: <a href="https://www.youtube.com/playlist?list=PLCC34OHNcOtpcgR9LEYSdi9r7XlbpkpK1">https://www.youtube.com/playlist?list=PLCC34OHNcOtpcgR9LEYSdi9r7XlbpkpK1</a> 10b. Text Mining with R, A Tidy Approach													
<b>Intended learning outcomes (ILOs)</b>																
<b>COURSE OBJECTIVES</b>																
CLO1. To recognize business intelligence architecture and its components covering databases, data warehouse, OLAP and data mining																
CLO2. To translate business problems into data mining problems and understand data mining process																
CLO3. To explore data mining techniques covering classification, regression, machine learning and text mining for business problem solving																
CLO4. To use data mining software tools for computing skills to solve data mining problems																
<b>Teaching methods</b>																
<b>PEDAGOGY</b>																
<ul style="list-style-type: none"> <li>▪ The course will be conducted through lectures, lab sessions, exercises, quizzes, assignment discussions/presentations and mini projects.</li> <li>▪ Small groups of students will be formed in the beginning of the course. There will be group projects based on business problems selected from various domains depending on the interest, experience and ambitions of the groups.</li> </ul>																
<b>Required attendance</b>																
<b>Examination (type of examination, scope)</b>																
<table border="1"> <thead> <tr> <th>Evaluation component</th> <th>Weight</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>Assignment</td> <td>30%</td> <td>Assignments are meant to help students learn in groups the application of certain key topics that are covered in the course. Students are expected to submit the assignments as written reports with supporting codes used. Anyone from the any group could be asked to present to the class key learnings from the assignment. Evaluation will use equal weights to completeness, thought process in choosing a solution path, and the use of relevant tools and techniques.</td> </tr> <tr> <td>Mini Project</td> <td>35%</td> <td>This will be based on business problems selected from various domains depending on the interest, experience and ambitions of the groups. Evaluation will use equal weights to choice of problem, thought process in choosing a solution path, and the use of relevant tools and techniques.</td> </tr> <tr> <td>Final examination</td> <td>35%</td> <td>This two-hour examination will cover all the topics of the course. Reading materials (pre-reads) and class work will be the basis for the examination. Marks will be distributed based on effort required to various question categories such as MCQ, fill in the blanks, descriptive and problem solving.</td> </tr> </tbody> </table>					Evaluation component	Weight	Description	Assignment	30%	Assignments are meant to help students learn in groups the application of certain key topics that are covered in the course. Students are expected to submit the assignments as written reports with supporting codes used. Anyone from the any group could be asked to present to the class key learnings from the assignment. Evaluation will use equal weights to completeness, thought process in choosing a solution path, and the use of relevant tools and techniques.	Mini Project	35%	This will be based on business problems selected from various domains depending on the interest, experience and ambitions of the groups. Evaluation will use equal weights to choice of problem, thought process in choosing a solution path, and the use of relevant tools and techniques.	Final examination	35%	This two-hour examination will cover all the topics of the course. Reading materials (pre-reads) and class work will be the basis for the examination. Marks will be distributed based on effort required to various question categories such as MCQ, fill in the blanks, descriptive and problem solving.
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<b>Overall grade relevance</b>																

<b>Exam resit opportunities</b>
<b>Recommended reading</b>
<b>Text Books</b> (Recommended): <ol style="list-style-type: none"><li>1. Han, J., Pei, J. &amp; Tong H. (2023). Data Mining Concepts and Techniques, 4th ed, Elsevier.</li><li>2. James, G., Witten, D., Hastie, T. and Tibshirani,R. (2013) An Introduction to Statistical Learning with Applications in R, Springer: NY</li></ol>
<b>Additional notes</b>

### 35005 Masterseminar AI-Based Information Systems

<b>Module number</b>
35005
<b>Course name</b>
Masterseminar AI-Based Information Systems
<b>Module coordinator</b>
Prof. Dr. Ulrich Gnewuch

Examination number	Credit points (ECTS)	Hours per week (SWS)
262694	7	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Summer and/or winter semester	1 semester	The module should be taken close to the end of the master's program as preparation for the master thesis.

<b>Workload</b>
Seminar 2 SWS (30 h attendance and 180 h own work).  Calculation basis: 15 weeks in a semester, including an examination week; each SWS corresponds to 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to the study and examination regulations for the respective degree program.  Good English skills are required. Participants are expected to write their seminar paper and deliver their presentation in English.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
In this seminar, we examine and discuss current topics in the field of information systems that are situated within the research focus areas of the chair. The theme of the seminar varies and is announced in advance. The seminar involves the review of scientific literature on a selected topic. Participants will document their method and results in a written seminar paper and present their findings to other seminar participants at the end of the semester.
<b>Intended learning outcomes (ILOs)</b>
After successful participation in this seminar, students will be able to: <ul style="list-style-type: none"> <li>- describe the principles of good scientific practice and key guidelines for academic writing</li> <li>- identify, review, and analyze scientific literature on a specific topic</li> <li>- write a scientific paper based on the reviewed literature</li> <li>- present the main results of their scientific work effectively</li> </ul>

- provide constructive and respectful feedback on others' work
<b>Teaching methods</b>
Seminar meetings, interactive presentations, and discussions Advice and feedback on the seminar paper and the final presentation
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Portfolio: Seminar paper (70%); presentation and discussion (30%).
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
<b>Recommended reading</b>
Core literature depends on the theme of the seminar and will be communicated beforehand. Participants are expected to read additional literature on their specific topic.
<b>Additional notes</b>
The course language is English.
The number of participants is limited. Prior application for this course is necessary. Information on the application process are provided on the chair's website.

## 35006 Artificial Intelligence (AI)-Based Business Information Systems

<b>Module number</b>
35006
<b>Course name</b>
Artificial Intelligence (AI)-Based Business Information Systems
<b>Module coordinator</b>
Prof. Dr. Ulrich Gnewuch

Examination number	Credit points (ECTS)	Hours per week (SWS)
482608	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 h attendance and 45 h self-study) Exercise 2 SWS (30 h attendance and 45 h self-study)
Calculation basis: 15 weeks in a semester, including an examination week; each SWS corresponds to 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the master's degree program in Information Systems.  Basic skills in data analysis and/or programming (e.g., Python, R) are highly recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
Artificial intelligence (AI) offers significant opportunities while also creating new challenges for businesses. In light of these dynamics, this course focuses on the design, management, use, and impact of AI-based business information systems. It is not a technical course, but rather takes a managerial/organizational perspective on the use of AI in businesses. Topics covered will include: <ul style="list-style-type: none"> <li>- Theoretical and conceptual foundations of AI-based business information systems</li> <li>- Business capabilities enabled by AI-based information systems: automation, engagement, insights &amp; decisions, and innovation</li> <li>- Challenges in and strategies for designing and managing AI-based information systems</li> <li>- Exercises and case studies on selected AI-based information systems (e.g., robotic process automation, conversational AI, explainable AI, generative AI)</li> </ul>

<b>Intended learning outcomes (ILOs)</b>
After successful participation in this course, students will be able to:
<ul style="list-style-type: none"><li>- Explain what AI-based business information systems are and how they enable important business capabilities</li><li>- Describe the theoretical and conceptual foundations that guide the design and management of different AI-based business information systems</li><li>- Identify key challenges in designing and managing different types of AI-based business information systems and develop strategies for addressing these challenges</li></ul>
In addition, students will gain some hands-on experience with explainable AI techniques and human-centered design approaches.
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>- Interactive lectures and classroom discussions</li><li>- Exercises, case studies, and student presentations</li><li>- Readings and pre-recorded videos</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Portfolio: Group work and presentations during the course (40%); final exam (60%)
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
According to the study and examination regulations for the master's degree program in Information Systems / Annually.
<b>Recommended reading</b>
Benbya, H., Pachidi, S., & Jarvenpaa, S. (2021). Artificial intelligence in organizations: Implications for information systems research. <i>Journal of the Association for Information Systems</i> , 22(2), 281-303.
Berente, N., Gu, B., Recker, J., & Santhanam, R. (2021). Managing artificial intelligence. <i>MIS Quarterly</i> , 45(3), 1433-1450.
Shneiderman, B. (2022). Human-centered AI. Oxford University Press.
<b>Additional notes</b>
All teaching material in English language. Teaching language is English.
Replaces the course "Design and Management of AI-Based Business Information Systems": Students who have already completed the course "Design and Management of AI-Based Business Information Systems" (35000) cannot register for this course.

### 35010 Master Colloquium: AI-Based Information Systems

<b>Module number</b>
35010
<b>Course name</b>
Master Colloquium: AI-Based Information Systems
<b>Module coordinator</b>
Prof. Dr. Ulrich Gnewuch

Examination number	Credit points (ECTS)	Hours per week (SWS)
283012	1	1
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every semester	1 semester	While working on the master thesis

<b>Workload</b>
Colloquium 1 SWS (15 h attendance and 15 h self-study)
Calculation basis: 15 weeks in a semester, including an examination week; each SWS corresponds to 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to the study and examination regulations for the respective degree program.
<b>Requirements</b>
Admission to write a master thesis at the chair is a requirement for participating in the colloquium.
<b>Language of instruction</b>
English

<b>Content</b>
The colloquium introduces students to the foundations of scientific research and equips them with essential skills for writing a master thesis. Additionally, it provides an opportunity for students to present their thesis project and receive feedback from both their peers and members of the chair.
<b>Intended learning outcomes (ILOs)</b>
After participating in the colloquium, students will be able to:
<ul style="list-style-type: none"> <li>- Describe the principles of good scientific practice and key guidelines for academic writing</li> <li>- Present and explain their own scientific work effectively</li> <li>- Handle and implement critical feedback</li> <li>- Provide constructive and respectful feedback on others' work</li> </ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"> <li>- Interactive sessions with student presentations and classroom discussions</li> <li>- Readings and self-study videos</li> </ul>

<b>Required attendance</b>
Yes
<b>Examination (type of examination, scope)</b>
Presentation
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
According to the study and examination regulations for the respective degree program.
<b>Recommended reading</b>
<b>Additional notes</b>
Participation is mandatory for all students who are writing their master thesis at the chair. Admission to write a master thesis at the chair is a requirement for participating in the colloquium. Further information on the thesis process is provided on the chair's website.

<b>35500 Multivariate Verfahren</b>		
<b>Modulnummer</b>		
MRIEB20232-XX-M16		
<b>Modultitel</b>		
35500 Multivariate Verfahren		
<b>Modulverantwortliche*r / Prüfer*innen</b>		
Prof. Dr. Joachim Schnurbus		
<b>Prüfungsnummer</b>	<b>ECTS</b>	<b>SWS</b>
201504	5	4
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Wintersemester	1 Semester	1
<b>Workload</b>		
4 SWS, davon ca. 3 SWS Vorlesung, ca. 1 SWS Übung. Dies entspricht 57 St. Präsenzzeit und 93 St. Eigenarbeitszeit. Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.		
<b>Verwendbarkeit</b>		
Methoden		
<b>Bezug zur LPO I</b>		
<b>Empfohlene Voraussetzungen</b>		
Grundlegende Mathematik- und Statistik-Kenntnisse.		
<b>Verpflichtende Voraussetzungen</b>		
<b>Unterrichtssprache</b>		
Deutsch		
<b>Inhalte</b>		
Multivariate Verfahren sind ein wichtiger Bestandteil in der empirischen Forschungspraxis, unter anderem im Bereich der Marktforschung. In diesem Modul werden grundlegende Analysetechniken für multivariate Datenstrukturen sowie deren theoretische Fundierung behandelt. Neben einer Einführung in die Grundlagen multivariater Analysemethoden umfasst das Modul folgende Themengebiete:		
<ul style="list-style-type: none"> <li>• Hauptkomponentenanalyse</li> <li>• Regressionsanalyse</li> <li>• Faktorenanalyse</li> <li>• Varianzanalyse</li> <li>• Diskriminanzanalyse</li> <li>• Clusteranalyse</li> </ul>		
<b>Lernergebnisse Lernziele</b>		
Studierende, die erfolgreich an dem Modul teilgenommen haben:		

<ul style="list-style-type: none"><li>• sind in der Lage, Fragestellungen, Anwendungsfelder und Potenziale von multivariaten statistischen Verfahren zu erkennen. Sie verstehen die grundlegenden strukturentdeckenden Verfahren (wie Clusteranalyse) und grundlegenden strukturprüfenden Verfahren (wie Regressionsanalyse) und deren Annahmen.</li><li>• können die Verfahren anwenden und kombinieren, sowie Modellschätzungen und Hypothesentests durchführen und analysieren.</li><li>• können Berechnungen, die mit der Statistiksoftware R erzeugt wurden, reproduzieren und den zugehörigen R-Code interpretieren.</li><li>• sind in der Lage, empirische Ergebnisse kritisch zu bewerten und weiterführende Literatur zu den Verfahren zu verstehen und zu diskutieren.</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht und Diskussion von Lehrinhalten. Vermittlung der theoretischen Grundlagen und Illustration anhand von Beispielen in der Vorlesung und Übung. Berechnen und besprechen von Übungsaufgaben. Anwenden der Statistiksoftware R (R-Vorkenntnisse werden nicht vorausgesetzt). Barrierefreie Vorlesungs- und Übungsmaterialien, Pflichtliteratur sowie Software sind ab Kursstart verfügbar.
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang)</b>
Klausur oder häusliche Leistungsfeststellung (60 Min.), oder mündliche (Online-)Prüfung.
<b>Gesamtnotenrelevanz</b>
100 %
<b>Wiederholungsmöglichkeit</b>
<b>Literatur</b>
<ul style="list-style-type: none"><li>• Handl, A. &amp; T. Kuhlenkasper (2017), Multivariate Analysemethoden, Springer.</li><li>• Johnson, R.A. &amp; D.W. Wichern (2007), Applied Multivariate Statistical Analysis, Pearson Prentice Hall.</li><li>• Ligges, U. (2008), Programmieren mit R, Springer.</li><li>• Kleiber, C. &amp; A. Zeileis (2008), Applied Econometrics with R, Springer.</li></ul>
<b>Weitere Hinweise</b>

### 35550 Topics in Applied Econometrics

<b>Module number</b>
35550 and 35551
<b>Module title</b>
35550 Topics in Applied Econometrics (lecture) & 35551 ~ (Tutorial)
<b>Module coordinator</b>
Prof. Dr. Harry Haupt, Prof. Dr. Joachim Schnurbus

Examination number	Credit points (ECTS)	Hours per week (SWS)
271030	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Usually every summer term	1 semester	2/4

<b>Workload</b>
Lecture 2 SWS (28 h Contact hours and 28 h Self-study) and Tutorial 2 SWS (28 h Contact hours, 28 h Self-study). We are calculating with 15 semester weeks (Lecture, Tutorial and Exam). Each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
An understanding of introductory statistics including inferential methods and regression analysis and test methods on bachelor level. Basic knowledge of R statistical software is an advantage.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
This module covers a selection (usually divided in three to four blocks) of fundamental research methods and techniques in applied econometrics. Topics included are: Maximum-Likelihood estimation and inference (for specification tests and various fields of microeconometric applications), advanced applications of least squares and GMM (for modeling heterogeneity and endogeneity in empirical practice), smoothing methods such as kernel and spline regression, robust inferential methods such as quantile regression and their interpretation, machine learning methods (and their applications in econometrics), and simulation-based methods (such as Bootstrap-, Monte Carlo-, and Bayesian techniques).
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully completed the module:
<ul style="list-style-type: none"> <li>• develop a basic understanding of some of the core methods of applied econometrics.</li> <li>• are able to reflect the underlying elementary mathematical foundations and corresponding assumptions of estimation and inference for the covered techniques, while developing an awareness of potential pitfalls in empirical practice.</li> </ul>

<ul style="list-style-type: none"><li>• can implement the methods in the statistical software R, apply the methods to empirical datasets and are able to provide economic interpretations and critically reflect the modeling results.</li></ul>
<b>Teaching methods</b> Interactive frontal teaching and discussion of the course content. Teaching of theoretical principles and illustration by examples in lecture and tutorial. Weekly (accessible) lecture and exercise materials and required literature. Some of the tutorials are hands-on using the open-source statistical software R.  Students are explicitly invited to play an active role in lectures and tutorials through questions and input for discussions. Additionally, students are invited to indicate those parts of the course for which they need additional training. Readings are essential to prepare the class and the exam.
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> Portfolio, consisting of two parts: <ul style="list-style-type: none"><li>• Part 1 (1/3): Short presentation of (a part of) a scientific paper or an application.</li><li>• Part 2 (2/3): Oral (online) exam or performance assessment at home.</li></ul>
<b>Overall grade relevance</b> One overall grade, 100%
<b>Exam resit opportunities</b>
<b>Recommended reading</b> Among others and depending on the selection of topics: Angrist, J.D. & Pischke J.-S. (2009); Mostly Harmless Econometrics, Princeton. Cameron, C.A. & Trivedi, P.K. (2005), Microeconomics: Methods & Applications, Cambridge. Franses, P.H., van Dijk, D. & A. Opschoor (2014), Time Series Models for Business and Economic Forecasting, Cambridge. Kleiber, C. & Zeileis, A. (2008), Applied Econometrics with R, Springer. Verbeek, M.. (2017), A Guide to Modern Econometrics, 5e, Wiley
<b>Additional notes</b>

### 35610 Paneldatenanalyse

<b>Modulnummer</b>
<b>Veranstaltungstitel</b>
35610 Paneldatenanalyse (VL) und 35611 Paneldatenanalyse (Ü)

#### Modulverantwortliche\*r / Prüfer\*innen

Prof. Dr. Harry Haupt, Dr. Markus Fritsch

Prüfungsnummer	ECTS	SWS
261080	5	2+2
Modulangebot	Zeitdauer des Moduls	Empfohlenes Studiensemester
Jedes Sommersemester	1 Semester	2

#### Workload

Vorlesung 2 SWS (30 St. Präsenzzeit und 45 St. Eigenarbeitszeit) und Übung 2 SWS (30 St. Präsenzzeit und 45 St. Eigenarbeitszeit). Es wird mit 15 Semesterwochen gerechnet (Vorlesung, Übung und Prüfung) und jede SWS geht mit 60 Minuten in die Berechnung ein.

#### Verwendbarkeit

Methoden

#### Bezug zur LPO I

#### Empfohlene Voraussetzungen

Kenntnis der Inhalte von „Econometric Methods“. Dies umfasst eine detaillierte Kenntnis des multiplen linearen Regressionsmodells für Querschnittsdaten (OLS-Schätzung, Tests sowie entsprechende zugrundeliegende Annahmen, Projektionsmatrizen) sowie solide Kenntnisse im Umgang mit der Statistiksoftware R. Kenntnisse von Modellen für Zeitreihendaten sind hilfreich, werden jedoch nicht vorausgesetzt.

#### Verpflichtende Voraussetzungen

keine

#### Unterrichtssprache

Deutsch

#### Inhalte

Zentraler Gegenstand des Moduls ist die Schätzung von Regressionsmodellen für Paneldaten. Hierbei werden neben grundlegenden Schätzverfahren und Fehlerkomponentenmodellen unter anderem die Fixed-Effects- und Random-Effects-Schätzung behandelt. Weitere Kursinhalte sind dynamische Paneldatenmodelle sowie Test- und Prognoseverfahren für Paneldaten (Stichwort: Best linear unbiased prediction). Die Vermittlung der Kursinhalte erfolgt in Form von Modelltheorie und Anwendung sowie mittels Besprechung und Diskussion ausgewählter Literatur. Die Inhalte werden auch anhand von Beispielen in der Statistiksoftware R veranschaulicht.

#### Lernergebnisse Lernziele

Nach erfolgreicher Teilnahme am Modul sind die Studierenden in der Lage:

- Fragestellungen, Anwendungsfelder und Potenziale von Panelmodellschätzungen zu erkennen.

<ul style="list-style-type: none"><li>• die zentralen Annahmen für statische und dynamische Panelmodellschätzer erläutern und kritisch reflektieren.</li><li>• geeignete Schätzverfahren für Paneldaten auf Basis der zugrundeliegenden Modelltheorie auszuwählen.</li><li>• statische und dynamische Panelmodellschätzungen in der Statistiksoftware R implementieren und die Schätzergebnisse interpretieren zu können.</li><li>• Hypothesen- und Modellspezifikationstests für Panelmodellschätzer anzuwenden und deren Ergebnisse einzuordnen und kritisch zu reflektieren.</li><li>• aktuelle Literatur zu lesen, zu verstehen und zu diskutieren.</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht und Diskussion von Lehrinhalten. Vermittlung der theoretischen Grundlagen und Illustration anhand von Beispielen in der Vorlesung und Übung. Die Theorie wird auch durch Beispiele in der Statistiksoftware R veranschaulicht. Wöchentliche Vorlesungs- und Übungsmaterialien sowie Pflichtliteratur.
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang)</b>
Schriftliche Prüfung oder häusliche Leistungsfeststellung (60 Minuten) oder mündliche (Online-)Prüfung
<b>Gesamtnotenrelevanz</b>
100%
<b>Wiederholungsmöglichkeit</b>
<b>Literatur</b>
Basisliteratur (andere Auflagen dieser Bücher sind ebenfalls verwendbar): - Wooldridge, J.M. (2019), Introductory Econometrics, 7A, Thomson South-Western. - Stock, J.H. und M.W. Watson (2019), Introduction to Econometrics, 4A, Pearson. - Greene, W.H. (2019), Econometric Analysis, 8A., Pearson.
Weiterführende Literatur: - Baltagi, B.H. (2021), Econometric Analysis of Panel Data, 6A., Wiley. - Wooldridge, J. (2010), Econometric Analysis of Cross Section and Panel Data, 2A, MIT Press. - Arellano, M. (2004), Panel Data Econometrics, Oxford University Press. - Angrist, J.D. und J.-S. Pischke (2009), Mostly Harmless Econometrics, Princeton University Press.
<b>Weitere Hinweise</b>
Die Theorie wird auch anhand von Beispielen in der Statistiksoftware R illustriert.

## 35621 Computational Statistics – Regression in R

<b>Module number</b>
35621
<b>Course name</b>
Computational Statistics – Regression in R
<b>Module coordinator</b>
Prof. Dr. Joachim Schnurbus

Examination number	Credit points (ECTS)	Hours per week (SWS)
261070	3	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester; if possible every semester	1 semester (or block course)	1

<b>Workload</b>
Computer lectures and exercises: 30 hrs. attendance and 60 hrs. self-study
The calculation is based on 15 semester weeks (14 lectures + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Methoden
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
The course aims at students with a basic knowledge in statistics and complements some of the topics treated in 'Econometric Methods'.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The course focuses on estimating and evaluating regression models with the statistical software R. Model evaluation procedures discussed in class range from graphical methods, classic validation techniques and tests to simulation-based approaches. The course includes model selection (i.e., finding the best model from a large number of possible models), model validation (i.e., checking whether the presumed best specification satisfies the model assumptions), and model interpretation (for linearly and/or nonlinearly transformed variables). Additionally, different data structures such as cross-sections, time series, and panel data are shortly discussed.
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully passed the module:

- are able to perform and interpret a regression analysis in the statistical software R.
- have the skill to select an appropriate statistical model, critically judge the validity of a model and in detail interpret the estimation results in order to provide decision support.

<ul style="list-style-type: none"><li>• are able to create Monte Carlo-simulations in order to perform a simulation-based assessment of statistical methods or models.</li><li>• understand statistical tests and can select, apply, and interpret the appropriate tests in regression context.</li></ul>
<b>Teaching methods</b>
Interactive frontal teaching and discussion of the R-Codes. Exercises that are worked on independently in R and then discussed together. Students are expected to deepen their knowledge by completing self-contained R-exercises. Accessible lecture and exercise materials and required literature.
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam or performance assessment at home (60 minutes) or portfolio. R-skills are certified via a certificate when the exam is passed.
<b>Overall grade relevance</b>
100%
<b>Exam resit opportunities</b>
<b>Recommended reading</b>
- Kleiber, C. & A. Zeileis (2008), Applied Econometrics with R, Springer. - Field, A. & Miles, J. & Field, Z. (2012), Discovering Statistics using R, SAGE. - Wooldridge, J. (2013), Introductory Econometrics, 5Ed., South Western. - Greene, W.H. (2012), Econometric Analysis, Pearson. - Ligges, U. (2008), Programmieren mit R, Springer.
<b>Additional notes</b>

## 35622 Computational Statistics – Statistical Learning in R

<b>Module number</b>
35622
<b>Module title</b>
Computational Statistics - Statistical Learning in R
<b>Module coordinator</b>
Prof. Dr. Joachim Schnurbus

Examination number	Credit points (ECTS)	Hours per week (SWS)
261001	3	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester, if possible every term.	1 semester (or block course)	2

<b>Workload</b>
Computer lectures and exercises: 30 hrs. attendance and 60 hrs. self-study
The calculation is based on 15 semester weeks (14 lectures + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Methoden
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
The course aims at students with a basic knowledge in statistics (especially regression methods) and basic knowledge of R (e.g. via 'Computational Statistics – Regression in R').
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
Statistical Learning sums up methods from computational statistics that are designed to deal with high dimensional, complex large-scale data sets. Various topics that facilitate modeling of and gaining a deeper insight into these data sets are introduced. Supervised (classification and regression) and unsupervised statistical learning techniques (like neural nets, boosting, clustering) are presented, discussed, and applied. Further topics comprise preprocessing (transformation of variables), resampling (cross-validation, bootstrapping), meta-parameter selection, model evaluation.
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully passed the module:

- are able to apply and interpret unsupervised and supervised learning methods in the statistical software R.
- have the skill to select a problem-adequate statistical learning method, to configure and employ the corresponding R-functions, to critically judge the validity of the outcomes, and to interpret the results in order to provide decision support.

<ul style="list-style-type: none"><li>• will be able to relate to recent literature on statistical learning.</li></ul>
<b>Teaching methods</b>
Interactive frontal teaching and discussion of the R-Codes. Exercises that are worked on independently in R and then discussed together. Students are expected to deepen their knowledge by completing self-contained R-exercises. Accessible lecture and exercise materials and required literature.
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam or performance assessment at home (60 minutes) or portfolio. R-skills are certified via a certificate when the exam is passed.
<b>Overall grade relevance</b>
100%
<b>Exam resit opportunities</b>
<b>Recommended reading</b>
- Kuhn, M. & Johnson, K. (2013), Applied Predictive Modeling, Springer. - Hastie, T., Tibshirani, R. & Friedman, J. (2009), The Elements of Statistical Learning: Data Mining, Inference, and Prediction, 2Ed., Springer. - Efron, B., Hastie, T. (2016), Computer Age Statistical Inference, Cambridge University Press. - Torgo, L. (2017), Data Mining with R: Learning with Case Studies, 2Ed., CRC Press. - James, G., Witten, D., Hastie, T & Tibshirani, R. (2015), An Introduction to Statistical Learning: with Applications in R, Springer.
<b>Additional notes</b>

**35777 Econometric Methods**

<b>Module number</b>
35777 and 35778 (Tutorial)
<b>Module title</b>
35777 Econometric Methods (Lecture) and 35778 Econometric Methods (Tutorial)
<b>Module coordinator</b>
Prof. Dr. Harry Haupt

Examination number	Credit points (ECTS)	Hours per week (SWS)
261120	5	3+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	1

<b>Workload</b>
Lecture 3 SWS (42 h Contact hours and 28 h Self-study) and Tutorial 2 SWS (28 h Contact hours, 42 h Self-study). We are calculating with 15 semester weeks (Lecture, Tutorial and Exam). Each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Bachelor's level understanding of calculus and matrix algebra, introductory statistics including inferential methods, regression analysis, and testing methods. Basic knowledge of R statistical software is an advantage.
<b>Requirements</b>
none
<b>Language of instruction</b>
English

<b>Content</b>
This module provides an introduction into the core methods of modern econometrics at international standard master's level. The following content is covered: Regression analysis and estimation principles, econometric models, hypothesis testing in regression, exact and asymptotic inference, endogeneity, and heteroscedasticity.
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully completed the module are able:

- to give a systematic overview of the core principles of modern econometrics.
- to understand regression estimation and inference methods and their basic interpretations
- to apply the acquired methods and principles to data-based problems.
- to perform econometric analyses and will know the underlying mathematical assumptions and the corresponding statistical properties of important regression-based testing and estimation procedures.
- to critically assess empirical results, identify potential pitfalls, falsify statements while quantifying the underlying uncertainty, and develop and interpret sound simple models.

<b>Teaching methods</b>
Interactive frontal teaching and discussion of the course content. Teaching of theoretical principles and illustration by examples in lecture and tutorial. Weekly (accessible) lecture and exercise materials and required literature. Some of the tutorials are hands-on using the open-source statistical software R.
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Written exam or home performance assessment (60 minutes) or oral (online) exam
<b>Overall grade relevance</b>
100%
<b>Exam resit opportunities</b>
<b>Recommended reading</b>
- Hansen, B. (2021), Econometrics. <a href="http://www.ssc.wisc.edu/~bhansen/econometrics/">http://www.ssc.wisc.edu/~bhansen/econometrics/</a> - Davidson, R. & J.G. MacKinnon (2009), Econometric Theory and Methods, Oxford Univ. Press. - Stock J.H. & M.M.Watson (2019) Introduction to Econometrics. 4e. Pearson. - Angrist J.D. & J.S. Pischke (2009) Mostly Harmless Econometrics. Princeton Univ. Press.
<b>Additional notes</b>

## 35780 Advanced Data Analytics

<b>Module number</b>
35780 and 35781 (Tutorial)
<b>Course name</b>
Advanced Data Analytics
<b>Module coordinator</b>
Prof. Dr. Harry Haupt, Dr. Markus Fritsch

Examination number	Credit points (ECTS)	Hours per week (SWS)
261004	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Usually every winter semester	1 semester	3

<b>Workload</b>
Lecture 2 SWS (30 h Contact hours and 45 h Self-study) and Tutorial 2 SWS (30 h Contact hours, 45 h Self-study). We are calculating with 15 semester weeks (Lecture, Tutorial, and Exam). Each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Methoden
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Basic understanding of calculus and matrix algebra, introductory statistics including inferential methods, regression analysis, and testing methods. Basic knowledge of statistical software R is an advantage.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
This module covers key state of the art techniques in statistical learning/machine learning. The emphasis of the course is on techniques from supervised learning in the context of regression modeling. The following content is covered: Fundamental concepts (bias-variance trade-off, curse of dimensionality, flexibility vs. interpretability, resampling techniques), key building blocks (parametric polynomials, spline-regression, tree-based modeling), and frequently employed algorithms (lasso, backfitting, random forest, boosting). Prediction and inference are discussed. Selected applications are used to motivate the different algorithms.
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully completed the module are able to:

- explain and reflect the main principles and key assumptions of the covered techniques.
- choose suitable and problem-adequate modeling approaches in the context of supervised learning.
- implement the approaches in the statistical software R.
- develop and evaluate predictive models for particular applications.

<ul style="list-style-type: none"><li>interpret and critically assess the modeling results.</li><li>discuss selected considerations regarding inference for predictive models and implement the approaches.</li></ul>
<b>Teaching methods</b>
Interactive frontal teaching and discussion of the course content. Teaching of theoretical principles and illustration by examples in lecture and tutorial. Weekly (accessible) lecture and exercise materials and required literature. Some of the tutorials are hands-on using the open-source statistical software R. Students are explicitly invited to play an active role in lectures and tutorials through questions and input for discussions. Readings are essential to prepare the class and the exam.
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Written exam or performance assessment at home (60 minutes) or oral (online) exam
<b>Overall grade relevance</b>
100%
<b>Exam resit opportunities</b>
<b>Recommended reading</b>
Hastie, T., R. Tibshirani, R., and J. Friedman (2017), <i>The Elements of Statistical Learning</i> , 2A, Springer. James, G., Witten, D., Hastie, T., and R. Tibshirani (2023), <i>An Introduction to Statistical Learning</i> , 2A, Springer. Kuhn, M. and K. Johnson (2013), <i>Applied Predictive Modeling</i> , Springer. Efron, B. and T. Hastie (2016), <i>Computer Age Statistical Inference: Algorithms, Evidence, and Data Science</i> , Cambridge University Press.
<b>Additional notes</b>

## 37500 Strategic IT Management

<b>Module number</b>
37500
<b>Course name</b>
Strategic IT Management
<b>Module coordinator</b>
Prof. Dr. Thomas Widjaja

Examination number	Credit points (ECTS)	Hours per week (SWS)
283003	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hours class attendance; 45 hours self-study)
Exercise 2 SWS (30 hours class attendance; 45 hours self-study)
Calculation is based on: every hr./sem.-week corresponds to 60 minutes. One semester is presumed to be 15 weeks, i.e. 14 course + 1 exam week
<b>Module applicability</b>
Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the Master's degree program in Information Systems. Successful attendance of the module "IT Management" (or comparable knowledge requirement) is recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
This module provides conceptual and analytical skills for designing, managing, and implementing information technology and information systems for organizations. The course provides an overview of the main tasks and goals of strategic IT management. In addition, selected current challenges of IT management will be discussed. Among others, the following topics will be addressed:
<ol style="list-style-type: none"> <li>1. Value of IT</li> <li>2. IT governance</li> <li>3. IT outsourcing</li> <li>4. Management of IT architectures</li> <li>6. Standardization of IT</li> <li>7. IT integration</li> <li>8. Business intelligence and big data</li> <li>9. Data-driven business models</li> </ol>

<b>Intended learning outcomes (ILOs)</b>
Students who have successfully participated in the module are able to <ul style="list-style-type: none"><li>• describe and explain the value contribution of IT.</li><li>• discuss the advantages and disadvantages of different IT governance archetypes.</li><li>• evaluate the economic benefits of IT outsourcing.</li><li>• describe the tasks of business intelligence.</li><li>• explain the goals of IT architecture management.</li><li>• perform selected methods of IT architecture management.</li><li>• evaluate the advantages and disadvantages of IT standardization.</li><li>• explain the key characteristics of data-driven business models.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive frontal teaching</li><li>• Case studies</li><li>• Working on exercises</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam, 60 Minutes, 100%
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Literature references will follow at the beginning of the course.
<b>Additional notes</b>
The course will be extended by guest lectures and case studies if necessary.
The course is a <b>lecture with seminar character</b> . The emphasis is on an interactive form of teaching and learning and is achieved, among others, through the work on and presentation of practical case studies.

## 37502 IT Architecture Management

<b>Module number</b>
37502
<b>Course name</b>
IT Architecture Management
<b>Module coordinator</b>
Prof. Dr. Thomas Widjaja

Examination number	Credit points (ECTS)	Hours per week (SWS)
283004	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
every summer semester	1 Semester	

<b>Workload</b>
Lecture 2 SWS (30 hours class attendance; 45 hours self-study)
Exercise 2 SWS (30 hours class attendance; 45 hours self-study)
Calculation is based on: every hr./sem.-week corresponds to 60 minutes. One semester is presumed to be 15 weeks, i.e. 14 course + 1 exam week
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the Master's degree programme in Business Information Systems. Successful attendance of the module "IT Management" (or comparable knowledge requirement) is recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
IT architectures define the company's IT components and their interactions. This module provides an overview of the tasks and objectives of IT architecture management and covers the following topics in more detail:
1. Introduction and Overview (information systems, systems theory, IT architecture, enterprise architecture, IT architectures as models, meta-models, and goals of IT architecture management).
2. Operating Model (standardization, integration, types of operating models, enterprise architecture core diagrams)
3. Frameworks for IS architecture management
4. Maturity levels of IT architectures (cost, management, outsourcing, and agility aspects of maturity levels of IT architectures)
5. Management of IT complexity (complex adaptive systems, emergence, IT complexity, IT heterogeneity, Ashby's Law of Requisite Variety, standards, management of functional redundancy)

6. Modularity (design structure matrices, IT architecture modularity and IT governance decentralization, design parameters, bi-modal architectures, and organizational ambidexterity)  
7. Architecture of digital platforms and Decentralized Autonomous Organizations (DAOs) (layered modular architecture, generativity, platform governance and boundary resources, platform openness).

**Intended learning outcomes (ILOs)**

Students, who have successfully participated in the module,

- classify enterprise architecture management as a sub-field of IT management.
- explain the goals of IT architecture management and their dependencies.
- explain the interactions between enterprise architectures and IT architectures.
- model enterprise and IT architectures from different perspectives.
- classify the management of redundancy and degree of standardization as central tasks of IT architecture management.
- explain the essential frameworks and methods for IT architecture management.
- implement the essential frameworks and methods for IT architecture management.

**Teaching methods**

- Interactive frontal teaching
- Case studies
- Working on exercises

**Required attendance**

**Examination (type of examination, scope)**

Exam, 60 Minutes, 100 %

**Overall grade relevance**

**Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

**Additional notes**

The course will be extended by guest lectures if necessary. Literature references will follow at the beginning of the course.

### 37504 IT-Services und IT-Servicemanagement

<b>Modulnummer</b>
37504
<b>Veranstaltungstitel</b>
IT-Services und IT-Servicemanagement
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Thomas Widjaja

Prüfungsnummer	ECTS	SWS
266180	5	4
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
jedes Wintersemester (nicht im WiSe 25/26)	1 Semester	

<b>Workload</b>
Vorlesung 2 SWS (30 St. Präsenzzeit und 45 St. Eigenarbeitszeit) Übung 2 SWS (30 St. Präsenzzeit und 45 St. Eigenarbeitszeit)
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Verwendbarkeit</b>
Wirtschaftsinformatik/ Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnung für den Masterstudiengang Wirtschaftsinformatik. IT-Management sowie Geschäftsprozessmanagement aus dem Bachelor-Studiengang Wirtschaftsinformatik oder gleichwertige Kenntnisse empfohlen.
<b>Verpflichtende Voraussetzungen</b>
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
Die Vorlesung setzt sich mit den zentralen IT-Managementaufgaben zur Erbringung von Services auseinander. Folgende Themen werden unter anderem behandelt:
1. Einführung und Überblick über digitale Dienstleistungen und das Management Digitaler Dienstleistungen aus zwei Perspektiven
2. Service Dominant Logic (SDL)
3. Digitalisierungsgrad von Services
4. Qualität von Services: u. a. „SERVQUAL“ zur Messung der Servicequalität sowie IT-spezifische Anpassungen (z. B. e-SERVQUAL)
5. Serviceorientierte Architekturen
6. Cloud Computing und Software as a Service (SaaS)
7. Nutzerdatenbasierte Services

<b>8. IT-Service-Management: Aufgaben des IT-Service-Managements, Modelle und Rahmenkonzepte (ITIL, COBIT), Unterstützung durch Software-Werkzeuge</b>
<b>Lernergebnisse Lernziele</b>
Studierende, die an diesem Modul teilgenommen haben,
<ul style="list-style-type: none"><li>• erklären die wichtigsten Grundbegriffe aus dem Bereich des IT-Service-Managements.</li><li>• spezifizieren IT-Services korrekt.</li><li>• unterstützen Organisationen bei der Entscheidung, ob ein IT-Service selbst erstellt oder vom Markt bezogen werden sollte.</li><li>• setzen Verfahren zur Messung der IT-Servicequalität um.</li><li>• bestimmen den Digitalisierungsgrad von Services.</li><li>• erklären die wesentlichen Parameter beim Erstellen von nutzerdatenbasierten Services nennen und deren Zusammenhänge.</li><li>• beschreiben die Wirkung von IT-Service-Management auf IT-Business-Alignment.</li></ul>
<b>Lehr- und Lernformen</b>
<ul style="list-style-type: none"><li>• Interaktiver Frontalunterricht</li><li>• Bearbeitung von Fallstudien in Gruppenarbeit</li><li>• Praktische Übung</li></ul>
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Klausur, 60 Minuten, 100 %
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<b>Weitere Hinweise</b>
Die Veranstaltung wird ggf. um Gastvorträge erweitert. Literaturhinweise folgen zu Beginn der Lehrveranstaltung.
<b>WICHTIG: Im WiSe 25/26 findet diese Veranstaltung NICHT statt, da sich Prof. Widjaja im Forschungsfreisemester befindet.</b>

### 37506 Master Seminar Business Information Systems

<b>Module number</b>
37506
<b>Course name</b>
Master seminar
<b>Module coordinator/ examiner(s)</b>
Prof. Dr. Thomas Widjaja

Examination number	Credit points (ECTS)	Hours per week (SWS)
266592	7	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregularly	1 semester	

<b>Workload</b>
Seminar 2 SWS (30 hours class attendance; 180 hours self-study) Exercise 2 SWS (30 hours class attendance; 45 hours self-study) Calculation is based on: every hr./sem.-week corresponds to 60 minutes. One semester is presumed to be 15 weeks, i.e. 14 course + 1 exam week
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>LPO I applicability</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the Master's degree program in Information Systems.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The aim of the seminar is to examine current, practice-relevant issues in business information systems in a theory-driven way. The seminar topics are based on the research areas of the chair.
Written work: Students must write a seminar paper on current topics in business informatics. The work can also include own empirical research. Oral presentation: Presentation and discussion of the seminar paper.
<b>Intended learning outcomes (ILOs)</b>
After successfully completing the seminar, students are able to: <ul style="list-style-type: none"> <li>• explain, structure and evaluate topics that are currently being discussed in research in the field of business informatics.</li> <li>• effectively research, structure and evaluate relevant scientific literature and embed it in their own argumentation in a reflective way in a scientific paper.</li> </ul>

<ul style="list-style-type: none"><li>• reflect on critical comments in the process of writing a scientific paper and critically evaluate other works themselves.</li><li>• create an independent scientific paper that is formally correct according to the rules of good scientific work and is structured and creative in terms of content.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Workshops for presenting and discussing interim results in the group and with the supervising lecturers</li><li>• Individual support</li><li>• Individual preparation of a seminar paper</li><li>• Presentation of the seminar paper and discussion of the results</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Portfolio: <ul style="list-style-type: none"><li>• Term paper, approx. 15 pages</li><li>• Oral performance (presentation and discussion), presentation approx. 10 minutes, discussion approx. 5 minutes</li></ul>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
If you fail, you can repeat all courses in accordance with § 6 of the subject-specific study and examination regulations.
<b>Recommended reading</b>
<b>Additional notes</b>
Registration is required for both the chair and Stud.IP! Further information can be found on the chair's homepage. If requested by all participants, the course can be held in German. The term paper can be submitted in either English or German.

### 37507 Data Analysis in R for Information Systems Research

<b>Module number</b>
37507
<b>Course name</b>
Data Analysis in R for Information Systems Research
<b>Module coordinator</b>
Prof. Dr. Thomas Widjaja

Examination number	Credit points (ECTS)	Hours per week (SWS)
266501	2	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hours class instruction; 30 hours self-study) Calculation is based on: every hr./sem.-week corresponds to 60 minutes. One semester is presumed to be 15 weeks, i.e. 14 course + 1 exam week
<b>Module applicability</b>
- Methods - Wirtschaftsinformatik/Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
In accordance with § 3 of the study and examination regulations for the master degree program information systems. Students should have knowledge in statistics on master level (preferably via the complementary course 'Computational Statistics – Regression in R'). It is possible to attend this course and the complementary course 'Computational Statistics – Regression in R' in the same semester (see "additional notes" for further information). Also, students should be familiar with the programming language R and RStudio (e.g., via prior experience or reading of the online documentation).
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The application of computational, data-driven research methods is an important skill for information systems researchers. These research methods can use data from various sources such as surveys. To analyze the data sets, this course focuses on structural equation modeling. The course provides the necessary statistical foundations and introduces the basic concepts and techniques of structural equation modeling. The concepts and techniques are applied to a self-collected real-world data-set and application examples from information systems research. The implementation of our own structural equation models will be demonstrated using the programming language R. On this basis, the course covers the following topics:
<ol style="list-style-type: none"> <li>1. Specification of measurement models</li> <li>2. Specification of structural models</li> </ol>

<p>3. Data collection and examination 4. PLS path model estimation 5. Reflective and formative measurement model assessment 6. Assessment of the structural model 7. Moderator and mediator analysis</p>
<b>Intended learning outcomes (ILOs)</b>
<p>Students, who have successfully participated in this module,</p> <ul style="list-style-type: none"><li>• have gone through the research process from data collection to analysis</li><li>• can differentiate different techniques for structural equation modeling</li><li>• can assess structural equation models used in information systems research papers</li><li>• are able to handle data sets and estimate their own structural equation models</li></ul>
<b>Teaching methods</b>
<p>Lecture with seminar character. The lecture will be conducted through an interactive classroom lecture, with real world exercises in the computer lab. Individual student presentations will be discussed in the classroom. Additionally, teams of students will analyze a self-collected data set from the context of information systems through structural equation modelling using R and consolidate their analysis results in a written report.</p>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
<p>To successfully pass the course, teams of students must analyze a data set from the context of information systems research.</p> <p>The teams provide a written report about their analysis (approx. 10 pages) which is worth 60% of the course grade. The teams of students additionally give an oral presentation (approx. 5 minutes per team member) followed by a discussion (approx. 10 minutes) about the analysis which they have conducted, which is worth 40%.</p>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
<p>Exam resits are detailed in § 6 of the subject-specific study and examination regulation.</p>
<b>Recommended reading</b>
<b>Additional notes</b>
<ul style="list-style-type: none"><li>• Hands-on exercises on techniques of structural equation modeling in the computer lab using R</li><li>• Collection of field data conducted by teams of students</li><li>• Please visit the website of the chair (<a href="http://www.bis.uni-passau.de">www.bis.uni-passau.de</a>) four weeks before the semester starts for information about the enrolment (especially for information about attendance on this course and the complementary course 'Computational Statistics – Regression in R')</li></ul>

### 37509 Cloud Anwendungsentwicklung und Applikationstest

<b>Modulnummer</b>
37509
<b>Veranstaltungstitel</b>
Cloud Anwendungsentwicklung und Applikationstest
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Widjaja, Dr. Maximilian Reiter

Prüfungsnummer	ECTS	SWS
283017	5	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Jedes Wintersemester	14 Tage (Blockveranstaltung)	3

<b>Workload</b>
14-tägige Blockveranstaltung vor Beginn des Semesters
Es wird mit folgendem Aufwand gerechnet:
<ul style="list-style-type: none"> <li>• 6 Stunden pro Tag mit Dozenten</li> <li>• Ca. 2 Stunden Nachbereitungszeit pro Tag</li> <li>• Ca. 4 Stunden Vorbereitungszeit für Abschlussvortrag</li> </ul>
<b>Verwendbarkeit</b>
Wirtschaftsinformatik/ Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Keine
<b>Verpflichtende Voraussetzungen</b>
Programmierkenntnisse (z.B. mit JavaScript oder TypeScript) sind erforderlich, da diese nicht im Rahmen der 2-wöchigen Blockveranstaltung vermittelt werden können.
Zur Überprüfung der empfohlenen Voraussetzungen ist ein gesondertes Anmeldeverfahren vorgesehen. Bewerbungsfristen und Bewerbungsmodus werden den Studierenden rechtzeitig über die studienbezogenen Informationskanäle mitgeteilt.
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
<ul style="list-style-type: none"> <li>• Einführung in Domain Driven Design und Microservices</li> <li>• Grundlagen Qualitätssicherung</li> <li>• Arbeiten im agilen Umfeld</li> <li>• Agiles Testen</li> <li>• Einführung in die Cloudbauung</li> <li>• Architektur Cloud-nativer Anwendungen</li> <li>• Entwicklung Cloud-nativer Anwendungen</li> <li>• Testautomatisierung Cloud-nativer Anwendungen</li> </ul>

<p>Das Modul führt Studierende in die aktuelle Softwareentwicklungspraxis ein. Der Schwerpunkt liegt dabei auf der Softwareentwicklung in der Cloud und insbesondere dem Testen der erzeugten Software.</p> <p>Im Rahmen der 14-tägigen Veranstaltung wird eine kleine App entwickelt und getestet. Als Vorgehensmodell wird ein agiler Ansatz gewählt, da ein Großteil der Software heutzutage auf Basis dieses Vorgehensmodells erstellt wird. Dabei wird auf diejenigen Konzepte näher eingegangen, die auch im Rahmen dieses Moduls zum Einsatz kommen.</p>
<b>Lernergebnisse Lernziele</b>
Nach erfolgreicher Teilnahme am Modul 37509
<ul style="list-style-type: none"><li>• verstehen Studierende, wie Software zum aktuellen Zeitpunkt entwickelt wird</li><li>• können Studierende die agilen Methoden von Scrum in der Praxis anwenden</li><li>• können Studierende Applikationen in der AWS-Cloud entwickeln</li><li>• können Studierende begründen, wie durch Tests qualitativ hochwertige Software entsteht</li></ul>
<b>Lehr- und Lernformen</b>
Interaktiver Frontalunterricht. Die Praxisübungen sind in die Blockveranstaltung integriert.
<b>Anwesenheitspflicht</b>
Ja
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
Selbständige Bearbeitung eines Projekts, Präsentation. Bewertung der Projektergebnisse (100 % der Gesamtnote) mit einer Note am Ende der Blockveranstaltung (inkl. Zwischendokumente und Projektplanung, System- und Benutzerdokumentation des fertigen Endproduktes). Portfolioprüfung.
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Keine Wiederholungsmöglichkeit der Prüfung; Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.
<b>Literatur</b>
<b>Weitere Hinweise</b>

**39606 Master Seminar Telecommunications and Internet Business**

<b>Module number</b>
39606
<b>Course name</b>
Masterseminar
<b>Module coordinator</b>
Prof Dr Jan Krämer

<b>Examination number</b>	<b>Credit points (ECTS)</b>	<b>Hours per week (SWS)</b>
266210	7	2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every semester	1 semester	One semester before writing the Master's thesis

<b>Workload</b>
Seminar 2 SWS (30 hours attendance time and 180 hours individual work time) The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is counted as 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to LPO I</b>
<b>Recommended prerequisites</b>
In accordance with § 3 of the study and examination regulations for the Master's degree programme in Wirtschaftsinformatik.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
Preparation of a seminar paper in the field of the Internet and telecommunications business. Thesis must be problem-orientated and contain own work in the form of a critical analysis of literature or a discussion of scientific methodology. The problem, objectives and approach of the work as well as the results of the study must be presented and discussed.
<b>Intended learning outcomes (ILOs)</b>
Students who have taken part in the module "Master Seminar Telecommunications and Internet Business": <ul style="list-style-type: none"><li>• explain their own scientific approach in the preparation of their seminar paper</li><li>• know the basics of scientific work and can analyse and interpret their research topic scientifically.</li><li>• present connections between their own work and topics from research in the field of Internet and telecommunications business</li><li>• acquire knowledge of presentation and communication techniques and are able to formulate and argue in defence of their subject-related positions and problem solutions.</li><li>• assess the quality of sources</li></ul>

<ul style="list-style-type: none"><li>• develop the ability to systematically and structurally analyse the scientific literature on a specific issue and to summarise and evaluate the Content.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Individual preparation of a seminar paper</li><li>• Presentation of the seminar paper</li><li>• Discussion of the results</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Successful participation in the seminar requires written and oral performance. The written assignment consists of a 15-page term paper. The oral performance consists of a presentation of your own work (approx. 20 minutes) and an active discussion of your own and other students' work.
Portfolio examination
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<b>Additional notes</b>
Please register via the chair. Further information can be found on the chair's website.

### 39607 Master Colloquium in Internet and Telecommunications Business

<b>Module number</b>
39607
<b>Course name</b>
Masterkolloquium
<b>Module coordinator</b>
Prof Dr Jan Krämer

Examination number	Credit points (ECTS)	Hours per week (SWS)
283001	1	1
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
every semester	1 semester	The module must be completed alongside the Master's thesis.

<b>Workload</b>
Colloquium 1 SWS (15 hours attendance time and 15 hours individual work time)
The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is counted as 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to LPO I</b>
<b>Recommended prerequisites</b>
In accordance with § 3 of the study and examination regulations for the Master's degree programme in Information Systems. The module must be completed alongside the Master's thesis.
<b>Requirements</b>
Admission to the final thesis and completion at the chair is a prerequisite for participation in the colloquium.
<b>Language of instruction</b>
English

<b>Contents</b>
The colloquium provides an introduction to scientific work and supplements any previous knowledge. It provides the necessary knowledge for the final thesis in
i) scientific research and assessment of the quality of sources,
ii) scientific writing and citation,
iii) scientific presentation, as well as
iv) an introduction to LaTeX.
In addition, the colloquium allows students to present and discuss their own Master's thesis in a plenary session.
<b>Intended learning outcomes (ILOs)</b>
Students who have taken part in the module "Master's Colloquium in Internet and Telecommunications Business":
<ul style="list-style-type: none"> <li>• explain their own scientific approach when writing their thesis</li> <li>• use their knowledge of scientific literature to write their thesis in accordance with the rules of good scientific work, formally correct and structured in terms of Content</li> </ul>

<ul style="list-style-type: none"><li>• present connections between their own work and topics from research in the field of Internet and telecommunications business</li><li>• illustrate and present their final thesis, taking into account the requirements of academic writing and citation</li><li>• assess the quality of sources</li><li>• develop a deeper understanding of scientific work and presentation and how to deal with criticism and the realisation of critical comments</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Discussion and joint development of the teaching Content</li><li>• Presentation of individual topics by students and doctoral candidates</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
An initial bibliography will be provided during the first counselling interview.
<b>Additional notes</b>
The module is compulsory for students writing their Master's thesis at the chair. Please note the regulations for registering theses at the chair. Admission to the thesis is a prerequisite for participation in the colloquium.

## 39612 Digital Markets and Online Platforms

<b>Module number</b>
39612
<b>Course name</b>
Digital Markets and Online Platforms
<b>Module coordinator</b>
Prof. Dr. Jan Krämer

Examination number	Credit points (ECTS)	Hours per week (SWS)
266201	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 Semester	

<b>Workload</b>
Lecture 2 SWS (30 hrs. attendance and 45 hrs. self-study) Tutorial 2 SWS (30 hrs. attendance and 45 hrs. self-study)
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Gem. § 4 der Prüfungs- und Studienordnung für den Masterstudiengang Wirtschaftsinformatik (Information Systems).
Basic knowledge of economics is highly recommended. Ideally, but not necessarily, basic knowledge of the Internet economy.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The lecture lays a methodological foundation in the economics of digital markets and online platforms, while paying special attention to strategic, technological and behavioral aspects of platform design. Particularly, this includes the following topics:

- Strategies for successful launch and governance of platforms
- Managing openness of platform ecosystems
- Reviews, Ratings and Recommender Systems
- Pricing on two-sided platforms
- Data-driven platform design and consumer behavior
- Regulating market power and competition issues in digital markets

<b>Intended learning outcomes (ILOs)</b>
Students who have successfully participated in the module “Digital Markets and Online Platforms”, <ul style="list-style-type: none"><li>• explain the current state of research on online platforms, firms' strategies in digital markets and the ongoing policy debate on regulation of digital markets.</li><li>• interpret business models, governance and design, and competition in the Internet economy.</li><li>• perform a complete analytical (algebraic) equilibrium analysis of game-theoretic models for competition between two-sided platforms.</li><li>• understand the design of and computations performed by various types of recommender systems.</li><li>• illustrate how platform design decisions shape behavior of economic actors on a platform.</li><li>• assess how different methodological approaches in the literature contribute to a better understanding of the topic and, where appropriate, to academic or policy debates.</li><li>• develop holistic strategies for platform businesses taking into account the idiosyncratic characteristics of digital markets.</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive lecture</li><li>• Tutorial</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Final exam 60 minutes - 100 %
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<ul style="list-style-type: none"><li>• Parker, G., van Alstyne M., Choudary S. (2016). Platform Revolution. W. W. Norton &amp; Company, Inc.</li><li>• Belleflamme, P &amp; M. Peitz (2021). The Economics of Platforms: Concepts and Strategies. Cambridge University Press.</li></ul>
<b>Additional notes</b>
<ul style="list-style-type: none"><li>• All teaching material in English language</li><li>• Teaching language in English</li><li>• Replaces the course “Electronic Markets”, students who have already completed the course “Electronic Markets” (PN: 266200) cannot register for this course.</li></ul>

### 39614 Governance of Platforms and Ecosystems

<b>Module number</b>
39614
<b>Course name</b>
Governance of Platforms and Ecosystems
<b>Module coordinator</b>
Dr. Chayannin Wipusanawan

Examination number	Credit points (ECTS)	Hours per week (SWS)
283019	5	3
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hrs. attendance and 70 hrs. self-study) Tutorial 1 SWS (15 hrs. attendance and 35 hrs. self-study)
The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Gem. § 4 der Prüfungs- und Studienordnung für den Masterstudiengang Wirtschaftsinformatik (Information Systems).  Basic knowledge of microeconomics is highly recommended.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
This module explores the economic principles that shape the governance and regulation of relationships between firms in digital network industries. Key topics include: <ul style="list-style-type: none"> <li>• Compatibility and the standardization process</li> <li>• Competition policy in digital markets</li> <li>• Sector-specific regulations for network industries and digital platforms</li> </ul> Students will gain insights into the economic dynamics driving digital markets and the regulatory frameworks that influence competition, innovation, and industry standards.

<b>Intended learning outcomes (ILOs)</b>
Students who have successfully completed the module are able to
<ul style="list-style-type: none"><li>• solve basic game-theoretical models of competition between firms and discuss the implications of the results on firm strategies and public policies</li><li>• explain the economic theories on compatibility and standardization, including their implications on competition and consumers</li><li>• explain and analyze competition policy issues pertaining to digital markets and platforms based on economic theory</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive lecture</li><li>• Tutorial</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Final exam (60 minutes): 100%
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<b>Additional notes</b>
<ul style="list-style-type: none"><li>• All teaching material in English language</li><li>• Teaching language in English</li></ul>

## 39720 Fundamentals of Business Analytics

<b>Module number</b>
39720
<b>Course name</b>
Fundamentals of Business Analytics
<b>Module coordinator</b>
Prof. Dr. Harry Haupt, Prof. Dr. Dirk Totzek, PD Dr. Joachim Schnurbus, Prof. Dr. Marc Goerigk

Examination number	Credit points (ECTS)	Hours per week (SWS)
261003	5	5
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every semester	Block	1

<b>Workload</b>
5 SWS (150h of own work)
<b>Module applicability</b>
Interdisziplinäres Vertiefungsangebot
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Basic knowledge in quantitative methods at the level of a management-oriented or economics-oriented bachelor's degree
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
Data Literacy (i.e., competencies in Data Analytics and Data-Driven Decision Making) and Mathematical Literacy (i.e., the fundamentals in Mathematics and Statistics) form a fundamental framework of modern management. These core competencies are refreshed and strengthened in this course. The course covers four subject areas.:
1) Fundamentals of Mathematics:
Sums, products, sets, linear equations, inequalities
Calculus (functions, limits, derivatives and integration)
Linear algebra (matrix algebra and systems of linear equations)
2) Fundamentals of Statistics
Random variables and stochastic modeling
Estimation and test theory
Regression modeling
3) Fundamentals of Management Science
Modeling of optimization problems
Introduction to algorithms, heuristics and metaheuristics
Linear programming

4) Fundamentals of Empirical Research Methods  
Business research process  
Primary and secondary data collection methods  
Hypothesis testing

**Intended learning outcomes (ILOs)**

Students who have successfully participated in the module "Fundamentals of Business Analytics" are able to identify appropriate quantitative methods to address questions and challenges in modern data-driven management, are able to reflect on the underlying elementary mathematical, statistical, optimization foundations and on the corresponding empirical research process, apply the methods and interpret the result from a management or economic perspective.

**Teaching methods**

E-learning/online course with supporting live sessions  
Intensive block course at the beginning of the semester (~ 4 weeks)  
individual learning organization, based on knowledge and competencies identified in the placement test

**Required attendance**

**Examination (type of examination, scope)**

Portfolio examination. The final grade depends on the successful completion of e-assessments qualifying in all four subject areas of the course.

**Overall grade relevance**

**Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

**Additional notes**

Online course

**39802 Masterseminar Wirtschaftsinformatik Daten- und Informationsmanagement**

<b>Modulnummer</b>
39802
<b>Veranstaltungstitel</b>
Masterseminar
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Jin Gerlach

Prüfungsnummer	ECTS	SWS
283015	7	2
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Jedes Wintersemester	1 Semester	

<b>Workload</b>
Seminar 2 SWS (30 St. Präsenzzeit und 180 St. Eigenarbeitszeit)
Es wird mit 15 Semesterwochen gerechnet (14 Vorlesungs- + 1 Prüfungswoche) und jede SWS geht mit 60 Minuten in die Berechnung ein.
<b>Verwendbarkeit</b>
Wirtschaftsinformatik/ Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Gem. § 3 der Studien- und Prüfungsordnungen für den Masterstudiengang Wirtschaftsinformatik.
<b>Verpflichtende Voraussetzungen</b>
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalte</b>
Im Rahmen des Seminars werden aktuelle Themen der Wirtschaftsinformatik untersucht, die im Bereich der Forschungsschwerpunkte des Lehrstuhls angesiedelt sind.
Schriftliche Leistung: Anfertigung einer Seminararbeit zu ausgewählten Seminarthemen. Im Rahmen der Seminararbeit soll eine wissenschaftliche Auseinandersetzung mit bestehender Theorie und ggf. Methoden im jeweiligen Themenbereich erfolgen. Auch eine eigene empirische Untersuchung kann Bestandteil der Seminararbeit sein.
Mündliche Leistung: Im Rahmen einer Präsentation wird die eigene Arbeit (Problemstellung, Ziele, Vorgehen und Ergebnisse) vorgestellt und mit den anderen Seminarteilnehmenden diskutiert.
<b>Lernergebnisse Lernziele</b>
Studierende, die an dem Modul „Masterseminar Daten- und Informationsmanagement“ teilgenommen haben:
<ul style="list-style-type: none"> <li>• erläutern ihr eigenes wissenschaftliches Vorgehen bei der Erstellung ihrer Seminararbeit,</li> </ul>

- nutzen die Grundlagen wissenschaftlichen Arbeitens und interpretieren ihr Forschungsthema wissenschaftlich,
- stellen Zusammenhänge zwischen ihrer eigenen Arbeit und der Themenstellung aus der Forschung im Bereich Daten- und Informationsmanagement dar,
- erwerben Kenntnisse der Präsentations- und Kommunikationstechniken,
- formulieren ihre fachbezogenen Positionen und Problemlösungen und verteidigen diese argumentativ,
- beurteilen die Qualität von Quellen,
- und entwickeln die Fähigkeiten, die Fachliteratur zu einer spezifischen Fragestellung systematisch und strukturiert zu erfassen und die Inhalte zu beurteilen.

Ziel des Seminars ist die Vertiefung der Kenntnisse in ausgewählten Themenbereichen der Wirtschaftsinformatik. Die Studierenden erlernen dabei Grundlagen des wissenschaftlichen Arbeitens, um sich kritisch mit den Grenzen des bestehenden Wissens auseinandersetzen zu können. Im Rahmen der Präsentation verbessern die Studierenden ihre Präsentations- und Kommunikationsfähigkeiten und lernen, sich an wissenschaftlichen Diskussionen zu beteiligen.

#### **Lehr- und Lernformen**

- Workshops zur Präsentation und Diskussion von Zwischenergebnissen, gemeinsam mit anderen Seminar teilnehmenden und Dozenten
- Individuelle Betreuung der Studierenden
- Individuelle Erstellung der Seminararbeit
- Präsentation der Seminararbeit und Diskussion der Ergebnisse

#### **Anwesenheitspflicht**

#### **Prüfungsleistung (Prüfungsform, Umfang)**

Portfolio. Hausarbeit, ca. 15-seitige

Mündliche Leistung (Vortrag und Diskussion), Vortrag ca. 20 Minuten, Diskussion ca. 10 Minuten

#### **Gesamtnotenrelevanz**

#### **Wiederholungsmöglichkeit**

Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.

#### **Literatur**

#### **Weitere Hinweise**

Anmeldung über den Lehrstuhl. Weitere Informationen dazu finden Sie auf der Lehrstuhl-Homepage.

### 39803 Strategies in the Software Industry

<b>Module number</b>
39803
<b>Course name</b>
Strategies in the Software Industry
<b>Module coordinator</b>
Prof. Dr. Jin Gerlach

Examination number	Credit points (ECTS)	Hours per week (SWS)
283014	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hrs. attendance time and 45 hrs. self-study time) Exercise 2 SWS (30 hrs. attendance time and 45 hrs. self-study time)
The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the Master's degree programme Information Systems.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
With many of the big tech companies being software companies nowadays, software is no longer only a product. Instead, a business model has developed around software. However, software characteristics differ from physical products, making it important to take specific strategic considerations into account. This course addresses the specifics of software as a good as well as the software industry and resulting consequences for strategies of software providers (e.g., software startups or established tech firms). Essential Contents include:
<ul style="list-style-type: none"> <li>• Characteristics of digital goods</li> <li>• Network effects and network effect markets</li> <li>• Digital value chains</li> <li>• Platforms</li> <li>• Fundamental principles of the software industry</li> <li>• Cloud computing and Software as a Service</li> </ul>

- Pricing strategies for software vendors
- Cooperation strategies for software vendors
- The value of data
- Data-based business models
- Privacy in data-based business models
- Specifics of Open Source Software

#### **Intended learning outcomes (ILOs)**

This course aims to provide fundamental knowledge on the specifics of the software industry with a focus on strategies in the software industry for software providers. After attending this course, the students

- explain central factors and specifics of software from an economic point of view,
- explain important aspects of the market for software,
- and, based on their acquired knowledge, students develop management decisions for software companies and develop strategies for software vendors.

#### **Teaching methods**

Interactive frontal teaching

Processing of exercise tasks

#### **Required attendance**

#### **Examination (type of examination, scope)**

Exam, 60 minutes, 100 %

#### **Overall grade relevance**

#### **Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

#### **Recommended reading**

#### **Additional notes**

- All teaching material in English language
- Teaching language also in English

### **39807 Management of Information Security and Privacy**

<b>Module number</b>
39807
<b>Course name</b>
Management of Information Security and Privacy
<b>Module coordinator</b>
Prof. Dr. Jin Gerlach

<b>Examination number</b>	<b>Credit points (ECTS)</b>	<b>Hours per week (SWS)</b>
250216	5	2+2
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
Lecture 2 SWS (30 hrs. attendance time and 45 hrs. self-study time) Exercise 2 SWS (30 hrs. attendance time and 45 hrs. self-study time)
The calculation is based on 15 semester weeks (14 lecture weeks + 1 examination week) and each SWS is included in the calculation with 60 minutes.
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
According to § 3 of the study and examination regulations for the Master's degree programme Information Systems.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
The ongoing digitization increases the importance for organizations to protect their digital assets, customer information, and privacy. To ensure such protection, organizations must adequately manage information security and customer privacy, which is associated with numerous challenges. This course addresses central organizational and management issues, processes, frameworks, theories, and challenges associated with the management of information security and privacy. Note: the course focuses on a management/organizational perspective. It is not a technical course.
Topics covered by this course are:

- Basic concepts associated with information security and privacy
- Risk management techniques for information security
- Organization of information security and privacy management
- Investment decisions with respect to information security
- Countermeasures for preventing information security and privacy incidents

<ul style="list-style-type: none"><li>• Measures for detecting security breaches</li><li>• Responding to information security breaches</li><li>• Tensions and tradeoffs with respect to privacy management</li><li>• Ethical perspectives on managing information security and privacy</li></ul>
<b>Intended learning outcomes (ILOs)</b>
This course aims to provide advanced knowledge on the management of information security and privacy in organizations. After attending this course, students
<ul style="list-style-type: none"><li>• explain key challenges regarding the management of information security and privacy in organizations,</li><li>• conceptualize organizational measures that help to improve information security and privacy protection,</li><li>• and, based on the knowledge they have acquired, students develop well-founded management decisions in organizations to enhance information security and privacy protection.</li></ul>
<b>Teaching methods</b>
Interactive frontal teaching Processing of exercise tasks
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Exam, 60 minutes, 100 %
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
<b>Additional notes</b>
- All teaching material in English language - Teaching language also in English

### 39908 Scientific Computing and Digital Reporting with Python

<b>Module number</b>
39908
<b>Course name</b>
Scientific Computing and Digital Reporting with Python
<b>Module coordinator</b>
Prof. Dr. Ralf Kellner

Examination number	Credit points (ECTS)	Hours per week (SWS)
262107	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
150 h (60 h contact studies / 90 h self-studies)
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Mathematics and statistics from the Bachelor's programme. At best, the course 'Fundamentals of Business Analytics' (39720) has already been taken beforehand.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>• Introduction to programming with Python</li> <li>• Statistical models (sklearn, statsmodels, etc. and own implementation)</li> <li>• Optimization using gradient-based algorithms (Scipy, Tensorflow, Pytorch)</li> <li>• Matrix decompositions with application examples such as principal component analysis</li> <li>• Access to data using APIs and web scraping</li> <li>• Digital reporting with the help of a specially programmed web application</li> <li>• Final project: data reference, analysis using a model, reporting of the results using a customized web app</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
After successfully completing the course, students will be able to carry out advanced data analyses using the Python programming language and inform external parties about the relevant results of the analyses in an appropriate manner. This includes all individual steps from collecting their own data, identifying and carrying out their own analyses to making the results accessible. In addition, course participants gain in-depth knowledge of the statistical modelling of financial market data. In addition to specific applications, the general competence of independent learning of new statistical models is trained.

<b>Teaching methods</b>
<ul style="list-style-type: none"><li>• Interactive lectures</li><li>• Interactive exercises</li><li>• Digital teaching materials on programming with Python and the methodological basics of the course</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
<ul style="list-style-type: none"><li>• Written exam</li><li>• Digital exam</li></ul>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
In the event of failure, all courses can be repeated in accordance with § 6 of the subject-specific study and examination regulations.
<b>Recommended reading</b>
<ul style="list-style-type: none"><li>• Deep Learning (2016) – Goodfellow, I., Bengio, Y., Courville, A.; MIT Press</li><li>• The Elements of Statistical Learning (2017) - Hastie, T., Tibshirani, R., Friedman, J.; Springer</li><li>• Hands-On Machine Learning with Scikit-Learn, Keras &amp; Tensorflow (2017) – Geron, A.; Wiley</li><li>• Learn Python Programming (2018) – Romano, F., Packt Publishing Ltd.</li><li>• Web Scraping with Python (2018) - Ryan Mitchell, O'Reilly Media, Inc.</li></ul>
<b>Additional notes</b>

### 39910 Financial Data Analytics and Machine Learning

<b>Module number</b>
39910
<b>Course name</b>
Financial Data Analytics and Machine Learning
<b>Module coordinator</b>
Prof. Dr. Ralf Kellner

Examination number	Credit points (ECTS)	Hours per week (SWS)
262502	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
150 h (60 h contact studies / 90 h self-studies)
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Fundamentals of mathematics and statistics.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>• Asset classes on capital markets</li> <li>• Stocks, bonds and options</li> <li>• Descriptive analysis of one- and multi-dimensional distributions of asset prices and returns</li> <li>• Introduction to portfolio theory</li> <li>• Factor models</li> <li>• Empirical analysis within and between asset classes</li> <li>• Principles of machine learning</li> <li>• Neural networks</li> <li>• Machine learning in the financial sector</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
Students gain a basic understanding of various asset classes on financial markets and the associated fundamental theories. Students are able to name the special features of financial data and apply the knowledge acquired in the course to real financial market developments. In addition, students understand how machine learning can be used in the financial sector in an insightful and informative way. Students interpret their own analyses, through which profound references to financial market theories are established.

<b>Teaching methods</b>
• Interactive lectures incl. digital documents
• Interactive exercise units
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
• Written exam
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
In the event of failure, all courses can be repeated in accordance with § 6 of the subject-specific study and examination regulations.
<b>Recommended reading</b>
• Options, Futures and other Derivatives (2021) – John C. Hull, Pearson Verlag
• Machine Learning in Finance (2021) – Dixon, M.F., Halperin, I., Bilokon, P.; Springer Verlag
• Statistics and Data Analysis for Financial Engineering (2015) – Ruppert, D., Matteson, D. S.; Springer
<b>Additional notes</b>

**39915 Deep Learning and Text Analysis in Finance**

<b>Module number</b>
39915
<b>Course name</b>
Deep Learning and Text Analysis in Finance
<b>Module coordinator</b>
Prof. Dr. Ralf Kellner

Examination number	Credit points (ECTS)	Hours per week (SWS)
262503	5	4
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	4

<b>Workload</b>
150 h (60 h contact studies / 90 h self-studies)
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Fundamentals of mathematics and statistics.
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>• Text Preprocessing</li> <li>• Simple frequency-based text models</li> <li>• Quantitative basics for understanding advanced text models</li> <li>• Word2Vec, Doc2Vec</li> <li>• Text models with attention mechanisms: encoder and decoder models</li> <li>• Use of text models in the financial sector <ul style="list-style-type: none"> <li>◦ Information processing of capital market participants</li> <li>◦ Quantification of capital market reactions</li> <li>◦ Identification of companies with risks in relation to climate change and the transformation to a CO2-neutral economy</li> </ul> </li> </ul>
<b>Intended learning outcomes (ILOs)</b>
Students who have successfully completed this course
<ul style="list-style-type: none"> <li>• develop a deep understanding of how modern text models work</li> <li>• establish the connection between general machine learning methods and modern text modelling</li> <li>• assess which form of text analysis is suitable for different situations</li> </ul>

<ul style="list-style-type: none"><li>use modern text models to analyse and evaluate important documents from the field of economics</li></ul>
<b>Teaching methods</b>
<ul style="list-style-type: none"><li>Interactive lectures incl. digital documents</li><li>Interactive exercise units</li></ul>
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
<ul style="list-style-type: none"><li>Written exam</li></ul>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
In case of failure, all courses can be repeated according to § 6 of the subject study and examination regulations.
<b>Recommended reading</b>
<ul style="list-style-type: none"><li>Machine Learning for Text (2018) – Aggarwal, C. C., Springer Verlag</li><li>When Is a Liability Not a Liability? Textual Analysis, Dictionaries, and 10-Ks (2011) – Loughran and McDonald, The Journal of Finance 66(1)</li><li>Disclosure Sentiment: Machine Learning vs. Dictionary Methods (2022) – Frankel et. al, Management Science 68(7)</li></ul>
<b>Additional notes</b>

## 5622V Software-Sicherheit / System Security

<b>Modulnummer</b>
5622V
<b>Veranstaltungstitel</b>
Software-Sicherheit / System Security
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Joachim Posegga

Prüfungsnummer	ECTS	SWS
405143	5	2V + 1Ü
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
jedes Sommersemester / every summer semester	1 Semester	

<b>Workload</b>
45 Std. Präsenz + 30 Std. Übungsaufgaben + 75 Std. Nachbearbeitung des Vorlesungsstoffes, Vorbereitung eines Referats und Prüfungsvorbereitung / 45 contact hours + 30 hrs exercises + 75 hrs follow-up, preparing a presentation and exam preparation
<b>Verwendbarkeit</b>
Wirtschaftsinformatik / Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Advanced IT Security
<b>Verpflichtende Voraussetzungen</b>
Keine / None
<b>Unterrichtssprache</b>
Deutsch oder Englisch / German or English

<b>Inhalt</b>
Der Inhalt des Moduls umfasst dabei z.B. risk & threat analysis, buffer und heap overflows, scripting languages, filter techniques, SQL injections, race conditions, attack surfaces, patch management, software testing, low level software security, Java security, reference monitors, least privilege principle, smart phone security, stack walks und history based access control.
The content of the module includes, i.e., risk & threat analysis, buffer and heap overflows, scripting languages, filter techniques, SQL injections, race conditions, attack surfaces, patch management, software testing, low-level software security, Java security, reference monitors, leases privilege principle, smart phone security, stack walks and history based access control.
<b>Lernergebnisse Lernziele</b>
<b>Kenntnisse / Skills/Knowledge</b>
Verständnis über Verwundbarkeiten deren Arten, Entstehung, Möglichkeiten der Ausnutzung und deren Folgen. Verstehen der Prinzipien für die Entwicklung sicherer Software. Überblick über Maßnahmen zur Schadensbegrenzung. Kenntnisse über Schritte zur forensischen Analyse von Sicherheitsvorfällen. Überblick der Akademische Leitsätze und praxisrelevante, „best practice“ Ansätze.

Understanding of the types of vulnerabilities, development, possibilities of use and its consequences. Understand the principles for the development of secure software. Overview of mitigation measures. Knowledge of steps for a forensic analysis of security incidents. Overview of Academic principles and practice-relevant “best practice“ approaches.

#### Fähigkeiten / Abilities

Aufspüren von Verwundbarkeiten; Ausbesserung von vorhandenen Verwundbarkeiten und forensische Analyse von Sicherheitsvorfällen

Detection of vulnerabilities; repair of existing vulnerabilities and forensic analysis of security incidents.

#### Kompetenzen / Competencies

Betrachtung von Systemen aus unterschiedlichen Blickwinkeln. Entwicklung, Analyse und Umsetzung möglicher Perspektiven und Reaktionsalternativen. Transformation und Reduktion akademischer Leitsätze auf praxisbezogene Anforderungen.

Consideration of systems from different angles. Development, analysis and implementation of possible perspectives and response alternatives. Transformation and reduction of academic principles to practical requirements.

#### Lehr- und Lernformen

Präsentation und Beamer, Tafel

Presentation and projector, blackboard

#### Anwesenheitspflicht

#### Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)

Teilprüfungsleistungen:

- Referat: ca. 30-min. Referat mit Präsentation über selbsterarbeitetes Thema. Die Studierenden können am Semesterbeginn aus einer Auswahl von Themen wählen.
- Schriftliche/mündliche Prüfung: 60-min. schriftliche Prüfung oder ca. 20-min. mündliche Prüfung. Die Prüfungsart wird am Semesterbeginn durch den/die Dozent(in) festgelegt und bekanntgegeben.

Eine Anmeldung zum Referat impliziert automatisch eine Anmeldung zu einem der angebotenen Termine zur schriftlichen/mündlichen Prüfung im Anschluss an den gleichen Vorlesungszeitraum. Zum Bestehen des Moduls müssen beide Teilprüfungsleistungen bestanden werden. Dabei wird die schriftliche/mündliche Prüfung mit 80% gewichtet, das Referat mit 20%.

This module is assessed in partial examinations:

- Oral presentation: approx 20 min. Students in small groups will present selected topics chosen during the semester.
- 60-minute written or 20-minute oral examination. The specific mode of assessment will be announced by the lecturer at the start of the semester.

Registration for the presentation automatically implies a registration for any of the dates offered for written/oral examination following the same course of lectures. In order to pass this module, students must pass both partial examinations. The exam will count 80% of the grade, the oral presentation 20%.

#### Gesamtnotenrelevanz

#### Wiederholungsmöglichkeit

Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.

#### Literatur

Michael Howard & David LeBlanc: Writing Secure Code, Microsoft Press, 2nd edition, 2002

Gary McGraw: Exploiting Software: How to Break Code, Addison-Wesley, February 2004

John Viega & Gary McGraw: Building Secure Software, Addison-Wesley, 2001  
Mark G. Graff & Kenneth R. van Wyk: Secure Coding, O'Reilly, 2003  
Brian A. La Macchia, Sebastian Lange, Matthew Lyons, Rudi Martin, and Kevin T. Price: .NET Framework Security, Addison-Wesley, 2002  
L. Gong, G. Ellison, M. Dageforde: Inside Java 2 Platform Security, Addison-Wesley, 2nd Edition, 200

**Weitere Hinweise**

**5724V Safety and Security of Critical Infrastructures**

<b>Modulnummer</b>
5724V
<b>Veranstaltungstitel</b>
Safety and Security of Critical Infrastructures (ehemalig: Sicherheit in Netzen)
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Dr. Hermann de Meer

Prüfungsnummer	ECTS	SWS
451006	6	2V + 2Ü
<b>Modulangebot</b>	<b>Zeitdauer des Moduls</b>	<b>Empfohlenes Studiensemester</b>
Unregelmäßig /irregular	1 Semester	

<b>Workload</b>
60 Std. Präsenz + 50 Std. Übungen + 70 Std. Nachbearbeitung des Vorlesung und Prüfungsvorbereitung / 60 contact hours + 50 hrs exercises + 70 hrs independent study and exam preparation
<b>Verwendbarkeit</b>
Wirtschaftsinformatik / Information Systems
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Grundlagen der IT-Sicherheit, Rechnernetze, Funktionale Sicherheit und Foundation of Energy Systems von Vorteil / Basics of IT Security, Computer Networks, Functional Safety and Foundation of Energy Systems advantageous
<b>Verpflichtende Voraussetzungen</b>
Keine / None
<b>Unterrichtssprache</b>
Deutsch oder Englisch / German or English

<b>Inhalt</b>
Das Modul beinhaltet im Bereich Netzsicherheit die Einführung in die Netzsicherheit und Sicherheitsprotokolle für Netzwerke. Weitere Inhalte sind die sichere drahtlose und mobile Kommunikation und der Bereich Sicherheit in drahtlosen Sensornetzwerken der die Punkte Einführung in die Sicherheit von Sensornetzen und Sicherheitsprotokolle in Sensornetzen umfasst. Zudem beinhaltet das Modul den Bereich Sicherheit im Smart Grid, dem zukünftigen intelligenten Stromnetz.
In the network security segment, the module includes an introduction to the network security and security protocols for networks. Other topics include secure wireless and mobile communication. The security in wireless sensor networks area includes an introduction to sensor network security and security protocols in sensor networks. The module also includes the area of security for Smart Grids, the intelligent power grids of the future.

<b>Lernergebnisse Lernziele</b>
<p><u>Kenntnisse / Skills/Knowledge:</u></p> <p>Die Studierenden lernen aktuelle und zukünftige Konzepte von Sicherheit in Netzen kennen. Sie erhalten Kenntnisse über die verschiedenen Bedrohungen und Angriffe sowie von der Konzeption und Implementierung von Sicherheitsdiensten zum Schutz des Netzes. Sie erlangen Kenntnisse über Methoden zur Gewährleistung von Sicherheitszielen wie Datenintegrität, Vertraulichkeit, Zurechenbarkeit und Verfügbarkeit. Bedrohungen wie Maskerade, Abhören von Daten, unberechtigter Zugang zu Services, Sabotage und Modifikation von Informationen können durch geeignete Sicherheitsdienste wie Authentizierungsservice oder Datenintegritätsservice ausgeschaltet werden.</p> <p>Students will learn about current and future concepts of security in networks. They will acquire knowledge of the various threats and attacks, as well as the design and implementation of security services for the protection of the network. They will gain knowledge of methods for ensuring security goals such as data integrity, confidentiality, accountability and availability. Threats such as masquerade, eavesdropping of data, unauthorized access to services, sabotage and modification of information can be turned off by suitable security services such as authentication services and data integrity services.</p>
<p><u>Fähigkeiten / Abilities:</u></p> <p>Die Studierenden entwickeln Fertigkeiten zum Design und Entwurf von Sicherheitsmechanismen bei verdrahteten Netzen, drahtlosen Netzen, mobilen Netzen, Sensornetzen und RFID-basierten Netzen. Sie erlangen die Fähigkeit aktuelle und künftige Konzepte der Netzsicherheit zu verstehen und zu bewerten. Durch die Analyse von verschiedenen Angriffsmethoden wie z.B. DoS oder Relay-Angriffe lernen sie, wie man geeignete Gegenmaßnahmen entwirft und in welcher Schicht des Protokollstacks welche Dienste auf welche Weise implementiert werden können, um die Angriffe zu verhindern.</p> <p>Students will develop skills to design security mechanisms in wired networks, wireless networks, mobile networks, sensor networks and RFID-based networks. They will gain the ability to understand current and future concepts of network security and evaluate them. By analyzing various attack methods such as DoS or relay attacks they learn how to design appropriate countermeasures and in what layer of the protocol stack which services can be implemented to prevent the attacks.</p>
<p><u>Kompetenzen / Competencies:</u></p> <p>Die Studierenden sind in der Lage, an Hand der Anforderungen selbstständig die erforderlichen Sicherheitsmechanismen wie Authentifizierungsprotokolle oder Datenintegritätsmechanismen zu entwerfen und zu implementieren</p> <p>Students will be able to understand the requirements for designing the security mechanisms such as authentication protocols and data integrity mechanisms and to implement them independently.</p>
<b>Lehr- und Lernformen</b>
Präsentation und Beamer, Tafel (Labor/Rechner) / Presentation and projector, blackboard (laboratory/computer)
<b>Anwesenheitspflicht</b>
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b>
90 Minuten Klausur / 90-minute written examination
<b>Gesamtnotenrelevanz</b>
<b>Wiederholungsmöglichkeit</b>
Bei Nichtbestehen können alle Veranstaltungen gemäß § 6 der Fachstudien- und -prüfungsordnung wiederholt werden.

<b>Literatur</b>
<b>Weitere Hinweise</b>
Yan Zhang, Security in RFID and sensor networks, Auerbach Publications, 2009, ISBN 9781420068399
G. Schaefer, Netzsicherheit, dpunkt.verlag Claudia Eckert, Christoph Krauß (2011). Sicherheit im Smart Grid: Eckpunkte für ein Energieinformationsnetz, Alcatel-Lucent-Stiftung. <a href="http://www.stiftungaktuell.de/index.php?article_id=21&amp;slice=364">http://www.stiftungaktuell.de/index.php?article_id=21&amp;slice=364</a>
Claudia Eckert, Christoph Krauß (2012). Sicherheit im Smart Grid: Sicherheitsarchitekturen für die Domänen Privatkunde und Verteilnetz unter Berücksichtigung der Elektromobilität, Alcatel- Lucent-Stiftung. <a href="http://www.stiftungaktuell.de/index.php?article_id=21&amp;slice=403">http://www.stiftungaktuell.de/index.php?article_id=21&amp;slice=403</a>

**5771V Multimedia Databases**

<b>Module number</b>
5771V
<b>Course name</b>
Multimedia-Datenbanken, Multimedia Databases
<b>Module coordinator</b>
Prof. Dr. Harald Kosch

Examination number	Credit points (ECTS)	Hours per week (SWS)
405031	7	3V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 Semester	

<b>Workload</b>
75 contact hours + 50 hrs exercises + 85 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik / Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
None
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
New media standards (here especially MPEG - MPEG-4 AVC or derived from MPEG DivX, mp3) and better recording devices in the media processing industry have been developed in recent years. New methods and tools are developed, which can manage the mass of recorded and transmitted data. The value of information largely depends on how easily the data can be searched and managed according to their Content. These multimedia databases are used exclusively. The multimedia search here differs substantially from textual search. We distinguish Content-based search, which for example is to enable color, contour, and texture based distributions for visual media and image-to- image comparisons. More accurate methods are based on a region -based search, which tries to identify parts of an image or video. The semantic search allows you to find media based on the fellow in the media persons, or places/events portrayed. A multimedia database system provides here the necessary functions for media manipulation and at the same time enables the Content-based and semantic search and that too in large amounts of data, which is made possible due to intelligent index structures.
Content structure:
Content -Based Indexing and Retrieval (visual media): color theory and presentation, brief overview of description of features such as texture, edges, extraction of features, retrieval systems and demos of multimedia data modeling (in XML: MPEG -7)
Multimedia DBMS:
Multimedia access structures, especially the family of R-trees, SS-trees and SR- Trees

Multimedia Anfrageverarbeitung and optimization Programming of multimedia DBMS Overview of common MMDB products and research prototypes
<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge</b> Students will acquire knowledge of techniques for multimedia processing and extraction of descriptive multimedia features and the development of multimedia database management systems and programming of multimedia databases.
<b>Abilities</b> Students will acquire the ability to perform practical specification of multimedia requests, implementation and optimization of multimedia queries and the use of multimedia standards.
<b>Competencies</b> Students will acquire the competence to transfer the database knowledge on multimedia data, extensions of SQL and mastery of object-relational constructs for multimedia, technical dealing with the media, management of multimedia data in general.
<b>Teaching methods</b> Slides-oriented lecture, panel use with examples, additional explanations and explanatory facts: Weekly tutorials in small groups. The presence tasks and the sample solutions are precalculated to the exercises Expected activities of students: Participation in compulsory and voluntary tutorials, independent study of secondary literature Slide script is accessible and available through Stud.IP
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
90-minute written examination
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> Harald Kosch: "Distributed Multimedia Database TechnoloRecommended reading gies supported by MPEG-7 and MPEG-21", CRC Press, November 2003, ISBN 0-8493-1854-8 Klaus Meyer-W egener: „Multimediale Datenbanken- Einsatz von Datenbanktechnik in Multimedia-Systemen“, 2. Auflage 2004, Teubner Verlag, ISBN 3-519-12419-X.
<b>Additional notes</b>

**5772 Data Modelling and Data Processing in the Internet of Things**

<b>Module number</b>
5772
<b>Course name</b>
Data Modelling and Data Processing in the Internet of Things
<b>Module coordinator</b>
Prof. Dr. Harald Kosch

Examination number	Credit points (ECTS)	Hours per week (SWS)
455386	5	2V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
30 + 15 contact hours + 105 hrs exercises, independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
None
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
Internet-of-Things(IoT) systems collect and aggregate sensor data from physical products. This enables control systems to be optimised, innovative services to be offered and new business models to be developed. IoT systems require an intelligent data concept and management that takes into account not only the collection and aggregation but also the evaluation of sensor data.
The lecture is divided into 3 parts:
1. Introduction to IoT and different web technologies relevant for IoT systems
<ul style="list-style-type: none"> <li>• IoT Systems, such as, microcontroller</li> <li>• IoT Frameworks and Architectures (e.g., Vorto)</li> <li>• JSON, JSON Schema, RDF, JSON-LD 1.1</li> <li>• IoT Datastores, such as from IoT Cloud Systems</li> </ul>
2. Data Modeling technologies for IoT
<ul style="list-style-type: none"> <li>• WoT Building Blocks: Thing Model, Thing Description and Binding Templates</li> <li>• Semantic Modeling (Context Extension)</li> </ul>
3. Data processing mechanisms in IoT
<ul style="list-style-type: none"> <li>• WoT API</li> </ul>

- Discovery
- Security
- Data coding
- Data processing

**Intended learning outcomes (ILOs)**Skills/Knowledge

Students gain an understanding of the basics of current data modeling approaches and their processing in the context of the Internet of Things (IoT) domain. They are able to describe data models of participating IoT systems and apply techniques to process and interpret them, for example, to enable interaction with other IoT systems (Plug&Play). They will be familiarized with the use of standardized (semantic) web technologies in the context of the W3C Web of Things (WoT) and can describe current applications in various areas of industry, including automation, energy and transport systems through their services.

Abilities

Participants will be equipped to implement fundamental approaches to data modeling for Internet of Things systems. They will be able to write service descriptions for concrete questions and applications in the Web of Things.

Competencies

Students learn basic and practical skills in the design of IoT systems, the technology blocks of the W3C Web of Things, as well as in the application of semantic web technologies.

**Teaching methods**

Projector presentation

**Required attendance****Examination (type of examination, scope)**

90-minute written or 20-minutes oral examination; the precise mode of assessment will be announced at the start of the semester.

**Overall grade relevance****Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

To be announced by the lecturer. The literature will be announced by the lecturer at the beginning of the lecture

**Additional notes**

**5777 Technologien zur Wahrung der Privatsphäre in Informationssystemen / Privacy-Preservation Technologies in Information Systems**

<b>Module number</b>
5777
<b>Course name</b>
Technologien zur Wahrung der Privatsphäre in Informationssystemen / Privacy-Preservation Technologies in Information Systems
<b>Module coordinator</b>
Prof. Dr. Harald Kosch

<b>Examination number</b>	<b>Credit points (ECTS)</b>	<b>Hours per week (SWS)</b>
472215	5	2V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
30 + 15 contact hours, 105 hours of exercises, independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
None
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
Preserving privacy and anonymity is a topic area that is influenced by both technical and legal conditions. The lecture discusses these conditions in the context of information systems. In the first part of the lecture the basic concepts and methods are conveyed. In the second part of the lecture, different use cases in information systems with specific anonymity and privacy frameworks are detailed.
1. Basics of privacy preservation
<ul style="list-style-type: none"> <li>• Legal basis in Europe (GDPR)</li> <li>• Anonymity and privacy</li> <li>• Basics of data management in information systems</li> <li>• Privacy-preserving methods (anonymization, privacy models)</li> <li>• Tradeoff between privacy and utility</li> </ul>
2. Use Cases
<ul style="list-style-type: none"> <li>• Medical research data <ul style="list-style-type: none"> <li>– Hippocratic databases and purpose-based access control</li> <li>– Pseudonymization</li> </ul> </li> </ul>

<ul style="list-style-type: none"> <li>• Data warehouse           <ul style="list-style-type: none"> <li>– Anonymization strategies</li> <li>– Query-based anonymization</li> </ul> </li> <li>• Social networks           <ul style="list-style-type: none"> <li>– Data protection requirements for social networks</li> <li>– Privacy preservation for graph data</li> </ul> </li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<u>Skills/Knowledge</u>
The students know the core concepts of technologies used for the protection of privacy in information systems. The students also know the legal basis of data protection in Europe (GDPR), which is contrasted to the technical possibilities. The students know the differences between privacy and anonymity, know principles for attacks on privacy and anonymity and methods to protect them. The students know the special requirements in relevant use cases for information systems, such as medical information systems or data warehouses.
<u>Abilities</u>
The students of the course master the selection and application of suitable methods for the protection of privacy and anonymity in information systems, taking into account the specifics of the information system and legal requirements. The students are able to determine and evaluate data protection risks in information systems.
<u>Competencies</u>
The participants understand the basics of technical data protection, in particular methods of anonymization, pseudonymization and privacy models. The participants also understand the legal basis for data protection in Europe - the General Data Protection Regulation (GDPR). The participants can select suitable methods for different information systems and apply them taking into account the specific framework conditions.
<b>Teaching methods</b>
Presentation with projector
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
90-minute written or 20-minutes oral examination; the precise mode of assessment will be announced at the start of the semester.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
The literature will be announced by the lecturer at the beginning of the lecture.
<b>Additional notes</b>

## 5820 Advanced IT-Security

<b>Module number</b>
5820
<b>Course name</b>
Advanced IT-Security
<b>Module coordinator</b>
Prof. Dr. Joachim Posegga

Examination number	Credit points (ECTS)	Hours per week (SWS)
405390	6	3V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Jeweils im Wintersemester	1 Semester	

<b>Workload</b>
60 contact hours + 40 hrs exercises + 80 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
None
<b>Requirements</b>
None
<b>Language of instruction</b>
Englisch

<b>Content</b>
In the module, the following topics are treated: Introduction to IT Security, Cryptographic Basics, Confidentiality, Integrity, Availability, Authentication & Authorization, security modules; OTPs, tokens, security protocols, foundations, SSL, IPSEC, user management, access protection, security of TCP/IP services, Basic security protocols and standards; Symmetric encryption (DES, AES, etc.); Asymmetric encryption (RSA, PGP), AAA in distributed systems, Kerberos, X.509 authentication, network and Internet security, IPsec, TLS/SSL, introduction to PKI, certificates, key generation, certificate authorities, certificate revocation and CA hierarchy.
<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge</b>
Basic knowledge of the key concepts for the operation of secure and (mostly) distributed computing systems. These include sub-components in the areas of operating systems, communications and IT security, especially cryptographic basics including PKI, principles of network security, principles of operating system security, basic security protocols and standards, security architectures, AAA in distributed systems
<b>Abilities</b>
Students have a firm grasp of concepts from selected sub-areas, based on exercises solved by the students themselves. Furthermore, they are able to analyse the security of operating systems and networks. Students are able to select appropriate encryption methods for various applications and

implement communication mechanisms in different scenarios. Students have the ability to correctly implement encryption methods.
<b>Competencies</b> Students are able to identify, evaluate and select concepts and architectural alternatives for communication mechanisms (services and protocols). Students are expected to be competent in the use of PKI technology in various scenarios and to be able to assess the security of symmetric and asymmetric encryption methods. Students are well-versed in security protocols and standards and are able to classify and assess security architectures. Students have learnt cooperation and teamwork in the classroom and practical computer tutorials. Students have also honed their problem-solving skills by working through the exercises in the tutorials, autonomously arriving at a solution. Students are able to systematically address the complexity and perform critical assessment of approaches and its algorithmic implementation.
<b>Teaching methods</b> Presentation, projector, blackboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> 90-minute written examination or 15-minute oral examination, depending on the number of listeners, in English or German. The exact mode of assessment will be indicated at the beginning of the semester
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
<b>Recommended reading</b> H.-P. Gumm, M. Sommer: „Einführung in die Informatik“, 5. Auflage Oldenbourg-Verlag, München, 2002 Dieter Gollmann: Computer Security, John Wiley, 1999 W. Stallings: Cryptography and Network Security, Pearson, 2003 Niemi and Nyberg: UMTS Security, John Wiley, 2003
<b>Additional notes</b>

## 5845 Search-Based Software Engineering

<b>Module number</b>
5845
<b>Course name</b>
Search-Based Software Engineering
<b>Module coordinator</b>
Prof. Dr. Gordon Fraser

Examination number	Credit points (ECTS)	Hours per week (SWS)
455378	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
60 contact hours + 120 hours exercises, independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Software Engineering, Programmierung I + II, SEP
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>• Local Search</li> <li>• Evolutionary Algorithms</li> <li>• Multi-Objective Optimisation</li> <li>• Memetic Algorithms</li> <li>• Novelty Search</li> <li>• Parallel Search</li> <li>• Search-based Testing</li> <li>• Genetic Programming</li> <li>• Genetic Improvement</li> <li>• Program Repair</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<u>Skills/Knowledge</u> Search-based software engineering (SBSE) applies metaheuristic search techniques such as genetic algorithms, simulated annealing and tabu search to software engineering problems. This course covers the theory of major classes of metaheuristic optimisation algorithms, including local search algorithms and population based optimisation (such as genetic algorithms and particle swarm

optimisation) and their application to software engineering problems across the software development lifecycle (requirements, design, planning, testing, maintenance, etc). Participants will learn the fundamental basics of meta-heuristic search, as well as essential local and population-based search algorithms and their application areas in software engineering.

**Abilities**

Participants know the most important meta-heuristic search algorithms and their application areas in software engineering. They will be able to implement, explain and compare relevant algorithms.

**Competencies**

Participants learn theoretical and practical competencies for the conception, implementation, and evaluation of search algorithms and their application to problems in software engineering. In particular, participants will be able to implement these algorithms and apply them to new problems.

**Teaching methods**

Presentation, projector, exercises

**Required attendance**

**Examination (type of examination, scope)**

90-minute exam or portfolio-exam. The exact mode of assessment will be announced at the start of the semester.

**Overall grade relevance**

**Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

Will be announced in the lectures. Further reading will be announced for the individual assignments.

**Additional notes**

## 5874V IT-Sicherheitsrecht

<b>Modulnummer</b>
5874V
<b>Veranstaltungstitel</b>
IT-Sicherheitsrecht
<b>Modulverantwortliche*r / Prüfer*innen</b>
Prof. Schröder / Dr. Hartl

Prüfungsnummer	ECTS	SWS
222430	5	2
Modulangebot	Zeitdauer des Moduls	SWS
Jedes Wintersemester	1 Semester	

<b>Workload</b>
30 Std. Präsenz + 120 Std. Nachbereitung und Prüfungsvorbereitung
<b>Verwendbarkeit</b>
Interdisziplinäres Vertiefungsangebot
<b>Bezug zur LPO I</b>
<b>Empfohlene Voraussetzungen</b>
Keine
<b>Verpflichtende Voraussetzungen</b>
Keine
<b>Unterrichtssprache</b>
Deutsch

<b>Inhalt</b>
Zunächst erfolgt eine grundlegende Einführung in die Thematik des IT-Sicherheitsrechts. Dabei werden Grundfragen an den Schnittstellen von Technik und Recht sowie rechtliche Grundprinzipien vorgestellt und ergänzend die relevanten Normen und die Arbeit mit zentralen rechtlichen Konzepten (allgemeine Grundlagen des Zivilrechts und öffentlichen Rechts wie insbesondere auslegungsbedürftige Tatbestandmerkmale, Ermessen oder Formen des Verwaltungshandeln) eingeführt.
Es folgen themenspezifische Blöcke immer unter Rückgriff auf eingeführten Grundlagen. Dabei werden – unter Berücksichtigung aktueller Entwicklungen und Schwerpunkte – Grundrechte und staatliches Eingriffshandeln sowie Schutzpflichten, Grundlagen des Datenschutzrechts, des technischen Datenschutzes, IT-Sicherheit im Unternehmenskontext (Modellierung der Organisation der IT-Sicherheit im Unternehmen), zivilrechtliche Themen und Cyber-Resilienz behandelt. Schließlich sind öffentlich-rechtliche Regularien und Vorgaben an den Schutz (kritischer) technischer Infrastruktur Teil der Veranstaltung.
Schwerpunkt der Veranstaltung sind insgesamt, vor dem Hintergrund der genannten Themen, die mehrdimensionalen rechtlichen Anforderungen an Akteure unter dem Aspekt der IT-Sicherheit, dabei vor allem die Vermeidung rechtlicher Risiken und der Umfang rechtlicher Verantwortung auf privater Ebene sowie Auftreten und (mögliche) Regulieransätze der öffentlichen Hand.

<b>Lernergebnisse Lernziele</b>
<b>Kenntnisse</b> Die Studierenden erwerben Kenntnisse der Rechtsgrundlagen des IT-Sicherheitsrechts (verfassungsrechtliche Grundlagen und öffentlich sowie zivilrechtliche Bezüge einschließlich des Datenschutzrechts und weiterer spezialgesetzlicher Regelungen) sowie des Themenkomplexes IT-Sicherheitsrecht insgesamt aus politischer, wirtschaftlicher und technischer Perspektive; dies schließt die Kenntnis der wichtigsten höchstrichterlichen Rechtsprechung mit ein. Zudem erlangen die Studierenden Kenntnis von Fallkonstellationen, in denen technische Systeme und ihr Einsatz in der Praxis typischerweise IT-sicherheitsrechtliche Fragen aufwerfen.
<b>Fähigkeiten</b> Die Studierenden beherrschen die Erfassung juristischer Probleme technischer Sachverhalte auf Basis der relevanten rechtlichen Grundlagen im IT-Sicherheitsrecht. Die Studierenden beherrschen die Erarbeitung von Lösungsvorschlägen für die jeweiligen rechtlichen Probleme im Themenbereich IT-Sicherheit.
<b>Kompetenzen</b> Die Studierenden besitzen die Kompetenz zur Anwendung spezifisch juristischer Methoden der Fallbearbeitung und -lösung sowie Transferkompetenz zur Anwendung des erworbenen Wissens und der erworbenen Fähigkeiten auf die typischerweise sehr schnell auftretenden neuen Probleme des IT-Sicherheitsrechts. Sie beherrschen die Interaktion zwischen technisch und juristisch ausgebildeten Personen im beruflichen Umfeld (gegenseitige Wissensvermittlung, gemeinsame Problemlösungsstrategien).
<b>Lehr- und Lernformen</b>  
<b>Anwesenheitspflicht</b>  
<b>Prüfungsleistung (Prüfungsform, Umfang, Gewichtung)</b> 90 Minuten Klausur oder ca. 20 Minuten mündliche Prüfung, je nach Anzahl der Hörer. Die genaue Prüfungsart wird zu Beginn des Semesters bekannt gegeben.
<b>Gesamtnotenrelevanz</b>  
<b>Wiederholungsmöglichkeit</b> Gem. der Prüfungs- und Studienordnung für den Masterstudiengang.
<b>Literatur</b> <ul style="list-style-type: none"><li>• Hinweise in der Vorlesung</li></ul>
<b>Weitere Hinweise</b>  

## 5881 Privacy Enhancing Techniques

<b>Module number</b>
5881
<b>Course name</b>
Privacy Enhancing Techniques
<b>Module coordinator</b>
Prof. Dr. Joachim Posegga

Examination number	Credit points (ECTS)	Hours per week (SWS)
405223	3	2V
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
30 contact hours + 60 hours Follow-up, preparing a presentation, and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
IT-Sicherheit, Security Insider Lab I oder II, System Security Advanced IT Security, Security Insider Lab I or II, System Security
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
The course covers the following topics:
<ul style="list-style-type: none"> <li>• Attacks against privacy, including traffic analysis, deanonymization, and side-channel attacks - Systematic privacy risk assessment (for instance, using LINDDUN)</li> <li>• Privacy issues and privacy enhancing technologies in particular environments, like clouds or mobile devices, and for particular applications, including location-based services</li> <li>• Special PETs, including Trusted-computing-based PETs, privacy preserving data mining and data release</li> <li>• Differential privacy - Privacy-preserving software systems and applications</li> <li>• Relation between cryptography and privacy</li> <li>• Anonymous credentials</li> <li>• Anonymous routing and anonymity systems</li> <li>• Lightweight privacy-enhancing technologies for constrained environments, to provide user consent.</li> </ul>

<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge</b> Students learn key technical concepts related to privacy, both regarding the associated issues in current and emerging technologies, and the possibilities of protecting the privacy in those applications. Students learn generic principles, methods, and tools of privacy by-design (PbD) and of privacy enhancing technologies (PETs), including data anonymization and perturbation techniques. They also learn which methods are adequate for particular situations, for data release, for big data applications (in clouds, for instance), and for applications based on sensors and actuators in constrained environments. On the other hand students will learn the basic limitations of PETs.
<b>Abilities</b> Students will develop skills in the early detection, identification, and evaluation of privacy threats and risks in existing or planned applications. In addition, they will be able to manage and respond to the risks, either suggesting modifications in the functionality of the application, or selecting or developing adequate privacy-friendly solutions, and implementing and instantiating them.
<b>Competencies</b> Students will know how to apply best practices and established technologies, such as Privacy by Design, LINDDUN. The students can explain the tradeoffs between privacy protection, security and functionality and to find compromises between these competing goals. They can compare the strengths and weaknesses of different PETs. The students can read and discuss the current research literature in this area.
<b>Teaching methods</b>
Projector, presentation and blackboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
This module is assessed in partial examinations: <ul style="list-style-type: none"><li>- Oral presentation: approx 20 min. Students in small groups will present selected topics chosen during the semester.</li><li>- 60-minute written or 20-minute oral examination. The specific mode of assessment will be announced by the lecturer at the start of the semester.</li></ul> Registration for the presentation automatically implies a registration for any of the dates offered for written/oral examination following the same course of lectures. In order to pass this module, students must pass both partial examinations. The exam will count 80% of the grade, the oral presentation 20%.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
To be announced in the lecture
<b>Additional notes</b>

## 5942 Network Science

<b>Module number</b>
5942
<b>Course name</b>
Network Science
<b>Module coordinator</b>
Prof. Dr. Michael Granitzer

Examination number	Credit points (ECTS)	Hours per week (SWS)
482601	5	2V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
45 contact hours + 105 hours exercises, preparation and follow-up
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Data Science
<b>Requirements</b>
<b>Language of instruction</b>
English

<b>Content</b>
In particular, the following topics are covered:
<ul style="list-style-type: none"> <li>• Basic Network Theory (Graph Types, Connectivity, Graph Traversal)</li> <li>• Networks (Small World Phenomenon, Strong and Weak Ties, Information Flow, Community Detection)</li> <li>• Analysing the context of social networks (Homophily and Segregation)</li> <li>• Positive and Negative Relationships in Networks</li> <li>• Information Networks (Structure of the Web, Link Analysis and Web Search)</li> <li>• Network Dynamics (Population Models, Information Cascades, Rich-get-richer, Cascading Behavior in Networks, Network Epidemics)</li> </ul>
<b>Intended learning outcomes (ILOs)</b>

<b>Skills/Knowledge</b>
The students gain insights into Modeling and analysing complex real-world networks with a special emphasis on social networks. In particular knowledge on the following topics will be gained:
<ul style="list-style-type: none"> <li>• Basic Graph Theory (Undirected/Directed/Bipartite Graphs, Connectivity, Graph Traversal)</li> <li>• Properties of Social Networks (Strong and Weak ties, Structural Balance, Context in Social Networks, Small World Networks)</li> </ul>

- Properties of Information Networks (Structure of the Web, Decentralized Search, Navigability of the Networks)
- Network Dynamics and Evolution

Abilities

The students will be able to analyse complex real-world networks and draw conclusions on their structural properties and dynamics. They will be able to develop and apply different algorithms for analysing networks, like for example clustering algorithms for detecting sub-structures and traversal algorithms for estimating statistical properties (e.g. centrality, clustering coefficient). Furthermore, students will be able to interpret the outcome of the algorithms in terms of underlying social theories, like for example Triadic Closure or Structural Balance Theory.

Competencies

Students acquire the competencies to analyse network data especially in web-based information systems and use this analysis to understand and refine those information systems.

**Teaching methods**

Blackboard, projector

**Required attendance**

**Examination (type of examination, scope)**

90-minute written or 20-minute oral examination. The mode of assessment will be announced at the start of the semester.

**Overall grade relevance**

**Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

- Networks, Crowds, and Markets: Reasoning About a Highly Connected World von David Easley und Jon Kleinberg von Cambridge University Press
- Barabási, Albert-László. Network science. Cambridge University Press, 2016.
- Mark Newman, Networks: An Introduction. Oxford University Press, 2010

**Additional notes**

**5945 Advanced Topics in Data Science**

<b>Module number</b>
5945
<b>Course name</b>
Advanced Topics in Data Science
<b>Module coordinator</b>
Prof. Dr. Michael Granitzer

Examination number	Credit points (ECTS)	Hours per week (SWS)
482603	5	2V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
45 contact hours + 105 hrs exercises, preparation and followup
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Data Science
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
The following topics will be covered:
<ul style="list-style-type: none"> <li>• Natural Computing</li> <li>• Deep Neural Networks</li> <li>• Representational Learning with Deep Networks including Autoencoder Networks (Denoising, Variational, Sparse), Hopfield Networks, Boltzmann Machines</li> <li>• (Deep) Convolutional Neural Networks</li> <li>• Recurrent Neural Networks</li> <li>• Deep Residual Networks</li> <li>• Deep Reinforcement Learning</li> <li>• Selected Application Areas</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<u>Skills/Knowledge</u>
The students will engage advanced topics and recent developments in the field of data science. Special emphasize will be placed on natural computing techniques, like genetic algorithms and deep

neural networks, as well as on reinforcement learning. The students will obtain in-depth knowledge on the particular algorithms and application areas (with focus web-based information systems).

**Abilities**

The students will be able to implement data analytical algorithms, in particular deep neural network and reinforcement learning approaches. They will be able to run advanced experiments on large data sets.

**Competencies**

The students will obtain the competencies to utilize recent data analytical methods, like deep learning, for analysing large data sets from web-based information systems (e.g. social media). Students will be enabled to setup experiments, conduct and evaluate them properly.

**Teaching methods**

Blackboard, projector

**Required attendance**

**Examination (type of examination, scope)**

90-minute examination or 20-minute oral examination. The precise mode of assessment will be announced at the start of the semester

**Overall grade relevance**

**Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

**Recommended reading**

Own Lecture Notes and selected publications. Literature will be announced depending on the concrete topics

**Additional notes**

## 5970V Scaling Database Systems

<b>Module number</b>
5970
<b>Course name</b>
Scaling Database Systems
<b>Module coordinator</b>
Prof. Dr. Stefanie Scherzinger

Examination number	Credit points (ECTS)	Hours per week (SWS)
451016	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 Semester	

<b>Workload</b>
60 contact hours + 45 hrs exercises + 75 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>reference to the LPO I</b>
<b>Recommended prerequisites</b>
Programming skills, fundamentals of databases and information systems (DBIS I + II)
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
<ul style="list-style-type: none"> <li>- Managing large amounts of data in BigTable-based systems such as Hadoop File System (HDFS).</li> <li>- Processing large amounts of data in MapReduce-based systems such as Hadoop.</li> <li>- Optimized evaluation of SQL queries on large volumes of data (as done in Hive and Spark).</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<u>Skills / Knowledge</u>
The students understand the importance of scalability when managing large amounts of data. They understand about strengths and limitations of NoSQL data stores and how database systems architecture enables performance.
<u>Abilities</u>
The students are able to map a specific data management problem to a suitable NoSQL database management system.

<b>Competencies</b> The students have the competence to design their own optimizations for data management systems and implement them.
<b>Teaching methods</b> Flipped classroom (videos for self-study, in-class exercises), programming project (Python).
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> Part 1: Individual Programming project “miniHive” in Python Part 2: 60-minute written examination
<b>Overall grade relevance</b> The points for the final grade are computed as follows: 30% from part 1, 70% from part 2.
<b>Exam resit opportunities</b> Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> Peter Bailis, Joseph M. Hellerstein, Michael Stonebraker, (editors), Readings in Database Systems, 5 th edition. Anand Rajaraman, Jeffrey Ullman: Mining of Massive Datasets, Cambridge University Press, 2020. Martin Kleppmann: Designing Data-Intensive Applications, O'Reilly, 2017. Stefanie Scherzinger, Build your own SQL-on-Hadoop Query Engine: A Report on a Term Project in a Master-level Database Course, SIGMOD Record, June 2019
<b>Additional notes</b>

## 5973 SQL for Data Science

<b>Module number</b>
5973
<b>Course name</b>
SQL for Data Science
<b>Module coordinator</b>
Prof. Dr. Stefanie Scherzinger

Examination number	Credit points (ECTS)	Hours per week (SWS)
451016	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 Semester	

<b>Workload</b>
60 contact hours + 60 hrs exercises + 60 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>reference to the LPO I</b>
<b>Recommended prerequisites</b>
Programming skills, fundamentals of databases and information systems (DBIS I + II)
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This advanced database class offers a comprehensive understanding of the data life cycle and the potential of SQL in various data analysis tasks. Students explore topics ranging from data loading and cleaning to pre-processing, while mastering relational databases and handling non-traditional data formats such as XML and text. Integration with programming languages like R and Python further enriches students' abilities, enabling seamless interaction with databases and enhancing data analysis workflows. Practical exercises and hands-on experience with MySQL and Postgres databases solidify students' competencies, equipping them with the essential skills to excel in data science and database management roles
<b>Intended learning outcomes (ILOs)</b>
<u>Skills / Knowledge</u>
SQL proficiency within the context of data science; Understanding of the data life cycle; Handling non-traditional data formats like XML and text; Integration of SQL with programming languages
<u>Abilities</u>
Perform data analysis tasks using SQL; Write efficient SQL queries, avoid SQL anti-patterns; Understand and navigate the data life cycle; Handle diverse data formats for analysis; Utilize SQL in conjunction with R and Python for enhanced data analysis capabilities

<b>Competencies</b>
Proficiency in SQL for data science applications; Competence in data loading, cleaning, and pre-processing; Ability to apply SQL queries for data exploration, cleaning, and transformation; Capability to integrate SQL with programming languages for enhanced data analysis workflows
<b>Teaching methods</b>
Presentation and projector, worksheets
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
60-minute written examination
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Antonio Badia: SQL for Data Science - Data Cleaning, Wrangling and Analytics with Relational Databases. Springer 2020
Bill Karwin: SQL Antipatterns. Pragmatic Programmers, LLC, 2017
Raghu Ramakrishnan, Johannes Gehrke: Database Management Systems. McGraw-Hill, 3rd edition, 2020
<b>Additional notes</b>

## 6061 Introduction to Deep Learning

<b>Module number</b>
6061
<b>Course name</b>
Introduction to Deep Learning
<b>Module coordinator</b>
Prof. Dr. Florian Lemmerich

Examination number	Credit points (ECTS)	Hours per week (SWS)
471616	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
60 contact hours + 120 hrs independent study and implementation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Advanced Topics in Data Science or Introduction to AI Engineering, Python Programming Language
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
The course will give an overview on the fundamentals and current approaches for deep learning and its main applications fields. In particular, it will cover:
<ul style="list-style-type: none"> <li>• Basics of Representation Learning</li> <li>• Perceptron Learning</li> <li>• Feedforward Neural Networks</li> <li>• Gradient Descent and Backpropagation</li> <li>• Regularization in Deep Learning</li> <li>• Convolutional Neural Networks</li> <li>• Recurrent Neural Networks</li> <li>• Autoencoders</li> <li>• Adversarial Training</li> <li>• Graph Neural Networks</li> <li>• Applications of Deep Learning for Text, Sequences, and Images</li> <li>• Explainability and Deep Learning</li> </ul>

<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge</b> Students will get to know about fundamentals of artificial neural networks, gain an overview on standard algorithms in the field as well as examples of recently proposed state-of-the-art techniques. Furthermore, students will get to know some standard tools to develop and apply deep learning techniques to machine learning problems.
<b>Abilities</b> The students will be able to implement deep learning approaches to practical machine learning problems. They obtain the ability to choose and improve neural network architectures suitable for specific machine learning tasks.
<b>Competencies</b> Students will strengthen their competence to analyze and assess algorithms for machine learning. Participants will learn to develop problem-oriented solutions with deep learning approaches independently.
<b>Teaching methods</b> Presentation with beamer, whiteboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> <ul style="list-style-type: none"><li>• 90 minutes written or 20 minutes oral exam depending on the number of participants.</li><li>• The students will be informed about the exact type of exam by the beginning of the semester</li></ul>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b> Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> <ul style="list-style-type: none"><li>• Goodfellow, Ian, Yoshua Bengio, and Aaron Courville: Deep Recommended reading learning. MIT press, 2016</li><li>• Aggarwal, Charu C.: Neural networks and deep learning. Springer 10 (2018): 978-3</li><li>• Additional literature will be announced at the beginning of the semester</li></ul>
<b>Additional notes</b> Notice: Replacing Deep Learning, cannot be credited twice.

**6064 Responsible Machine Learning**

<b>Module number</b>
6064
<b>Course name</b>
Responsible Machine Learning
<b>Module coordinator</b>
Prof. Dr. Florian Lemmerich

Examination number	Credit points (ECTS)	Hours per week (SWS)
471617	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every summer semester	1 semester	

<b>Workload</b>
60 contact hours + 120 h independent study and implementation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Advanced Topics in Data Science and/or Introduction to AI Engineering, Python Programming Language
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
The course will give an overview on the main challenges and current approaches for responsible machine learning. This module will focus on explainable and interpretable approaches to machine learning, specifically for classification. It will discuss the relevancy of interpretability and will introduce white-box learning algorithms (e.g., decision tree learning, rule-based classification and simple regression models) and methods to explain black-box solutions (e.g., LIME, counterfactual explanations). The course will also cover the challenges of biases and fairness in machine learning, and will cover how these can be measured at an individual or at a group level. Students will also get to know about algorithms to counteract such biases with pre-, in-, or post-processing methods. In addition, the course will also provide an overview and introduce key approaches of privacy-aware machine learning, and reproducibility issues in machine learning.
<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge</b>
Students will get to know about the main aspects of applying machine learning responsibly in sensitive settings, e.g., when working with behavioral data. This covers the problem settings, challenges, and main algorithmic approaches for ex plainable, fair, privacy-aware, and reliable machine learning.

<b>Abilities</b> The students will be able to identify potential issues of machine learning and artificial intelligence applications and apply appropriate measures to address them. Students will improve their ability to assess, select and implement solutions for machine learning tasks, specifically when working with data from or about human behavior.
<b>Competencies</b> Students will strengthen their awareness with respect to algorithmic transparency, fairness, privacy, and reliability. They will improve their competence to critically assess artificial intelligence approaches with sensitive data. Participants will learn to develop problem-oriented machine learning solutions for sensitive data independently.
<b>Teaching methods</b> Presentation projector, whiteboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> 90-minute written or 20-minute oral examination depending on the number of participants. The students will be informed about the exact type of exam by the beginning of the semester.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b> Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> <ul style="list-style-type: none"><li>• Molnar, Christoph: Interpretable machine learning, 2nd edition, 2020. Online book available at <a href="https://christophm.github.io/interpretable-ml-book/">https://christophm.github.io/interpretable-ml-book/</a>.</li><li>• Solon Barocas, Moritz Hardt, Arvind Narayanan: Fairness and Machine learning - Limitations and Opportunities, 2017. Online book available at <a href="https://fairmlbook.org/pdf/fairmlbook.pdf">https://fairmlbook.org/pdf/fairmlbook.pdf</a></li><li>• Additional literature can be announced at the beginning of the semester.</li></ul>
<b>Additional notes</b>

**6090 Security of Computer and Embedded Systems / Sicherheit von Rechnern und eingebetteten Systemen**

<b>Module number</b>
6090
<b>Course name</b>
Security of Computer and Embedded Systems / Sicherheit von Rechnern und eingebetteten Systemen
<b>Module coordinator</b>
Prof. Dr. Elif Bilge Kavun

<b>Examination number</b>	<b>Credit points (ECTS)</b>	<b>Hours per week (SWS)</b>
455385	5	2V + 1Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Every winter semester	1 semester	

<b>Workload</b>
45 contact hours + 50 hrs exercises + 55 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
None
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This module provides an introduction into computer security and embedded security. In particular, this module focuses on approaches and techniques for building secure systems and for the secure operation of systems.
The module requires an understanding of mathematical concepts (e.g., modulo-arithmetic, complex numbers, group theory) and logic (set theory, predicate logic, natural deduction).
Moreover, the module requires an understanding of a programming language (e.g., Python, C) and basic software engineering knowledge. Some exercises require a basic command of Linux in general and the command line (shell) in particular.
The module includes the topics:
<ul style="list-style-type: none"> <li>• Computer Security Fundamentals</li> <li>• Access Control</li> <li>• Embedded Systems</li> <li>• Need for Security in Embedded Systems</li> <li>• Cryptographic Foundations</li> <li>• Attacking Crypto</li> <li>• Public Key Infrastructures (PKIs)</li> </ul>

- Digital Signatures
- Security Protocols
- Formal Analysis of Security Protocols
- Secure Software Development Lifecycle (SSDL)
- Threat Modelling
- Common Vulnerability Scoring System (CVSS)
- Software Vulnerabilities
- Secure Programming
- Security Testing: Basics, Fuzzing, Static Analysis
- Security of Third-Party Components
- RFID Security
- Hardware Fingerprinting & IC Security

#### **Intended learning outcomes (ILOs)**

##### Skills/Knowledge

Students get to know

- the complexity of the security landscape,
- the potential vulnerabilities associated, e.g., authentication, data integrity,
- the advantages and disadvantages different information security principles,
- understand the risks of security vulnerabilities.

##### Abilities

Students practice a detailed understanding of industrially relevant issues relating to computer security and embedded security as well as the ability to present material in a concise yet comprehensive manner and to target that material appropriately to the audience in question.

##### Competencies

The students gain awareness on the different types of computer attacks and their effect on data security and privacy, get an understanding of the fundamental principles of information security and get some practical knowledge of how these principles and implementing technologies can be used to ensure better data and system security.

#### **Teaching methods**

Presentation and projector, blackboard

#### **Required attendance**

#### **Examination (type of examination, scope)**

Written exam (90 minutes) or oral exam in English according to the number of participants (about 20 minutes); the precise mode of assessment will be announced at the start of the semester.

#### **Overall grade relevance**

#### **Exam resit opportunities**

Exam resits are detailed in § 6 of the subject-specific study and examination regulation.

#### **Recommended reading**

- J. Gersting. Mathematical Structures for Computer Science. WH Freeman, 7th edition, 2016.
- R. J. Anderson. Security Engineering: A Guide to Building Dependable Distributed Systems. John Wiley & Sons Inc., 1<sup>st</sup> edition, 2001.
- A. J. Menezes, S. A. Vanstone, and P. C. V. Oorschot. Handbook of Applied Cryptography. CRC Press Inc., 5th edition, 2001.
- M. Howard, D. LeBlanc, and J. Viega. 24 Deadly Sins of Software Security: Programming Flaws and How to Fix Them. McGraw-Hill Inc., 1st edition, 2010.

AND

- Online resources will be provided and specific readings will be announced during the lectures and exercise sessions.

**Additional notes**

**6120 Principles of AI Engineering**

<b>Module number</b>
6120
<b>Course name</b>
Principles of AI Engineering
<b>Module coordinator</b>
Prof. Dr. Steffen Herbold

Examination number	Credit points (ECTS)	Hours per week (SWS)
455410	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
60 contact hours + 45 hrs exercises + 75 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Software Engineering, Introduction to AI Engineering
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This module covers the following topics:
<ul style="list-style-type: none"> <li>• Requirements engineering for systems with AI components</li> <li>• Architecture and design of systems with AI components</li> <li>• AI/ML pipelines</li> <li>• Testing of AI components</li> <li>• Data quality</li> <li>• Continuous deployment and MLOps</li> <li>• Responsible development of AIs</li> <li>• Ethical and regulatory aspects</li> </ul>
<b>Intended learning outcomes (ILOs)</b>
<b>Skills/Knowledge:</b> The students know the terminology and methods for the development of applications with components powered by Artificial Intelligence (AI) and how they can be used in operation. They know how to define requirements for AI systems, can define and implement suitable architectures, and ensure their quality of such systems. They can assess non-functional aspects of AI systems to ensure a responsible, ethical, and regulatory compliant use.

<b>Teaching methods</b>
Presentation with a projector, blackboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
Portfolio: Implementation of a semester project completed with a presentation of approximately 10 minutes duration and a 2 page written report featuring a demonstration of results at the end of the semester. A 60-minute written or oral examination of approximately 15 minutes duration conducted either in German or English. The form of assessment is announced at the beginning of the semester.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Will be announced at the beginning of the lecture
<b>Additional notes</b>

**6123 Deep Learning for Natural Language and Code**

<b>Module number</b>
6123
<b>Course name</b>
Deep Learning for Natural Language and Code
<b>Module coordinator</b>
Prof. Dr. Steffen Herbold

Examination number	Credit points (ECTS)	Hours per week (SWS)
472700	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
60 contact hours + 45 hrs exercises + 75 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Introduction to Deep Learning
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This module covers the following topics:
<ul style="list-style-type: none"> <li>• Typical tasks for language and code processing</li> <li>• Word embeddings and recurrent neural networks</li> <li>• Transformers and pre-training</li> <li>• Encoder-only models</li> <li>• Decoder-only models</li> <li>• Encoder-decoder models</li> <li>• Encoder-decoder models</li> <li>• Domain-specific models</li> <li>• Embeddings for code</li> <li>• Transformers for code</li> <li>• Multimodal models</li> </ul>
<b>Intended learning outcomes (ILOs)</b>

<u>Skills/Knowledge:</u>
The students know the typical tasks that can be solved through natural language and code processing. They know modern deep learning approaches to address these tasks and know how to

implement them in practice. They know how select suitable methods for a given problem. They know the limitations of the models and can evaluate their performance.
<b>Teaching methods</b>
Presentation with a projector, blackboard
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
90-minute written or 20-minutes oral examination; the precise mode of assessment will be announced at the start of the semester.
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b>
Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b>
Will be announced at the beginning of the lecture
<b>Additional notes</b>

**6206 Data on the Web**

<b>Module number</b>
6206
<b>Course name</b>
Data on the Web
<b>Module coordinator</b>
Prof. Dr. Stefanie Scherzinger

Examination number	Credit points (ECTS)	Hours per week (SWS)
455417	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
Irregular	1 semester	

<b>Workload</b>
60 contact hours + 60 hrs exercises + 60 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Databases and Information Systems, Algorithms and Data Structures, Web and Data Engineering
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This module focuses on the principles of sharing data on the web through REST and Linked Open Data APIs. It shows suitable data formats for publishing data on the web, explains the role of ontologies and data vocabularies in improving data interoperability, and presents how to consume data using the SPARQL query language.
<b>Intended learning outcomes (ILOs)</b>
<u>Skills/Knowledge:</u> The students acquire a systematic understanding of publishing and sharing data on the web. They know basic and advanced models and formats for representing data on the web as knowledge graphs, the principles for achieving data interoperability through ontologies, and advanced technologies for querying the data.
<u>Abilities:</u> The students can identify, understand, and access/query data published on the web (REST, SPARQL). They can also publish their data in an interoperable way exploiting existing and designing their ontologies to describe the data. They can combine data from different data sources into a single knowledge graph and query it.

<b>Competencies:</b> The students have the competence to select appropriate technologies for publishing and consuming data on the web, design ontologies to describe the data, and design and execute queries (SPARQL) on top of the data.
<b>Teaching methods</b> Lectures, presentation and demonstrations with a projector, blackboard, practical seminar, demonstrations with a projector, students work on exercises using their own laptops
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b>
<ul style="list-style-type: none"><li>Part 1: At least 50% of points from small practical assignments from the labs, i.e., work with the particular systems. Can be done during the exercises or as homework. Not a part of the final grading.</li><li>Part 2: A graded 60-minute written examination of terminology and theoretical principles.</li></ul> <p>The points for the final grade are computed as follows: Part 1 is pass/fail, and must be passed. Part 2 is graded.</p>
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b> Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> <ul style="list-style-type: none"><li>Tom Heath and Christian Bizer. Linked Data: Evolving the Web into a Global Data Space. Synthesis Lectures on the Semantic Web: Theory and Technology, Morgan &amp; Claypool. 2011</li><li>Bob DuCharme. Learning SPARQL: Querying and Updating with SPARQL 1.1. O'Reilly Media, Inc. 2013</li><li>Panos Alexopoulos. Semantic Modeling for Data. O'Reilly Media, Inc. 2020</li><li>Mayank Kejriwal, Craig A. Knoblock, Pedro Szekely. Knowledge Graphs (Adaptive Computation and Machine Learning series). MIT Press. 2021</li></ul>
<b>Additional notes</b>

## 6210 Semantic Data Integration

<b>Module number</b>
6210
<b>Course name</b>
Semantic Data Integration
<b>Module coordinator</b>
Prof. Dr. Alsayed Algergawy

Examination number	Credit points (ECTS)	Hours per week (SWS)
473270	6	2V + 2Ü
<b>Availability</b>	<b>Duration</b>	<b>Recommended semester</b>
irregular	1 semester	

<b>Workload</b>
60 contact hours + 60 hrs exercises + 60 hrs independent study and exam preparation
<b>Module applicability</b>
Wirtschaftsinformatik/ Information Systems
<b>Reference to the LPO I</b>
<b>Recommended prerequisites</b>
Databases and Information Systems, Algorithms and Data Structures, Web and Data Engineering
<b>Requirements</b>
None
<b>Language of instruction</b>
English

<b>Content</b>
This module focuses on the principles of data integration describing the importance of data integration in different applications and use cases. Different schemes of integration such virtual and physical data integration will be covered. The course will further focus on virtual and web data integration. Further topics covered are various aspects of data integration, such as data and semantic heterogeneities, schema and ontology matching, and the role of semantics and ontologies in improving data integration and data interoperability
<b>Intended learning outcomes (ILOs)</b>
<u>Skills/Knowledge</u> The students acquire a systematic understanding how to combine and integrate different data sources using a broad range of techniques for data integration. During the integration process, the students will know basic and advanced models and formats for representing data, how to identify and discover data and semantic heterogeneities across different data sources, the principles for achieving data interoperability through ontologies, and advanced technologies for querying the data
<u>Abilities</u> The students can identify, understand, and access/query different data sources (conjunctive queries, XQuery, and SPARQL). They can also identify and discover different heterogeneities across data sources, how to resolve these kinds of heterogeneities through schema and ontology matching.

They can combine data from different data sources into a mediated schema making use of discovered matches and query it.
<b>Competencies</b> The students obtain the competency to select appropriate technologies for identifying and discovering data and semantic heterogeneities through schema and ontology matching, design ontologies to describe the data, and design and execute queries on top of the data.
<b>Teaching methods</b> Lectures, presentation and demonstrations with a projector, blackboard, practical seminar, demonstrations with a projector, students work on exercises using their own laptops
<b>Required attendance</b>
<b>Examination (type of examination, scope)</b> 90-minute written examination
<b>Overall grade relevance</b>
<b>Exam resit opportunities</b> Exam resits are detailed in § 6 of the subject-specific study and examination regulation.
<b>Recommended reading</b> <ul style="list-style-type: none"><li>• AnHai Doan, Alon Halevy, Zachary Ives: Principles of Data Integration. Morgan Kaufmann, 2012.</li><li>• Barbella, Marcello, and Genoveffa Tortora. "A Semi-automatic Data Integration Process of heterogeneous databases." Pattern Recognition Letters (2023).</li><li>• Ulf Leser, Felix Naumann: Informationsintegration. Dpunkt Verlag, 2007.</li><li>• Luna Dong, Divesh Srivastava: Big Data Integration. Morgan &amp; Claypool, 2015.</li><li>• Serge Abiteboul, et al: Web Data Management. Cambridge University Press, 2012.</li><li>• Mountantonakis, Michalis, and Yannis Tzitzikas. "Large-scale semantic integration of linked data: A survey." ACM Computing Surveys (CSUR) 52.5 (2019): 1-40.</li><li>• Jérôme Euzenat, Pavel Shvaiko: Ontology Matching. Springer, 2007.</li><li>• Felix Naumann: An Introduction to Duplicate Detection. Morgan &amp; Claypool, 2012.</li></ul>
<b>Additional notes</b>