CONSTRUCTOR UNIVERSITY

Study Program Handbook

Management, Decisions and Data Analytics

Bachelor of Science

Subject-specific Examination Regulations for Management, Decisions and Data Analytics (Fachspezifische Prüfungsordnung)

The subject-specific examination regulations for Management, Decisions and Data Analytics are defined by this program handbook and are valid only in combination with the General Examination Regulations for Undergraduate degree programs (General Examination Regulations = Rahmenprüfungsordnung). This handbook also contains the program-specific Study and Examination Plan (Chapter 5).

Upon graduation, students in this program will receive a Bachelor of Science (BSc) degree with a scope of 180 ECTS (for specifics see Chapter 3 of this handbook).

Version	Valid as of	Decision	Details
Fall 2024-V1.3		July 15, 2026	Mandatory status of Constructor Track New Skills modules changed to mandatory elective
		June 10, 2026 May 13, 2026 April 15, 2026	Changes to Constructor Track New Skills modules
Fall 2025- V1.2		Apr 16, 2026	Nonsubstantial major change: Change of the "Forms of Learning and Teaching" and update of the Module Coordinator for Agency, Leadership and Accountability. Changes in New Skills Modules Argumentation, Data Visualization and Communication (Perspective I & II): Module coordinator, prerequisites removed, forms of teaching and learning. Causation & Correlation (Perspective I): Module Coordinator updated; forms of learning and teaching revised.

			Models, Matrices and Theories of Complex Systems: Prerequisites revised, module title updated, and module description amended. Complex Problem Solving: Module achievement added, Forms of learning and teaching updated, perquisites revised. Community Impact Project: Clarified the semester scheduling. Logic (Perspective I): Module coordinator updated, Forms of learning and teaching revised.
Fall 2025- V1.1		Feb 02, 2026 Dec 11, 2025	Implementation of Examination Concept according to policies. Non-substantial Minor Change: Introduction of the new GER module “Introduction to German Culture & Society”
Fall 2025- V1	Sept 01, 2025	Feb 22, 2023	Originally approved by the Academic Senate

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1 Program Overview

1.1 Concept

1.1.1 The Constructor University Educational Concept

Constructor University aims to educate students for both an academic and a professional career by emphasizing three core objectives: academic excellence, personal development, and employability to succeed in the working world. Constructor University offers an excellent research driven education experience across disciplines to prepare students for graduate education as well as career success by combining disciplinary depth and interdisciplinary breadth with supplemental skills education and extra-curricular elements. Through a multi-disciplinary, holistic approach and exposure to cutting-edge technologies and challenges, Constructor University develops and enables the academic excellence, intellectual competences, societal engagement, professional and scientific skills of tomorrows leaders for a sustainable and peaceful future.

In this context, it is Constructor University's aim to educate talented young people from all over the world, regardless of nationality, religion, and material circumstances, to become citizens of the world who are able to take responsible roles for the democratic, peaceful, and sustainable development of the societies in which they live. This is achieved through a high-quality teaching as well as manageable study loads and supportive study conditions. Study programs and related study abroad programs convey academic knowledge as well as the ability to interact positively with other individuals and groups in culturally diverse environments. The ability to succeed in the working world is a core objective for all study programs at Constructor University, both in terms of actual disciplinary subject matter and also to the social skills and intercultural competence. Study-program-specific modules and additional specializations provide the necessary depth, interdisciplinary offerings provide breadth while the university-wide general foundation and methods modules, optional German language and Humanities modules, and an extended internship period strengthen the employability of students. The concept of living and learning together on an international campus with many cultural and social activities supplements students' education. In addition, Constructor University offers professional advising and counseling.

Constructor University's educational concept is highly regarded both nationally and internationally. While the university has consistently achieved top marks over the last decade in Germany's most comprehensive and detailed university ranking by the Center for Higher Education (CHE), it has also been listed by one of the most widely observed university rankings, the Times Higher Education (THE) ranking. More details on the current ranking positions can be found at https://constructor.university/more/about-us.

1.1.2 Program Concept

The BSc Management, Decisions and Data Analytics (MDDA) program's mission is to prepare students for their professional occupations in a globalized world, driven by a need to create value from an abundance of data. Nowadays, companies of any size, ranging from highly innovative start-ups to large multinational-enterprises, have access to multiple data sources and face immense competitive pressure to utilize this data for their operational and strategic decision-making. To succeed in this environment, managers need to develop not only managerial skills but have to extend their knowledge to fields such as machine learning and data analytics. But ultimately, value creation out of data also encompasses a deep understanding of how humans – with their behavior captured in data – form

decisions. The Management, Decisions and Data Analytics program is designed for young scholars from all over the world who share an interest in business activities, management and entrepreneurship in a data-driven context.

The program prepares students to solve management and business problems by applying methods such as machine learning, big data analytics and data visualization in the process of decision making. It addresses key managerial and methodological skills for the next generation of young professionals in times of digital transformation.

The three years BSc program is structured around three main pillars: (1) Management, (2) Decision Making and (3) Data Analytics. In the first year, students will focus on the foundations of these three pillars. The second year is dedicated to business courses aiming at the digital transformation and entrepreneurship. In the Decision-Making pillar, students will deepen their understanding of the decision-making processes, both for individuals and within organizations. The third part of the second year comprises data analytics and machine learning. In the third year, tailormade specialization courses will combine the three pillars in a holistic way by focusing on subjects such as use of data in Marketing. In their sixth semester, the students will work on their Bachelor Thesis. Moreover, the students will do a mandatory internship between the second and third year.

To expose students to relevant theories, to their application and to the latest scientific methods in this field, the program applies a combination of lectures, seminars, and case studies and fosters an informed, comparative, and critical understanding of common business practices, problems, and values in a data-driven context.

1.2 Specific Advantages of the MDDA Program at Constructor University

Right from the start, the Management, Decisions and Data Analytics program exposes students to the challenges of data-driven businesses. Challenging case studies of real companies require students to develop creative solutions in intercultural teams. Working in small teams to tackle these challenges is an integral part of the study program. With its diverse and international student body and its strength in cutting-edge research on computer science, management, psychology and data analytics, Constructor University provides an ideal environment to study Management, Decisions and Data Analytics. Already in the classroom students are exposed to transnational and culturally diverse teams and topics from a variety of industries. This intense exposure to real challenges of data-driven companies combined with highly international and diverse student teams is a unique advantage of the Management, Decisions and Data Analytics program at Constructor University. The unique combination of business, technology and methodology will provide students with a competitive edge in the job market and advance into a future-oriented career in a global company or innovative start-up. Likewise, the study program qualifies students to continue their studies in international graduate schools.

1.3 Program-specific Educational Aims

1.3.1 Qualification Aims

The Management, Decisions and Data Analytics study program awards a Bachelor of Science degree.

This program aims to prepare young talents for careers in management within a data-driven economy and teaches them to apply data in managerial decision processes and to create value from data. The program covers key frameworks in management and decision making, paired with the concepts and tools necessary to process and analyze data within the corporate context. Furthermore, the students will apply these skills in multinational groups to analyze and evaluate real-world challenges and to create professional solutions to these challenges.

The scientific education provided by the program focuses on quantitative techniques and coursework.

1.3.2 Intended Learning Outcomes

By the end of the program, students will be able to:

1. understand and analyze the important issues that influence the choice of business strategy in a data-driven economy;
2. develop practical knowledge and management skills for digital transformation;
3. describe the major models and theories of behavioral decision making;
4. discuss applications of decision-making research in business;
5. apply and evaluate social cognitive and social influence theories to explain or predict real-world phenomena;
6. apply fundamental data science methods to structured data and use state-of-the-art tools to prepare and process unstructured data;
7. identify and evaluate important problem types and solution approaches in data analytics;
8. transform theoretical knowledge from management, decision making and data analytics into creative approaches while solving real-world problems;
9. use academic or scientific methods as appropriate in the field of MDDA such as defining research questions, justifying methods, collecting, assessing and interpreting relevant information, and drawing scientifically-founded conclusions that consider social, scientific and ethical insights;
10. develop and advance solutions to problems and arguments in their subject area and defend these in discussions with specialists and non-specialists;
11. engage ethically with academic, professional and wider communities and to actively contribute to a sustainable future, reflecting and respecting different views;
12. take responsibility for their own learning, personal and professional development and role in society, evaluating critical feedback and self-analysis;
13. apply their knowledge and understanding to a professional context;
14. take on responsibility in a diverse team;
15. adhere to and defend ethical, scientific and professional standards.

1.4 Career Options and Support

The BSc Management, Decisions and Data Analytics program is centered around the ever-increasing need for managers being able to understand and use data in a business setting. The unique combination of business, technology and methodology will provide students with a competitive edge in the job market and advance into a future-oriented career in a global company or innovative start-up. Likewise, the study program qualifies students to continue their studies in international graduate schools.

The Career Service Center (CSC) helps students in their career development. It provides students with high-quality training and coaching in CV creation, cover letter formulation, interview preparation, effective presenting, business etiquette, and employer research as well as in many other aspects, thus helping students identify and follow up on rewarding careers after graduating from Constructor University. Furthermore, the Alumni Office helps students establish a long-lasting and global network which is useful when exploring job options in academia, industry, and elsewhere.

1.5 Admission Requirements

Admission to Constructor University is selective and based on a candidate's school and/or university achievements, recommendations, self-presentation, and performance on standardized tests. Students admitted to Constructor University demonstrate exceptional academic achievements, intellectual creativity, and the desire and motivation to make a difference in the world.

The following documents need to be submitted with the application:

- Recommendation Letter (optional)
- Official or certified copies of high school/university transcripts
- Educational History Form
- Standardized test results (SAT/ACT) if applicable
- Motivation statement
- ZeeMee electronic resume (optional)
- Language proficiency test results (TOEFL Score: 90, IELTS: Level 6.5 or equivalent)

Formal admission requirements are subject to higher education law and are outlined in the Admission and Enrollment Policy of Constructor University.

For more detailed information about the admission visit: https://constructor.university/admission-aid/application-information-undergraduate

1.6 More information and contacts

For more information on the study program please contact the Study Program Coordinator:

Prof. Dr. Sven Voelpel

Professor of Business Administration

E-mail: svoelpel@constructor.university

Or visit our program website: https://constructor.university/programs/undergraduate-education/management-decisions-and-data-analytics

For more information on Student Services please visit:

https://constructor.university/student-life/student-services

2 The Curricular Structure

2.1 General

The curricular structure provides multiple elements for enhancing employability, interdisciplinarity, and internationality. The unique CONSTRUCTOR Track, offered across all undergraduate study programs, provides comprehensive tailor-made modules designed to achieve and foster career competency. Additionally, a mandatory internship of at least two months after the second year of study and the possibility to study abroad for one semester give students opportunities to gain insight into the professional world, apply their intercultural competences and reflect on their roles and ambitions for employment and in a globalized society.

All undergraduate programs at Constructor University are based on a coherently modularized structure, which provides students with an extensive and flexible choice of study plans to meet the educational aims of their major and complete their studies within the regular period.

The framework policies and procedures regulating undergraduate study programs at Constructor University can be found on the website (https://constructor.university/student-life/student-services/university-policies).

2.2 The Constructor University 4C Model

Constructor University offers study programs that comply with the regulations of the European Higher Education Area. All study programs are structured according to the European Credit Transfer System (ECTS), which facilitates credit transfer between academic institutions. The three-year undergraduate programs involve six semesters of study with a total of 180 ECTS credit points (CP). The undergraduate curricular structure follows an innovative and student-centered modularization scheme - the 4C-Model.It groups the disciplinary content of the study program in three overarching themes, CHOICE-CORE-CAREER according to the year of study, while the university-wide CONSTRUCTOR Track is dedicated to multidisciplinary content, methods as well as intellectual skills and is integrated across all three years of study. The default module size is 5 CP, with smaller 2.5 CP modules being possible as justified exceptions, e.g., if the learning goals are more suitable for 2.5 CP and the overall student workload is balanced.

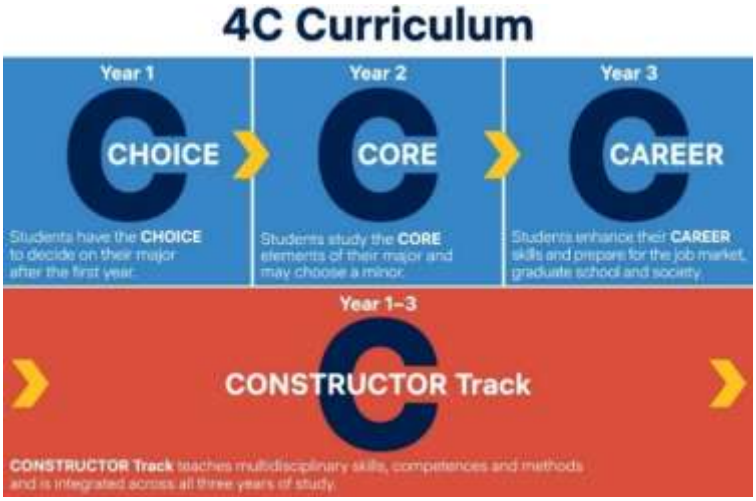

Figure 1: The Constructor University 4C-Mode

2.2.1 Year 1 – CHOICE

The first study year is characterized by offerings of disciplinary education that builds on and expands upon the students' entrance qualifications. Students select introductory modules for a total of 45 CP from the CHOICE area. The Academic Advising Coordinator offers curriculum counseling to all Bachelor students independently of their major, while Academic Advisors, in their capacity as contact persons from the faculty, support students individually in deciding on their major study program.

To pursue Management, Decisions and Data Analytics as a major, students take the following mandatory (m) CHOICE modules (45 CP):

- CHOICE Module: Introduction to International Business (m, 7.5 CP)
- CHOICE Module: Introduction to Finance and Accounting (m, 7.5 CP)
- CHOICE Module: Essentials of Cognitive Psychology (m, 7.5 CP)
- CHOICE Module: Essentials of Social Psychology (m, 7.5 CP)
- CHOICE Module: Introduction to Data Science (m, 7.5 CP)
- CHOICE Module: Data Structures and Processing (m, 7.5 CP)

The combination of modules from all three pillars of the MDDA program allows students to develop a holistic understanding of the complex nature of data-driven businesses right from the start of their studies.

2.2.1.1 Major Change Option

Students can still change to another major at the beginning of their second year of studies, provided they have taken the corresponding mandatory CHOICE modules in their first year of studies. All students must participate in an entry advising session with their Academic Advisors to learn about their major change options and consult their Academic Advisor during the first year of studies prior to changing their major. Students in the MDDA program can change their major after the first year to the ISCP program, which shares the following mandatory CHOICE modules.

- ISCP
  CHOICE Module: Essentials of Cognitive Psychology (7.5 CP)
  CHOICE Module: Essentials of Social Psychology (7.5 CP)

2.2.1.2 Minor Option

The Management, Decisions and Data Analytics students cannot take an additional minor as their study program already combines three different disciplines.

2.2.2 Year 2 – CORE

In their second year, students take a total of 45 CP from a selection of in-depth, discipline-specific CORE modules. Building on the introductory CHOICE modules and applying the methods and skills students have already acquired so far (see 2.3.1), these modules aim to expand the students' critical understanding of the key theories, principles, and methods in their major for the current state of knowledge and best practice.

To pursue MDDA as a major, all 45 CP from the following mandatory CORE modules need to be acquired:

- CORE Module: Digital Transformation and Information Economy (m, 5 CP)

- CORE Module: Design Thinking, E-Business & E-Services (m, 2.5 CP)
- CORE Module: Entrepreneurship and Innovation (m, 7.5 CP)
- CORE Module: Social Cognition (m, 5 CP)
- CORE Module: Organizational Psychology and Communication (m, 5 CP)
- CORE Module: Judgment & Decision (m, 5 CP)
- CORE Module: Data Analytics and Modeling (m, 7.5 CP)
- CORE Module: Applied Machine Learning (m, 7.5 CP)

2.2.3 Year 3 – CAREER

During their third year, students prepare and make decisions for their career after graduation. To explore available choices fitting individual interests, and to gain professional experience, students take a mandatory summer internship (see 2.2.3.1). The third year of studies allows MDDA students to further sharpen their profile with a selection of discipline-specific, research-oriented specialization modules that can be combined to enhance their individual competences in the natural sciences, strategy development for novel research approaches or managerial capabilities. Furthermore, the third year also focuses on the responsibility of students beyond their discipline (see CONSTRUCTOR Track).

The fifth semester also opens a mobility window for a diverse range of study abroad options. Finally, the sixth semester is dedicated to fostering the students' research experience by involving them in a Bachelor thesis project.

2.2.3.1 Internship / Start-up and Career Skills Module

As a core element of Constructor University's employability approach students are required to engage in a mandatory two-month internship of 15 CP that will usually be completed during the summer between the second and third years of study. This gives students the opportunity to gain first-hand practical experience in a professional environment, apply their knowledge and understanding in a professional context, reflect on the relevance of their major to employment and society, reflect on their own personal role in employment and society, and to develop a professional orientation. The internship can also establish valuable contacts for the students' bachelor's thesis project, for the selection of a master program graduate school or further employment after graduation. This module is complemented by career advising and several career skills workshops throughout all six semesters that prepare students for the transition from student life to professional life. As an alternative to the full-time internship, students interested in setting up their own company can apply for a start-up option to focus on developing their business plans.

For further information, please contact the Student Career Support (https://constructor.university/student-life/career-services).

2.2.3.2 Specialization Modules

In the third year of their studies, students take 15 CP from major-specific or major-related, advanced Specialization modules to consolidate their knowledge and to be exposed to state-of-the-art research in the areas of their interest. This curricular component is offered as a portfolio of modules, from which students can make free selections during their fifth and sixth semester. The default specialization module size is 5 CP, with smaller 2.5 CP modules being possible as justified exceptions.

To pursue MDDA as a major, at least 15 CP from the following mandatory elective Specialization modules need to be taken:

- Specialization: Data Analytics (me, 5 CP)
- Specialization: Contemporary Topics in Marketing (me, 5 CP)
- Specialization: Advanced Econometrics (me, 5 CP)
- Specialization: Financial Data Analytics (me, 5 CP)
- Specialization: Blockchain Technology and Applications (me, 5 CP)

Please consult the *CampusNet* online catalogue for further options.

2.2.3.3 Study Abroad

Students have the opportunity to study abroad for a semester to extend their knowledge and abilities, broaden their horizons and reflect on their values and behavior in a different context as well as on their role in a global society. For a semester abroad (usually the fifth semester), modules related to the major with a workload equivalent to 22.5 CP must be completed. Modules recognized as study abroad CP need to be pre-approved according to Constructor University's study abroad procedures. Several exchange programs allow students to directly enroll at prestigious partner institutions worldwide. Constructor University's participation in Erasmus+, the European Union's exchange program, provides an exchange semester at a number of European universities that include Erasmus study abroad funding.

For further information, please contact the International Programs office (https://constructor.university/student-life/study-abroad/international-office).

MDDA students that wish to pursue a study abroad in their fifth semester are required to select their modules at the study abroad partners such that they can be used to substitute between 10-15 CP of major-specific Specialization modules and between 5-15 CP of modules equivalent to the non-disciplinary New Skills modules (see CONSTRUCTOR Track). In their sixth semester, according to the study plan, returning study-abroad students complete the Bachelor Thesis/Seminar module (see next section), they take any missing Specialization modules to reach the required 15 CP in this area, and they take any missing New Skills modules to reach the required 15 CP in this area.

2.2.3.4 Bachelor Thesis/Seminar Module

This module is a mandatory graduation requirement for all undergraduate students. It consists of two module components in the major study program guided by a Constructor University faculty member: the Bachelor Thesis (12 CP) and a Seminar (3 CP). The title of the thesis will appear on the students' transcripts.

Within this module, students apply the knowledge skills, and methods they have acquired in their major discipline to become acquainted with actual research topics, ranging from the identification of suitable (short-term) research projects, preparatory literature searches, the realization of discipline-specific research, and the documentation, discussion, and interpretation of the results.

With their Bachelor Thesis students demonstrate mastery of the contents and methods of their major-specific research field. Furthermore, students show the ability to analyze and solve a well-defined problem with scientific approaches, a critical reflection of the status quo in scientific literature, and the original development of their own ideas. With the permission of a Constructor University faculty supervisor, the Bachelor Thesis can also have an interdisciplinary nature. In the seminar, students

present and discuss their theses in a course environment and reflect on their theoretical or experimental approach and conduct. They learn to present their chosen research topics concisely and comprehensively in front of an audience and to explain their methods, solutions, and results to both specialists and non-specialists.

2.3 The CONSTRUCTOR Track

The CONSTRUCTOR Track is another important feature of Constructor University's educational model. The Constructor Track runs orthogonal to the disciplinary CHOICE, CORE, and CAREER modules across all study years and is an integral part of all undergraduate study programs. It provides an intellectual tool kit for lifelong learning and encourages the use of diverse methodologies to approach cross-disciplinary problems. The CONSTRUCTOR track contains Methods, New Skills and German Language and Humanities modules.

2.3.1 Methods Modules

Methods such as mathematics, statistics, programming, data handling, presentation skills, academic writing, and scientific and experimental skills are offered to all students as part of the Methods area in their curriculum. The modules that are specifically assigned to each study programs equip students with transferable academic skills. They convey and practice specific methods that are indispensable for each students' chosen study program. Students are required to take a minimum of 20 CP in the Methods area. The size of all Methods modules is 5 CP.

To pursue MDDA as a major, the following Methods modules (20 CP) must be taken as mandatory modules:

- Methods Module: Applied Calculus (m, 5 CP)
- Methods Module: Applied Statistics with R (m, 5 CP)
- Methods Module: Digital Marketing Fundamentals and SEO (m, 5 CP)
- Methods Module: Econometrics (m, 5 CP)

2.3.2 New Skills Modules

This part of the curriculum constitutes an intellectual and conceptual tool kit that cultivates the capacity for a particular set of intellectual dispositions including curiosity, imagination, critical thought, and transferability. It nurtures a range of individual and societal capacities, such as self-reflection, argumentation and communication. Finally, it introduces students to the normative aspects of inquiry and research, including the norms governing sourcing, sharing, withholding materials and research results as well as others governing the responsibilities of expertise as well as the professional point of view.

All students are required to take 20 CP of New Skills modules in their second year and third year of studies. Students choose New Skills modules from the following portfolio:

- New Skills Module: Logic* (me, 2.5 CP)
- New Skills Module: Causation and Correlation* (me, 2.5 CP)
- New Skills Module: Argumentation, Data Visualization and Communication* (me, 5 CP)
- New Skills Module: Models, Matrices and Theories of Complex Systems (me, 5 CP)

- New Skills Module: Complex Problem Solving (me, 5 CP).
- New Skills Module: Agency, Leadership and Accountability (me, 5 CP)
- New Skills Module: Community Impact Project (me, 5 CP).

Some of these modules (marked by *) will be offered with two different perspectives from which the students can only choose one for the fulfillment of graduation requirements of their degree program. The module perspectives are independent modules which examine the topic from different points of view. Please see the module description in chapter 7 for more details such as scheduling, content and assessment.

2.3.3 German Language and Humanities Modules

Students are required to take 5 CP of German language or Humanities modules. German language abilities foster students' intercultural awareness and enhance their employability in their host country. They are also beneficial for securing mandatory internships (between the 2nd and 3rd year) in German companies and academic institutions. Constructor University supports its students in acquiring basic as well as advanced German skills in the first year of the Constructor Track. Non-native speakers of German are encouraged to take 2 German modules (2.5 CP each), but are not obliged to do so. Native speakers and other students who are not taking advantage of this offer take alternative modules in Humanities in each of the first two semesters:

- Humanities Module: Introduction to Philosophical Ethics (me, 2.5 CP)
- Humanities Module: Introduction to the Philosophy of Science (me, 2.5 CP)
- Humanities Module: Introduction to Visual Culture (me, 2.5 CP)

2.4 Management, Decisions and Data Analytics as a minor

The Management, Decisions and Data Analytics study program does not offer a minor for students from other study programs.

3 MDDA Undergraduate Program Regulations

3.1 Scope of these Regulations

The regulations in this handbook are valid for all students who entered the Management, Decisions and Data Analytics undergraduate program at Constructor University in Fall 2025. In case of a conflict between the regulations in this handbook and the general Policies for Bachelor Studies, the latter apply (see https://constructor.university/student-life/student-services/university-policies).

In exceptional cases, certain necessary deviations from the regulations of this study handbook might occur during the course of study (e.g., change of the semester sequence, assessment type, or the teaching mode of courses).

Updates to Study Program Handbooks are based on the policies approved by the Academic Senate on substantial and non-substantial changes to study programs. Students are integrated in the decision-making process through their respective committee representatives. All students affected by the changes will be properly informed.

In general, Constructor University therefore reserves the right to change or modify the regulations of the program handbook also after its publication at any time and in its sole discretion.

3.2 Examination Concept

According to the Policies for Bachelor and Master studies, modules generally carry at least five ECTS. Each program ensures appropriate examination frequency and organization, justified in an examination concept and regularly reviewed with student involvement.

Constructor University's examination concept follows the principle of Constructive Alignment (Biggs 1996), ensuring that learning outcomes, activities, and assessments are consistently aligned: students learn what is intended, and assessments both measure and shape learning. Where one assessment cannot cover all Intended Learning Outcomes (ILOs) complementary forms could be used (e.g., written exams plus lab reports). Module descriptions map ILOs to assessments.

In specific contexts, such as asynchronous online modules or courses emphasizing student engagement, Module Achievements or other types of formative assessments may support competence-oriented assessment.

Student feedback, embedded in the Quality Assurance System (QAS), systematically monitors workload, competence orientation, and alignment of ILOs and assessments. Student surveys and feedback are regulated in the Policy for student surveys and evaluations.

3.3 Degree

Upon successful completion of this study program, students are awarded a Bachelor of Science degree in Management, Decisions and Data Analytics.

3.4 Graduation Requirements

In order to graduate, students need to obtain 180 CP. In addition, the following graduation requirements apply:

Students need to complete all mandatory components of the program as indicated in the Study and Examination Plan in Chapter 5 of this handbook.

4 chematic Study Plan for Management, Decisions and Data Analytics

Figure 1 shows schematically the sequence and types of modules required for the study program. A more detailed description, including the assessment types, is given in the Study and Examination Plans in the following section.

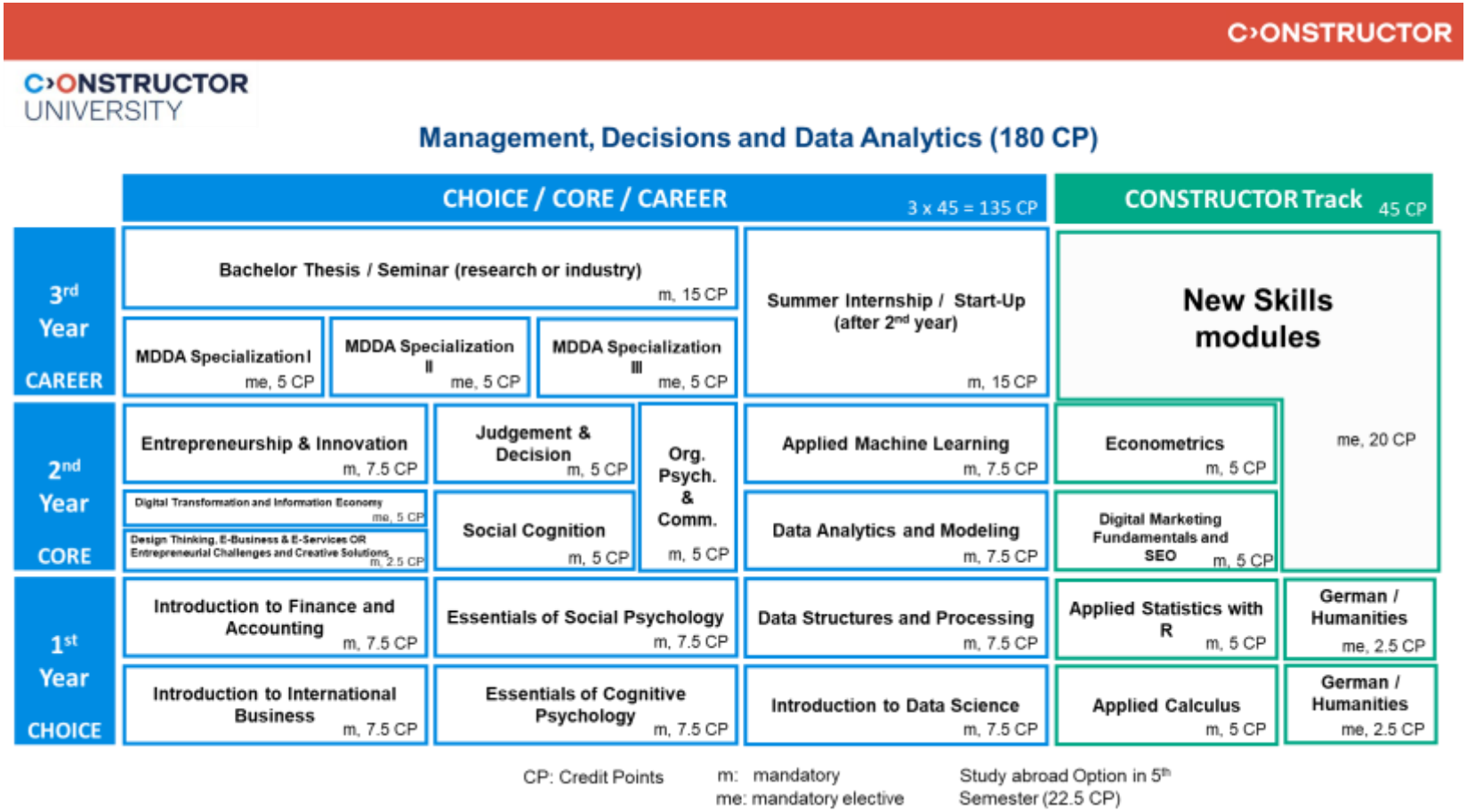

Figure 2: Schematic Study Plan for MDDA

5 Study and Examination Plan

Management, Decisions and Data Analytics

Matriculation Fall 2025

	Program-Specific Modules	Type	Assessment	Period	Status[1]	Sem.	ECTS
Year 1 - CHOICE							**45**
*Take the mandatory CHOICE unit **(s)** listed below, this is a requirement for the MDDA program.*							
Modules Code	**Unit: Management I**						**15**
CH-300	**Module: Introduction to International Business**				**m**	**1**	**7.5**
CH-300-A	Introduction to International Business	Lecture	Written examination	Examination period			5
CH-300-B	Introduction to International Business Seminar	Seminar					2.5
CH-301	**Module: Introduction to Finance and Accounting**				**m**	**2**	**7.5**
CH-301-A	Introduction to Finance	Seminar	Written examination	Examination period			2.5
CH-301-B	Introduction to Accounting	Seminar					2.5
CH-301-C	Finance and Accounting Tutorial	Tutorial					2.5
	Unit: Decision I						**15**
CH-340	**Module: Essentials of Cognitive Psychology**				**m**	**1**	**7.5**
CH-340-A	Essentials of Cognitive Psychology	Lecture	Written examination	Examination period			
CH-341	**Module: Essentials of Social Psychology**				**m**	**2**	**7.5**
CH-341-A	Essentials of Social Psychology	Lecture	Written examination	Examination period			
	Unit: Data Analytics I						**15**
CH-700	**Introduction to Data Science**				**m**	**1**	**7.5**
CH-700-A	Introduction to Data Science	Lecture (online)	Written examination	Examination period			
CH-701	**Module: Data Structures and Processing**				**m**	**2**	**7.5**
CH-701-A	Data Structures and Processing	Lecture (online)	Written examination	Examination period			
Year 2 - CORE							**45**
Take all three units listed below							
	Unit: Management II						**15**
CO-611	**Module: Digital Transformation and Information Economy**				**m**	**3**	**5**
CO-611-A	Digital Transformation and Information Economy	Seminar	Presentation	During the semester			5
CO-612	**Module: Design Thinking, E-Business & E-Services**				**m**	**3**	**2.5**
CO-612-A	Design Thinking, E-Business & E-Services	Seminar	Presentation	During the semester			2.5
CO-603	**Module: Entrepreneurship and Innovation**				**m**	**4**	**7.5**
CO-603-A	Entrepreneurship and Innovation	Seminar	Presentation	During the semester			7.5
	Unit: Decision II						**15**
CO-681	**Module: Social Cognition**				**m**	**3**	**5**
CO-681-A	Social Cognition	Seminar	Term paper	During the semester			2.5
CO-681-B	Social Cognition Lab	Lab	Laboratory report	During the semester			2.5
CO-686	**Module: Judgment & Decision Making**				**m**	**4**	**5**
CO-686-A	Judgment & Decision Making	Seminar	Written examination	Examination period			
CO-682	**Module: Organizational Psychology & Communication**				**m**	**3/4**	**5**
CO-682-A	Organizational Psychology	Seminar	Written examination	Examination period		4	2.5
CO-682-B	Communication and Interaction	Seminar	Written examination	Examination period		3	2.5
	Unit: Data Analytics II						**15**
CO-710	**Module: Data Analytics and Modelling**				**m**	**3**	**7,5**
CO-710-A	Data Analytics and Modelling	Lecture	Written examination	Examination period			
CO-711	**Module: Applied Machine Learning**				**m**	**4**	**7,5**
CO-711-A	Applied Machine Learning	Lecture	Written examination	Examination period			

	Constructor Track Modules (General Education)	Type	Assessment	Period	Status[1]	Sem.	ECTS
							15
Module Code	**Unit: Methods**						**10**
CTMS-MAT-08	**Module: Applied Calculus**				**m**	**1**	**5**
CTMS-08	Applied Calculus	Lecture	Written examination	Examination period			
CTMS-MET-03	**Module: Applied Statistics with R**				**m**	**2**	**5**
CTMS-03	Applied Statistics with R	Lecture&Lab	Written examination	Examination period			
	Unit: German Language and Humanities (choose one module for each sememster)						**5**
	German is default language and open to Non-German speakers (on campus and online).[3]						
CTLA-	**Module: Language 1**				**me**	**1**	**2.5**
CTLA-	Language 1	Seminar	Various	Various			
CTLA-	**Module: Language 2**				**me**	**2**	**2.5**
CTLA-	Language 2	Seminar	Various	Various			
CTHU-HUM-001	**Humanities Module: Introduction into Philosophical Ethics**				**me**	**2**	**2.5**
CTHU-001	Introduction into Philosophical Ethics	Lecture (online)	Written examination	Examination period			2.5
CTHU-HUM-002	**Humanities Module: Introduction to the Philosophy of Science**				**me**	**1**	**2.5**
CTHU-002	Introduction to the Philosophy of Science	Lecture (online)	Written examination	Examination period			
CTHU-HUM-003	**Humanities Module: Introduction to Visual Culture**				**me**	**2**	**2.5**
CTHU-003	Introduction to Visual Culture	Lecture (online)	Written examination	Examination period			
							15
	Unit: Methods						**10**
CTMS-MET-20	**Module: Digital Marketing Fundamentals and SEO**				**m**	**3**	**5**
CTMS-20	Digital Marketing Fundamentals and SEO	Lecture	Presentation	During the semester			
CTMS-MET-05	**Module: Econometrics**				**m**	**4**	**5**
CTMS-05	Econometrics	Seminar	Written examination	Examination period			
	Unit: New Skills						**5**
Students must take a total 20 CP in New Skills modules in year 2 and 3							
CTNS-NSK- 01	**Module: Logic (perspective I)***				**me**	**3/5**	**2.5**
CTNS-01	Logic (perspective I)	Online Lecture	Written examination	Examination period			
CTNS-NSK-02	**Module: Logic (perspective II)***				**me**	**3/5**	**2.5**
CTNS-02	Logic (perspective II)	Online Lecture	Written examination	Examination period			
CTNS-NSK-03	**Module: Causation and Correlation (perspective I)***				**me**	**4/6**	**2.5**
CTNS-03	Causation and Correlation (perspective I)	Online Lecture	Written examination	Examination period			
CTNS-NSK-04	**Module: Causation and Correlation (perspective II)***				**me**	**4/6**	**2.5**
CTNS-04	Causation and Correlation (perspective II)	Online Lecture	Written examination	Examination period			
*These modules are offered with two different perspectives, students may only select one							

Year 3 - CAREER								45
CA-INT-900	**Module: Summer Internship**				**m**	**4/5**	**15**
CA-INT-900-0	Summer Internship		Project report				
CA-MDDA-800	**Module: Seminar / Thesis MDDA**				**m**	**6**	**15**
CA-MDDA-800-S	Thesis seminar MDDA	Seminar	Presentation	15th of May			3
CA-MDDA-800-T	Thesis MDDA	Thesis	Thesis	During the semester			12
	Unit: Specialization[2] (Take a total of 15 CP of specialization modules)				**m**		**15**
MDE-CO-02	**Module: Data Analytics**				**me**	**5**	**5**
MDE-CO-02	Data Analytics	Lecture	Project report	During the semester			
CA-S-IBA-803	**Module: Contemporary Topics in Marketing**				**me**	**5**	**5**
CA-IBA-803	Contemporary Topics in Marketing	Seminar	Term paper	During the semester			
CA-S-GEM-801	**Module: Advanced Econometrics**				**me**	**5**	**5**
CA-GEM-801	Advanced Econometrics	Seminar	Term paper	During the semester			
CA-S-MDDA-801	**Module: Financial Data Analytics**				**me**	**5**	**5**
CA-MDDA-801	Financial Data Analytics	Seminar	Term paper	During the semester			
CA-S-IBA-805	**Blockchain Technology and Applications**				**me**	**6**	**5**
CA-IBA-805	Blockchain Technology and Applications	Lecture	Term paper	During the semester			
Total ECTS								

							15
	Unit: New Skills						**10**
Students must take a total 20 CP in New Skills modules in year 2 and 3							
CTNS-NSK-05	**Module: Models, Matrices and Theories of Complex Systems**				**me**	**3/5**	**5**
CTNS-05	Models, Matrices and Theories of Complex Systems	Seminar (online)	Written examination	Examination period			
CTNS-NSK-06	**Module: Complex Problem Solving**				**me**	**3/5**	**5**
CTNS-06	Complex Problem Solving	Lecture (online)	Written examination	Examination period			
CTNS-NSK-07	**Module: Argumentation, Data Visualization and Communication (perspective I)***				**me**	**3/5**	**5**
CTNS-07	Argumentation, Data Visualization and Communication (perspective I)	Lecture (online)	Written examination	Examination period			
CTNS-NSK-08	**Module: Argumentation, Data Visualization and Communication (perspective II)***				**me**	**4/6**	**5**
CTNS-08	Argumentation, Data Visualization and Communication (perspective II)	Lecture (online)	Written examination	Examination period			
CTNS-NSK-09	**Module: Agency, Leadership & Accountability**				**me**	**4/6**	**5**
CTNS-09	Agency, Leadership & Accountability	Lecture (online)	Written examination	Examination period			
CTNS-CIP-10	**Module: Community Impact Project**				**me**	**3/5**	**5**
CTNS-10	Community Impact Project	Project	Project Assessment	During the Sememster			
*These modules are offered with two different perspectives, students may only select one							

[1] Status (m = mandatory, e = elective, me = mandatory elective)

[2] For a full listing of all CHOICE / CORE / CAREER / Constructor Track units / modules please consult the **CampusNet online catalogue** and /or the study program handbooks.

[3] German native speakers will have alternatives to the language courses (in the field of Humanities).

Figure 3: Study and Examination Plan for MDDA

6 Modules

6.1.1 Introduction to International Business

Module Name	Introduction to International Business
Module Code	2025-CH-300
Module ECTS	7.5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Prof. Dr. Christoph Lattemann

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	1	Mandatory
2025-IBA-BA International Business Administration	1	Mandatory
2025-IEM-BSc Industrial Engineering & Management	1	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory
2025-Minor-EIM-BSc Minor EIM	1	Mandatory

Student Workload	
Seminar	17.5
Independent Study	50
Independent Study	85
Lecture	35
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Introduction to International Business	CH-300-A	Lecture	5
Introduction to International Business - Seminar	CH-300-B	Seminar	2.5

Module Description

This module provides the basics needed for making informed and effective business decisions in today's global economy. It focuses on the domains of business such as international strategy and organizational structure, selecting and managing entry modes, developing and marketing products internationally and managing international operations. Issues of globalization, cross-cultural businesses, politics and law in business, economic systems and development, international trade, and international financial markets will also be covered. Upon completing the module, students will know

how to use a number of international business analytical tools, and have experience with case study analysis: including, PEST, CAGE, International Market Selection and Modes of Entry. Global corporate social responsibility and sustainability issues will also be discussed.

Intended Learning Outcomes

No	Competence	ILO
1	Understand	Understand and describe the process of globalization and how it affects markets and production e.g., identify the two forces causing globalization to increase, identify the types of companies that participate in international business, describe the global business environment and identify its four main elements.
2	Describe	Describe culture and explain the significance of both national culture and subcultures, identify the components of culture and the impact on business, describe the two main frameworks used to classify cultures and explain their practical use.
3	Describe	Describe each main type of political system. Identify the origins of political risk and how managers can reduce its effects. List the main types of legal systems and explain how they differ. Describe the major legal and ethical issues facing international companies.
4	Describe	Describe what is meant by a centrally planned economy and explain why its use is declining. Identify the main characteristics of a mixed economy and explain the emphasis on privatization. Describe the different ways to measure a nation's level of development.
5	Discuss	Discuss international trade and trade patterns. Explain absolute advantage and comparative advantage and identify their differences. Explain the factor proportions and international product life cycle theories as well as trade and national competitive advantage theories.
6	Describe	Describe the political, economic, and cultural motives behind governmental intervention in trade. List and explain the methods governments use to promote and restrict international trade.
7	Define	Define regional economic integration and identify its five levels. Discuss the benefits and drawbacks associated with regional economic integration.
8	Discuss	Discuss international capital market, international bond, international equity, and Eurocurrency markets. Discuss the four primary functions of the foreign exchange market. Explain how currencies are quoted and the different rates given.
9	Explain	Explain how exchange rates influence the activities of domestic and international companies. Identify the factors that help determine exchange rates and their impact on business.
10	Identify	Identify international strategies and the corporate-level strategies that companies use.
11	Discuss	Discuss the important issues that influence the choice of organizational structure.

12	Explain	Explain why and how companies use exporting, importing, and countertrade. Explain the various means of financing export and import activities. Describe the different contractual entry modes that are available to companies. Discuss the important strategic factors in selecting an entry mode.
13	Explain	Explain the impact globalization is having on international marketing activities. Understand the various dimensions for developing international product, promotional, pricing and distribution strategies (4P's marketing mix).
14	Use	Use concepts, tools and frameworks and apply them in the international business context. Develop and improve your analytical and critical thinking skills by applying them to contemporary international business issues. Improve communication skills like reading, writing, speaking, and listening. Prepare and deliver oral presentations as well as written works either prepared individually or as a team. Improve your research skills by analyzing real business situations, identifying problems, evaluating and discussing options and prepare recommendations. These recommendations need to be fact-based, undertaken qualitative and quantitative analyses.

Indicative Literature

- Peng, M., Meyer K. (2019). International Business, 3 ed, Boston: Cengage Learning EMEA.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to International Business	Written Examination	120 Minutes	100	45%	1-14
Introduction to International Business - Seminar					

Module Achievement

To pass the module achievement, the average of five case studies (+ one case presentation) has to be 45% or higher. Apart from acquiring practical skills, each participant further needs to demonstrate sufficient understanding of the application of business frameworks for a given context and business challenge. Only with sufficient knowledge, students show that they understand business problems and can solve the challenges by using business frameworks. This is a basic requirement to show that students are ready for the final exam. If the average of all quizzes is lower than 45 %, students have to re-take the course again.

6.1.2 Introduction to Finance and Accounting

Module Name	Introduction to Finance and Accounting
Module Code	2025-CH-301
Module ECTS	7.5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Prof. Dr. Andreas Seebeck

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	2	Mandatory
2025-IBA-BA International Business Administration	2	Mandatory
2025-IEM-BSc Industrial Engineering & Management	2	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory
2025-Minor-EIM-BSc Minor EIM	2	Mandatory

Student Workload	
Lecture	35
Tutorial	17.5
Independent Study	135
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Introduction to Finance	CH-301-A	Lecture	2.5
Introduction to Accounting	CH-301-B	Lecture	2.5
Finance and Accounting Tutorial	CH-301-C	Tutorial	2.5

Module Description

This module introduces students to the basics of finance and financial accounting. The module is split into three sub-parts.

The first part focuses on finance and investment and will provide students with the basics of corporate finance and investments. It offers an overview of the different sources of finance from private and public sources, and it introduces several important analytical tools and techniques from corporate finance.

The second part focuses on financial accounting. It outlines the framework of accounting including its nature, purposes, and the context. In addition, it covers the basic concepts, conventions, and principles

of accounting as well as the accounting equation. Moreover, the recognition and measurement principles are taught. Finally, the module covers the preparation and analysis of financial statements. This part uses the International Financial Reporting Standards as reference.

The third part of the module is designed as a tutorial. In this tutorial students repeat, apply, and practice the techniques from both finance and accounting lectures. Students work on exercises individually and in small groups.

Usability and Relationship to other Modules

- Builds on the module “Introduction to International Business”

- The module prepares students for the CORE modules in the second and third study year

Recommended Knowledge

It is recommended that students have passed "Introduction to International Business" before attending "Introduction to Finance and Accounting.

Intended Learning Outcomes

No	Competence	ILO
1	Define	Define the basic types of financial management decisions and the role of the financial manager.
2	Explain	Explain the goal of financial management.
3	Compute	Compute the external financing needed to fund a firm’s growth and name the determinants of a firm’s growth.
4	Determine	Determine the future value of an investment made today and the present value of cash to be received at a future date.
5	Define	Define important bond features, types of bonds, and bond ratings.
6	Outline	Outline the impact of inflation on interest rates.
7	Apply	Apply the Present Value (PV), Net Present Value (NPV), Payback rule, Internal Rate of Return (IRR), and the Profitability Index (PI).
8	Apply	Apply the concept of scenario and sensitivity analysis, calculate the tax shield, accounting break-even point and degree of operating leverage.
9	Identify	Identify and describe the major functions of financial accounting and financial reporting.
10	Explain	Explain the relationship between financial statement elements.
11	Describe	Describe the roles and desirable attributes of financial reporting standards.
12	Demonstrate	Demonstrate knowledge and understanding of the elements of the balance sheet, income statement, cash flow statement, and statement of shareholders’ equity.
13	Describe	Describe, explain, and classify cash flow items.

Indicative Literature

- Phillips, F., Clor-Proell, S., Libby,R., Libby P. (2021). Fundamentals of Financial Accounting, 7th Edition. New York: McGraw-Hill Education.
- Ross, S.A., Westerfield, R. and Jordan, B.D., 2023. Fundamentals of corporate finance, 13th Edition. Tata McGraw-Hill Education.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to Finance	Written Examination	120 Minutes	100	45%	1-13
Introduction to Accounting					1-13
Finance and Accounting Tutorial					1-13

Module Achievement

6.1.3 Essentials of Cognitive Psychology

Module Name	Essentials of Cognitive Psychology
Module Code	2025-CH-340
Module ECTS	7.5
Program Owner	2025-ISCP-BA (Integrated Social and Cognitive Psychology)
Module Coordinator	Prof. Dr. Song Yan

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	1	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory
2025-Minor-Cog-Psych-BA Minor Cognitive Psychology	1	Mandatory

Student Workload	
Lecture	52.5
Independent Study	135
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Essentials of Cognitive Psychology	CH-340-A	Lecture	7.5

Module Description

The module provides a comprehensive overview of the major fields of cognitive psychology and beyond. It focuses on how humans attend and perceive their environment; learn and remember information; solve problems and make decisions; differ in intelligence and personality; communicate via language; experience emotions; and what drives them (motivation) etc. The module covers the historical foundations of psychology, current influential theories and models as well as empirical research methods. This module also includes methods for critical thinking (evaluating current approaches and research results); the scientific cycle, including the basics of theory of science. The emphasis of this module is on human behavior, and it provides the basis for all other modules in psychology and prepares students for subsequent CORE and Specialization modules.

Intended Learning Outcomes

No	**Competence**	**ILO**
1	Explain	Explain basic concepts in psychology (sensation, perception, learning, memory, problem solving, decision making, intelligence, personality, language, emotion, motivation)

2	Explain	Explain the difference between scientific psychology and everyday psychology
3	Identify	Identify the limitations of theoretical approaches

Indicative Literature

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Essentials of Cognitive Psychology	Written Examination	180 minutes	100	45%	All intended learning outcomes of the module.

Module Achievement

6.1.4 Essentials of Social Psychology

Module Name	Essentials of Social Psychology
Module Code	2025-CH-341
Module ECTS	7.5
Program Owner	2025-ISCP-BA (Integrated Social and Cognitive Psychology)
Module Coordinator	Prof. Dr. Ulrich Kühnen

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	2	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory
2025-Minor-Cog-Psych-BA Minor Cognitive Psychology	2	Mandatory

Student Workload	
Lecture	52.5
Independent Study	135
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Essentials of Social Psychology	CH-341-A	Lecture	7.5

Module Description

In this module, you will begin to explore the influence that the actual or perceived presence of others can have on people's behaviors, thoughts, judgments and emotions – which are very much influenced by contextual factors such as the living environment, the social structure, or the political sphere, to name a few. However, context also refers to factors that influence how an object or a person is perceived, such as the perceiver's mood, expectations, needs and prior knowledge of a perceiver. Other social psychology issues of interest include how people interact, how inter-group con-flict can be understood, and when people help each other or aggress against each other.

This module reviews important aspects of social psychological research, which then will be discussed in more detail in the respective CORE and Specialization seminars. Therefore, you will be familiarized with fundamental theories and concepts such as theories of attribution, dissonance, and self-perception theory, person perception and social encoding, stereo-types, inter-group conflict, motivation, and social identity.

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain seminal individual-level and group-level theories of social psychology
2	Explain	Explain major research approaches to psychological phenomena
3	Analyze	Analyze selected current social debates (e.g., about migration) in social psychological terms
4	Name	Name and describe relationships with related sciences (e.g., biology, sociology)
5	Describe	Describe current 'hot topics' in social psychological research

Indicative Literature

- Gilovich, T., Keltner, D., Chen, S. & Nisbett, R. (2018). Social Psychology. 5th International Student Edition. New York: W.W. Norton & Company ltd

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Essentials of Social Psychology	Written Examination	180 min	100	45%	All intended learning outcomes of the module.

Module Achievement

6.1.5 Introduction to Data Science

Module Name	Introduction to Data Science
Module Code	2025-CH-700
Module ECTS	7.5
Program Owner	2025-Minor-Data-Science (Minor in Data Science)
Module Coordinator	Prof. Dr. Hilke Brockmann

Study Semester		
Program	**Semester**	**Status**
2025-F-ACS-BSc Applied Computer Science	1	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory
2025-Minor-Data-Science Minor in Data Science	1	Mandatory
2025-S-ACS-BSc Applied Computer Science	2	Mandatory

Student Workload	
Asynchronous Self Study	52.5
Interactive Learning	57.5
Exam Preparation	20
Independent Study	57.5
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Introduction to Data Science	CH-700-A	Lecture (Online)	7.5

Module Description

The module introduces data science with an integrated presentation of three essential components, namely, (1) societal/legal implications and business opportunities, (2) technical/theoretical background and case studies, (3) an introduction to the Python coding environment. The first component entails a conceptual introduction to the opportunities and the challenges of a digitally transformed and data-driven society, presentations on industry standards and legal frameworks, and discussions of critical issues such as cybersecurity and surveillance. The second component includes topics such as data science terminology, digital data and their representations, and introductions to exploratory data analysis and prominent supervised and unsupervised learning tasks. The third component offers an introduction to the Python ecosystem of data representation, processing, analysis, and visualization, starting with Jupyter notebooks, installing suitable environments, and introductions to data science related packages such as NumPy, SciPy, Matplotlib, Seaborn, and Pandas. Fundamental data science concepts are summarized and illustrated using real-world data from various disciplines. Flexible educational formats (mostly online and hybrid) allow for asynchronous learning.

Lectures are combined with an exposure to Python programming and data processing and visualization environments, including hands-on practicals, examples, and exercises.

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain societal implications of the digital transformation.
2	Understand	Understand the legal data protection framework.
3	Carry out	Carry out basic data processing and visualization tasks.
4	Apply	Apply fundamental data science methods to structured data.
5	Understand	Understand the logic of Python scripts and functions.
6	Compose	Compose Python code using templates.

Indicative Literature

- Ani Adhikari, John DeNero, David Wagner. Computational and Inferential Thinking: The Foundations of Data Science. 2022. https://inferentialthinking.com/.
- Jake Vanderplas. Python Data Science Handbook. O'Reilly 2016. An online version is available at https://jakevdp.github.io/PythonDataScienceHandbook/.
- Philip D. Brooker. Programing with Python for Social Scientists. Sage 2020.
- Shin Takahasi, Iroha Inoue. The Manga Guide to Linear Algebra. Trend-Pro 2012.
- Shoshana Zuboff. The Age of Surveillance Capitalism. London: Profile 2019.
- Steven S. Skiena. The Data Science Design Manual. Springer 2017.
- The Alan Turing Institute, Data Science for the Social Good.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to Data Science	Written Examination	180 minutes	100	45%	1-6

Module Achievement

The module achievement encourages regular engagement with the contents of this online module. It facilitates the acquisition of knowledge on the foundations of the methods and of practical skills for their application. As such, the module achievement systematically prepares the students for the final examination.

The module achievement comprises weekly quizzes. To pass the module achievement, the average result across all quizzes has to be 50 % or higher. It does not impact the overall module grade. Only

students who successfully pass the module achievement by the first deadline are eligible to sit for the final examination. Students whose average result across all quizzes is lower than 50 % are given a second opportunity to pass the module achievement and, thereby, sit for the make-up exam.

6.1.6 Data Structures and Processing

Module Name	Data Structures and Processing
Module Code	2025-CH-701
Module ECTS	7.5
Program Owner	2025-Minor-Data-Science (Minor in Data Science)
Module Coordinator	Dr. Georgi Dragolov

Study Semester		
Program	**Semester**	**Status**
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory
2025-Minor-Data-Science Minor in Data Science	2	Mandatory

Student Workload	
Asynchronous Self Study	52.5
Interactive Learning	57.5
Exam Preparation	20
Independent Study	57.5
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Data Structures and Processing	CH-701-A	Lecture (Online)	7.5

Module Description

In this module, data structures and the data analysis pipeline are introduced in three parts. The first part gives an overview of the data analysis pipeline from capturing and processing to storing and analyzing data. Database concepts and management as well as the basic distinction between structured and unstructured data are reviewed, including an introduction to the relational data model, supplemented by examples of how specific disciplinary databases are handled. The second part is concerned with different types of structured data, starting with time series and images as examples of ordered data vectors and data matrices, respectively, and addressing both numeric and text data. Particular emphasis will be on tables and their higher-dimensional extensions, allowing for multivariate correlation and regression studies. The third part deals with unstructured data as obtained from web scraping and text mining. Unstructured data need to be prepared for subsequent analyses and use through operations such as merging, ordering, transforming, and resampling. Flexible educational formats (mostly online and hybrid) allow for asynchronous learning. Lectures are combined with Python exercises with particular emphasis on the Pandas package. Disciplinary applications and case studies are immersed as bridging elements.

Recommended Knowledge

Required for solving the coding assignments are Python skills at the level achieved after successful completion of the module Introduction to Data Science.

Intended Learning Outcomes

No	Competence	ILO
1	Enumerate	Enumerate and explain key operations along the data analysis pipeline.
2	Understand	Understand the basics of database management and important data models.
3	Process	Process ordered data sets such as time series and images.
4	Prepare	Prepare unstructured data sets for processing and analysis.
5	Apply	Apply the Pandas package to process and display time series, images, and tables.

Indicative Literature

- Ani Adhikari, John DeNero, David Wagner. Computational and Inferential Thinking: The Foundations of Data Science. Originally developed for the UC Berkeley course Data 8: Foundations of Data Science. An online version of the textbook is available at https://inferentialthinking.com/.
- Jake Vanderplas. Python Data Science Handbook. O'Reilly 2016. An online version is available at https://jakevdp.github.io/PythonDataScienceHandbook/.
- Steven S. Skiena. The Data Science Design Manual. Springer 2017.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Data Structures and Processing	Written Examination	180 min	100	45%	1-6

Module Achievement

The module achievement encourages regular engagement with the contents of this online module. It facilitates the acquisition of knowledge on the foundations of the methods and of practical skills for

their application. As such, the module achievement systematically prepares the students for the final examination. The module achievement comprises weekly quizzes. To pass the module achievement, the average result across all quizzes has to be 50 % or higher. It does not impact the overall module grade. Only students who successfully pass the module achievement by the first deadline are eligible to sit for the final examination. Students whose average result across all quizzes is lower than 50 % are given a second opportunity to pass the module achievement and, thereby, sit for the make-up exam.

6.1.7 Digital Transformation and Information Economy

Module Name	Digital Transformation and Information Economy
Module Code	2025-CO-611
Module ECTS	5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Dr. Matthias Meckel

Study Semester		
Program	**Semester**	**Status**
2025-IBA-BA International Business Administration	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory
2025-Minor-EIM-BSc Minor EIM	3	Mandatory

Student Workload	
Lecture and Presentations	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Digital Transformation and Information Economy	CO-611-A	Seminar	5

Module Description

Information is a key resource in today's business operations and an important tool for decision-making. This module provides the basics for making informed and effective business decisions in today's information economy. The content of this module is located in the intersection of the Information Economy, Electronic Business, Electronic Commerce, and Electronic Services.

The overall goal of this module is to help students to learn, understand and practice entrepreneurial and innovation processes in the information age. The "Digital Transformation and Information Economy" module helps students to understand today's real-life challenges and problems and to explain complex problems coherently and concisely. Further, students learn to develop and present innovative user-centered and theory-oriented solutions for real-world challenges in an IT-driven world.

The module is strongly based on the paradigm of user-centeredness, the user centered design of services and the ideas of Service Dominant Logic. Service-dominant (S-D) logic is a meta-theoretical framework for explaining value creation, through exchange, among configurations of actors. One underlying idea of S-D logic is that goods are a distribution mechanism for co-created service provision.

In the information age, these co-created services can be supported and enhanced through information technologies (applications and devices). Hence, new technologies enable humans to apply their competences to benefit others and reciprocally benefit from others' applied competences through service-for-service exchange in a more advanced way.

Major challenges and concerns of the digital transformation and information economy will be reflected:

- the role of information in an information society

- globalization & strategic business

- information infrastructure

- new theories and concepts (such as service dominant logic, customer integration, gamification, P2P)

- new applications (e.g., Web 2.0 and Industry 4.0, Facebook, Twitter, Google, eBay, WeChat, …)

- new business models

- ethics and security

The module will enable students to collaborate across disciplines with experts in other areas (in particular Design and Engineering) and to apply knowledge in areas of expertise other than their own (thus building so called t-shaped people).

Recommended Knowledge

- Basic knowledge of management concepts and economics

- This module is based on the knowledge students acquired in the CHOICE modules during the first study year

Usability and Relationship to other Modules

This module prepares students who are interested in the consequences of digitization and creative problem solving for their independent studies in the Bachelor Thesis module

Intended Learning Outcomes

No	Competence	ILO
1	Describe	Describe the role of information in the internet economy and in the digital transformation.
2	Summarize	Summarize and classify the new Web 2.0 and Industry 4.0 technologies.
3	Indicate	Indicate the economic and business rules in the information age.
4	Develop	Develop practical knowledge and management skills for digital transformation.
5	Develop	Develop broad global and strategic perspectives.
6	Develop	Develop sensitivity to international social responsibility and public interest issues from various perspectives.

7	Explain	Explain the "service dominant logic" (SDL) for business/entrepreneurial activities and the power of new technologies (e.g. IoT) for customer relationship management.
8	Improve	Improve their oral communication, group and individual presentation skills.
9	Work	Work better as individuals, group members, and group leaders.
10	Outline	Outline how business ethics are also applicable in the field of Information Systems and Management.
11	Adapt	Adapt to a new working culture based on a user-centricity, empathy, and playful testing.

Indicative Literature

- Brynjolfsson, E., McAfee, A. (2016). The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies. New York: Norton & Company, ISBN-13: 978-0393350647, ISBN-10: 0393350649
- Laudon, K. C., Traver, C.G., (2011). Management Information Systems – Managing the Digital Firm (12th Edition). Upper Sadle River: Pearson; ISBN-10: 0-27-375453-X; ISBN-13: 978-0-27-375453-X

Entry Requirements

Prerequisites	2025-CH-300 Introduction to International Business 2025-CH-301 Introduction to Finance and Accounting
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Digital Transformation and Information Economy	Project Assessment	40 minutes; Group presentation	100	45%	1-11

Module Achievement

6.1.8 Design Thinking, E-Business & E-Service

Module Name	Design Thinking, E-Business & E-Service
Module Code	2025-CO-612
Module ECTS	2.5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Prof. Dr. Christoph Lattemann

Study Semester		
Program	**Semester**	**Status**
2025-IBA-BA International Business Administration	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory

Student Workload	
Project Work	17.5
Independent Study	45
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Design Thinking, E-Business & E-Services	CO-612-A	Seminar	2.5

Module Description

This module helps students to improve their theoretical and practical skills in finding practical and innovative solutions for real-world challenges in a business environment

The Design Thinking approach has rapidly been adopted by some of the world's leading brands, such as Apple, Google, Samsung, and GE and the approach is being taught at leading universities around the world, including Stanford and Harvard

Design Thinking is a human-focused, prototype-driven process for innovation. Students will develop a solid understanding of the fundamental concepts of Design Thinking and will learn how to implement new found knowledge in their professional work life

This module is intentionally designed as a 2.5 CP module to enhance Employability by exposing students to professionally relevant working and thinking modes (Dsign Thinking) rather than requiring in-depth content specialization.

Recommended Knowledge

- Basic knowledge of management concepts and economics

- This module is based on the knowledge students acquired in the CHOICE modules during the first study year

Usability and Relationship to other Modules

This module prepares students who are interested in the consequences of digitization and creative problem solving for their independent studies in the Bachelor Thesis module

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply the fundamental concepts of Design Thinking by working through a complete innovation project.
2	Understand	Understand why Design Thinking is relevant in an IT-driven world.
3	Apply	Apply ethnographic and analysis methods, which differ from classical market research, such as focus groups and surveys.
4	Initiate	Initiate a new working culture based on a user-centric approach, empathy, and playful testing.
5	Apply	Apply early and fast prototyping as well as testing methods that will help reduce risks and accelerate organizational learning.
6	Work	Work in a team of diverse people and in a diverse environment.

Indicative Literature

- Jakob Schneider und Marc Stickdorn (2010) This is Service Design Thinking: Basics, Tools, Cases; Consortium Book Sales & Dist; ISBN: 9063692560, 9789063692568.

Entry Requirements

Prerequisites	2025-CH-310 Microeconomics 2025-CH-311 Macroeconomics 2025-CH-300 Introduction to International Business 2025-CH-301 Introduction to Finance and Accounting
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Design Thinking, E-Business & E-Services	Project Assessment	30 minutes (Group presentation)	100	45%	1-6

Module Achievement

6.1.9 Entrepreneurship and Innovation

Module Name	Entrepreneurship and Innovation
Module Code	2025-CO-603
Module ECTS	7.5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Prof. Dr. Sven Voelpel

Study Semester		
Program	**Semester**	**Status**
2025-IBA-BA International Business Administration	4	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	4	Mandatory
2025-Minor-EIM-BSc Minor EIM	4	Mandatory

Student Workload	
Seminar	52.5
Independent Study	135
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Entrepreneurship and Innovation	CO-603-A	Seminar	7.5

Module Description

Innovation is the principal source of sustainable competitive advantage for firms around the world. However, building an organization that can successfully and repeatedly bring innovations to market is a daunting managerial challenge. This module will focus on the practices and processes managers use to manage innovation effectively. Over the semester, several aspects will be examined with regard to innovation: such as exploring, executing, leveraging and renewing innovation. The focus will be on entrepreneurial organizations. The module is designed to provide a deep grounding in the field of innovation for managers and entrepreneurs whose goal is to play a leading role in innovation-driven firms. The material moves between strategic issues (what should you do?) and organizational and managerial issues (how should you get it done?). The focus of the module is on exemplifying and experiencing the innovation process and implementation. Students have to develop business ideas and business plans. They will also be trained to present their business ideas in a pitch.

Recommended Knowledge

This module is based on the knowledge students acquired in the CHOICE modules during the first study year. For preparation, students should recall the topics related to innovation and financial planning.

Usability and Relationship to other Modules

This module prepares students who are interested in founding their own business or StartUp. As such the module can support students who would like to choose the StartUp – Option in the "Internship/ StartUp and Career Skills" module

Intended Learning Outcomes

No	Competence	ILO
1	Identify	Identify organizational, managerial and financial opportunities and challenges within businesses.
2	Create	Create value in terms of products and services while forming a business idea.
3	Sell	Sell their ideas to investors using excellent oral and visual presentation skills.
4	Transform	Transform theoretical knowledge into creative approaches while solving real-world problems.
5	Evaluate	Evaluate the needs of innovation and initiate creative processes to expand businesses.
6	Analyze	Analyze markets and identify the best opportunities for the company formation.

Indicative Literature

- Fraser, L.M., Ormiston, A. (2015). Understanding Financial Statements, 11th Edition, London: Pearson.
- Hisrich, R., Peters, M., Shepherd D (2017). Entrepreneurship & Innovation, 10th Edition, New York: McGraw-Hill.
- Phillips, F., Libby,R., Libby P. (2015). Fundamentals of Financial Accounting, 5th Edition. New York: McGraw-Hill Education.

Entry Requirements

Prerequisites	2025-CH-300 Introduction to International Business 2025-CH-301 Introduction to Finance and Accounting
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Entrepreneurship and Innovation	Presentation	10 minutes	100	45%	1-6

Module Achievement

6.1.10 Social Cognition

Module Name	Social Cognition
Module Code	2025-CO-681
Module ECTS	5
Program Owner	2025-ISCP-BA (Integrated Social and Cognitive Psychology)
Module Coordinator	Prof. Dr. Christian Stamov Roßnagel

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Social Cognition	CO-681-A	Seminar	2.5
Social Cognition Lab	CO-681-B	Laboratory	2.5

Module Description

Individual experience is embedded in various social contexts ranging in layers of complexity from one's immediate social situation (e.g., others being present) to institutions (such as the workplace or the educational system) to cultural meaning systems. The components of this module investigate the dynamic and mutual relationship between individual actors and their social contexts across these layers of complexity. How is individual experience influenced by the actual or presumed presence of others? Do people act differently as members of social groups than they do as individuals? What are the implications of our insights into the social embeddedness of human behavior for interventions aimed at modifying behaviors?

This module will promote your insight into recent developments in social psychology as well as help you acquire a broad and thorough understanding of today's most important topics in social psychological research. You will refine your meth- odological skills by analyzing extant research as well as designing new studies. Moreover, you will be given sufficient opportunity to familiarize yourself with the approaches to and issues of application-oriented research.

A single assessment type cannot sufficiently test all intended learning outcomes. The laboratory report evaluates research design and analysis skills, whereas the term paper evaluates the capacity for applying core concepts, critical analysis, and academic writing.

Recommended Knowledge

Social Cognition self-assessment on Campusnet.

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain seminal models and fundamental processes of social cognition and group processes
2	Describe	Describe and critically evaluate the social-cognitive approach
3	Analyze	Analyze and contrast selected alternative explanations
4	Explain	Explain major sources of individual-level and group-level social influence
5	Name	Name needs for and outline strategies to modify or extend current theories and models
6	Apply	Apply social cognitive theorizing to explain or predict real-world phenomena

Indicative Literature

Entry Requirements

Prerequisites	2025-CH-340 Essentials of Cognitive Psychology
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Social Cognition	Term Paper	2000 words	50	45%	Intended learning outcomes (1-5)
Social Cognition Lab	Laboratory Report	1500 Words	50	45%	Intended learning outcomes (1-3, 6)

Module Achievement

6.1.11 Organizational Psychology & Communication

Module Name	Organizational Psychology & Communication
Module Code	2025-CO-682
Module ECTS	5
Program Owner	2025-ISCP-BA (Integrated Social and Cognitive Psychology)
Module Coordinator	Prof. Dr. Christian Stamov Roßnagel

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Communication and Interaction	CO-682-B	Seminar	2.5
Organizational Psychology	CO-682-A	Seminar	2.5

Module Description

Building on the conceptual and methodological foundations established in the Social Cognition module, the general question guiding this module is how insights into the socio-cultural embeddedness of human behavior can help us 'understand' (e.g., assess, diagnose) and change behavior in complex real-world settings. One such setting are organizations, i.e., structured social units in which people collaborate to reach collective goals. We explore how person level and organizationlevel factors (e.g., organizational climate) interact to shape workers' organizational behavior in terms of motivation, communication, and collaboration. We will pay special attention to the opportunities and challenges of the increasing diversity of people in contemporary organizations.

Communication, and the social interaction it involves, is a fascinating example of both such opportunities and challenges. While communicative processes unfold differently as a function of the diversity contexts they are embedded in, at the same time those processes are the means to systematically influence social interactions in diverse groups, teams, and organizations in a solution-oriented manner. Different as communicative processes may be at the surface level (including, for instance, verbal interactions, nonverbal cues, and human-computer interaction), there are fundamental cognitive and social processes that underlie human communication in all its forms. We will look at how communication shapes personal relationships and differentiates potentially hazardous

misunderstandings from successful interactions in a range of settings, such as sales communication, supervisor-employee interactions, therapeutic change talk, and conflict resolution and negotiation.

In addition to providing you with insights into current 'hot topics' in social and cultural psychology, this module focuses on the approaches and contemporary issues of application-oriented research in both fields. Using case studies from actual consulting projects as examples, you will refine your skills for analyzing real-life situations in a theory-based fashion and of designing strategies for assessments and interventions in selected communication settings.

Recommended Knowledge

- Basics of correlational statistics

- Concepts of generali-zability, external, in-ternal, and ecological validity

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain how quantitative theories may and may not be applied to individuals, groups, or organizations
2	Explain	Explain how evidence-based problem solutions are generated
3	Apply	Apply qualitative and quantitative methods to design case-specific data collection strategies
4	Demonstrate	Demonstrate the ability to communicate high-level research findings to non-experts without information loss
5	Apply	Apply social influence theories to develop strategies for stakeholder management

Indicative Literature

- King, D. & Lawley, S. (2019). Organizational Behaviour (3e). Oxford: Oxford University Press. ISBN: 9780198807780
- Röhner J. & Schütz, A. (2021). Psychology of Communication. Wiesbaden: Springer. ISBN 978-3-030-60169-0

Entry Requirements

Prerequisites	2025-CH-340 Essentials of Cognitive Psychology
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Communication and Interaction	Written Examination	60 Minutes	50	45%	All intended learning outcomes of the module.
Organizational Psychology	Written Examination	60 Minutes	50		All intended learning outcomes of the module.

Module Achievement

6.1.12 Judgment & Decision Making

Module Name	Judgment & Decision Making
Module Code	2025-CO-686
Module ECTS	5
Program Owner	2025-ISCP-BA (Integrated Social and Cognitive Psychology)
Module Coordinator	Prof. Dr. Song Yan

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	4	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	4	Mandatory

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Judgment & Decision Making	CO-686-A	Seminar	5

Module Description

Judgment and decision-making are broad and complex areas of great theoretical interest and practical impact in almost all of contemporary disciplines. The focus here is on psychological perspectives. Applications of decision-making re-search in marketing, medicine, law, and other areas are discussed. This module includes topics such as heuristics and biases, decision making under risk and uncertainty, preference and choice, confidence, and more.

Upon successful completion of this module, you understand the models and methods of research in judgment and deci-sion making. The aim of this module is to provide you with basic concepts from probability theory and expected utility theory to serve as a benchmark for evaluating judgments and decision-making. Psychological models of decision-making that describe human judgment and decision making are discussed. Historical background and classic paradigms are also provided to enable you to understand and evaluate current research.

Recommended Knowledge

- Basics in probability theory

- Scientific writing

Intended Learning Outcomes

No	Competence	ILO
1	Describe	Describe the major models and theories of behavioral decision making
2	Explain	Explain this field's major methods, results, and controversies
3	Select	Select generalizable findings and apply them to solve actual decision-making problems
4	Discuss	Discuss applications of decision-making research in marketing, medicine, and law

Indicative Literature

Entry Requirements

Prerequisites	2025-CH-340 Essentials of Cognitive Psychology
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Judgment & Decision Making	Written Examination	120 min	100	45%	All intended learning outcomes of the module.

Module Achievement

6.1.13 Data Analytics and Modeling

Module Name	Data Analytics and Modeling
Module Code	2025-CO-710
Module ECTS	7.5
Program Owner	2025-Minor-Data-Science (Minor in Data Science)
Module Coordinator	Prof. Dr. Joachim Vogt Prof. Dr. Adalbert F.X. Wilhelm

Study Semester		
Program	**Semester**	**Status**
2025-S-ACS-BSc Applied Computer Science	2	Mandatory
2025-F-ACS-BSc Applied Computer Science	3	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory
2025-Minor-Data-Science Minor in Data Science	3	Mandatory

Student Workload	
Asynchronous Self Study	52.5
Interactive Learning	57.5
Exam Preparation	20
Independent Study	57.5
Total Hours	**187.5**

Module Components	**Number**	**Type**	**CP**
Data Analytics and Modeling	CO-710-A	Lecture (Online)	7.5

Module Description

The module offers an introduction to the principles of data analytics and predictive data modeling and is structured into four parts. First, essential concepts from statistics are reviewed in the data modeling context, illustrating key ideas including randomness, distributions, and confidence regions. Examples and case studies are discussed to distinguish between proper and improper uses of statistics. Basic linear algebra is reviewed in the second part of the module, emphasizing vectors, distances, linear equations, matrices, and inversion. Key ideas such as the least squares approach are motivated with geometrical principles. The third part of the module is concerned with matrix decompositions such as the Singular Value Decomposition (SVD) and its close relatives Principal Component Analysis (PCA) and Empirical Orthogonal Function (EOF) analysis. The fourth part clarifies the distinction between linear and nonlinear modeling, and introduces key nonlinear techniques. Flexible educational formats

(mostly online and hybrid) allow for asynchronous learning. Lectures are combined with Python exercises. Disciplinary applications and case studies are immersed as bridging elements.

Recommended Knowledge

Required for solving the coding assignments are Python skills at the level achieved after successful completion of the module Introduction to Data Science. Furthermore, students are encouraged to review first-year level statistics and linear algebra.

Intended Learning Outcomes

No	Competence	ILO
1	Identify	Identify important problem types and solution approaches in data analytics.
2	Understand	Understand how key concepts from statistics and linear algebra enter data science.
3	Explain	Explain matrix decompositions and their usage in data science.
4	Discuss	Discuss regularization concepts and optimality criteria in data analytics.
5	Know	Know the basics of nonlinear modeling and related computational approaches.
6	Convert	Convert data structures to Python/NumPy arrays for usage in data modeling.
7	Apply	Apply Python statistics and linear algebra tools in data analytics and modeling.

Indicative Literature

- Ani Adhikari, John DeNero, David Wagner. Computational and Inferential Thinking: The Foundations of Data Science 2019. Originally developed for the UC Berkeley course Data 8: Foundations of Data Science. An online version of the textbook is available at https://inferentialthinking.com/.
- Gilbert Strang: Linear Algebra and Learning from Data. Wellesley-Cambridge 2019. See https://math.mit.edu/~gs/learningfromdata/.
- Jake Vanderplas. Python Data Science Handbook. O'Reilly 2016. An online version is available at https://jakevdp.github.io/PythonDataScienceHandbook/.
- Joe Suzuki: Statistical Learning with Math and Python. Springer 2021.
- Steven S. Skiena. The Data Science Design Manual. Springer 2017.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Data Analytics and Modeling	Written Examination	180 minutes	100	45%	1-7

Module Achievement

The module achievement encourages regular engagement with the contents of this online module. It facilitates the acquisition of knowledge on the foundations of the methods and of practical skills for their application. As such, the module achievement systematically prepares the students for the final examination.

The module achievement comprises weekly quizzes. To pass the module achievement, the average result across all quizzes has to be 50% or higher. It does not impact the overall module grade. Only students who successfully pass the module achievement by the first deadline are eligible to sit for the final examination. Students whose average result across all quizzes is lower than 50% are given a second opportunity to pass the module achievement and, thereby, sit for the make-up exam.

6.1.14 Applied Machine Learning

Module Name	Applied Machine Learning
Module Code	2025-CO-711
Module ECTS	7.5
Program Owner	2025-Minor-Data-Science (Minor in Data Science)
Module Coordinator	Dr. Georgi Dragolov

Study Semester		
Program	**Semester**	**Status**
2025-MDDA-BSc Management, Decisions and Data Analytics	4	Mandatory
2025-Minor-Data-Science Minor in Data Science	4	Mandatory

Student Workload	
Asynchronous Self Study	52.5
Interactive Learning	57.5
Exam Preparation	20
Independent Study	57
Total Hours	**187**

Module Components	**Number**	**Type**	**CP**
Applied Machine Learning	CO-711-A	Lecture (Online)	7.5

Module Description

The module provides a hands-on introduction to Machine Learning (ML), emphasizing practical aspects of workflows and applications. Topics include k-Means clustering, Nearest Neighbor (NN) and Naive Bayes techniques, Decision Trees, Support Vector Machines (SVMs). Particular emphasis is on Neural Networks and Deep Learning. Theoretical concepts such as distance metrics, graphs, and networks are reviewed. Flexible educational formats (mostly online and hybrid) allow for asynchronous learning. Lectures are combined with Python exercises with particular emphasis on the scitkit-learn package. Disciplinary applications and case studies are immersed as bridging elements

Recommended Knowledge

Required for solving the coding assignments are Python skills at the level achieved after successful completion of the module Introduction to Data Science. Furthermore, students are encouraged to review first-year level statistics and linear algebra.

Intended Learning Outcomes

No	Competence	ILO
1	Enumerate	Enumerate and describe main Machine Learning (ML) tasks and applications.
2	Discern	Discern and explain important ML approaches to classification and regression.
3	Apply	Apply Nearest Neighbor and Naive Bayes techniques to classification problems.
4	Employ	Employ Decision Trees and Support Vector Machines to solve data science problems.
5	Understand	Understand and use Neural Network and Deep Learning techniques.
6	Address	Address Machine Learning tasks by means of the Python library SciKit-learn (sklearn).

Indicative Literature

- Jake Vanderplas. Python Data Science Handbook. O'Reilly 2016. An online version is available at https://jakevdp.github.io/PythonDataScienceHandbook/.
- Joe Suzuki: Statistical Learning with Math and Python. Springer 2021.
- Steven S. Skiena. The Data Science Design Manual. Springer, 2017.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Applied Machine Learning	Written Examination	180 min	100	45%	1-6

Module Achievement

6.1.15 Financial Data Analytics

Module Name	Financial Data Analytics
Module Code	2025-CA-S-MDDA-801
Module ECTS	5
Program Owner	2025-MDDA-BSc (Management, Decisions and Data Analytics)
Module Coordinator	Prof. Dr. Andreas Seebeck

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Financial Data Analytics	CA-MDDA-801	Seminar	5

Module Description

The module aims to allow participants to analyze financial and non-financial disclosure of corporations from around the world and to show the links between accounting statements, valuation methods and investment analysis.

Students will learn to extract information from structured and unstructured financial statements. For instance, they will learn how to use the SEC EDGAR website and other databases for financial statement analysis purposes. Next, they will gain experience in analyzing financial data using modern data and text mining approaches and statistical methods. Throughout the course, students will gain hands-on experience in the use of data and text mining approaches to analyze real world financial problems.

Finally, students will gain an understanding of the limitations of financial statement analysis and the methods for evaluating the quality of financial statements.

Recommended Knowledge

Basic Concepts of Accounting and Finance

Intended Learning Outcomes

No	Competence	ILO
1	Calculate	Calculate and use accounting ratios.
2	Extract	Extract decision-relevant information from quantitative and qualitative disclosure.
3	Conduct	Conduct an analysis of corporate strategy and link this to the company's financial performance.
4	Identify	Identify and apply the tools of financial statement analysis, including appropriate technology.
5	Integrate	integrate and apply finance and accounting concepts for valuation analysis, including appropriate technology.
6	Apply	Apply a set of diagnostics to assess the quality of the accounting in financial statements.

Indicative Literature

- Ou, J. A., & Penman, S. H. (1989). Financial statement analysis and the prediction of stock returns. Journal of Accounting and Economics, 11(4), 295-329.
- Subramanyam, K. R. (2014). Financial statement analysis. Không nhà xuất bản.
- Yam, P., Cheung, K. C., Fan, K., & Chen, Y. (2023). Financial Data Analytics with Machine Learning, Optimization and Statistics. United Kingdom: Wiley.

Entry Requirements

Prerequisites	2025-CH-301 Introduction to Finance and Accounting
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Financial Data Analytics	Term Paper	2500 words	100	45%	1-6

Module Achievement

6.1.16 Advanced Econometrics

Module Name	Advanced Econometrics
Module Code	2025-CA-S-GEM-801
Module ECTS	5
Program Owner	2025-GEM-BA (Global Economics and Management)
Module Coordinator	Prof. Dr. Colin Vance

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Advanced Econometrics	CA-GEM-801	Seminar	5

Module Description

The goal of this module is to build on the knowledge acquired in the "Econometrics" module, covering select advanced concepts of regression analysis as it applies to empirical social science research. The prime learning objective is to understand different approaches of secondary data analysis, where and how to apply particular econometric estimators, and their limitations. Particular emphasis will be placed on identifying exogenous sources of variation and methods for identifying causal relationships between variables. The class will also cover some of the opportunities and pitfalls associated with the analysis of "big data", drawing on current examples and available data. Textbook-based lectures ensure the transmission of the necessary knowledge. Exercises in class further promote the students' capacity to differentiate and debate the merits of alternative econometric techniques for testing particular hypotheses.

This module aims at consolidating students' command of econometrics and related statistical techniques. A command of econometrics constitutes an important fundament for undergraduate studies in the fields of economics and helps students to critically appraise scientific statements about causality in many situations, including professional settings. This module helps students to assess and criticize econometric findings in academic papers and promotes their capacity to differentiate between bias and statistical precision in interpreting their own econometric results.

Recommended Knowledge

- Notions of substantive versus statistical significance

- Basic knowledge of econometrics

- Academic writing skills

- Students prepare best for this module by reading Edward Leamer's seminal article "Let's take the con out of Econometrics," published in the American Economic Review in 1983. The article covers many of the key issues that econometricians still grapple with today, such as whether randomization is essential.

Usability and Relationship to other Modules

This module builds on the second-year methods module "Econometrics", as well as on models and topics from the first-year modules "Microeconomics" and "Macroeconomics" and from the second-year modules "Environmental and Resource Economics" and "Public Economics and Policy". The module expands students' understandings of econometrics beyond the introductory level towards advanced techniques and applications.

Intended Learning Outcomes

No	Competence	ILO
1	Identify	Identify the econometric method appropriate to specific data types.
2	Implement	Implement the method using R-software and interpret the results.
3	Design	Design an empirical research project based on a research question, using an appropriate estimation strategy and secondary data to derive results and draw conclusions.
4	Articulate	Articulate model results in terms that a lay person can understand.
5	Discriminate	Discriminate between the notions of "economic significance" and "statistical significance.

Indicative Literature

- Angrist, J. D., Pischke, J. S. (2014). Mastering metrics: The path from cause to effect. Princeton University Press.
- Antonakis, J., Bendahan, S., Jacquart, P. Lalive, R. (2010). On making causal claims: A review and recommendations. The Leadership Quarterly, 21(6): 1086-1120.

Entry Requirements

Prerequisites	2025-CTMS-MET-05 Econometrics
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Advanced Econometrics	Written Examination	120 Minutes	100	45%	1-5

Module Achievement

6.1.17 Blockchain Technology and Applications

Module Name	Blockchain Technology and Applications
Module Code	2025-CA-S-IBA-805
Module ECTS	5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Prof. Dr. Lennart Ante

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	6	Mandatory Elective
2025-IBA-BA International Business Administration	6	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	6	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	6	Mandatory Elective

Student Workload	
Lecture	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Blockchain Technology and Applications	CA-IBA-805	Lecture	5

Module Description

This module introduces blockchain technology and its wide-ranging applications across business and society. It provides a thorough overview of foundational concepts, including the structure and operation of distributed ledgers, the mechanisms of decentralization, and the role of cryptographic security in ensuring data integrity. The course also covers consensus protocols such as Proof of Work and Proof of Stake, along with advanced topics like smart contracts, tokenization, and interoperability. By integrating theoretical knowledge with case studies and examples, the module contextualizes how blockchain technology is reshaping industries such as finance, healthcare, and supply chain management.

Students will engage deeply with blockchain use cases, including cryptocurrencies, non-fungible tokens (NFTs), or decentralized finance (DeFi). Through practical activities, they will learn to set up wallets, create and deploy tokens, and interact with decentralized applications (dApps). These hands-on sessions are designed to provide a functional understanding of blockchain tools, while discussions on challenges such as security, scalability and energy consumption encourage critical thinking about its

broader implications. The module also explores emerging innovations like the integration of blockchain with artificial intelligence.

The course aims to develop practical and theoretical skills that are relevant to job opportunities in the blockchain sector and beyond.

Recommended Knowledge

- Basic understanding of digital technologies and business management

- Students are encouraged to familiarize themselves with fundamental blockchain concepts by exploring online resources

Usability and Relationship to other Modules

This module provides foundational knowledge and hands-on experience in blockchain technology, preparing students for advanced topics in digital transformation, fintech, and entrepreneurship

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain the core concepts, architecture, and principles of blockchain technology.
2	Analyze	Analyze the economic, business and societal implications of blockchain applications.
3	Apply	Apply blockchain tools, including digital wallets, tokenization, and transaction verification.
4	Evaluate	Evaluate the potential and limitations of blockchain applications.
5	Propose	Propose blockchain-based solutions to address business and societal challenges, while considering the practical and contextual constraints of their implementation.

Indicative Literature

- Antonopoulos, A. M. (2017). Mastering Bitcoin: Unlocking Digital Cryptocurrencies. O'Reilly Media.
- Nakamoto, S. (2008). Bitcoin: A Peer-to-Peer Electronic Cash System.
- Steinmetz, F., Ante, L. & Fiedler, I. (2020). Blockchain and the digital economy: The socio-economic impact of blockchain technology. Agenda Publishing. https://doi.org/10.2307/j.ctv16qjxg0.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Blockchain Technology and Applications	Term Paper	2500 words	100	45%	1-5

Module Achievement

6.1.18 Data Analytics

Module Name	Data Analytics
Module Code	2025-MDE-CO-02
Module ECTS	5
Program Owner	2025-DE-MSc (Data Engineering)
Module Coordinator	Prof. Dr. Adalbert F.X. Wilhelm

Study Semester		
Program	**Semester**	**Status**
2025-AST-MSc Advanced Software Technology	1	Mandatory Elective
2025-CSSE-MSc Computer Science & Software Engineering	1	Mandatory Elective
2025-DE-MSc Data Engineering	1	Mandatory
2025-DSSB-MSc Data Science for Society and Business	1	Mandatory Elective
2025-MBA-120-MA MBA 120	1	Mandatory Elective
2025-MBA-60-MA MBA 60	1	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective

Student Workload	
Independent Study	90
Lecture	17.5
Tutorial	17.5
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Data Analytics	MDE-CO-02	Lecture	5

Module Description

This module introduces concepts and methods of data analytics. The objective of the module is to present methods for gaining insight from data and drawing conclusions for analytical reasoning and decision-making. The module comprises a broad spectrum of methods for modelling and understanding complex datasets. Comprising both descriptive and predictive analytics, the standard portfolio of supervised and unsupervised learning techniques is introduced. Automatic analysis components, such as data transformation, aggregation, classification, clustering, and outlier detection, will be treated as an integral part of the analytics process.

As a central part of this module, students are introduced to the major concepts of statistical learning such as cross-validation, feature selection, and model evaluation. The course takes an applied approach and combines the theoretical foundation of data analytics with practical exposure to the data analysis process.

Recommended Knowledge

- Read the Syllabus.

- Take the free online course: Introduction to Data Science at https://cognitiveclass.ai/courses/data-science-101/

Usability and Relationship to other Modules

In this module students will learn concepts and various techniques for data analysis. They will be rigorously applied in MDE-CS-03 as well as in the applied projects MDE-DIS-02 and MDE-DIS-03, and typically also in the master thesis.

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain advanced data analytics techniques in theory and application.
2	Apply	Apply data analytics methods to real-life problems using appropriate tools.
3	Evaluate	Evaluate and compare different data analytics algorithms and approaches.
4	Apply	Apply statistical concepts to evaluate data analytics results.

Indicative Literature

- A. Telea, Data Visualization: Principles and Practice, Wellesley, Mass.: AK Peters, 1st edition, 2008. (DV).
- G. James, D.Witten, T. Hastie, Rob Tibshirani: Introduction to Statistical Learning with R by Springer, 2013 (ISLR).
- M. Ward, G. Grinstein, D. Keim, Interactive Data Visualization: Foundations, Techniques, and Applications. AK Peters, 1st edition, 2010. (IDV)

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Data Analytics	Project Report	20 Pages	100	45%	1-4

Module Achievement

6.1.19 Contemporary Topics in Marketing

Module Name	Contemporary Topics in Marketing
Module Code	2025-CA-S-IBA-803
Module ECTS	5
Program Owner	2025-IBA-BA (International Business Administration)
Module Coordinator	Dr. Matthias Meckel

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	6	Mandatory Elective
2025-IBA-BA International Business Administration	6	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	6	Mandatory Elective

Student Workload	
Seminar	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Contemporary Topics in Marketing	CA-IBA-803	Seminar	5

Module Description

The module aims to provide an overview and understanding of frontline topics in marketing. The purpose is also to stimulate interest in a further exploration of these topics, for continued research and thesis work. The overall objective is to provide students with an explicit marketing-based mindset and a set of conceptual, analytical, and practical tools with which to come to terms with contemporary marketing issues, thus enabling them to challenge and improve existing practices and theories

The module covers a set of marketing topics that (a) are important in contemporary marketing, from both a theoretical and practical point of view, and (b) have not received extensive coverage in previous marketing-related modules

Recommended Knowledge

- Basic Concepts of Marketing

- It is recommended that students chose the “Marketing” module in their second year to gain in-depth knowledge of basic marketing concepts prior to this specialization. Students should at least familiarize themselves with basic marketing concepts as outlined in the syllabus of the “Marketing” module.

Intended Learning Outcomes

No	Competence	ILO
1	Illustrate	Illustrate an understanding of contemporary topics in marketing relating to theories, models, research methods and empirical phenomena.
2	Analyze	Analyze and assess published journal articles in the field of marketing.
3	Discuss	Discuss contemporary marketing phenomena and practices.
4	Design	Design an adequate empirical research approach for an analysis of a contemporary topic in marketing.

Indicative Literature

- Hanlon, A. (2019). Digital Marketing - Strategic Planning & Integration. Thousand Oakes: Sage.

Entry Requirements

Prerequisites	2025-CH-300 Introduction to International Business 2025-CH-301 Introduction to Finance and Accounting
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Contemporary Topics in Marketing	Term Paper	2500 words	100	45%	1-4

Module Achievement

6.1.20 Internship / Startup and Career Skills

Module Name	Internship / Startup and Career Skills
Module Code	2025-CA-INT-900
Module ECTS	15
Program Owner	Career (Career Module for UG programs)
Module Coordinator	Dr. Tanja Woebs Clémentine Senicourt

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	5	Mandatory
2025-CBT-BSc Chemistry and Biotechnology	5	Mandatory
2025-CS-BSc Computer Science	5	Mandatory
2025-ECE-BSc Electrical and Computer Engineering	5	Mandatory
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory
2025-F-ACS-BSc Applied Computer Science	5	Mandatory
2025-IBA-BA International Business Administration	5	Mandatory
2025-IRPH-BA International Relations: Politics and History	5	Mandatory
2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory
2025-PHDS-BSc Physics and Data Science	5	Mandatory
2025-BCCB-BSc Biochemistry and Cell Biology	6	Mandatory
2025-CBT-BSc Chemistry and Biotechnology	6	Mandatory
2025-CS-BSc Computer Science	6	Mandatory
2025-ECE-BSc	6	Mandatory

Electrical and Computer Engineering		
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	6	Mandatory
2025-GEM-BA Global Economics and Management	6	Mandatory
2025-IBA-BA International Business Administration	6	Mandatory
2025-IRPH-BA International Relations: Politics and History	6	Mandatory
2025-ISCP-BA Integrated Social and Cognitive Psychology	6	Mandatory
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	6	Mandatory
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	6	Mandatory
2025-PHDS-BSc Physics and Data Science	6	Mandatory
2025-RIS-BSc Robotics and Intelligent Systems	6	Mandatory
2025-S-ACS-BSc Applied Computer Science	6	Mandatory
2025-SDT-BSc Software, Data and Technology	6	Mandatory

Student Workload	
Internship	308
Internship Event	2
Independent Study	32
Interactive Learning	33
Total Hours	**375**

Module Components	**Number**	**Type**	**CP**
Internship	CA-INT-900-0	Internship	15

Module Description

The aims of the internship module are reflection, application, orientation, and development: for students to reflect on their interests, knowledge, skills, their role in society, the relevance of their major subject to society, to apply these skills and this knowledge in real life whilst getting practical experience, to find a professional orientation, and to develop their personality and in their career. This module supports the programs' aims of preparing students for gainful, qualified employment and the development of their personality.

The full-time internship must be related to the students' major area of study and extends lasts a minimum of two consecutive months, normally scheduled just before the 5th semester, with the internship event and submission of the internship report in the 5th semester. Upon approval by the SPC and SCS, the internship may take place at other times, such as before teaching starts in the 3rd semester or after teaching finishes in the 6th semester. The Study Program Coordinator or their faculty delegate approves the intended internship a priori by reviewing the tasks in either the Internship Contract or Internship Confirmation from the respective internship institution or company. Further regulations as set out in the Policies for Bachelor Studies apply.

Students will be gradually prepared for the internship in semesters 1 to 4 through a series of mandatory information sessions, seminars, and career events.

The purpose of the Career Services Information Sessions is to provide all students with basic facts about the job market in general, and especially in Germany and the EU, and services provided by the Student Career Support.

In the Career Skills Seminars, students will learn how to engage in the internship/job search, how to create a competitive application (CV, Cover Letter, etc.), and how to successfully conduct themselves at job interviews and/or assessment centers. In addition to these mandatory sections, students can customize their skill set regarding application challenges and their intended career path in elective seminars.

Finally, during the Career Events organized by the Career Service Center (e.g. the annual Constructor Career Fair and single employer events on and off campus), students will have the opportunity to apply their acquired job market skills in an actual internship/job search situation and to gain their desired internship in a high-quality environment and with excellent employers.

As an alternative to the full-time internship, students can apply for the StartUp Option. Following the same schedule as the full-time internship, the StartUp Option allows students who are particularly interested in founding their own company to focus on the development of their business plan over a period of two consecutive months. Participation in the StartUp Option depends on a successful presentation of the student's initial StartUp idea. This presentation will be held at the beginning of the 4th semester. A jury of faculty members will judge the student's potential to realize their idea and approve the participation of the students. The StartUp Option is supervised by the Faculty StartUp Coordinator. At the end of StartUp Option, students submit their business plan. Further regulations as outlined in the Policies for Bachelor Studies apply.

The concluding Internship Event will be conducted within each study program (or a cluster of related study programs) and will formally conclude the module by providing students the opportunity to present on their internships and reflect on the lessons learned within their major area of study. The purpose of this event is not only to self-reflect on the whole internship process, but also to create a professional network within the academic community, especially by entering the Alumni Network after graduation. It is recommended that all three classes (years) of the same major are present at this event to enable networking between older and younger students and to create an educational environment for younger students to observe the "lessons learned" from the diverse internships of their elder fellow students.

Recommended Knowledge

- Information provided on CSC

- Major specific knowledge and skills

- Please see the section “Knowledge Center” at JobTeaser Career Center for information on Career Skills seminar and workshop offers and for online tutorials on the job market preparation and the application process. For more information, please see https://constructor.university/student-life/career-services.

- Participating in the internship events of earlier classes

Usability and Relationship to other Modules

This module applies skills and knowledge acquired in previous modules to a professional environment and provides an opportunity to reflect on their relevance in employment and society. It may lead to thesis topics.

Intended Learning Outcomes

No	Competence	ILO
1	Describe	Describe the scope and the functions of the employment market and personal career development.
2	Apply	Apply professional, personal, and career-related skills for the modern labor market, including self-organization, initiative and responsibility, communication, intercultural sensitivity, team and leadership skills, etc.
3	Manage	Manage their own career orientation processes independently by identifying personal interests, selecting appropriate internship locations or start-up opportunities, conducting interviews, succeeding at pitches or assessment centers, negotiating related employment, managing their funding or support conditions (such as salary, contract, funding, supplies, work space, etc.).
4	Apply	Apply specialist skills and knowledge acquired during their studies to solve problems in a professional environment and reflect on their relevance in employment and society.
5	Justify	Justify professional decisions based on theoretical knowledge and academic methods.
6	Reflect	Reflect on their professional conduct in the context of the expectations of and consequences for employers and their society.
7	Reflect	Reflect on and set their own targets for the further development of their knowledge, skills, interests, and values.
8	Establish	Establish and expand their contacts with potential employers or business partners, and possibly other students and alumni, to build their own professional network to create employment opportunities in the future.
9	Discuss	Discuss observations and reflections in a professional network.

Indicative Literature

Entry Requirements

Prerequisites	2025-CA-INT-900 Internship / Startup and Career Skills At least 15 CP from CORE modules in the major
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Internship	Project Report	3500 words	100	Pass/Fail	1-9

Module Achievement

6.1.21 Bachelor Thesis and Seminar MDDA

Module Name	Bachelor Thesis and Seminar MDDA
Module Code	2025-CA-MDDA-800
Module ECTS	15
Program Owner	2025-MDDA-BSc (Management, Decisions and Data Analytics)
Module Coordinator	Study Program Chair

Study Semester		
Program	**Semester**	**Status**
2025-MDDA-BSc Management, Decisions and Data Analytics	6	Mandatory

Student Workload	
Independent Study/Laboratory Work	350
Seminar	25
Total Hours	**375**

Module Components	**Number**	**Type**	**CP**
Thesis MDDA	CA-MDDA-800-T	Thesis	12
Thesis Seminar MDDA	CA-MDDA-800-S	Seminar	3

Module Description

This module is a mandatory graduation requirement for all undergraduate students to demonstrate their ability to deal with a problem from their respective major subject independently by means of academic/scientific methods within a set period. Although supervised, the module requires the student to be able to work independently and regularly and set their own goals in exchange for the opportunity to explore a topic that excites and interests them personally and which a faculty member is interested to supervise. Within this module, students apply their acquired knowledge about the major discipline, skills, and methods to conduct research, ranging from the identification of suitable (short-term) research projects, preparatory literature searches, the realization of discipline-specific research, and the documentation, discussion, interpretation and communication of the results.

This module consists of two components, an independent thesis and an accompanying seminar. The thesis component must be supervised by a Constructor University faculty member and requires short-term research work, the results of which must be documented in a comprehensive written thesis including an introduction, a justification of the methods, results, a discussion of the results, and conclusions. The seminar provides students with the opportunity to present, discuss and justify their and other students' approaches, methods and results at various stages of their research to practice these skills to improve their academic writing, receive and reflect on formative feedback, thereby growing personally and professionally.

Recommended Knowledge

- Comprehensive knowledge of the subject and deeper insight into the chosen topic;

- Ability to plan and undertake work independently;

- Skills to identify and critically review literature.

- Identify an area or a topic of interest and discuss this with your prospective supervisor in good time.

- Create a research proposal including a research plan to ensure timely submission.

- Ensure you possess all required technical research skills or are able to acquire them on time.

- Review again the University's Code of Academic Integrity and Guidelines to Ensure Good Academic Practice

Usability and Relationship to other Modules

This module builds on all previous modules of the program. Students apply the knowledge, skills and competencies they acquired and practiced during their studies, including research methods and the ability to acquire additional skills independently as and if required

Intended Learning Outcomes

No	Competence	ILO
1	Plan	Plan and organize advanced learning processes independently.
2	Design	Design and implement appropriate research methods taking full account of the range of alternative techniques and approaches
3	Collect	Collect, assess and interpret relevant information
4	Draw	Draw scientifically founded conclusions that consider social, scientific and ethical insights
5	Apply	Apply their knowledge and understanding to a context of their choice
6	Develop	Develop, formulate and advance solutions to problems and arguments in their subject area, and defend these through argument
7	Discuss	Discuss information, ideas, problems and solutions with specialists and non-specialists

Indicative Literature

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Thesis MDDA	Thesis	6000-8000 words	80	45%	1-6
Thesis Seminar MDDA	Presentation	15-30 min	20	45%	6-7

Module Achievement

7 Constructor Track Modules

7.1 Methods Modules

7.1.1 Applied Calculus

Module Name	Applied Calculus
Module Code	2025-CTMS-MAT-08
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Igors Gorbovickis

Study Semester		
Program	**Semester**	**Status**
2025-GEM-BA Global Economics and Management	1	Mandatory
2025-IBA-BA International Business Administration	1	Mandatory
2025-IBA-Online-BA International Business Administration (Online)	1	Mandatory
2025-IEM-BSc Industrial Engineering & Management	1	Mandatory
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	1	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory

Student Workload	
Lecture	35
Independent Study	90
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Applied Calculus	CTMS-08	Lecture	5

Module Description

This module gives a broad overview of the methods of Calculus, putting more emphasis on applications, rather than on mathematical rigor. Most of the concepts and methods are backed up by examples from chemistry, biology, economics and/or other sciences. In this module students enhance both their quantitative problem-solving skills as well as their conceptual understanding of mathematical methods.

The lecture comprises the following topics:

- Brief review of elementary functions and their graphs

- Intuitive understanding of limits; horizontal and vertical asymptotes

- Derivatives and their computation

- Applications of derivatives (interpretation of derivatives, their units, local linear approximation, error propagation, optimization problems)

- Brief introduction to functions of several variables, partial derivatives, local minima and maxima

- Integrals and their computation

- Applications of integrals (accumulated change, average value, applications in probability: density functions and cumulative distribution functions)

- Brief introduction to differential equations

Usability and Relationship to other Modules

- The module serves as preparation for the 2nd year IEM CORE module Operations Research.

- This serves as preparation for the 1st year GEM and IBA modules Microeconomics, Macroeconomics and Introduction to Finance and Accounting

- A mathematically rigorous treatment of Calculus is provided in the module Analysis I

- The first-year modules Calculus and Elements of Linear Algebra I+II can be used in place of the modules Applied Calculus and Finite Mathematics, respectively, to satisfy the graduation requirements in majors in which they are mandatory.

Recommended Knowledge

- Knowledge of Mathematics at high school level (Functions, graphs of functions, linear and polynomial functions, logarithms and exponential function, basic trigonometric functions, elementary methods for solving systems of linear and nonlinear equations).

- Some familiarity with elementary calculus (limits, derivatives) is helpful, but not required

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply the fundamental concepts of Calculus in structured situations.
2	Command	Command the methods described in the content section of this module description to the extent that they can solve standard text-book problems reliably and with confidence.
3	Explain	Explain importance of the methods of Calculus in problems arising from applications.
4	Understand	Understand the methods of Calculus, used in other modules, as well as in scientific literature.

Indicative Literature

- D. Hughes-Hallett, A. Gleason, P. Lock, D. Flath, et al. (2010/2013). Applied Calculus, 4th or 5th edition. Hoboken: Wiley.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Applied Calculus	Written Examination	120 Minutes	100	45%	All

Module Achievement

7.1.2 Applied Statistics with R

Module Name	Applied Statistics with R
Module Code	2025-CTMS-MET-03
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Adalbert F.X. Wilhelm

Study Semester		
Program	**Semester**	**Status**
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	2	Mandatory
2025-GEM-BA Global Economics and Management	2	Mandatory
2025-IBA-BA International Business Administration	2	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	2	Mandatory
2025-IEM-BSc Industrial Engineering & Management	2	Mandatory
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	2	Mandatory
2025-IRPH-BA International Relations: Politics and History	2	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	2	Mandatory
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory

Student Workload	
Assessment Preparation	10
Lecture	17.5
Independent Study	80
Laboratory	17.5
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Applied Statistics with R	CTMS-03	Lecture and Laboratory	5

Module Description

We live in a world full of data and more and more decisions are taken based on a comprehensive analysis of data. A central method of data analysis is the use of models describing the relationship between a set of predictor variables and a response. This module provides a thorough introduction to quantitative data analysis covering graphical representations, numerical summary statistics, correlation, and regression models. The module also introduces the fundamental concepts of statistical inference. Students learn about the different data types, how to best visualize them and how to draw conclusions from the graphical representations. Students will learn in this module the ideas and techniques of regression models within the generalized linear model framework involving multiple predictors and co-variates. Students will learn how to become an intelligent user of statistical techniques from a prosumers perspective to assess the quality of presented statistical results and to produce high-quality analyses by themselves. By using illustrative examples from economics, engineering, and the natural and social sciences students will gain the relevant background knowledge for their specific major as well as an interdisciplinary glimpse of other research fields. The general objective of the module is to enable students to become skilled statistical modelers who are well versed in the various assumptions, limitations, and controversies of statistical models and their application. Regular exercises and practical sessions will corroborate the students' proficiency with the statistical software R.

Recommended Knowledge

Get acquainted to statistical thinking by watching online videos for introductory probability and statistics as well as paying attention whenever arguments are backed up by empirical data

Usability and Relationship to other Modules

- Quantitative analytical skills are used and needed in many modules of all study programs

- Pre-requisite for Econometrics

- This module introduces students to R in preparation for the 2nd year mandatory method module on econometrics and 3rd year module on advanced econometrics

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply basic techniques in statistical modeling and quantitative research methods.
2	Describe	Describe fundamental statistical concepts, procedures, their assumptions and statistical fallacies.
3	Explain	Explain the potential of using quantitative methods in all fields of applications.
4	Express	Express informed skepticism of the limitations of statistical reasoning.
5	Interpret	Interpret statistical modeling results in scientific publications.
6	Perform	Perform basic and intermediate-level statistical analyses of data, using R.

Indicative Literature

- Charles Wheelan (2013). Naked Statistics: Stripping the Dread from The Data. New York: W.W. Norton & Company.
- Christopher Gandrud (2015). Reproducible Research with R and RStudio, Second Edition. The R Series, Chapman & Hall/CRC Press.
- John Maindonald, W. John Braun (2010). Data Analysis and Graphics Using R – an Example-Based Approach, Third Edition, Cambridge Series. In Statistical and Probabilistic Mathematics. Cambridge: Cambridge University Press.
- Michael J. Crawley (2013). The R Book, Second Edition. Hoboken: John Wiley & Sons.
- Peter Daalgard (2008). Introductory Statistics with R. Berlin: Springer.
- Randall E. Schumacker (2014). Learning Statistics Using R. Thousand Oaks: Sage.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Applied Statistics with R	Written Examination	120 Minutes	100	45%	All

Module Achievement

7.1.3 Digital Marketing Fundamentals and SEO

Module Name	Digital Marketing Fundamentals and SEO
Module Code	2025-CTMS-MET-20
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Matthias Meckel

Study Semester		
Program	**Semester**	**Status**
2025-IEM-BSc Industrial Engineering & Management	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory
2025-S-ACS-BSc Applied Computer Science	3	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	4	Mandatory Elective

Student Workload	
Asynchronous Self Study	80
Independent Study	45
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Digital Marketing Fundamentals and SEO	CTMS-20	Lecture	5

Module Description

This module is focused on key aspects of digital marketing and search engine optimisation (SEO), methodologies essential in today's online-driven marketing practice. State-of-the-art digital strategies, data-driven approaches, and SEO techniques will be at the core of the module.

The overall goal of this module is to help students without prior marketing knowledge to learn, understand, and practice the fundamentals of applied digital marketing methodology. This module helps students to navigate today's marketing challenges in a complex, dynamic online environment, where adaptability is essential, and where managers need to focus on achieving strategic goals through effective online presence rather than repetitive tasks.

Students will learn to develop and present consumer-centered and data-driven solutions for real-world digital marketing challenges.

Major challenges and concerns will be reflected:

- The role of data, the customer, and online visibility in a transformed digital landscape

- State-of-the-art digital marketing and SEO techniques

- Ethical and data security considerations in digital marketing

Intended Learning Outcomes

No	Competence	ILO
1	Develop	Develop practical knowledge and digital marketing skills, and mind sets to master address the challenges of today's online markets
2	Understand	Understand (routine) marketing processes in various context and how to state-of-the art digital methodologies to inform marketing decisions
3	Summarize	Summarize and classify the new data- and SEO-focused customer-driven methodologies within a digital marketing context
4	Understand	Understand the idea and potential for value -creation through of consumer-centric, data-informed digital marketingity
5	Apply	Apply innovative digital creativity methods and processes to enhance for marketing effectiveness

Indicative Literature

- Charlesworth (2023): Digital Marketing A Practical Approach, 4th edition
- Dibb, Simkin, Pride Ferrell (2023): Marketing Concepts and Strategies, 9th edition
- Enge, Spencer, Stricchiola (2023): The Art of SEO, 4th edition
- Hanlon (2022): Digital Marketing, 2nd edition
- Kotler (2022): Marketing: An Introduction, 15th edition
- Kotler, Keller, Chernev (2021): Marketing Management, Global Edition, 16th edition.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Digital Marketing Fundamentals and SEO	Presentation	30 minutes	100	45%	1-5

Module Achievement

7.1.4 Econometrics

Module Name	Econometrics
Module Code	2025-CTMS-MET-05
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Fabian Dehos

Study Semester		
Program	**Semester**	**Status**
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	4	Mandatory
2025-GEM-BA Global Economics and Management	4	Mandatory
2025-IBA-BA International Business Administration	4	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	4	Mandatory
2025-IEM-BSc Industrial Engineering & Management	4	Mandatory Elective

Student Workload	
Independent Study	90
Seminar	35
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Econometrics	CTMS-05	Seminar	5

Module Description

This module focuses on the application of econometric methods to the analysis of secondary data. Specifically, the goal is to expose students to some of the issues and challenges typically confronted by econometricians when analyzing empirical data in the realms of social science research, business and finance. Emphasis will be placed on the intuition underlying various commonly applied econometric techniques, and on the steps needed to implement them. The module expands on the knowledge acquired in statistics and intensifies discussions of multiple regression analysis. The general objective is to become familiar with contemporary methods that are used in econometric and business analyses and to become a critical reader of case studies. In this regard, a clear distinction will be drawn along two dimensions: between questions of statistical significance versus those of economic or social significance; and between correlation and causation. The module takes a practical approach that

covers how to estimate econometric models using R software. Sessions will often include computer applications to foster understanding of the discussed topics.

Recommended Knowledge

- An accessible overview of regression analysis can be found in Sykes, A.O. (1993). An Introduction to Regression Analysis. Coase-Sandor Institute for Law & Economics, Univ. of Chicago Working Paper No. 20. https://chicagounbound.uchicago.edu/law_and_economics/51/. Students are also encouraged to read: Ziliak, Stephen T. (2008). Retrospectives: Guinnessometrics: The Economic Foundation of "Student's". Journal of Economic Perspectives 22(4): 199-216.

- Knowledge of the ordinary least-squares regression model.

- Ability to estimate regression models using R software.

- Skills in conducting statistical inference tests.

Usability and Relationship to other Modules

- The module is a mandatory / mandatory elective module of the Methods area that is part of the Constructor Track (Methods and New Skills modules; Language and Humanities modules).

- This module builds on models and topics from the first-year modules "Microeconomics" and "Macroeconomics" and from the second-year modules "Environmental and Resource Economics" and "Development Economics"

- This module introduces students to R in preparation for the 2nd year mandatory method module on econometrics and 3rd year GEM module on advanced econometrics; the statistics skills prepare students for all 2nd and 3rd year GEM modules and the thesis

- This module prepares students in IBA for the analysis of data in the 2nd year modules International Strategic Management and Marketing and the 3rd year module Contemporary Topics in Marketing and the thesis

- Mandatory for a major in GEM.

- Mandatory elective for a major in IBA

- Elective for all other study programs.

Intended Learning Outcomes

No	Competence	ILO
1	Explain	Explain the mechanics and assumptions underpinning the Ordinary Least Squares (OLS) regression model.
2	Estimate	Estimate an OLS model on secondary data using R-software.
3	Interpret	Interpret the coefficient estimates from an OLS model with respect to their sign and magnitude.
4	Conduct	Conduct one- and two-sided tests of the statistical significance of coefficients.

Indicative Literature

- Abadie, A. & Cattaneo, M.D. (2018). Econometric methods for program evaluation. Annual Review of Economics, 10, 465-503.
- Angrist, J.D. & Pischke, J.S. (2014). Mastering'metrics: The path from cause to effect. Princeton University Press.
- Kabacoff, R. (2015). R in action: Data analysis and graphics with R. Chapter 8. Manning Publications Co.
- Wooldridge, J. M. (2015). Introductory econometrics: A modern approach. 6th edition. Cambridge Learning.
- Ziliak, Stephen T. (2008). Guinnessometrics: The economic foundation of "student's". Journal of Economic Perspectives 22(4), 199-216.

Entry Requirements

Prerequisites	2025-CTMS-MET-03 Applied Statistics with R
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Econometrics	Written Examination	120 Minutes	100	45%	All

Module Achievement

7.2 New Skills Modules

7.2.1 Logic (perspective I)

Module Name	Logic (perspective I)
Module Code	2025-CTNS-NSK-01
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Marina Christodoulou

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	3	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	3	Mandatory Elective
2025-CS-BSc Computer Science	3	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	3	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	3	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	3	Mandatory Elective
2025-GEM-BA Global Economics and Management	3	Mandatory Elective
2025-IBA-BA International Business Administration	3	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	3	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	3	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	3	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	3	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	3	Mandatory Elective

2025-PHDS-BSc Physics and Data Science	3	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	3	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	3	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	4	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	4	Mandatory Elective
2025-S-ACS-BSc Applied Computer Science	4	Mandatory Elective

Student Workload	
Independent Study	27.5
Online Lecture	17.5
Tutorials	17.5
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Logic (perspective I)	CTNS-01	Lecture (Online)	2.5

Module Description

Suppose a friend asks you to help solve a complicated problem? Where do you begin? Arguably, the first and most difficult task you face is to figure out what the heart of the problem actually is. In doing that you will look for structural similarities between the problem posed and other problems that arise in different fields that others may have addressed successfully. Those similarities may point you to a pathway for resolving the problem you have been asked to solve. But it is not enough to look for structural similarities. Sometimes relying on similarities may even be misleading. Once you've settled tentatively on what you take to be the heart of the matter, you will naturally look for materials, whether evidence or arguments, that you believe is relevant to its potential solution. But the evidence you investigate of course depends on your formulation of the problem, and your formulation of the problem likely depends on the tools you have available - including potential sources of evidence and argumentation. You cannot ignore this interactivity, but you can't allow yourself to be hamstrung entirely by it. But there is more. The problem itself may be too big to be manageable all at once, so you will have to explore whether it can be broken into manageable parts and if the information you have bears on all or only some of those parts. And later you will face the problem of whether the solutions to the particular sub problems can be put together coherently to solve the entire problem taken as a whole.

What you are doing is what we call engaging in computational thinking. There are several elements of computational thinking illustrated above. These include: Decomposition (breaking the larger problem down into smaller ones); Pattern recognition (identifying structural similarities); Abstraction (ignoring irrelevant particulars of the problem): and Creating Algorithms), problem-solving formulas.

But even more basic to what you are doing is the process of drawing inferences from the material you have. After all, how else are you going to create a problem-solving formula, if you draw incorrect inferences about what information has shown and what, if anything follows logically from it. What you must do is apply the rules of logic to the information to draw inferences that are warranted.

We distinguish between informal and formal systems of logic, both of which are designed to indicate fallacies as well as warranted inferences. If I argue for a conclusion by appealing to my physical ability to coerce you, I prove nothing about the truth of what I claim. If anything, by doing so I display my lack of confidence in my argument. Or if the best I can do is berate you for your skepticism, I have done little more than offer an ad hominem instead of an argument. Our focus will be on formal systems of logic, since they are at the heart of both scientific argumentation and computer developed algorithms. There are in fact many different kinds of logic and all figure to varying degrees in scientific inquiry. There are inductive types of logic, which purport to formalize the relationship between premises that if true offer evidence on behalf of a conclusion and the conclusion and are represented as claims about the extent to which the conclusion is confirmed by the premises. There are deductive types of logic, which introduce a different relationship between premise and conclusion. These variations of logic consist in rules that if followed entail that if the premises are true then the conclusion too must be true.

There are also modal types of logic which are applied specifically to the concepts of necessity and possibility, and thus to the relationship among sentences that include either or both those terms. And there is also what are called deontic logic, a modification of logic that purport to show that there are rules of inference that allow us to infer what we ought to do from facts about the circumstances in which we find ourselves. In the natural and social sciences most of the emphasis has been placed on inductive logic, whereas in math it is placed on deductive logic, and in modern physics there is an increasing interest in the concepts of possibility and necessity and thus in modal logic. The humanities, especially normative discussions in philosophy and literature are the province of deontic logic.

This module will also take students through the central aspects of computational thinking, as it is related to logic; it will introduce the central concepts in each, their relationship to one another and begin to provide the conceptual apparatus and practical skills for scientific inquiry and research.

This 2.5 CP module supports Academic Excellence by providing essential contextual knowledge that underpins the program's qualification aims, while appropriately limiting academic depth relative to the core technical competencies of the field

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply the various principles of logic and expand them to computational thinking.
2	Understand	Understand the way in which logical processes in humans and in computers are similar and different at the same time.
3	Apply	Apply the basic rules of first-order deductive logic and employ them rules in the context of creating a scientific or social scientific study and argument.
4	Employ	Employ those rules in the context of creating a scientific or social scientific study and argument.

Indicative Literature

- Frege, Gottlob (1879), Begriffsschrift, eine der arithmetischen nachgebildete Formelsprache des reinen Denkens [Translation: A Formal Language for Pure Thought Modeled on that of Arithmetic], Halle an der Salle: Verlag von Louis Nebert.
- Gödel, Kurt (1986), Russels mathematische Logik. In: Alfred North Whitehead, Bertrand Russell: Principia Mathematica. Vorwort, S. V–XXXIV. Suhrkamp.
- Kubica, Jeremy. Computational fairy tales. Jeremy Kubica, 2012.
- Leeds, Stephen. "George Boolos and Richard Jeffrey. Computability and logic. Cambridge University Press, New York and London1974, x+ 262 pp." The Journal of Symbolic Logic 42.4 (1977): 585-586.
- McCarthy, Timothy. "Richard Jeffrey. Formal logic: Its scope and limits. of XXXVIII 646. McGraw-Hill Book Company, New York etc. 1981, xvi+ 198 pp." The Journal of Symbolic Logic 49.4 (1984): 1408-1409.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Logic (perspective I)	Written Examination	60 Minutes	100	45%	All

Module Achievement

7.2.2 Logic (perspective II)

Module Name	Logic (perspective II)
Module Code	2025-CTNS-NSK-02
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Jules Coleman

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	3	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	3	Mandatory Elective
2025-CS-BSc Computer Science	3	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	3	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	3	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	3	Mandatory Elective
2025-GEM-BA Global Economics and Management	3	Mandatory Elective
2025-IBA-BA International Business Administration	3	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	3	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	3	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	3	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	3	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	3	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	3	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	3	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	3	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	3	Mandatory Elective

2025-RIS-BSc Robotics and Intelligent Systems	3	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	3	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	4	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	4	Mandatory Elective
2025-S-ACS-BSc Applied Computer Science	4	Mandatory Elective

Student Workload	
Independent Study	45
Online Lecture	17.5
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Logic (perspective II)	CTNS-02	Lecture (Online)	2.5

Module Description

The focus of this module is on formal systems of logic, since they are at the heart of both scientific argumentation and computer developed algorithms. There are in fact many kinds of logic and all figure to varying degrees in scientific inquiry. There are inductive types of logic, which purport to formalize the relationship between premises that if true offer evidence on behalf of a conclusion and the conclusion and are represented as claims about the extent to which the conclusion is confirmed by the premises. There are deductive types of logic, which introduce a different relationship between premise and conclusion. These variations of logic consist in rules that if followed entail that if the premises are true then the conclusion too must be true.

This module introduces logics that go beyond traditional deductive propositional logic and predicate logic and as such it is aimed at students who are already familiar with basics of traditional formal logic. The aim of the module is to provide an overview of alternative logics and to develop a sensitivity that there are many different logics that can provide effective tools for solving problems in specific application domains.

The module first reviews the principles of a traditional logic and then introduces many-valued logics that distinguish more than two truth values, for example true, false, and unknown. Fuzzy logic extends traditional logic by replacing truth values with real numbers in the range 0 to 1 that are expressing how strong the believe into a proposition is. Modal logics introduce modal operators expressing whether a proposition is necessary or possible. Temporal logics deal with propositions that are qualified by time. One can view temporal logics as a form of modal logics where propositions are qualified by time constraints. Interval temporal logic provides a way to reason about time intervals in which propositions are true.

The module will also investigate the application of logic frameworks to specific classes of problems. For example, a special subset of predicate logic, based on so-called Horn clauses, forms the basis of

logic programming languages such as Prolog. Description logics, which are usually decidable logics, are used to model relationships and they have applications in the semantic web, which enables search engines to reason about resources present on the Internet.

This 2.5 CP module supports Academic Excellence by providing essential contextual knowledge that underpins the program's qualification aims, while appropriately limiting academic depth relative to the core technical competencies of the field

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply the various principles of logic.
2	Explain	Explain practical relevance of non-standard logic.
3	Describe	Describe how many-valued logic extends basic predicate logic.
4	Apply	Apply basic rules of fuzzy logic to calculate partial truth values.
5	Sketch	Sketch basic rules of temporal logic.
6	Implement	Implement predicates in a logic programming language.
7	Prove	Prove some simple non-standard logic theorems.

Indicative Literature

- Baader, Franz. "The Description Logic Handbook: Theory Implementation and Applications", Cambridge University Press, 2nd edition, May 2010.
- Bergmann, Merry. "An Introduction to Many-Valued and Fuzzy Logic: Semantics, Algebras, and Derivation Systems", Cambridge University Press, April 2008.
- Fisher, Michael. "An Introduction to Practical Formal Methods Using Temporal Logic", Wiley, Juli 2011.
- Sterling, Leon S., Ehud Y. Shapiro, Ehud Y. "The Art of Prolog", 2nd edition, MIT Press, March 1994.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Logic (perspective II)	Written Examination	60 Minutes	100	45%	All

Module Achievement

7.2.3 Causation and Correlation (perspective I)

Module Name	Causation and Correlation (perspective I)
Module Code	2025-CTNS-NSK-03
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Marina Christodoulou

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	4	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	4	Mandatory Elective
2025-CS-BSc Computer Science	4	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	4	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	4	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	4	Mandatory Elective
2025-GEM-BA Global Economics and Management	4	Mandatory Elective
2025-IBA-BA International Business Administration	4	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	4	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	4	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	4	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	4	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	4	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	4	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	4	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	4	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	4	Mandatory Elective

2025-RIS-BSc Robotics and Intelligent Systems	4	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	4	Mandatory Elective

Student Workload	
Independent Study	27.5
Online Lecture	17.5
Tutorials	**17.5**
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Causation and Correlation	CTNS-03	Lecture (Online)	2.5

Module Description

In many ways, life is a journey. And also, as in other journeys, our success or failure depends not only on our personal traits and character, our physical and mental health, but also on the accuracy of our map. We need to know what the world we are navigating is actually like, the how, why and the what of what makes it work the way it does. The natural sciences provide the most important tool we have developed to learn how the world works and why it works the way it does. The social sciences provide the most advanced tools we have to learn how we and other human beings, similar in most ways, different in many others, act and react and what makes them do what they do. In order for our maps to be useful, they must be accurate and correctly reflect the way the natural and social worlds work and why they work as they do.

The natural sciences and social sciences are blessed with enormous amounts of data. In this way, history and the present are gifts to us. To understand how and why the world works the way it does requires that we are able to offer an explanation of it. The data supports a number of possible explanations of it. How are we to choose among potential explanations? Explanations, if sound, will enable us to make reliable predictions about what the future will be like, and also to identify many possibilities that may unfold in the future. But there are differences not just in the degree of confidence we have in our predictions, but in whether some of them are necessary future states or whether all of them are merely possibilities? Thus, there are three related activities at the core of scientific inquiry: understanding where we are now and how we got here (historical); knowing what to expect going forward (prediction); and exploring how we can change the paths we are on (creativity).

At the heart of these activities are certain fundamental concepts, all of which are related to the scientific quest to uncover immutable and unchanging laws of nature. Laws of nature are thought to reflect a causal nexus between a previous event and a future one. There are also true statements that reflect universal or nearly universal connections between events past and present that are not laws of nature because the relationship they express is that of a correlation between events. A working thermostat accurately allows us to determine or even to predict the temperature in the room in which it is located, but it does not explain why the room has the temperature it has. What then is the core difference between causal relationships and correlations? At the same time, we all recognize that given where we are now there are many possible futures for each of us, and even had our lives gone just the slightest bit differently than they have, our present state could well have been very different

than it is. The relationship between possible pathways between events that have not materialized but could have is expressed through the idea of counterfactual.

Creating accurate roadmaps, forming expectations we can rely on, making the world a more verdant and attractive place requires us to understand the concepts of causation, correlation, counterfactual explanation, prediction, necessity, possibility, law of nature and universal generalization. This course is designed precisely to provide the conceptual tools and intellectual skills to implement those concepts in our future readings and research and ultimately in our experimental investigations, and to employ those tools in various disciplines.

This 2.5 CP module supports Academic Excellence by providing essential contextual knowledge that underpins the program's qualification aims, while appropriately limiting academic depth relative to the core technical competencies of the field

Intended Learning Outcomes

No	Competence	ILO
1	Formulate	Formulate testable hypotheses that are designed to reveal causal connections and those designed to reveal interesting, important and useful correlations.
2	Distinguish	Distinguish scientifically interesting correlations from unimportant ones.
3	Apply	Apply critical thinking skills to evaluate information.
4	Understand	Understand when and why inquiry into unrealized possibility is important and relevant.

Indicative Literature

- Goodman, Nelson. Fact, fiction, and forecast. Harvard University Press, 1983.
- Quine Willard, Van Orman, and Joseph Silbert Ullian. The web of belief. Vol 2. New York: Random house, 1978.
- Thomas S. Kuhn: The Structure of Scientific Revolutions. Nelson, fourth edition, 2012.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Causation and Correlation	Written Examination	60 Minutes	100	45%	1-4

Module Achievement

7.2.4 Causation and Correlation (perspective II)

Module Name	Causation and Correlation (perspective II)
Module Code	2025-CTNS-NSK-04
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Eoin Ryan Dr. Irina Chiaburu Prof. Dr. Keivan Mallahi Karai

Study Semester		
Program	**Semester**	**Status**
2025-ISCP-BA Integrated Social and Cognitive Psychology	3	Mandatory Elective
2025-S-ACS-BSc Applied Computer Science	3	Mandatory Elective
2025-BCCB-BSc Biochemistry and Cell Biology	4	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	4	Mandatory Elective
2025-CS-BSc Computer Science	4	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	4	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	4	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	4	Mandatory Elective
2025-GEM-BA Global Economics and Management	4	Mandatory Elective
2025-IBA-BA International Business Administration	4	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	4	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	4	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	4	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	4	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	4	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	4	Mandatory Elective

2025-MDDA-BSc Management, Decisions and Data Analytics	4	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	4	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	4	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	4	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	4	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective

Student Workload	
Independent Study	45
Online Lecture	17.5
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Causation and Correlation (perspective II)	CTNS-04	Lecture (Online)	2.5

Module Description

Causality or causation is a surprisingly difficult concept to understand. David Hume famously noted that causality is a concept that our science and philosophy cannot do without, but it is equally a concept that our science and philosophy cannot describe. Since Hume, the problem of cause has not gone away, and sometimes seems to get even worse (e.g., quantum mechanics confusing previous notions of causality). Yet, ways of doing science that lessen our need to explicitly use causality have become very effective (e.g., huge developments in statistics). Nevertheless, it still seems that the concept of causality is at the core of explaining how the world works, across fields as diverse as physics, medicine, logistics, the law, sociology, and history - and ordinary daily life - through all of which, explanations and predictions in terms of cause and effect remain intuitively central.

Causality remains a thorny problem but, in recent decades, significant progress has occurred, particularly in work by or inspired by Judea Pearl. This work incorporates many 20th century developments, including statistical methods - but with a reemphasis on finding the why, or the cause, behind statistical correlations -, progress in understanding the logic, semantics and metaphysics of conditionals and counterfactuals, developments based on insights from the likes of philosopher Hans Reichenbach or biological statistician Sewall Wright into causal precedence and path analysis, and much more. The result is a new toolkit to identify causes and build causal explanations. Yet even as we get better at identifying causes, this raises new (or old) questions about causality, including metaphysical questions about the nature of causes (and effects, events, objects, etc), but also questions about what we really use causality for (understanding the world as it is or just to glean predictive control of specific outcomes), about how causality is used differently in different fields and activities (is cause in physics the same as that in history?), and about how other crucial concepts relate

to our concept of cause (space and time seem to be related to causality, but so do concepts of legal and moral responsibility).

This course will introduce students to the mathematical formalism derived from Pearl's work, based on directed acyclic graphs and probability theory. Building upon previous work by Reichenbach and Wright, Pearl defines a "a calculus of interventions" of "do-calculus" for talking about interventions and their relation to causation and counterfactuals. This model has been applied in various areas ranging from econometrics to statistics, where acquiring knowledge about causality is of great importance.

At the same time, the course will not forget some of the metaphysical and epistemological issues around cause, so that students can better critically evaluate putative causal explanations in their full context. Abstractly, such issues involve some of the same philosophical questions Hume already asked, but more practically, it is important to see how metaphysical and epistemological debates surrounding the notion of cause affect scientific practice, and equally if not more importantly, how scientific practice pushes the limits of theory. This course will look at various ways in which empirical data can be transformed into explanations and theories, including the variance approach to causality (characteristic of the positivistic quantitative paradigm), and the process theory of causality (associated with qualitative methodology). Examples and case studies will be relevant for students of the social sciences but also students of the natural/physical world as well.

This 2.5 CP module supports Academic Excellence by providing essential contextual knowledge that underpins the program's qualification aims, while appropriately limiting academic depth relative to the core technical competencies of the field

Recommended Knowledge

Basic probability theory

Intended Learning Outcomes

No	Competence	ILO
1	Have	Have a clear understanding of the history of causal thinking.
2	Form	Form a critical understanding of the key debates and controversies surrounding the idea of causality.
3	Recognize	Recognize and apply probabilistic causal models.
4	Explain	Explain how understanding of causality differs among different disciplines.
5	Demonstrate	Demonstrate how theoretical thinking about causality has shaped scientific practices.

Indicative Literature

- Ilari, Phyllis McKay and Federica Russo. Causality: Philosophical Theory Meets Scientific Practice. Oxford University Press 2014.
- Paul, L. A. and Ned Hall. Causation: A User's Guide. Oxford University Press 2013.
- Pearl, Judea, Glymour Madelyn and Jewell, Nicolas. Causal Inference in Statistics: A Primer. Wiley 2016.
- Pearl, Judea. Causality: Models, Reasoning and Inference. Cambridge University Press 2009.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Causation and Correlation (perspective II)	Written Examination	60 Minutes	100	45%	1-5

Module Achievement

7.2.5 Models, Matrices and Theories of Complex Systems

Module Name	Models, Matrices and Theories of Complex Systems
Module Code	2025-CTNS-NSK-05
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Marc-Thorsten Hütt

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	5	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	5	Mandatory Elective
2025-CS-BSc Computer Science	5	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	5	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory Elective
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	5	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	5	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	5	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	5	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	5	Mandatory Elective

Student Workload	
Independent Study	90
Online Lecture	35
Total Hours	**125**

Module Components	Number	Type	CP
Models, Matrices and Theories of Complex Systems	CTNS-05	Seminar (Online)	5

Module Description

Linear and nonlinear models together with matrix approaches can be useful in diverse disciplines to implement quantitative, computational approaches to exploring complex systems. Some of the most popular data and systems analysis strategies are built upon matrices. Examples include principal component analysis (PCA), the optimization techniques used in Operations Research (OR), the assessment of stable and unstable states in nonlinear dynamical systems, as well as aspects of machine learning.

Here we introduce the toolbox of linear models and matrix-based methods embedded in a wide range of transdisciplinary applications (part 1). We describe its foundation in linear algebra and graph theory (part 2) and the embedding of these systems in nonlinear dynamics (part 3). At the end of the course, we outline applications to graph theory and machine learning (part 4). Along the way we will encounter some of the classical approaches in complex systems: self-organization, deterministic chaos, cellular atomata and fractals. Throughout the course, examples from neuroscience, social sciences, medicine, biology, physics, chemistry, and other fields are used to illustrate these methods.

A strong emphasis of the course is on the sensible usage of linear approaches in a nonlinear world. We will critically reflect the advantages, as well as the disadvantages and limitations of this method. Guiding questions are: How appropriate is a linear approximation of a nonlinear system? What do you really learn from PCA? How reliable are the optimal states obtained via linear programming (LP) techniques?

In the end, students will have a clearer understanding of matrix approaches, as well as linear and nonlinear models in their own discipline, but they will also see the full transdisciplinarity of this topic. They will make better decisions in their choice of data analysis methods and become mindful of the challenges when going from linear to nonlinear thinking

Intended Learning Outcomes

No	Competence	ILO
1	Apply	Apply the concept of linear modeling in their own discipline.
2	Distinguish	Distinguish between linear and nonlinear interpretation strategies and understand the range of applicability of linear models.
3	Make	Make use of data analysis / data interpretation strategies from other disciplines, which are derived from linear algebra.
4	Know	Be aware of the ties that linear models have to machine learning and network theory,

5	Note	Note that these four ILOs can be loosely associated with the four parts of the course indicated above.

Indicative Literature

- Part 1: material from Linear Algebra for Everyone, Gilbert Strang, Wellesley-Cambridge Press, 2020.
- Part 2: material from Introduction to Linear Algebra (5th Edition), Gilbert Strang, Cambridge University Press, 2021.
- Part 3: Mainzer, Klaus. "Introduction: from linear to nonlinear thinking." Thinking in Complexity: The Computational Dynamics of Matter, Mind and Mankind (2007): 1-16.; material from Mathematics of Big Data: Spreadsheets, Databases, Matrices, and Graphs, Jeremy Kepner, Hayden Jananthan, The MIT Press, 2018.; material from Introduction to Linear Algebra (5th Edition), Gilbert Strang, Cambridge University Press, 2021.
- Part 4: material from Linear Algebra and Learning from Data, Gilbert Strang, Wellesley-Cambridge Press, 2019.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	The modules Logic and Causation & Correlation are highly recommended

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Models, Matrices and Theories of Complex Systems	Written Examination	120 Minutes	100	45%	1-4

Module Achievement

7.2.6 Complex Problem Solving

Module Name	Complex Problem Solving
Module Code	2025-CTNS-NSK-06
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Marco Verweij

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	5	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	5	Mandatory Elective
2025-CS-BSc Computer Science	5	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	5	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory Elective
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	5	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	5	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	5	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	5	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	5	Mandatory Elective

Student Workload	
Independent Study	72.5
Online Lecture	35
Tutorials	**17.5**
Total Hours	**125**

Module Components	Number	Type	CP
Complex Problem Solving	CTNS-06	Lecture (Online)	5

Module Description

Complex problems are, by definition, non-linear and/or emergent. Some fifty years ago, scholars such as Herbert Simon began to argue that societies around the world had developed an impressive array of tools with which to solve simple and even complicated problems, but still needed to develop methods with which to address the rapidly increasing number of complex issues. Since then, a variety of such methods has emerged. These include 'serious games' developed in computer science, 'multisector systems analysis' applied in civil and environmental engineering, 'robust decision-making' proposed by the RAND Corporation, 'design thinking' developed in engineering and business studies, 'structured problem-solving' used by McKinsey & Co., 'real-time technology assessment' advocated in science and technology studies, and 'deliberative decision-making' emanating from political science.

In this course, students first learn to distinguish between simple, complicated and complex problems. They also become familiar with the ways in which a particular issue can sometimes shift from one category into another. In addition, the participants learn to apply several tools for resolving complex problems. Finally, the students are introduced to the various ways in which natural and social scientists can help stakeholders resolve complex problems. Throughout the course examples and applications will be used. When possible, guest lectures will be offered by experts on a particular tool for tackling complex issues. For the written, take-home exam, students will have to select a specific complex problem, analyse it and come up with a recommendation - in addition to answering several questions about the material learned.

Recommended Knowledge

- The modules Logic and Causation & Correlation are highly recommended.

- Being able to read primary academic literature

- Willingness to engage in teamwork

- Camillus, J. (2008). Strategy as a wicked problem. Harvard Business Review 86: 99-106;

- Rogers, P. J. (2008). Using programme theory to evaluate complicated and complex aspects of interventions. Evaluation, 14, 29–48.

Intended Learning Outcomes

No	Competence	ILO
1	Identify	Identify a complex problem.

2	Develop	Develop an acceptable recommendation for resolving complex problems.
3	Understand	Understand the roles that natural and social scientists can play in helping stakeholders resolve complex problems.

Indicative Literature

- Camillus, J. (2008). Strategy as a wicked problem. Harvard Business Review 86: 99-106; Rogers, P. J. (2008). Using programme theory to evaluate complicated and complex aspects of interventions. Evaluation, 14, 29–48.
- Chia, A. (2019). Distilling the essence of the McKinsey way: The problem-solving cycle. Management Teaching Review 4(4): 350-377.
- Den Haan, J., van der Voort, M.C., Baart, F., Berends, K.D., van den Berg, M.C., Straatsma, M.W., Geenen, A.J.P., & Hulscher, S.J.M.H. (2020). The virtual river game: Gaming using models to collaboratively explore river management complexity, Environmental Modelling & Software 134, 104855.
- Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C.S., & Walker, B. (2002). Resilience and sustainable development: Building adaptive capacity in a world of transformations. AMBIO: A Journal of the Human Environment 31(5): 437-440.
- Ostrom, E. (2010). Beyond markets and states: Polycentric governance of complex economic systems. American Economic Review 100(3): 641-72.
- Pielke, R. Jr. (2007). The honest broker: Making sense of science in policy and politics. Cambridge: Cambridge University Press.
- Project Management Institute (2021). A guide to the project management body of knowledge (PMBOK® guide).
- Schon, D. A., & Rein, M. (1994). Frame reflection: Toward the resolution of intractable policy controversies. New York: Basic Books.
- Simon, H. A. (1973). The structure of ill structured problems. Artificial Intelligence 4(3-4): 181-201.
- Verweij, M. & Thompson, M. (Eds.) (2006). Clumsy solutions for a complex world. London: Palgrave Macmillan.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Complex Problem Solving	Written Examination	120 Minutes	100	45%	1-3

Module Achievement

The module achievement is designed to encourage students to regularly engage with the online course materials throughout the semester, thereby providing them with a sufficient grounding in the concepts and applications of complex problem-solving to take the exam. The module achievement consists of online quizzes tied to the course content. In order to fulfill the module achievement — and to be eligible to sit for the final exam — students are required to participate in at least 80% of the available online quizzes. The module achievement is assessed on a pass/non-pass basis and does not affect the overall module grade. Given the flexible, online nature of the quizzes, students are able to complete them at their own convenience within the set timeframes. Students who do not meet the 80% participation threshold before their first exam attempt will have the opportunity to fulfill the module achievement prior to their second exam attempt.

7.2.7 Argumentation, Data Visualization and Communication (perspective I)

Module Name	Argumentation, Data Visualization and Communication (perspective I)
Module Code	2025-CTNS-NSK-07
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Arvid Kappas

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	5	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	5	Mandatory Elective
2025-CS-BSc Computer Science	5	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	5	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	5	Mandatory Elective
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	5	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	5	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	5	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	5	Mandatory Elective

2025-S-ACS-BSc Applied Computer Science	5	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	5	Mandatory Elective

Student Workload	
Independent Study	72,5
Online Lecture	35
Tutorial	17,5
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Argumentation, Data Visualization and Communication (perspective I)	CTNS-07	Lecture (Online)	5

Module Description

One must be careful not to confuse argumentation with being argumentative. The latter is an unattractive personal attribute, whereas the former is a requirement of publicly holding a belief, asserting the truth of a proposition, the plausibility of a hypothesis, or a judgment of the value of a person or an asset. It is an essential component of public discourse. Public discourse is governed by norms and one of those norms is that those who assert the truth of a proposition or the validity of an argument or the responsibility of another for wrongdoing open themselves up to good faith requests to defend their claims. In its most general meaning, argumentation is the requirement that one offer evidence in support of the claims they make, as well as in defense of the judgments and assessments they reach. There are different modalities of argumentation associated with different contexts and disciplines. Legal arguments have a structure of their own as do assessments of medical conditions and moral character. In each case, there are differences in the kind of evidence that is thought relevant and, more importantly, in the standards of assessment for whether a case has been successfully made. Different modalities of argumentation require can call for different modes of reasoning. We not only offer reasons in defense of or in support of beliefs we have, judgments we make and hypotheses we offer, but we reason from evidence we collect to conclusions that are warranted by them.

This course is divided into three sections. Section one develops argumentation skills, including how to construct and evaluate claims, how to reason from evidence to conclusions, and how to recognize the cognitive biases and fallacies that can cause arguments to fail. Section two focuses on data visualization as a tool for supporting arguments. A well-designed graph can clarify complex evidence and make an argument accessible, while a poorly designed one can distort the truth. Section three addresses communication. Even a well-designed and supported argument will not persuade its audience if it is not communicated well. You will explore models of communication, the importance of rhetorics, and the ethics of attempting to change the mind of others, including the new and exciting challenges posed by generative AI.

The thread that runs through these sections is a consistent concern with how to support what we claim effectively. Some reasoning is linear: from A we infer B, and from A and B, we infer C, building stepwise towards a conclusion. But not all reasoning takes this form. Sometimes we argue for a claim by showing

that it slots neatly, or fits coherently, with other claims for which we have independent support, or by establishing that those individual pieces of evidence mutually reinforce one another. A key goal of this course is to introduce you to these different structures of justification so that you are aware of both the norms of your discipline and to what makes knowledge trustworthy in the first place.

There are three fundamental ideas that we want to extract from this segment of the course. These are (1) that argumentation is itself a requirement of being a researcher who claims to have made findings of one sort or another; (2) that there are different forms of appropriate argumentation for different domains and circumstances; and (3) that there are different forms of reasoning on behalf of various claims or from various bits of evidence to conclusions: whether those conclusions are value judgments, political beliefs, or scientific conclusions. Our goal is to familiarize you with all three of these deep ideas and to help you gain facility with each.

Recommended Knowledge

The modules Logic and Causation & Correlation are highly recommended.

Intended Learning Outcomes

No	Competence	ILO
1	Distinguish	Distinguish among different modalities of argument, e.g. legal arguments, vs. scientific ones.
2	Construct	Construct arguments using tools of data visualization.
3	Communicate	Communicate conclusions and arguments concisely, clearly and convincingly.

Indicative Literature

- Cairo, A (2012). The Functional Art: An introduction to information graphics and visualization. New Ridders.
- Knaflic, C.N. (2015). Storytelling with data: A data visualization guide for business professionals. John Wiley & Sons.
- Tufte, E.R. (1985). The visual display of quantitative information. The Journal for Healthcare Quality (JHQ), 7(3), 15.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs

Argumentation, Data Visualization and Communication (perspective I)	Written Examination	120 Minutes	100	45%	1-3

Module Achievement

None

7.2.8 Argumentation, Data Visualization and Communication (perspective II)

Module Name	Argumentation, Data Visualization and Communication (perspective II)
Module Code	2025-CTNS-NSK-08
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Prof. Dr. Arvid Kappas

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	6	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	6	Mandatory Elective
2025-CS-BSc Computer Science	6	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	6	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	6	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	6	Mandatory Elective
2025-GEM-BA Global Economics and Management	6	Mandatory Elective
2025-IBA-BA International Business Administration	6	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	6	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	6	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	6	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	6	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	6	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	6	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	6	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	6	Mandatory Elective

2025-S-ACS-BSc Applied Computer Science	6	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	6	Mandatory Elective

Student Workload	
Independent Study	80
Online Lecture	35
Tutorial	10
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Argumentation, Data Visualization and Communication (perspective II)	CTNS-08	Lecture (Online)	5

Module Description

Humans are a social species, and interaction is crucial throughout the entire life span. While much of human communication involves language, there is a complex multichannel system of nonverbal communication that enriches linguistic content, provides context, and is also involved in structuring dynamic interaction. Interactants achieve goals by encoding information that is interpreted in the light of current context in transactions with others. This complexity implies also that there are frequent misunderstandings as a sender's intention is not fulfilled. Students in this course will learn to understand the structure of communication processes in a variety of formal and informal contexts. They will learn what constitutes challenges to achieving successful communication and to how to communicate effectively, taking the context and specific requirements for a target audience into consideration. These aspects will be discussed also in the scientific context, as well as business, and special cases, such as legal context - particularly with view to argumentation theory.

Communication is a truly transdisciplinary concept that involves knowledge from diverse fields such as biology, psychology, neuroscience, linguistics, sociology, philosophy, communication and information science. Students will learn what these different disciplines contribute to an understanding of communication and how theories from these fields can be applied in the real world. In the context of scientific communication, there will also be a focus on visual communication of data in different disciplines. Good practice examples will be contrasted with typical errors to facilitate successful communication also with view to the Bachelor's thesis.

Recommended Knowledge

- The modules Logic and Causation & Correlation are highly recommended.

- Ability and openness to engage in interactions

- Media literacy, critical thinking and a proficient handling of data sources

- Own research in academic literature

Intended Learning Outcomes

No	Competence	ILO
1	Analyze	Analyze communication processes in formal and informal contexts.
2	Identify	Identify challenges and failures in communication.
3	Design	Design communications to achieve specified goals to specific target groups.
4	Understand	Understand the principles of argumentation theory.
5	Use	Use data visualization in scientific communications.

Indicative Literature

- Douglas Walton: Argumentation Theory – A Very Short Introduction. In: Simari, G., Rahwan, I. (eds) Argumentation in Artificial Intelligence. Springer, Boston, MA, 2009.
- Joseph A. DeVito: The Interpersonal Communication Book (Global edition, 16th edition), 2022.
- Steven L. Franconeri, Lace M. Padilla, Priti Shah, Jeffrey M. Zacks, and Jessica Hullman: The Science of Visual Data Communication: What Works Psychological Science in the Public Interest, 22(3), 110–161, 2022.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Argumentation, Data Visualization and Communication (perspective II)	Presentation	7-11 mins	100	45%	1-5

Module Achievement

None

7.2.9 Agency, Leadership, and Accountability

Module Name	Agency, Leadership, and Accountability
Module Code	2025-CTNS-NSK-09
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Marina Christodoulou

Study Semester		
Program	**Semester**	**Status**
2025-S-ACS-BSc Applied Computer Science	5	Mandatory
2025-BCCB-BSc Biochemistry and Cell Biology	6	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	6	Mandatory Elective
2025-CS-BSc Computer Science	6	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	6	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	6	Mandatory Elective
2025-F-ACS-BSc Applied Computer Science	6	Mandatory Elective
2025-GEM-BA Global Economics and Management	6	Mandatory Elective
2025-IBA-BA International Business Administration	6	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	6	Mandatory
2025-IRPH-BA International Relations: Politics and History	6	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	6	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	6	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	6	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	6	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	6	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	6	Mandatory Elective

2025-SDT-BSc Software, Data and Technology	6	Mandatory Elective

Student Workload	
Independent Study	72,5
Online Lecture	35
Tutorial	17,5
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Agency, Leadership, and Accountability	CTNS-09	Lecture (Online)	5

Module Description

Each of us is judged by the actions we undertake and held to account for the consequences of them. Sometimes we may be lucky and our bad acts don't have harmful effects on others. Other times we may be unlucky and reasonable decisions can lead to unexpected or unforeseen adverse consequences for others. We are therefore held accountable both for choices and for outcomes. In either case, accountability expresses the judgment that we bear responsibility for what we do and what happens as a result. But our responsibility and our accountability in these cases is closely connected to the idea that we have agency.

Agency presumes that we are the source of the choices we make and the actions that result from those choices. For some, this may entail the idea that we have free will. But there is scientific world view that holds that all actions are determined by the causes that explain them, which is the idea that if we knew the causes of your decisions in advance, we would know the decision you would make even before you made it. If that is so, how can your choice be free? And if it is not free, how can you be responsible for it? And if you cannot be responsible, how can we justifiably hold you to account for it?

These questions express the centuries old questions about the relationship between free will and a determinist world view: for some, the conflict between a scientific world view and a moral world view.

But we do not always act as individuals. In society we organize ourselves into groups: e.g. tightly organized social groups, loosely organized market economies, political societies, companies, and more. These groups have structure. Some individuals are given the responsibility of leading the group and of exercising authority. But one can exercise authority over others in a group merely by giving orders and threatening punishment for non-compliance.

Exercising authority is not the same thing as being a leader? For one can lead by example or by encouraging others to exercise personal judgment and authority. What then is the essence of leadership?

The module has several educational goals. The first is for students to understand the difference between actions that we undertake for which we can reasonably held accountable and things that we do but which we are not responsible for. For example, a twitch is an example of the latter, but so too may be a car accident we cause as a result of a heart attack we had no way of anticipating or

controlling. This suggests the importance of control to responsibility. At the heart of personal agency is the idea of control. The second goal is for students to understand what having control means. Some think that the scientific view is that the world is deterministic, and if it is then we cannot have any personal control over what happens, including what we do. Others think that the quantum scientific view entails a degree of indeterminacy and that free will and control are possible, but only in the sense of being unpredictable or random. But then random outcomes are not ones we control either. So, we will devote most attention to trying to understand the relationships between control, causation and predictability.

But we do not only exercise agency in isolation. Sometimes we act as part of groups and organizations. The law often recognizes ways in which groups and organizations can have rights, but is there a way in which we can understand how groups have responsibility for outcomes that they should be accountable for. We need to figure out then whether there is a notion of group agency that does not simply boil down to the sum of individual actions. We will explore the ways in which individual actions lead to collective agency.

Finally, we will explore the ways in which occupying a leadership role can make one accountable for the actions of others over which one has authority.

Intended Learning Outcomes

No	Competence	ILO
1	Understand	Understand and reflect how the social and moral world views that rely on agency and responsibility are compatible, if they are, with current scientific world views.
2	Understand	Understand how science is an economic sector, populated by large powerful organizations that set norms, fund research agendas.
3	Identify	Identify the difference between being a leader of others or of a group - whether a research group or a lab or a company - and being in charge of the group.
4	Learn	Learn to be a leader of others and groups. Understand that when one graduates one will enter not just a field of work but a heavily structured set of institutions and that one's agency and responsibility for what happens, what work gets done, its quality and value, will be affected accordingly.

Indicative Literature

- Feinberg, Joel. "Doing & deserving; essays in the theory of responsibility." (1970).
- Hull, David L. "Science as a Process." Science as a Process. University of Chicago Press, 2010.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Agency, Leadership, and Accountability	Written Examination	120 Minutes	100	45%	1-4

Module Achievement

7.2.10 Community Impact Project

Module Name	Community Impact Project
Module Code	2025-CTNS-CIP-10
Module ECTS	5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	CIP Faculty Coordinator

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc **Biochemistry and Cell Biology**	5	Mandatory Elective
2025-CBT-BSc **Chemistry and Biotechnology**	5	Mandatory Elective
2025-ECE-BSc **Electrical and Computer Engineering**	5	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective
2025-BCCB-BSc Biochemistry and Cell Biology	5	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	5	Mandatory Elective
2025-CS-BSc Computer Science	5	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	5	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	5	Mandatory Elective
2025-GEM-BA Global Economics and Management	5	Mandatory Elective
2025-IBA-BA International Business Administration	5	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	5	Mandatory Elective

2025-ISCP-BA Integrated Social and Cognitive Psychology	5	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	5	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	5	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	5	Mandatory Elective

Student Workload	
Introductory, Accompanying, and Final Events	10
Self-Organized Teamwork	115
Total Hours	**125**

Module Components	**Number**	**Type**	**CP**
Community Impact Project	CTNS-10	Project	5

Module Description

CIPs are self-organized, major-related, and problem-centered applications of students' acquired knowledge and skills. These activities will ideally be connected to their majors so that they will challenge the students' sense of practical relevance and social responsibility within the field of their studies. Projects will tackle real issues in their direct and/or broader social environment. These projects ideally connect the campus community to other communities, companies, or organizations in a mutually beneficial way.

Students are encouraged to create their own projects and find partners (e.g., companies, schools, NGOs), but will get help from the CIP faculty coordinator team and faculty mentors to do so. They can join and collaborate in interdisciplinary groups that attack a given issue from different disciplinary perspectives.

Student activities are self-organized but can draw on the support and guidance of both faculty and the CIP faculty coordinator team.

Students may begin their project in the 4th semester but must complete it by the end of the 5th semester; the module counts towards the workload of the 5th semester.

Usability and Relationship to other Modules

Students who have accomplished their CIP (6th semester) are encouraged to support their fellow students during the development phase of the next year's projects (4th semester).

Recommended Knowledge

- Basic knowledge of the main concepts and methodological instruments of the respective disciplines.

- Develop or join a community impact project before the 5th or 6th semester based on the introductory events during the 4th semester by using the database of projects, communicating with fellow students and faculty, and finding potential companies, organizations, or communities to target.

Intended Learning Outcomes

No	Competence	ILO
1	Understand	Understand the real-life issues of communities, organizations, and industries and relate them to concepts in their own discipline.
2	Enhance	Enhance problem-solving skills and develop critical faculty, create solutions to problems, and communicate these solutions appropriately to their audience.
3	Apply	Apply media and communication skills in diverse and non-peer social contexts.
4	Develop	Develop an awareness of the societal relevance of their own scientific actions and a sense of social responsibility for their social surroundings.
5	Reflect	Reflect on their own behavior critically in relation to social expectations and consequences.
6	Work	Work in a team and deal with diversity, develop cooperation and conflict skills, and strengthen their empathy and tolerance for ambiguity.
		The Community Impact Project is designed to convey the required personal and social competencies for enabling students to finish their studies at Constructor University as socially conscious and responsible graduates (part of the Constructor University's mission) and to convey social and personal abilities to the students, including a practical awareness of the societal context and relevance of their academic discipline.

Indicative Literature

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Community Impact Project	Project Assessment		100	Pass/Fail	All

Module Achievement

7.3 Languages and Humanities Modules

7.3.1 Languages

The descriptions of the language modules are provided in a separate document, the "Language Module Handbook" that can be accessed from the Constructor University's Language & Community Center internet sites https://constructor.university/student-life/language-community-center.

7.3.2 Humanities

7.3.3 Introduction to the Philosophy of Science

Module Name	Introduction to the Philosophy of Science
Module Code	2025-CTHU-HUM-002
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Eoin Ryan

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	1	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	1	Mandatory Elective
2025-CS-BSc Computer Science	1	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	1	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	1	Mandatory Elective
2025-GEM-BA Global Economics and Management	1	Mandatory Elective
2025-IBA-BA International Business Administration	1	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	1	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	1	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	1	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	1	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	1	Mandatory Elective

2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	1	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	1	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	1	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	1	Mandatory Elective
2025-BCCB-BSc Biochemistry and Cell Biology	2	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	2	Mandatory Elective
2025-CS-BSc Computer Science	2	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	2	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	2	Mandatory Elective
2025-IBA-BA International Business Administration	2	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	2	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	2	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	2	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	2	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	2	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	2	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	2	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	2	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	2	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	2	Mandatory Elective

Student Workload	
Independent Study	45
Online Lecture	17.5
Total Hours	**62.5**

Module Components	Number	Type	CP
Introduction to the Philosophy of Science	CTHU-002	Lecture (Online)	2.5

Module Description

This humanities module will introduce students to some of the central ideas in philosophy of science. Topics will include distinguishing science from pseudo-science, types of inference and the problem of induction, the pros and cons of realism and anti-realism, the role of explanation, the nature of scientific change, the difference between natural and social sciences, scientism and the values of science, as well as some examples from philosophy of the special sciences (e.g., physics, biology).

The course aims to give students an understanding of how science produces knowledge, and some of the various contexts and issues which mean this process is never entirely transparent, neutral, or unproblematic. Students will gain a critical understanding of science as a human practice and technology; this will enable them both to better understand the importance and success of science, but also how to properly critique science when appropriate.

This 2.5 CP module is part of a portfolio of several 2.5 CP modules designed to allow students to have a wider choice of electives. To compensate for the smaller size of this module, the assessment is of smaller scope.

Intended Learning Outcomes

No	Competence	ILO
1	Understand	Understand key ideas from the philosophy of science.
2	Discuss	Discuss different types of inference and rational processes.
3	Describe	Describe differences between how the natural sciences, social sciences and humanities discover knowledge.
4	Identify	Identify ways in which science can be more and less value-laden.
5	Illustrate	Illustrate some important conceptual leaps in the history of science.

Indicative Literature

- James Ladyman, Understanding Philosophy of Science (2002).
- Paul Song, Philosophy of Science: Perspectives from Scientists (2022).
- Peter Godfrey-Smith Theory and Reality (2021)

Entry Requirements

Prerequisites	None

Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to the Philosophy of Science	Written Examination	60 Minutes	100	45%	1-5

Module Achievement

7.3.4 Introduction to Philosophical Ethics

Module Name	Introduction to Philosophical Ethics
Module Code	2025-CTHU-HUM-001
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Eoin Ryan

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc Biochemistry and Cell Biology	1	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	1	Mandatory Elective
2025-CS-BSc Computer Science	1	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	1	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	1	Mandatory Elective
2025-IBA-BA International Business Administration	1	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	1	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	1	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	1	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	1	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	1	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	1	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	1	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	1	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	1	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	1	Mandatory Elective

2025-BCCB-BSc Biochemistry and Cell Biology	2	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	2	Mandatory Elective
2025-CS-BSc Computer Science	2	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	2	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	2	Mandatory Elective
2025-GEM-BA Global Economics and Management	2	Mandatory Elective
2025-IBA-BA International Business Administration	2	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	2	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	2	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	2	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	2	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	2	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	2	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	2	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	2	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	2	Mandatory Elective

Student Workload	
Independent Study	45
Online Lecture	17.5
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Introduction to Philosophical Ethics	CTHU-001	Lecture (Online)	2.5

Module Description

The nature of morality - how to lead a life that is good for yourself, and how to be good towards others - has been a central debate in philosophy since the time of Socrates, and it is a topic that continues to be vigorously discussed. This course will introduce students to some of the key aspects of philosophical ethics, including leading normative theories of ethics (e.g. consequentialism or utilitarianism, deontology, virtue ethics, natural law ethics, egoism) as well as some important questions from metaethics (are useful and generalizable ethical claims even possible; what do ethical speech and ethical judgements actually do or explain) and moral psychology (how do abstract ethical principles do when realized by human psychologies). The course will describe ideas that are key factors in ethics (free will, happiness, responsibility, good, evil, religion, rights) and indicate various routes to progress in understanding ethics, as well as some of their difficulties.

This 2.5 CP module is part of a portfolio of several 2.5 CP modules designed to allow students to have a wider choice of electives. To compensate for the smaller size of this module, the assessment is of smaller scope.

Intended Learning Outcomes

No	Competence	ILO
1	Describe	Describe normative ethical theories such as consequentialism, deontology and virtue ethics.
2	Discuss	Discuss some metaethical concerns.
3	Analyze	Analyze ethical language.
4	Highlight	Highlight complexities and contradictions in typical ethical commitments.
5	Indicate	Indicate common parameters for ethical discussions at individual and social levels.
6	Analyze	Analyze notions such as objectivity, subjectivity, universality, pluralism, value.

Indicative Literature

- Mark van Roojen Metaethicas: A Contemporary Introduction (2015).
- Russ Shafer-Landay A Concise Introduction to Ethics (2019).
- Simon Blackburn Being Good (2009).

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to Philosophical Ethics	Written Examination	60 Minutes	100	45%	1-6

Module Achievement

7.3.5 Introduction to Visual Culture

Module Name	Introduction to Visual Culture
Module Code	2025-CTHU-HUM-003
Module ECTS	2.5
Program Owner	2025-CT (CONSTRUCTOR Track Area)
Module Coordinator	Dr. Irina Chiaburu

Study Semester		
Program	**Semester**	**Status**
2025-BCCB-BSc **Biochemistry and Cell Biology**	1	Mandatory Elective
2025-CBT-BSc **Chemistry and Biotechnology**	1	Mandatory Elective
2025-CS-BSc Computer Science	1	Mandatory Elective
2025-ECE-BSc Electrical and Computer Engineering	1	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	1	Mandatory Elective
2025-IBA-BA International Business Administration	1	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	1	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	1	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	1	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	1	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	1	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	1	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	1	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	1	Mandatory Elective
2025-BCCB-BSc Biochemistry and Cell Biology	2	Mandatory Elective
2025-CBT-BSc Chemistry and Biotechnology	2	Mandatory Elective
2025-CS-BSc Computer Science	2	Mandatory Elective

2025-ECE-BSc Electrical and Computer Engineering	2	Mandatory Elective
2025-ESSMER-BSc Earth Sciences and Sustainable Management of Environmental Resources	2	Mandatory Elective
2025-GEM-BA Global Economics and Management	2	Mandatory Elective
2025-IBA-BA International Business Administration	2	Mandatory Elective
2025-IBA-Online-BA International Business Administration (Online)	2	Mandatory Elective
2025-IEM-BSc Industrial Engineering & Management	2	Mandatory Elective
2025-IEM-Online-BSc Industrial Engineering & Management (Online)	2	Mandatory Elective
2025-IRPH-BA International Relations: Politics and History	2	Mandatory Elective
2025-ISCP-BA Integrated Social and Cognitive Psychology	2	Mandatory Elective
2025-MCCB-BSc Medicinal Chemistry and Chemical Biology	2	Mandatory Elective
2025-MDDA-BSc Management, Decisions and Data Analytics	2	Mandatory Elective
2025-MMDA-BSc Mathematics, Modeling, and Data Analytics	2	Mandatory Elective
2025-PHDS-BSc Physics and Data Science	2	Mandatory Elective
2025-RIS-BSc Robotics and Intelligent Systems	2	Mandatory Elective
2025-SDT-BSc Software, Data and Technology	2	Mandatory Elective

Student Workload	
Independent Study	45
Online Lecture	17.5
Total Hours	**62.5**

Module Components	**Number**	**Type**	**CP**
Introduction to Visual Culture	CTHU-003	Lecture (Online)	2.5

Module Description

Of the five senses, the sense of sight has for a long time occupied the central position in human cultures. As John Berger has suggested this could be because we can see and recognize the world

around us before we learn how to speak. Images have been with us since the earliest days of the human history. In fact, the earliest records of human history are images found on cave walls across the world. We use images to capture abstract ideas, to catalogue and organize the world, to represent the world, to capture specific moments, to trace time and change, to tell stories, to express feelings, to better understand, to provide evidence and more. At the same time, images exert their power on us, seducing us into believing in their 'innocence', that is into forgetting that as representations they are also interpretations, i.e., a particular version of the world.

The purpose of this course is to explore multiple ways in which images and the visual in general mediate and structure human experiences and practices from more specialized discourses, e.g., scientific discourses, to more informal and personal day-to-day practices, such as self-fashioning in cyberspace. We will look at how social and historical contexts affect how we see, as well as what is visible and what is not. We will explore the centrality of the visual to the intellectual activity, from early genres of scientific drawing to visualizations of big data. We will examine whether one can speak of visual culture of protest, look at the relationship between looking and subjectivity and, most importantly, ponder the relationship between the visual and the real.

This 2.5 CP module is part of a portfolio of several 2.5 CP modules designed to allow students to have a wider choice of electives. To compensate for the smaller size of this module, the assessment is of smaller scope.

Intended Learning Outcomes

No	Competence	ILO
1	Understand	Understand a range of key concepts pertaining to visual culture, art theory and cultural analysis.
2	Understand	Understand the role visuality plays in development and maintenance of political, social, and intellectual discourses.
3	Think	Think critically about images and their contexts.
4	Reflect	Reflect critically on the connection between seeing and knowing.

Indicative Literature

- Berger, J., Blomberg, S., Fox, C., Dibb, M., & Hollis, R. (1973). Ways of seeing.
- Foucault, M. (2002). The order of things: an archaeology of the human sciences (Ser. Routledge classics). Routledge.
- Hunt, L. (2004). Politics, culture, and class in the French revolution: twentieth anniversary edition, with a new preface (Ser. Studies on the history of society and culture, 1). University of California Press.
- Miller, V. (2020). Understanding digital culture (Second). SAGE.
- Thomas, N. (1994). Colonialism's culture: anthropology, travel and government. Polity Press.

Entry Requirements

Prerequisites	None
Co-requisites	None
Additional Remarks	None

Assessment and Completion

Module Component	Examination Type	Duration or Length	Weight (%)	Minimum for Pass	ILOs
Introduction to Visual Culture	Written Examination	60 Minutes	100	45%	1-4

Module Achievement

8 Appendix

8.1 Intended Learning Outcomes Assessment-Matrix

Management, Decisions and Data Analysis (MDDA)					Introduction to International Business	Introduction to Finance and Accounting	Essentials of Cognitive Psychology	Essentials of Social Psychology	Introduction to Data Science	Data Structures and Processing	Digital Transformation and Information Economy	Design Thinking, E-Business & E-Services	Entrepreneurship and Innovation	Social Cognition	Org. Psychology & Communication	Judgment & Decision-Making	Data Analytics and Modeling	Applied Machine Learning	Data Analytics	Contemporary Topics in Marketing	Advanced Econometrics	Financial Data Analytics	Internship / Startup and Career Skills	Bachelor Thesis	CT Methods	CT German Language and Humanities Modules	CT New Skills
Semester					1	2	1	2	1	2	3	3	4	3	3/4	4	3	4	5	5	5	5	4-5	6	1-4	1-2	3-6
Mandatory/ Mandatory elective					m	m	m	m	m	m	m	m	m	m	m	m	m	m	me	me	me	me	m	m	m	m	m
ECTS Credits					7,5	7,5	7.5	7.5	7.5	7.5	5	2,5	7,5	5	5	5	7.5	7,5	5	5	5	5	15,0	15,0	20,0	5,0	20,0
	Competencies*																										
Program Learning Outcomes	**A**	**E**	**P**	**S**																							
understand and analyze the important issues that influence the choice of business strategy in a data-driven economy	x				x	x					x	x	x		x				x	x		x	x	x			
develop practical knowledge and management skills for digital transformation	x	x			x	x					x	x	x						x	x			x	x			
describe the major models and theories of behavioral decision making	x						x	x					x	x	x	x				x			x	x			
discuss applications of decision-making research in business	x				x	x	x	x	x		x	x	x	x	x	x			x	x	x	x	x	x			
apply and evaluate social cognitive and social influence theories to explain or predict real-world phenomena	x	x	x	x			x	x			(x)	(x)	x	x	x	x				x			x	x			
apply fundamental data science methods to structured data and use state-of-the-art tools to prepare and process unstructured data	x	x							x	x							x	x	x		x	x	(x)	x	x		
identify and evaluate important problem types and solution approaches in data analytics	x	x							x	x	x	x	x				x	x	x	x		x	x	x			
transform theoretical knowledge from management, decision making and data analytics into creative approaches while solving real-world problems;	x	x		x	x	x	(x)	(x)	x	x	x	x	x	(x)	(x)	x	x	x	x	x	x	x	x	x			
use academic or scientific methods as appropriate in the field of MDDA such as defining research questions, justifying methods, collecting, assessing and interpreting relevant information, and drawing scientifically-founded conclusions that consider social, scientific and ethical insights	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x		x
develop and advance solutions to problems and arguments in their subject area and defend these in discussions with specialists and non-specialists	x	x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x			
engage ethically with academic, professional and wider communities and to actively contribute to a sustainable future, reflecting and respecting different views	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x			x
take responsibility for their own learning, personal and professional development and role in society, evaluating critical feedback and self-analysis		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x
apply their knowledge and understanding to a professional context		x			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
take on responsibility in a diverse team		x	x	x	x		x	x			x	x	x	x	x	x			x	x			x				
adhere to and defend ethical, scientific and professional standards	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			x
Assessment Type																											
Written examination					x	x	x	x	x	x					x	x	x	x							x	x	x
Term paper														x						x	x	x					
Essay																										x	
Project report																			x				x				
Poster presentation																											
Laboratory report														x													
Program Code																											
Oral examination																										x	
Presentation											x	x	x											x	x		x
Practical Assessments																											
Project Assessments																											x
Portfolio Assessments																											
Bachelor Thesis																								x			
Module achievements					x				x	x							x	x								x	x

*Competencies: A-scientific/academic proficiency; E-competence for qualified employment; P-development of personality; S-competence for engagement in society

Figure 4: Intended Learning Outcomes Assessment-Matrix