JACOBS UNIVERSITY

Module Handbook

Undergraduate Studies 2018/2019

Bachelor of Arts, Bachelor of Science

Introduction

All undergraduate programs at Jacobs University are based on a coherently modularized structure, which provides students with a broad and flexible choice of study plans to meet their major as well as minor study interests.

The first study year is characterized by a broad offer in disciplinary and interdisciplinary education. Students select three CHOICE modules from a variety of study programs. As a unique asset, our curricula allow students to select their study program freely from among the three selected CHOICE modules during their first year of study.

In the second year, students take three in-depth, discipline-specific CORE modules. One CORE module can also be taken from a second, complementary discipline, which allows students to incorporate a minor study track into their undergraduate education. Students will generally qualify for a minor if they have successfully taken at least one CHOICE module and one CORE module in a second field.

This module handbook provides the module data for all 1st year CHOICE, all 2nd year CORE and all 3rd year CAREER modules offered by Jacobs University, as well as the Jacobs Track (General Education) modules.

For further detailed information concerning the general curricular structure of Jacobs University as well as the program specific information, please consult the respective study program handbook.

Jacobs University's Undergraduate Study Programs according to Focus Area

Focus Area Health

- Medicinal Chemistry and Chemical Biology (MCCB)
- Physics (PHY)
- Chemistry (CHEM)
- Biochemistry and Cell Biology (BCCB)
- Earth and Environmental Sciences (EES)

Focus Area Mobility

- Intelligent Mobile Systems (IMS)
- Mathematics (MATH)
- Electrical and Computer Engineering (ECE)
- Computer Science (CS)
- Industrial Engineering and Management (IEM)

Focus Area Diversity

- Psychology (PSYCH)
- Global Economics and Management (GEM)
- Integrated Social Sciences (ISS)
- International Relations: Politics and History (IRPH)
- International Business Administration (IBA)

Remarks:
In the focus area Health, we additionally offer the Bachelor of Science program *Medical Natural Sciences,* which follows a slightly different curricular structure. Therefore, MedNat modules are not listed in this handbook.

Module Assessment data reflects the status in the previous study year.

Fall 2018 – Version 1

Overview Undergraduate Modules 2018/19

Type	Module Number	Module Name	Contact Person	Mandatory for	Mandatory elective for	Page
CHOICE	CH01-CellBio	Cell Biology	C. Hammann	BCCB		4
CHOICE	CH02-BioChem	Biochemistry and Molecular Biology	S. Springer, S. Illenberger	BCCB, MCCB		5
CHOICE	CH03-OrgChem	Organic Chemistry	T. Nugent	CHEM, MCCB		6
CHOICE	CH04-GenEES	General Earth and Environmental Sciences	M.Bau, J. Vogt	EES		7
CHOICE	CH05-PrincChemPhys	Principles of Chemistry and Physics	J. Fritz, P. Schupp, D. Gabel, U. Kortz	CHEM, PHY		8
CHOICE	CH06-ClassModPhys	Classical and Modern Physics	J. Fritz, P. Schupp	PHY		9
CHOICE	CH07-FundMath	Fundamental Mathematics	M. Oliver	MATH		10
CHOICE	CH08-GenCS	General Computer Science	J. Schönwälder	CS		11
CHOICE	CH09-IntroIMS	Introduction to Intelligent Mobile Systems	F. Maurelli	IMS		12
CHOICE	CH10-IntroEE	Introduction to Electrical Engineering	W. Henkel	ECE		13
CHOICE	CH11-GenIEM	General Industrial Engineering and Management	S. Chankov	IEM		14
CHOICE	CH12-GenMan	General Management	T. Halaszovich	IBA, GEM		15
CHOICE	CH13-GenEcon	General Economics	O. Berthod	GEM, IBA		16
CHOICE	CH14-IntroSocSci	Introduction to the Social Sciences	J. Fruchtmann	ISS		17
CHOICE	CH15-IntroIR	Introduction to International Relations	K. Smith Stegen	IRPH		18
CHOICE	CH16-IntroPsych	Introduction to Psychology	S. Yan, C. Stamov Roßnagel	PSYCH		19
CORE	CO01-Biomed	Biomedicine	S. Illenberger		BCCB	20
CORE	CO02-InfImm	Infection and Immunity	M. Ullrich		BCCB	21
CORE	CO03-MolBio	Molecular Biology	C. Hammann		BCCB	22
CORE	CO04-ChemBio	Chemical Biology	S. Springer, M. Ullrich		MCCB	23
CORE	CO05-DrugProd	Drug Action and Production	S. Springer, H. Fernandez-L.		MCCB	24
CORE	CO06-DrugDev	Drug Development	S. Springer, D. Gabel, U. Kortz		MCCB	25
CORE	CO07-ChemBiotec	Chemical Biotechnology	E. Nevoigt, H. Fernandez-L.		CHEM	26
CORE	CO08-PhysChem	Physical and Analytical Chemistry	D. Gabel, U. Kortz		CHEM	27
CORE	CO09-InorgSuMolChem	Inorganic and Supramolecular Chemistry	D. Gabel, U. Kortz		CHEM	28
CORE	CO10-FundEES	Fundamental Earth and Environmental Sciences	M.Bau, J. Vogt		EES	29
CORE	CO11-EOEnvChem	Earth, Ocean, and Environmental GeoChemistry	M.Bau, J. Vogt		EES	30
CORE	CO12-EOEnvPhys	Earth, Ocean, and Environmental GeoPhysics	M.Bau, J. Vogt		EES	31
CORE	CO13-StatPhys	Statistical Physics and Fields	J. Fritz, P. Schupp		PHY	32
CORE	CO14-ApplPhys	Applied Physics	J. Fritz, P. Schupp		PHY	33
CORE	CO15-ClassDyn	Classical and Quantum Dynamics	J. Fritz, P. Schupp		PHY	34
CORE	CO16-CoreMaths	Core Mathematics	M. Oliver		MATH	35
CORE	CO17-CorePureMath	Core Pure Mathematics	M. Oliver		MATH	36
CORE	CO18-CoreAppMath	Core Applied Mathematics	M. Oliver		MATH	37
CORE	CO19-ApplCS	Applied Computer Science	J. Schönwälder		CS	38
CORE	CO20-TechCS	Technical Computer Science	J. Schönwälder		CS	39
CORE	CO21-TheoCS	Theoretical Computer Science	J. Schönwälder		CS	40
CORE	CO22-IntelSys	Intelligent Systems	F. Maurelli		IMS	41
CORE	CO23-AutoControl	Automation and Control	F. Maurelli		IMS	42
CORE	CO24-PlanOpt	Planning and Optimization	F. Maurelli		IMS	43
CORE	CO25-Communic	Communications	W. Henkel		ECE	44
CORE	CO26-ElectroNoise	Electronics and Noise	W. Henkel		ECE	45
CORE	CO27-SigProcess	Signal Processing	W. Henkel		ECE	46
CORE	CO28-FinLeanProjMan	Finance, Lean and Project Management	T. Halaszovich		IBA	47
CORE	CO29-ProcessEng	Process Engineering	S. Chankov	IEM		48
CORE	CO30-ProductEng	Production and Engineering	S. Chankov	IEM		49
CORE	CO31-StratMan	Strategy and Management	T. Halaszovich		IBA	50
CORE	CO32-ManDivers	Managing Diversity	T. Halaszovich		IBA, GEM	51
CORE	CO33-EconPolicy	Economic Policy Challenges	O. Berthod		GEM	52
CORE	CO34-EconInstOrg	Economic Institutions and Organization	O. Berthod		GEM	53
CORE	CO35-IntPolitics	International Politics and Policy	K. Smith Stegen		ISS, IRPH	54
CORE	CO36-CommCultCom	Communication, Culture and Consumption	J. Fruchtmann		ISS	55
CORE	CO37-CrisisConf	Crisis and Conflict Management	J. Fruchtmann		ISS	56
CORE	CO38-GlobDynHist	Global Dynamics in Historical Perspective	K. Smith Stegen		IRPH	57
CORE	CO39-ArenaPolLife	Arenas of Political Life	K. Smith Stegen		IRPH	58
CORE	CO40-BioBrainCog	Biology, Brain, and Cognition	S. Yan, B. Godde		PSYCH	59
CORE	CO41-HumanSoCo	Humans in Social Context	S. Yan, C. Stamov Roßnagel		PSYCH	60
CORE	CO42-ApplPsych	Applied Psychology	S. Yan, C. Stamov Roßnagel		PSYCH	61
CAREER	CA-S-BCCB	Specialization Area BCCB	C. Hammann	BCCB		62
CAREER	CA-S-MCCB	Specialization Area MCCB	S. Springer, T. Nugent	MCCB		63
CAREER	CA-S-CHEM	Specialization Area CHEM	D. Gabel, U. Kortz	CHEM		64
CAREER	CA-S-EES	Specialization Area EES	M. Bau, J. Vogt	EES		65
CAREER	CA-S-PHY	Specialization Area PHY	J. Fritz, P. Schupp	PHY		66
CAREER	CA-S-MATH	Specialization Area MATH	M. Oliver	MATH		67
CAREER	CA-S-CS	Specialization Area CS	J. Schönwälder	CS		68
CAREER	CA-S-IMS	Specialization Area IMS	F. Maurelli	IMS		69
CAREER	CA-S-ECE	Specialization Area ECE	W. Henkel	ECE		70
CAREER	CA-S-IEM	Specialization Area IEM	S. Chankov	IEM		71
CAREER	CA-S-IBA	Specialization Area IBA	T. Halaszovich	IBA		72
CAREER	CA-S-GEM	Specialization Area GEM	O. Berthod	GEM		73
CAREER	CA-S-ISS	Specialization Area ISS	J. Fruchtmann	ISS		74
CAREER	CA-S-IRPH	Specialization Area IRPH	K. Smith Stegen	IRPH		75
CAREER	CA-S-PSYCH	Specialization Area PSYCH	S. Yan, C. Stamov Roßnagel	PSYCH		76
CAREER	CA02-Internship	Internship	C. Klähn	all programs		77
CAREER	CA03-StudyAbroad	Study Abroad	Y. Salauyova	all programs		78
CAREER	CA04-XXXX	Project / Thesis (generic for Health focus)	Study Program Coordinator	Health programs		79
CAREER	CA04-XXXX	Project / Thesis (generic for Mobility focus)	Study Program Coordinator	Mobility programs		80
CAREER	CA04-XXXX	Project / Thesis (generic for Diversity focus)	Study Program Coordinator	Diversity programs		81
Jacobs Track	JTLA-Language	Language	S. Cramer, D. Mosbach		all programs	82
Jacobs Track	JTME-MethodsMath	Methods / Mathematics	A. Wilhelm		all programs	83
Jacobs Track	JTSK-Skills	Skills	A. Wilhelm		all programs	84
Jacobs Track	JTTA-TriArea	Triangle Area	D. Mosbach		all programs	85
Major / Minor Options						86

Module Data Sheet

Module Name **Cell Biology**	*Module Code* **CH01-CellBio**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 49 average grade: 2.2 (1.0=best) passing rate: 97% student rating: 4.3/5 (5=best) feedback rate: 53%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

Cell Biology is an introductory module giving a comprehensive overview about cellular structure and physiology. It will explain cellular architecture and organization and how cells need to interact and communicate in multicellular organisms. This module will thus provide insight into both, the organismal organization and specialization of cells as well as the underlying molecular processes, e.g., gene expression and intracellular transport. Both 5-ECTS-lectures are complemented by corresponding 2.5-ECTS lab courses, offering practical training in key techniques applied in modern molecular cell biology. This module provides the foundation from which you may progress to the higher level modules "Biomedicine" and "Infection and Immunity".

Module Aims

This module aims at teaching core concepts in cell biology on both, the level of the individual cell as well as cells in a multi-cellular context. It will provide the fundamental understanding of cellular processes and their experimental analyses preparing students for advanced studies in modern molecular cell biology.

Intended Learning Outcomes (ILOs)

- Explain the molecular composition of cells and how a cells molecular repertoire defines its properties
- Understand the plasticity of cells allowing them to fulfill specific functions in tissues and organs
- Teaching core concepts in molecular cell biology
- Explaining the structure-function relationship of biomolecules at the cellular level
- Gain first insight into the experimental analysis of cells on both, theoretical and practical levels

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for BCCB (CH02, **CH01**)
- Pre-requisite for 2nd year BCCB CORE module CO01
- One of two possible pre-requisites for 2nd year BCCB CORE module CO02
- Elective for: all other study programs

Module Assessment

Quizzes 38.75%, lab reports 27.5%, final exam 22.5%, poster 6.25%, active participation 2.5%, and Material Safety Data Sheet 2.5%.
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH01-520122	From Cells to Tissues and Body Functions	Lecture	5	28	75	35
CH01-520123	General Cell Biology Lab	Lab	2.5	6	255	25.5
CH01-520102	General Molecular Cell Biology	Lecture	5	28	75	35
CH01-520112	General Molecular Cell Biology Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Biochemistry and Molecular Biology**	*Module Code* **CH02-BioChem**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 45 average grade: 2.3 (1.0=best) passing rate: 97% student rating: 4.4/5 (5=best) feedback rate: 47%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

Biochemistry and Molecular Biology is a first year module that explains how the structure of biological molecules (proteins, sugars, lipids, nucleic acids) defines their biochemical properties and cellular functions. Students will be introduced to the basics of thermodynamics and molecular kinetics to understand key biomolecular concepts, e.g., protein folding, metabolism, and gene expression. Each of the two 5-ECTS-lectures is complemented by a corresponding 2.5 ECTS lab course offering practical training in key techniques applied in biochemistry and molecular biology. This module provides the foundation for the CORE modules "Molecular Biology" and "Chemical Biology".

Module Aims

This module aims at teaching comprehensively core concepts in biochemistry and molecular biology. It will provide the fundamental understanding of the versatile functions of biological molecules and their experimental investigation, preparing students for advanced studies in biochemistry and molecular biology.

Intended Learning Outcomes (ILOs)

- Explain the structure and biochemical properties of the major classes of biological molecules
- Understand how chemical structure defines cellular function
- Gain first insight into the experimental analysis of biological molecules at both theoretical and practical levels
- Understand the molecular principles underlying gene expression.
- Introduction to thermodynamics and kinetics.

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for BCCB (**CH02**, CH01)
- One of two mandatory 1st year CHOICE modules for MCCB (**CH02**, CH03)
- Pre-requisite for 2nd year BCCB CORE module CO03
- One of two possible pre-requisites for 2nd year BCCB CORE module CO02
- One of two possible pre-requisites for 2nd year MCCB CORE modules CO04, CO05, and CO06
- Elective for: all other study programs

Module Assessment

Final exam 30%, quizzes 46.66%, lab reports 20%, and Material Safety Data Sheet 3.33%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH02-520101	General Biochemistry and Molecular Biology I	Lecture	5	28	75	35
CH02-520111	General Biochemistry and Molecular Biology I Lab	Lab	2.5	6	255	25.5
CH02-520201	General Biochemistry and Molecular Biology II	Lecture	5	28	75	35
CH02-520121	General Biochemistry and Molecular Biology II Lab	Lab	2.5	6	255	25.5

JACOBS UNIVERSITY

Module Data Sheet

Module Name **Organic Chemistry**	*Module Code* **CH03-OrgChem**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 38 average grade: 2.6 (1.0=best) passing rate: 97% student rating: 4.0/5 (5=best) feedback rate: 81%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

We begin by reestablishing atomic structure, and the importance of Lewis dot structures, resonance, valence-shell electron-pair repulsion, and valence-bond theory to give meaning to a covalent bond. Hybridization is then introduced to allow an accurate and predictive accounting of molecular shape. This foundation permits the introduction of: functional groups, conformation, chirality, acidity and basicity, and the basics of equilibria, thermodynamic, and kinetic phenomena. With these concepts in hand, we develop organic reactivity by examining the mechanistic pathways (arrow pushing) and chemical principles behind substitution, elimination, and addition reactions. Common reagents and functional group transformations are then learned in the context of the importance of their order and type (retrosynthetic analysis and strategy) for brevity in synthesis.

Module Aims

The student will obtain a strong foundation in the main principles and concepts of organic chemistry and will be conversant in a wide array of subtopics. At each new level of understanding in this "two –course-one-lab"-module a stronger understanding for the biological relevance of organic molecules will be apparent. Natural product and pharmaceutical drug examples are elucidated on in class and firmly establish the connectivity with bioactivity. The lecture material is complemented by hands-on practical experience involving lab safety, basic chemical reactions and techniques, including lab equipment and basic chemical reactions in organic chemistry (esterification, bromination, saponification, substitution, natural product isolation).

Intended Learning Outcomes (ILOs)

- Nomenclature is interwoven at all times
- Bonding and hybridization, aromaticity, HOMO/LUMO concepts
- Lewis acids and bases
- The basics of equilibrium, thermodynamic, and kinetic phenomena
- Conformation, stereochemistry, chirality
- Major functional group manipulations: alkyl halides, alkenes, alkynes, alcohols, ethers, aromatic compounds, ketones, esters, carboxylic acids, amines, imines, amides, phenols
- Reactive species (carbocations, carbanions, radicals)
- Synthesis
- Name reactions: aldol, Friedel-Crafts alkylation and acylation, Diels-Alder reaction, Williamson ether synthesis, Swern Oxidation, Wittig olefination, Hofmann rearrangement, Haloform reaction, etc.
- Natural Products

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for CHEM (**CH03**, CH05)
- One of two mandatory 1st year CHOICE modules for MCCB (CH02, **CH03**)
- One of two possible pre-requisites for 2nd year CHEM CORE modules CO07 and CO09
- One of two possible pre-requisites for 2nd year MCCB CORE modules CO04, CO05, and CO06
- Elective for: all other study programs

Module Assessment: Module re-assessment options are regulated in the Undergraduate Student Policy.
Exams 44%, lab results/reports 27.5%, lab performance 22.5%, and quizzes 6%

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH03-400102	Organic Chemistry I	Lecture	5	28	75	35
CH03-400112	Organic Chemistry I Lab	Lab	2.5	6	255	25.5
CH03-400103	Organic Chemistry II	Lecture	5	28	75	35
CH03-400113	Organic Chemistry II Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **General Earth and Environmental Sciences**	*Module Code* **CH04-GenEES**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* - New module -
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

This module offers introductory lectures and practical courses in Earth and Environmental Sciences to build the theoretical and practical cornerstones of Earth, Ocean, Climate and Planetary Sciences, on which the anthropogenic impact on the natural (near-)surface environment of Planet Earth can be recognized and quantified. In two lectures "Introduction to Earth and Environmental Sciences" and "The Earth-Ocean System and its Evolution", the students familiarise with the different compartments of Planet Earth and the endogenic and exogenic processes that shaped them and that controlled their evolution since the Earth formed some 4.5 billion years ago. Early exposure to remote-sensing and in-situ Earth data is provided in the practical course "DataLab: Introduction to Earth System Data". During a three-day excursion and the accompanying lectures of the course "FieldLab: GeoEnvironmental Systems and their Chemistry" students are offered an introduction to basic techniques of field geology and field geochemistry using geology, water chemistry and environmental problems in the old mining district of the Harz Mountains, Germany, as examples.

Module Aims

This module forms the conceptual cornerstone of the second-year CORE modules in the "Earth and Environmental Sciences" program, and provides the essential fundamental theoretical knowledge and practical skills.

Intended Learning Outcomes (ILOs)

Discipline Specific Skills

- Knowledge of basic concepts in Earth and Environmental Science;
- Knowledge of terminology used in Earth and Environmental Science;
- Knowledge of major anthropogenic disturbances of the natural (near-)surface system;
- Familiarity with the basic practical skills of geological and geochemical field work;
- Familiarity with data commonly encountered in Earth and Environmental Sciences and with the tools used to analyse them.

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for EES
- Prerequisite for 2nd year EES modules CO10, CO11 and CO12
- Elective for: all other study programs

Module Assessment

Midterm exam 25%, final exam 35%, reports 21.5%, field book notes & active participation 12%, exercises 6.5%
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH04-210121	Introduction to Earth and Environmental Science	Lecture	5	28	75	35
CH04-210123	The Earth-Ocean System and its Evolution	Lecture	5	28	75	35
CH04-210111	Field Lab: Earth and Environmental Systems and their Chemistry	Excursion (Lecture + Lab)	2.5	4 lectures/ 3 lab days	75/ 600	35
CH04-210103	DataLab: Introduction to Earth System Data	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Principles of Chemistry and Physics**	*Module Code* **CH05-PrincChemPhys**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* - New module -
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

The bi-functional module "Principles of Chemistry and Physics" provides an introduction to basic concepts of Inorganic/General Chemistry and selected topics of Physics. Two introductory lecture courses ("General Chemistry" (focus on atomic structure, stoichiometry, reactions, periodic table, gases, bonding, liquids, solids) and "Thermodynamics and Optics" (focus on thermodynamics from physics perspective and on basic optical phenomena and instruments) are complemented by laboratory courses (General Chemistry Lab and Thermodynamics and Optics Lab) to develop fundamental practical and experimental skills.

Module Aims

This module forms the basis for the second-year CORE modules in the "Chemistry" and the "Physics" programs and aims at providing the essential fundamental theoretical knowledge and quantitative description of chemical and physical phenomena including practical skills for laboratory work.

Intended Learning Outcomes (ILOs)

- Knowledge of basic concepts in General and Inorganic Chemistry
- Knowledge of general properties of Matter
- Knowledge of fundamental concepts in Measurements and Moles
- Knowledge of basic types of Chemical Reactions
- Ability to perform Stoichiometric Calculations
- Knowledge of general properties of Gases
- Knowledge of basic concepts in Inorganic Chemistry
- Knowledge about the Elements and Trends in the Periodic Table
- Knowledge about basic concepts of Chemical Bonding
- Knowledge of Reactivity of Elements and Compounds
- Physical description of optical and thermodynamic phenomena.
- Quantitative description and analysis of physical phenomena.

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for chemistry (CH03, **CH05**)
- One of two mandatory 1st year CHOICE modules for physics majors (**CH05**, CH06)
- Elective for: all other study programs

Module Assessment

Midterm exam 28%, final exam 34%, reports 18%, performance & attendance 11.5%, quiz/homework 8.5%
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH05-400101	General Chemistry	Lecture	5	28	75	35
CH05-200102	Thermodynamics and Optics	Lecture	5	28	75	35
CH05-400111	General Chemistry Lab	Lab	2.5	6	255	25.5
CH05-200112	Thermodynamics and Optics Lab	Lab	2.5	6	255	25.5

JACOBS UNIVERSITY

Module Data Sheet

Module Name **Classical and Modern Physics**	*Module Code* **CH06-ClassModPhys**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* - New module -
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

Classical and Modern Physics is an introduction to the physical and mathematical description of natural phenomena. Physics is the most fundamental of all natural sciences and mathematics is its language as for many other scientific and engineering disciplines. In this module, we will study fundamental laws of physics and the underlying mathematical concepts and applications. Topics include basic physical concepts like motion, force, fields and energy, oscillations and waves, relativity, electrodynamics, quantum physics, and an introduction to condensed matter, particle and nuclear physics. The mathematical concepts used are vector calculus, differential equations, complex analysis. Lectures are complemented by practical sessions that provide training in experimental as well as computational skills, including a quantitative analysis of measurements.

Module Aims

The module comprises a calculus based overview of classical and modern physics and an introduction to the relevant mathematical methods. The goal is to be able to understand, analyze, and develop mathematical models of physical systems. The module provides the foundation for advanced studies in physics and other quantitative sciences.

Intended Learning Outcomes (ILOs)

- Explain natural phenomena, physical systems and technical devices qualitatively as well as quantitatively.
- Construct mathematical models of natural phenomena and physical systems and do a quantitative analysis.
- Understand the fundamental laws of physics and the underlying mathematical concepts.
- Investigate physical systems using computational and experimental methods.
- Communicate in scientific language and know the field-specific technical terms.

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for physics majors (CH05, **CH06**)
- Elective for: all other study programs

Module Assessment

Midterm exam 28%, final exam 34%, reports 17.5%, performance 8.5%, quiz(es) 2%, homework 6.5%, attendance 3.5%

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH06-200104	Classical Physics	Lecture	5	28	75	35
CH06-200114	Classical Physics Lab	Lab	2.5	6	255	25.5
CH06-200102	Modern Physics	Lecture	5	28	75	35
CH06-200112	Modern Physics Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Fundamental Mathematics**	*Module Code* **CH07-FundMath**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 34 average grade: 2.1 (1.0=best) passing rate: 94% student rating: 4.2/5 (5=best) feedback rate: 30%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

Fundamental Mathematics is the central first year major-specific module. It complements the first-year Service Mathematics courses in Calculus/Analysis and Linear Algebra with additional in-depth material necessary for any Mathematics student and useful for students of other quantitative majors or those with an independent interest in Mathematics.

Module Aims

This module, complemented by courses in the Jacobs Track, provides students with the fundamental mathematical concepts necessary to continue into the Mathematics Core and useful for further study in any of the quantitative science and engineering majors. The module further develops problem solving skills, presentation skills, and gives a first introduction to the use of mathematical software.

Intended Learning Outcomes (ILOs)

- Have a good command of single and multivariable calculus in one and several variables
- Be familiar with the foundations of mathematical analysis
- Know the basics of Linear Algebra and its applications.
- A first introduction to broadly usable mathematical and quantitative programming and writing tools

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for MATH
- Pre-requisite for 2nd year MATH CORE modules CO16, CO17, and CO18
- Elective for: all other study programs

Module Assessment

Exams 44.75%, homework 30.25%, presentation 12.5%, paper 7.5%, and self- and peer-evaluation 5%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH07-100101	Analysis I	Lecture	5	28	75	35
CH07-100111	Mathematical Software Lab	Lab	2.5	6	255	25.5
CH07-100212	Analysis II	Lecture	5	28	75	35
CH07-100122	Undergraduate Seminar	Seminar	2.5	6	255	25.5

Module Data Sheet

Module Name **General Computer Science**	*Module Code* **CH08-GenCS**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 70 average grade: 3.0 (1.0=best) passing rate: 78% student rating: 4.0/5 (5=best) feedback rate: 43%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

The introductory module General Computer Science covers abstract and concrete notions of computing machines, information, and algorithms. You will develop an understanding of the mathematical foundations of computer science. Core concepts such as algorithms, computations, and complexity will be introduced. The module also introduces you to basic data structures and elementary sort and search algorithms. You will learn how to represent graphs and how basic graph algorithms work. By studying elementary algorithms in depth, you will learn how to prove properties of algorithms such as their complexity. The module finally introduces you to different programming paradigms and how to approach and solve programming problems in a systematic way. The object-oriented programming paradigm and object-oriented design patterns will be studied in some depths.

Module Aims

This module aims to teach you core concepts of computer science. It covers the mathematical foundation of computer science and it provides an in depths understanding of elementary data structures and algorithms for sorting, searching, and graph traversal. The module introduces object-oriented programming languages and object-oriented design pattern.

Intended Learning Outcomes (ILOs)

- Understand Boolean logic and number systems
- Be familiar with the big O notation and able to apply it to Boolean expressions
- Recall basic proof techniques and how they can be applied to show properties of algorithms
- Explain different sorting and search algorithms and their complexity properties
- Understand basic data structures such as arrays, vectors, lists, stacks, trees, hash tables, and maps
- Can write programs in an object-oriented programming language and can apply object-oriented design pattern

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for CS
- Pre-requisite for 2nd year CS CORE module CO19
- Elective for: all other study programs

Module Assessment

Exams 61.25%, homework 22.5%, course assignments 8.75%, and quizzes 7.5%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH08-320101	Introduction to Computer Science	Lecture	5	28	75	35
CH08-320142	Programming in C++ I	Lab	2.5	6	255	25.5
CH08-320201	Algorithms and Data Structures	Lecture	5	28	75	35
CH08-320143	Programming in C++ II	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Introduction to Intelligent Mobile Systems**	*Module Code* **CH09-IntroIMS**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 69 average grade: 2.3 (1.0=best) passing rate: 97% student rating: 4.2/5 (5=best) feedback rate: 18%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

This is an introductory module providing a strong theoretical and practical foundation for the core courses in the second year. The key components required to make man-made mobile systems intelligent are sensors, actuators, and algorithms. Students will be given an overview of basic technologies and concepts underlying each of these components. The module will cover the fundamental engineering tools to model mechanical, electrical, and mechatronic systems. A detailed introduction to linear systems theory will be provided, aided by computer simulation. Finally, you will get an introduction to basic electronics and complement your knowledge with lab exercises.

Module Aims

This module aims to teach you concepts which lie at the heart of technologies and algorithms needed to design intelligent mobile systems. These include introductory physical modeling and simulation, systems theory, control theory, artificial intelligence, and electronics.

Intended Learning Outcomes (ILOs)

- Model common mechanical and electrical systems which are part of intelligent mobile systems
- Explore linear systems and tune their behavior in simulation
- Understand basic electronic components and circuits
- Understand basic algorithms used in the field of Artificial Intelligence

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for IMS
- Pre-requisite for 2nd year IMS CORE module CO23
- Elective for: all other study programs

Module Assessment

Task-wise demos and oral quizzes 42.5%; homework, quizzes, and programming projects 32.5%; exams 23.75%; and active participation 1.25%

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH09-320103	General Intelligent Mobile Systems I	Lecture	5	28	75	35
CH09-320113	Introduction to Intelligent Mobile Systems Lab I	Lab	2.5	6	255	25.5
CH09-320104	General Intelligent Mobile Systems II	Lecture	5	28	75	35
CH09-320114	Introduction to Intelligent Mobile Systems Lab II	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Introduction to Electrical Engineering**	*Module Code* **CH10-IntroEE**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 33 average grade: 2.5 (1.0=best) passing rate: 78% student rating: 4,0/5 (5=best) feedback rate: 38%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

The module comprises the classical introduction to Electrical Engineering (EE) in general. Starting from the basics of the electric phenomenon, its fundamental elements (charge, current, potential, energy, etc.), its interaction with materials (conductivity, capacitance, inductance etc.) and its manipulation by man-made structures (electronic components and circuits), the course then develops into a wide set of general principles, laws and analytical tools to understand electric circuits and electric systems in general. The module also offers a solid foundation on which specialization areas in EE (*e.g.* Communications, Control, etc.) are built.

Module Aims

Students will be taught the essentials of electrical engineering, including circuit theory applied not only to DC steady state, but also transient analysis and AC circuits. Classic materials include (but are not limited to): Kirchhoff's Laws, Volta's Law, Faraday's Law, Thevenin and Norton's Theorem, Tellegen's Theorem, Source Transformations, Non-linear electronic components, OpAmp circuits, State-space Method, Laplace Transform for Higher-order Circuits, Circuit Transfer Functions, AC power analysis, Fourier Series and Transform, etc.

Intended Learning Outcomes (ILOs)

- Understanding of the fundamental principles of electric systems (charge, current, potential, energy and its conservation, etc.)
- Ability to analyze electric circuits including: resistive circuits, operational circuits, higher-order circuits (transient and steady-state) in both DC and AC variations, in both time and frequency domains.
- Understanding of the origins of electric signals and their processing via electric circuits, with application to digital signal processing and communications
- Ability to operate lab equipment (oscilloscopes, electric sources, voltmeters) to investigate simple DC and AC circuits. This lab equipment is also utilized in other areas.
- Analytical and mathematical modeling skills of electric networks, which transcend application to electric circuits and can also be used to study other physical systems (such as mechanical systems and control systems)

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for ECE
- Pre-requisite for 2nd year ECE CORE modules CO25, CO26, and CO27
- Elective for: all other study programs

Module Assessment

Exams 55%, tests / reports 35%, attendance & active participation 5%, and homework 5%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH10-300101	General Electrical Engineering I	Lecture	5	28	75	35
CH10-300102	General Electrical Engineering II	Lecture	5	28	75	35
CH10-300111	Electrical Engineering I Lab	Lab	2.5	6	255	25.5
CH10-300112	Electrical Engineering II Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **General Industrial Engineering and Management**	*Module Code* **CH11-GenIEM**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 95 average grade: 2.5 (1.0=best) passing rate: 98% student rating: 4.0/5 (5=best) feedback rate: 34%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

General IEM is an introductory module designed to provide an overview of processes in industrial systems, logistics and supply chains. Students will learn the fundamentals of industrial engineering, industrial management, manufacturing technology, and logistics systems. Practical sessions will offer a number of exercises and activities to demonstrate and substantiate the technical concepts taught in lectures. The module provides a solid basis for further development in the Industrial Engineering and Management field, equipping the students with tools and concepts that are highly relevant for the further modules.

Module Aims

This module aims to cover the fundamental skills in industrial engineering and management and to provide students with a broad view of operations within the factory and supply chain related processes. Moreover, the module introduces students to new technologies, future trends and strategies in industrial engineering and management.

Intended Learning Outcomes (ILOs)

- Get a broad overview of the scope of industrial systems, manufacturing, transportation, resource and supply chain management.
- Comprehend the entire value added chain from the supplier to the customer (the procurement, the production, the distribution and the reverse (waste management) logistics)
- Gain a basic understanding of the main principles of industrial systems' analysis (e.g. business process modeling, computer simulation of production processes, distribution planning, safety stock calculation, linear programming)
- Get familiar with the main manufacturing technologies (casting, milling, welding, and grinding), the manufacturing process flow, bill of materials, and factory planning principles

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for IEM
- Pre-requisite for 2nd year IEM CORE modules CO29 and CO30
- Elective for: all other study programs

Module Assessment

Final exam 46%, group project / case study 35%, homework assignment / quizzes 19%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH11-050103	Industrial Engineering	Lecture	5	28	75	35
CH11-050111	Industrial Engineering Lab	Lab	2.5	6	255	25.5
CH11-050262	Basics of Manufacturing Technology (Intersession)	Seminar	2.5	14	75	17.5
CH11-050101	Introduction to Logistics & SCM	Lecture	5	28	75	35

Module Data Sheet

Module Name **General Management**	*Module Code* **CH12-GenMan**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 128 average grade: 2.6 (1.0=best) passing rate: 96% student rating: 3.4/5 (5=best) feedback rate: 50%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

The module "General Management" provides the foundation for the basic domains of business practices and management tools in the international context in which modern businesses increasingly interact with their various stakeholders. The module consists of three courses: "Introduction to International Business", "Entrepreneurship and Innovation", and "Financial Accounting".
"International Business" provides the foundation for the basic domains of business (accounting, economics, finance, management, marketing and production). It builds the base for all other management and business courses. "Entrepreneurship and Innovation" deals with firm-internal processes and methods to start and run a business. "Financial Accounting" explains the applications of international accounting standards. Special emphasis is placed on managing international entrepreneurship with respect to how accounting applies to global strategies and the key accounting issues that influence multinational decision making.

Module Aims

This module describes and analyzes the business-eco system which defines the environment for firm's activities. It further aims to teach basic practices and tools to run a business and explains firm's international driving forces. The module will also provide the basics in international accounting to understand the fundamental pillars of firm's activities. This module provides the foundation from which you may progress to higher level modules in Managing Diversity, Finance, Lean and Project Management, and Strategy and Management.

Intended Learning Outcomes (ILOs)

- Describe and discuss global economic development from a firm's perspective
- Identify international strategies and the corporate-level strategies that companies use
- Explain the impact globalization is having on international marketing activities
- Perform entry level accounting operations (balance sheet, profit/loss and cash flow statements)
- Develop a well-presented business plan; Create an appropriate business model
- Demonstrate the understanding of how to launch the individual's entrepreneurial career
- Learn how to apply the Design Thinking Approach
- Apply critical thinking skills; Demonstrate oral communication skills; Demonstrate written communication skills
- Analyze international environment; Analyze ethical issues
- Utilize technology skills

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for GEM (CH13, **CH12**)
- One of two mandatory 1st year CHOICE modules for IBA (**CH12**, CH13)
- Pre-requisite for 2nd year IBA CORE module CO31
- One of two possible pre-requisites for 2nd year IBA CORE module CO28 and IBA/GEM CORE module CO32
- Elective for: all other study programs

Module Assessment

Presentations 38.75%, exams 36.25%, written assignments 13.75%, panel discussion 6.25%, quizzes 2.5%, and attendance & active participation 2.5%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH12-032201	Introduction to International Business	Seminar	5	28	75	35
CH12-930103	Financial Accounting	Seminar	5	28	75	35
CH12-930113	Entrepreneurship & Innovation I	Seminar	2.5	14*	75	17.5
CH12-930123	Entrepreneurship & Innovation II	Seminar	2.5	14*	75	17.5

** When scheduled during a lab rotation (default option), seminars may have up to 18 sessions.*

Module Data Sheet

Module Name **General Economics**	*Module Code* **CH13-GenEcon**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 141 average grade: 2.4 (1.0=best) passing rate: 96% student rating: 3.8/5 (5=best) feedback rate: 32%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

This module introduces the workings of economies, progressing from individual to national markets. The decisions that firms, workers and consumers make are examined in Microeconomics. Macroeconomics addresses the whole economy of a country in terms of the goal of stable and sustainable economic growth. A key question in both, Microeconomics and Macroeconomics, is when, how and why governments may want to intervene in markets in order to deliver satisfactory outcomes for society as a whole, while balancing the contradicting interests of various societal stakeholders. Two seminars with 2.5 credits each have an emphasis on specific examples of such economic policy controversies and conflicts.

Module Aims

The aim of this module is to enable students to employ economic theories, models and methods to understand market dynamics and to address real world problems. By explaining the essentials of economic thought, it enables students to critically evaluate the determinants, motives and effects of decisions taken by various economic actors and the government.

Intended Learning Outcomes (ILOs)

- Be able to understand and analyze the consumption patterns of private households and the costs, profitability and production decisions of firms
- Know about different cost structures, market dynamics and government regulations in various industries, including high tech industries
- Learn how to analyze the performance of national economies through key indicators such as GDP growth, unemployment, inflation, government deficit and trade imbalances
- Expalin and evaluate the goals and effectiveness of government interventions to combat economic crises in the form of monetary and fiscal policies
- Learn how supply side measures such as improvements in infrastructure, education, and research can improve long-term growth and the international competitiveness of companies
- Understand that economic development and economic policy decisions have a strong potential of producing winners and losers among economic actors

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 1st year CHOICE modules for GEM (**CH13**, CH12)
- One of two mandatory 1st year CHOICE modules for IBA (CH12, **CH13**)
- Pre-requisite for 2nd year GEM CORE modules CO33 and CO34
- One of two possible pre-requisites for 2nd year IBA/GEM CORE module CO32
- Elective for: all other study programs

Module Assessment

Presentation/ paper 48.75%, exams 41.25%, attendance & active participation 7.5%, and homework 2.5%
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH13-032101	Microeconomics	Lecture	5	28	75	35
CH13-032103	Economic Policy Issues I	Seminar	2.5	14*	75	17.5
CH13-032102	Macroeconomics	Lecture	5	28	75	35
CH13-032104	Economic Policy Issues II	Seminar	2.5	14*	75	17.5

** When scheduled during a lab rotation (default option), seminars may have up to 18 sessions.*

Module Data Sheet

Module Name **Introduction to the Social Sciences**	*Module Code* **CH14-IntroSocSci**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 49 average grade: 1.8 (1.0=best) passing rate: 100% student rating: 4.1/5 (5=best) feedback rate: 59%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

Introduction to the Social Sciences is an introductory module which provides the essentials for understanding contemporary societies. You will study what the main differences between democracies and other political regime types are (the political science perspective); how the set-up of societies change over time and differ across world regions (the sociological perspective); and how mass communication systems work and which role they play in politics and society (the mass communication perspective). This module provides the basis from which you progress to higher-level modules in the Social Sciences.

Module Aims

This module aims to teach you key concepts of political science, sociology, and mass communication, and how they speak to each other. By drawing on examples from many world regions, the module also demonstrates how important cross-national comparisons in order to understand the world.

Intended Learning Outcomes (ILOs)

Discipline Specific Skills

- Understand the variety of political regimes that exist in today's world
- Identify basic types of societies, and how they play out in different parts of the world
- Understand how mass media work and which influence they have
- Understand how politics, mass media, and society influence each other

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for ISS
- Elective for: all other study programs

Module Assessment

Group project/presentation 27.5%, final exam 26.25%, active participation 23.75%, written assignments 12.5%, quizzes 5%, and role play event 5%

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH14-910101	Comparing Political Systems	Lecture	5	28	75	35
CH14-930101	Social Structure & Processes I	Seminar	2,5			
CH14-910112	Mass Media in Digital Contexts	Lecture	5	28	75	35
CH14-930111	Social Structure & Processes II	Seminar	2,5			

Module Data Sheet

Module Name **Introduction to International Relations**	*Module Code* **CH15-IntroIR**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	Past study year info - New module -
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

This module is a dynamic introduction to the interdisciplinary field of International Relations. Students begin their studies with the interactive seminar "Introduction to International Relations Theory", in which they learn the core theories of international relations and gain insights into war and peace and the conditions that encourage international cooperation. The theoretical work is "brought to life" through in-class cooperation exercises, a war & diplomacy game, and a role-play event simulating an international crisis. Students also examine the challenges of global governance and the effectiveness of and controversies surrounding several international organizations. In the "Politics and Writing Lab" seminar, students learn core concepts of political science and gain a fundamental understanding of the main subfields. Students will also develop and refine their academic writing skills. In the third course of the module, "Modern European History", students are acquainted with the study of history and acquire an understanding of the political, economic and social foundations of the modern era.

Module Aims

The module provides students with an overview of the topics and methods that define the field of International Relations, both from a political and a historical perspective. This dual approach allows students to understand the functioning of international relations in the modern era, which improves their ability to analyze current international developments and challenges. Generally, the module equips students with the academic and writing skills needed for IRPH.

Intended Learning Outcomes (ILOs)

- Gain familiarity with studying history and the main fields of political science, including international relations
- Develop and refine academic writing skills
- Understand key developments of international relations in the modern period
- Learn the core theories of international relations
- Identify key actors and institutions in international relations

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for IRPH
- Elective for: all other study programs

Module Assessment

Exams 33.75%, presentation 22.5%, written assignments 21.25%, active participation and quizzes 17.5%, and role play event 5%

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH15-910102	Introduction to International Relations Theory	Lecture	5	28	75	35
CH15-830102	Modern European History	Lecture	5	28	75	35
CH15-850201	Politics and Writing Lab I	Seminar	2.5	14*	75	17,5
CH15-850202	Politics and Writing Lab II	Seminar	2.5	14*	75	17,5

** When scheduled during a lab rotation (default option), seminars may have up to 18 sessions.*

Module Data Sheet

Module Name **Introduction to Psychology**	*Module Code* **CH16-IntroPsych**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 81 average grade: 2.2 (1.0=best) passing rate: 100% student rating: 3.6/5 (5=best) feedback rate: 32%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 1 (CHOICE)

Module Description / Content

This module is a broad introduction to the field of psychology including: sensation, perception, and attention; learning and memory; intelligence, language, and cognition; emotion and motivation; development, personality, and social behavior. The module also teaches the research methods used by psychologists across these areas to study the origins and variations in human behavior including experimental design, psychophysics, and the rational of neuro-scientific methods. This module provides the foundation for higher-level modules in Biology, Brain, and Cognition; Humans in Social Context; and Applied Psychology.

Module Aims

This module aims to give you a broad overview of the field of psychology, in particular of its core theories and empirical findings. Emphasis is placed on scientific methods and analysis of behavior, understanding theories, and interpreting research findings, with the ultimate goal of understanding human behavior from a scientific perspective.

Intended Learning Outcomes (ILOs)

- Explain the basic psychological processes
- Relate different psychological processes to each other
- Understand the link between theories and data
- Understand and apply psychological research methods

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 1st year CHOICE module for PSYCH
- Pre-requisite for 2nd year PSYCH CORE modules CO40, CO41, and CO42
- Elective for: all other study programs

Module Assessment

Final exam 32%, quizzes 30%,project 10%, lab report 11.5%, attendance & active participation 10%, and poster 6.5%
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CH16-710103	Introduction to Psychology I	Lecture	5	28	75	35
CH16-710111	Introduction to Psychology II	Lecture	5	28	75	35
CH16-710113	Methods in Psychology and Neuroscience I	Practical Class/ Seminar	2.5	14*	75	17.5
CH16-710114	Methods in Psychology and Neuroscience II	Practical Class/ Seminar	2.5	14*	75	17.5

** When scheduled during a lab rotation (default option), seminars may have up to 18 sessions.*

Module Data Sheet

Module Name **Biomedicine**	*Module Code* **CO01-Biomed**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Module CH01-CellBio_Cell Biology ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 25 average grade: 2.0 (1.0=best) passing rate: 100% student rating: 4.3/5 (5=best) feedback rate: 39%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Biomedicine is an advanced module that builds on the CHOICE module Cell Biology. Biomedicine first expands knowledge on key cellular processes often affected in diseases, e.g. gene expression, cell proliferation, intracellular trafficking, signal transduction and general turnover of cellular compounds. The module will address how these processes become altered in different diseases, e.g., cancer and neurodegenerative diseases, and how diagnostic tools and therapies (ranging from chemical to cell-based approaches) can be developed according to a disease's molecular origin. Two lectures are complemented by a corresponding 5 ECTS lab course that introduces students to modern methodology in cell biological research and biomedicine.

Module Aims

This module aims at teaching how profound understanding of cellular processes helps develop diagnostic tools and therapeutic strategies in modern molecular and translational medicine. Key techniques applied in cell-based, functional analyses and imaging of protein trafficking in mammalian cells will be introduced in the lab course.

Intended Learning Outcomes (ILOs)

- Advanced understanding of key regulatory processes in cell biology.
- Overview about possible mechanisms of disease
- Introduction to diagnostics and therapy development
- Approaching research questions of protein targeting and trafficking experimentally

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for BCCB (mandatory elective for BCCB students taking a minor) (**CO01**, CO02, CO03)
- Elective for: all other study programs

Module Assessment

Quizzes 38.33%, lab report 20%, final exam 33.33%, active participation 5%, Material Safety Data Sheet 3.33%. Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO01-520234	Advanced Molecular Cell Biology	Lecture	5	28	75	35
CO01-520235	Molecular Mechanisms of Disease , Diagnostics and Therapy	Lecture	5	28	75	35
CO01-520241	Advanced Molecular Cell Biology Lab (Intersession)	Lab	5	9	397	59.5

Module Data Sheet

Module Name **Infection and Immunity**	*Module Code* **CO02-InfImm**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH01-CellBio - Cell Biology) and CH02-BioChem - Biochemistry and Molecular Biology ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 27 average grade: 1.8 (1.0=best) passing rate: 100% student rating: 4.4/5 (5=best) feedback rate: 28%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Infection and Immunity is an advanced module that builds on both BCCB CHOICE modules ("Cell Biology" and "Biochemistry and Molecular Biology"). It combines the fundamentals of microbiology with an overview about the human immune system. Students will learn how microbes act in the environment and on human health, and how scientists investigate and control microbial pathogens. The immune system will be explained and how identifies and eliminates cancer cells, viruses, bacteria, and parasites. Immune evasion mechanisms of pathogens will be elucidated as well as therapeutic approaches. In the 5 ECTS lab course, students will learn to isolate, handle, characterize, and taxonomically identify microorganisms using classical and state-of-the-art technologies.

Module Aims

This module teaches core concepts in microbiology and immunology and their experimental investigation. Both are needed to understand the "arms race" between pathogens and the host immune system. For several diseases, the underlying molecular mechanisms will be analyzed, e.g. host-pathogen interactions, hypersensitivity, and autoimmune diseases.

Intended Learning Outcomes (ILOs)

- Understanding of the principles of the world of microorganisms
- Introduction to the complexity of the immune system
- Knowledge of pathogens, diseases, and therapeutic strategies
- Introduction to methodology in microbiology and immunology

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for BCCB (mandatory elective for BCCB students taking a minor) (CO01, **CO02**, CO03)
- Elective for: all other study programs

Module Assessment

Quizzes 23.33%, lab report 20%, examinations 43.33%, active participation 13.33%.
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO02-520233	Microbes and Infection	Lecture	5	28	75	35
CO02-520221	Microbiology Lab	Lab	5	12	255	51
CO02-520322	Immunology	Lecture	5	28	75	35

Module Data Sheet

Module Name **Molecular Biology**	*Module Code* **CO03-MolBio**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Module CH02-BioChem - Biochemistry and Molecular Biology ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 22 average grade: 2.2 (1.0=best) passing rate: 93% student rating: 3.6/5 (5=best) feedback rate: 48%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Molecular Biology is an advanced module that builds on the CHOICE module Biochemistry and Molecular Biology. This module introduces the molecular basis of the flow of genetic information with special emphasis on regulatory mechanisms. Students will also learn about principles governing molecular evolution, i.e. types of mutations, causes and consequences of mutations, and how mutations of genes shape a population's adaptation to environmental changes. The corresponding 5 ECTS lab course provides an integrated view on the molecular analysis of biomolecules involved in molecular information pathways.

Module Aims

This module aims at teaching advanced level understanding of how genetic information can be selectively utilized in individual cells to produce proteins according to cellular needs. It will analyze how alterations in the DNA sequence by mutations may affect all levels of gene expression and thus alter a cell's fitness or performance.

Intended Learning Outcomes (ILOs)

- Advanced understanding of genetic information flow
- Investigation of key regulatory processes in molecular biology
- Analysis of how mutations influence gene expression and cellular performance
- Discuss how mutations may support evolutionary selection processes

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for BCCB (mandatory elective for BCCB students taking a minor) (CO01, CO02, **CO03**)
- Elective for: all other study programs

Module Assessment

Quizzes 43.33%, lab reports 20%, final exam 33.33% and Material Safety Data Sheet 3.33%.
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO03-520224	Molecular Information Pathways	Lecture	5	28	75	35
CO03-530661	Molecular Evolution	Lecture	5	28	75	35
CO03-520225	Molecular Biology Lab	Lab	5	12	255	51

Module Data Sheet

Module Name **Chemical Biology**	*Module Code* **CO04-ChemBio**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH02-BioChem_Biochemistry and Molecular Biology or CH03-OrgChem_Organic Chemistry ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 15 average grade: 2.3 (1.0=best) passing rate: 100% student rating: 3.8/5 (5=best) feedback rate: 25%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Chemical Biology asks how small molecules, such as pharmaceutical drugs, act on biological targets, such as proteins or genes, and how they can be used to influence processes in cells and in the entire organism, both for advancing fundamental knowledge and for treating diseases. Work in chemical biology requires a thorough understanding of how these drug targets function and what natural role they play in the cell. Chemical Biology is an essential complement of Medicinal Chemistry enabling the exploration, design, testing and safety assessment of drugs, a key expertise for a career in the pharmaceutical industry.

Module Aims

The module 'Chemical Biology' provides well-rounded knowledge: how the targets of drugs, proteins and DNA molecules, function and interact with small molecules; recent examples of cellular process manipulation with small molecules; and important therapeutic approaches based on small molecule intervention. A laboratory course provides practical experience of such systems.

Intended Learning Outcomes (ILOs)

- Understand structure and dynamics of proteins, DNA, lipids, and carbohydrates on an advanced level.
- Thoroughly understand thermodynamics and kinetics of biomolecular interaction, ligand binding, and enzymatic catalysis.
- Analyze the bioactivity potential of small molecules and of biologicals.
- Have a representative understanding of important targets for small molecules in the cell, which is important both for basic research and for therapy.
- Practically handle cells and proteins, perform binding and catalysis assays, and analyze the action of small molecules.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MCCB (mandatory elective for MCCB students taking a minor) (**CO04**, CO05, CO06)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO04-520203	Introduction to Chemical Biology	Lecture	5	28	75	35
CO04-520213	Advanced Biochemistry Lab	Lab	5	12	255	51
CO04-520223	Biological Activity – from bench to bedside	Lecture	5	28	75	35

Module Data Sheet

Module Name **Drug Action and Production**	*Module Code* **CO05-DrugProd**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH02-BioChem_Biochemistry and Molecular Biology or CH03-OrgChem_Organic Chemistry ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 8 average grade: 2.2 (1.0=best) passing rate: 100% student rating: 3.3/5 (5=best) feedback rate: 55%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module introduces students to pharmaceuticals used in current medical practice. Grouped according to therapeutic areas, drugs in current use are discussed in terms of their chemical structure, structural requirement for action, basic pharmacology, synthesis and analysis. The module summarizes current knowledge on the action and production of drugs in the pharmaceutical industry and the essential set of scientific methods and approaches used in drug production and analysis. This knowledge forms the basis for all future drug development.

Module Aims

The module provides a rounded knowledge on drug molecules in current medical use including their chemical structure, structural requirements for drug activity. Students learn to understand basic drug action including pharmacological aspects, binding selectivity, tissue specific receptor subtypes, pharmacokinetics, pharmacodynamics and bioavailability. In addition the practice of drug production including both chemical synthesis and biotechnological approaches will be introduced. This is complemented by an introduction to analytical methods used in the pharmaceutical industry. These include methods for structure elucidation, drug identification and drug quantification used in drug development, production, quality control and in vivo pharmacological studies. The module includes two integrated laboratory courses providing practical experience in biotechnological drug production and analysis.

Intended Learning Outcomes (ILOs)

- Knowledge on structural requirements for drug action
- Knowledge on basic pharmacology of drug action
- Knowledge on drug production by chemical and biotechnological means
- Knowledge about pharmaproteins and their production in genetically engineered cells
- Obtain skill set of scientific methods used in pharmaceutical chemistry and biotechnology
- Obtain knowledge on analytical methods used or drug identification and quantification
- Provide practical lab experience in selected areas of biotechnology and analytical pharmaceutical chemistry using state of the art equipment

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MCCB (mandatory elective for MCCB students taking a minor) (CO04, **CO05**, CO06)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO05-400233	Biopharmaceuticals	Lecture	2.5	14	75	17.5
CO05-400234	Biopharmaceutical Production Lab	Lab	2.5	18	75	22.5
CO05-400241	Pharmaceutical Analytical Chemistry	Lecture	2.5	14	75	17.5
CO05-400243	Pharmaceutical Analytical Chemistry Lab	Lab	2.5	18	75	22.5
CO05-400244	Pharmaceutical Chemistry	Lecture	5.0	28	75	35

Module Data Sheet

Module Name **Drug Development**	*Module Code* **CO06-DrugDev**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH02-BioChem_Biochemistry and Molecular Biology or CH03-OrgChem_Organic Chemistry ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 8 average grade: tba passing rate: tba student rating: 3.8/5 (5=best) feedback rate: 19%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Pharmaceutical drug development is an interdisciplinary scientific endeavor founded on the discovery of new chemical entities that act at biologically relevant disease targets. The work flow of medicinal chemistry entails target validation, high throughput assay screening of 'chemical libraries', drug discovery, drug optimization (in-silico and laboratory) via structure activity relationships, lead candidate identification, toxicology, preclinical and finally clinical trials. A constant underlying theme is how, why, and when to take advantage of chemical principles to achieve the desired outcome of forming a therapeutic agent (active pharmaceutical ingredient).

Module Aims

Students will obtain a clear picture of the science behind the identification of drug candidates (basic research) and the steps needed to reach the final marketed drug. In this regard, you will learn how the three dimensional structure and functional group content of an organic molecule can be advantageously tailored to elicit a biological effect from both the experimental and theoretical view. In doing so, you will also become familiar with the scientific jargon of drug discovery and the overarching principles that bring biological relevance to organic chemistry. The societal impact of extended and/or improved quality of life through the treatment of disease will be self-evident from the classroom discussions. This core content will be elaborated on in the corresponding laboratory components.

Intended Learning Outcomes (ILOs)

- Molecular interactions: Salt bridges, covalent bonds, and non-covalent interactions
- Drug target interactions
- Structure-Activity Relationships (SAR)
- Synthesis
- Molecular modeling
- Absorption, Distribution, Metabolism, and Excretion (ADME)
- Bioassay identification and high throughput screening
- Fluency with Binding Data

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MCCB (mandatory elective for MCCB students taking a minor) (CO04, CO05, **CO06**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO06-400272	Medicinal Chemistry	Lecture	5	28	75	35
CO06-400271	Medicinal Chemistry Lab (Intersession)	Lab	5	6	255	25.5
CO06-400275	Medicinal Chemistry of Fluorine and Phosphorus	Lecture	2.5	14	75	17,5
CO06-400274	Introduction to Molecular Simulations	Lecture	2.5	14	75	17,5

Module Data Sheet

Module Name **Chemical Biotechnology**	*Module Code* **CO07-ChemBiotec**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH03-OrgChem (Organic Chemistry) or CH04-InorgChem (Inorganic Chemistry and Environmental Systems) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 12 average grade: 1,8 (1.0=best) passing rate: 100% student rating: n.a. feedback rate: 23%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module provides insight into how biotechnology impacts chemical production. The replacement of both chemical catalysts by enzymes and cells and of fossil resources by renewable raw materials are two aspects which are increasingly pushed by the chemical industry in order to achieve a more sustainable production of bulk and fine chemicals, building blocks for chemical industry as well as food ingredients, bioplastics, and biofuels. Using a number of commercially successful examples as well as current R&D efforts of chemical industry, the students will be introduced into the advantages and practice of implementing cells or enzymes for the production of industrially relevant products.
Moreover, the module describes the utilization of biomass and biomass waste streams as feedstock for production of the above mentioned compounds. The concept of biorefinery is also discussed.

Module Aims

This module covers the application of cells (mainly microorganisms) and enzymes to the synthesis of a plethora of compounds that are relevant in the chemical industry. Examples will highlight how biological systems can be utilized in a cost-effective manner for the mild, environmentally friendly, production of chemicals. The students will learn the different ways of how biocatalysts can be used, i.e. biotransformations using isolated enzymes and whole cells for chemical conversion steps (to replace chemical catalysts) as well as de novo synthesis of complex chemicals from simple nutrients by fermenting cells. The underlying metabolic principles will be discussed. Moreover, the module also describes the utilization of biomass (e.g. agricultural subproducts, single cell protein, food waste, algal biomass) for the production of biofuels (e.g. bioethanol, biobutanol, biodiesel, biogas), commodity and fine chemicals. The concept of biorefinery is discussed and examples will illustrate how a new bioeconomy is raising globally. The module will contain practical laboratory demonstrations and hands-on experimentation that will help students to consolidate the theoretical knowledge they have obtained during the lectures.

Intended Learning Outcomes (ILOs)

- Understand the concept of a bioeconomy, as opposed to fossil resource utilization
- Understand the impact of biocatalysts in chemical industry
- Understand how the cellular metabolism can be exploited to produce chemicals
- Understanding of transferring enzymes and whole metabolic pathways from a donor organism to the production host
- Evaluate the feasibility of bio-based approaches
- Know the potential of biorefineries for the sustainable chemical production
- Bridge chemistry with biology and technology
- Acquire sufficient engineering knowledge as applied to biotechnological systems
- Understand bioprocessing technology and bioprocess design
- Understand the biological basis of (bio) chemical engineering and technology
- Elements of enzyme technology and enzyme immobilization

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CHEM (mandatory elective for CHEM students taking a minor) (**CO07**, CO08, CO09)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO07-400105	Bioproducts and Biosystems Engineering	Lecture	5	28	75	35
CO07-400115	Bioproducts & Biosystems Engineering Lab	Lab	2.5	6	255	25.5
CO07-400104	Enzymes and Cells in Biochemical Production	Lecture	5	28	75	35
CO07-400114	Biochemical Production Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Physical and Analytical Chemistry**	*Module Code* **CO08-PhysChem**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 8 average grade: 1.0 (1.0=best) passing rate: 100% student rating: 3.0/5 (5=best) feedback rate: 56%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Teaching physical principles and measurements to understand the properties of matter. The course Physical Chemistry introduces fundamental thermodynamical principles, intermolecular forces, electrochemistry as well as underlying physical principle of chemical kinetics. The students will apply the course content to experiments on osmotic pressure, electrochemistry and optical instrumentation. The analytical chemistry part will provide an overview over the physical principles of spectroscopic and separation methods and their application in quantitative and qualitative analysis.

Module Aims

Students should learn to understand physical principles of investigating matter in space and time to identify and quantify chemical entities. Students should be able to apply this knowledge to solving chemical problems in experimental research.

Intended Learning Outcomes (ILOs)

- Explain the basic concepts of physical chemistry
- Thermodynamic principles, equilibrium, entropy,
- Physical properties of intermolecular forces and their impact on reaction kinetics
- Identification of the rate limiting steps in a reaction
- Communicate key practical skills relating specifically to physical chemistry
- Knowledge on physical principles and applications of spectroscopic methods for quantitative and qualitative analysis
- Relating spectral information to chemical structure
- Provide the analytical toolbox for the practicing experimental chemist

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CHEM (mandatory elective for CHEM students taking a minor) (CO07, **CO08**, CO09)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO08-400211	Physical Chemistry	Lecture	5	28	75	35
CO08-400262	Physical Chemistry Lab	Lab	2.5	6	255	25.5
CO08-400121	Analytical Chemistry	Lecture	5	28	75	35
CO08-400231	Analytical Chemistry Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Inorganic and Supramolecular Chemistry**	*Module Code* **CO09-InorgSuMolChem**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH03-OrgChem (Organic Chemistry) or CH05-PrincChemPhys (Principles of Chemistry and Physics) ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 8 average grade: 1,3 (1.0=best) passing rate: 100% student rating: 4,3/5 (best 5.0) feedback rate: 50%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module gives information about inorganic materials and polymers, and about organic materials and polymers. Coordination compounds as basis of inorganic materials will be discussed. Methods for structure elucidation of polymeric and solid materials will be presented. Basic reactions to form these materials will be given. Industrially important materials and their preparation will be discussed. Examples of non-covalent interactions as basis for supramolecular chemistry are shown, and sensors based on the different technologies will be discussed. An introduction into surface and colloid chemistry forms part of the module.

Module Aims

The module will enable the student to recognize the nature of materials, to know their use in technological settings, and to identify appropriate methods to characterize materials. The basic principle of sensors and of surface-ac

Intended Learning Outcomes (ILOs)

- Recognize the nature of materials and their components
- Know the properties of coordination complexes of transition metals
- Correlate structure and properties
- Know how to characterize polymeric and solid-state materials
- Know the basic reactions of formation of organic polymers
- Describe different uses of polymers
- Know the basic principles of sensors

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CHEM (mandatory elective for CHEM students taking a minor) (CO07, CO08, **CO09**)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO09-400221	Inorganic Chemistry	Lecture	5	28	75	35
CO09-400232	Inorganic Chemistry Lab	Lab	2.5	6	255	25.5
CO09-420432	Supramolecular Chemistry	Lecture	5	28	75	35
CO09-420434	Supramolecular Chemistry Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Fundamental Earth and Environmental Sciences**	*Module Code* **CO10-FundEES**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE modules CH04-GenEES – General Earth and Environmental Sciences ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 10 average grade: tba passing rate: tba student rating: 4.2/5 (5=best) feedback rate: 26%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module "Fundamental Earth and Environmental Sciences" is comprised of essential geoscience courses that represent the backbone of a sound university education in the geosciences. Core courses on Sedimentology, Structural Geology, Volcanism and Metamorphism are complemented by applied courses in environmental and resource geoscience. If relevant, both marine and terrestrial systems are discussed. Key elements of these courses are on-campus practicals during which the students are introduced to geological methods and techniques. These essential practical skills are further expanded upon and applied in a real-world scenario during a five day off-campus geological field camp.

Module Aims

This module is the backbone of university education in "Earth and Environmental Sciences" and provides theoretical knowledge and practical skills in key geological disciplines and two important fields ("environment" and "resources") that offer a broad range of internship and job opportunities both in industry and academia. This module lays the foundations for process-based understanding of marine and terrestrial environments in the Earth System and practical, hands-on skills and methodological key competencies for both the geochemistry-focused "Earth, Ocean and Environmental Chemistry" CORE module and the geophysics-focused "Earth, Ocean and Environmental Physics" CORE module.

Intended Learning Outcomes (ILOs)

- Knowledge of core disciplines such as Sedimentology and Structural Geology,
- Knowledge of sedimentary, igneous and metamorphic rocks and minerals,
- Knowledge of essential terminology and concepts in applied fields such as "environment" and "resources",
- Familiarity with the basic practical skills of geological and geochemical field work.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for EES (mandatory elective for EES students taking a minor) (**CO10**, CO11, CO12)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO10-210201	Volcanism and Metamorphism	Lecture	2.5	14	75	17.5
CO10-210203	Sedimentology	Lecture	2.5	14	75	17.5
CO10-210206	Structural Geology	Lecture	2.5	14	75	17.5
CO10-210204	Marine Environments	Lecture	2.5	14	75	17.5
CO10-210133	Introduction to Mineralogy	Lecture	2.5	14	75	17.5
CO10-041202	Fieldtrip Environmental Changes and Challenges in Northwestern Germany	Excursion (Lab)	2.5	4 lectures, 4 lab days	75/600	45

Module Data Sheet

Module Name **Earth, Ocean and Environmental GeoChemistry**	*Module Code* **CO11-EOEnvChem**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH04-GenEES – General Earth and Environmental Sciences ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 12 average grade: 2.3 (1.0=best) passing rate: 100% student rating: 4.2/5 (5=best) feedback rate: 29%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module "Earth, Ocean and Environmental GeoChemistry" is comprised of fundamental geochemistry courses that represent the backbone of a sound university education in geochemistry and geochemistry-focused environmental and resource science. Core courses on igneous and aqueous (trace) element geochemistry and introductory courses on stable and radiogenic isotope geochemistry are complemented by a course on the biogeochemical aspects of environmental and resource science and an off-campus field camp focusing on environmental sciences. All courses address terrestrial as well as marine systems.

Module Aims

This module is the backbone of university education in geochemistry-focused fields and provides theoretical knowledge and practical skills in geochemical key disciplines (igneous and aqueous trace element geochemistry, stable and radiogenic isotope geochemistry) and important fields to which these geochemical disciplines are applied ("environment" and "resources"). Both marine and terrestrial systems are addressed, in order to create a holistic view of the Earth System. This module provides important in-depth knowledge about geochemistry-related Earth, Ocean and Environmental Science opening a broad range of internship and job opportunities both in industry and academia. The module further provides knowledge and skills that are essential to make an educated decision about the field of research for the B.Sc. thesis.

Intended Learning Outcomes (ILOs)

- Knowledge of core disciplines such as Igneous and Aqueous Geochemistry,
- Knowledge of Stable and Radiogenic Isotope Geochemistry;
- Knowledge of basic terminology and concepts related to the geochemical aspects of environmental and resource science;
- Familiarity with the basic practical skills of geochemical and environmental field work.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for EES (mandatory elective for EES students taking a minor) (CO10, **CO11**, CO12)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO11-210241	Geochemistry of Igneous and Aqueous Systems	Lecture	2.5	14	75	17.5
CO11-210302	Environmental Geochemistry	Lecture	2.5	14	75	17.5
CO11-210362	Applied Geochemistry	Lecture	2.5	14	75	17.5
CO11-210301	Isotope Geochemistry	Lecture	2.5	14	75	17.5
CO11-210373	Mineral Resources	Lecture	2.5	14	75	17.5
CO11-210202	Fieldtrip Volcanism and Hydrochemistry in the Eifel, Germany	Excursion (Lab)	2.5	4 lectures / 4 lab days	75/600	45

Module Data Sheet

Module Name **Earth, Ocean, and Environmental Physics**	*Module Code* **CO12-EOEnvPhys**	*ECTS* **15**
Pre-requisites ☒CHOICE Module CH04-GenEES – General Earth and Environmental Sciences ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 11 average grade: 2.0 (1.0=best) passing rate: 100% student rating: 4.2/5 (5=best) feedback rate: 30%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module "Earth, Ocean, and Environmental Physics" covers topics and methods that are essential in geophysics and physical oceanography. Emphasis will be on the quantitative assessment of physical processes and structures in terrestrial and marine systems. Important concepts are introduced and studied in lectures, and then applied and consolidated in practical courses such as field trips and computer labs on remote sensing and data analysis. The module constitutes one of the CORE pillars of the Earth and Environmental Sciences (EES) program and in general may complement the education of students interested in a physics-based presentation of fundamental EES topics.

Module Aims

The module provides the thematic and methodological foundation for physics-based disciplines in Earth, ocean, and environmental sciences. Problem-oriented thinking, data analysis and modeling skills are trained and developed using real-world examples and meaningful case studies. After completion, our students are prepared to evaluate their career options in physics-oriented EES disciplines.

Intended Learning Outcomes (ILOs)

- Knowledge of key processes and concepts in Earth, Ocean, and Environmental (EOE) Sciences.
- Application of physical concepts and methods to real-world problems in EOE Sciences.
- Knowledge of fundamental techniques in applied and environmental geophysics.
- Numerical analysis and modeling of EOE processes and dynamics.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for EES (mandatory elective for EES students taking a minor) (CO10, CO11, **CO12**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO12-210223	Marine and Applied Geophysics	Lecture	2.5	14	75	17.5
CO12-210225	Physics of System Earth	Lecture	5	28	75	35
CO12-210214	Physical Oceanography	Lecture	2.5	14	75	17.5
CO12-210213	Earth System Monitoring and Remote Sensing	Lecture	2.5	14	75	17.5
CO12-210251	Oceanographic Excursion / Research Cruise North Sea	Excursion (Lab)	2.5	5 days	600	50

Module Data Sheet

Module Name **Statistical Physics and Fields**	*Module Code* **CO13-StatPhys**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH05-PrincChemPhys (Principles of Chemistry and Physics) or CH06-ClassModPhys (Classical and Modern Physics) ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 11 average grade: 2.8 (1.0=best) passing rate: 50% student rating: 3.8/5 (5=best) feedback rate: 41%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module provides an introduction to the physics of systems of large numbers of particles and to their continuum field theory limit. All fundamental forces of nature can be formulated in terms of field theories in a way that reconciles classical mechanics with Einstein's relativity theories. In this module we focus on electromagnetic fields, related phenomena and applications. Statistical physics deals with complex systems of large numbers of particles. In this module, we review classical thermodynamics and extended it to a microscopic statistical description of many particle systems. This module complements the module on classical and quantum dynamics. Together they provide a solid foundation for more advanced courses. Accompanying lab courses give deeper insights into the systems discussed in the lectures and provide instructive examples in advanced physics.

Module Aims

The aim of the module is an introduction to core topics of physics at a level that prepares for actual research. At the same time, the mathematical repertoire and problem solving skills are developed. The module serves as a foundation for physics specialization subjects.

Intended Learning Outcomes (ILOs)

- Understand the theoretical foundations and practical applications of electrodynamics and statistical physics.
- Solve challenging problems of practical relevance using advanced mathematical techniques.
- Explain properties of gases and condensed matter by a microscopic statistical model.
- Learn basic experimental techniques and procedures needed to investigate fluids and solid state materials.
- Communicate in scientific language using advanced field-specific technical terms.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PHY (mandatory elective for PHY students taking a minor) (**CO13**, CO14, CO15)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO13-200213	Electrodynamics	Lecture	5	28	75	35
CO13-200212	Statistical Physics	Lecture	5	28	75	35
CO13-200222	Statistical Physics and Fields – Advanced Lab	Lab	5	12	255	51

Module Data Sheet

Module Name **Applied Physics**	*Module Code* **CO14-ApplPhys**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH05-PrincChemPhys (Principles of Chemistry and Physics) or CH06-ClassModPhys (Classical and Modern Physics) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 6 average grade: 2.3 (1.0=best) passing rate: 100% student rating: 4.7/5 (5=best) feedback rate: 38%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module discusses advanced applications of physics in modern technology using a descriptive and experimental approach. It builds on the general concepts and methods developed in the Physics of Natural Sciences Module. The first part focuses on energy sources and energy storage technology. It includes the pertinent concepts of thermodynamics and physical chemistry. The second part introduces computational simulation methods as an important tool, useful for the understanding and investigation of physical systems and for a speed-up of the development of new technologies. Additional lab courses give deeper insights into the systems discussed in the lectures and provide instructive examples of experiments in advanced physics.

Module Aims

This module aims for an understanding of modern technology from the perspective of physics. Renewable energy is a topic with high societal impact and the scientific understanding of the promises and problems of different options for the generation, storage and use of energy is another aim. An introduction to thermodynamics with applications is given. Computational techniques for the description, modeling, and development of physical systems are introduced as an alternative to experiments.

Intended Learning Outcomes (ILOs)

- Understand advanced concepts of energy generation and storage.
- Describe and judge different approaches to address the world's energy problem.
- Understand the scientific background of energy technologies.
- Explain the basic strategies to simulate physical systems.
- Apply computer simulations to describe and analyze general problems in physics.
- Communicate in scientific language using advanced field-specific technical terms.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PHY (elective for PHY students taking a minor) (CO13, **CO14**, CO15)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO14-201231	Renewable Energy	Lecture	5	28	75	35
CO14-200221	Renewable Energy – Advanced Lab	Lab	5	12	255	51
CO14-200331	Introduction to Computer Simulation Methods	Lecture	5	28	75	35

Module Data Sheet

Module Name **Classical and Quantum Dynamics**	*Module Code* **CO15-ClassDyn**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Modules CH05-PrincChemPhys (Principles of Chemistry and Physics) or CH06-ClassModPhys (Classical and Modern Physics) ☐None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 9 average grade: 2.5 (1.0=best) passing rate: 80% student rating: 4.5/5 (5=best) feedback rate: 38%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module provides a thorough introduction to the theoretical foundations of physics. We will study the physics of particles in the macroscopic world and that of quanta in the atomic realm, while exploring the mathematical structure of nature. The module covers several core topics of physics: Analytical mechanics, special relativity, quantum mechanics and applications. It is complemented by the module on statistical physics and fields, which covers further fundamental topics. Accompanying lab courses give deeper insights into the systems discussed in the lectures and provide instructive examples in advanced physics.

Module Aims

The aim of the module is an introduction to core topics of physics at a level that prepares for actual research. At the same time, the mathematical repertoire and problem solving skills are developed. The module serves as a foundation for physics specialization subjects.

Intended Learning Outcomes (ILOs)

- Understand the theoretical foundations of classical and quantum physics.
- Solve challenging problems of practical relevance using advanced mathematical techniques.
- Formulate physical laws using variational methods and derive the equations of motion of physical systems.
- Grasp the equivalence of energy and matter in the framework of the special theory of relativity.
- Comprehend particle-wave complementarity in quantum mechanics.
- Communicate in scientific language using advanced field-specific technical terms.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PHY (mandatory elective for PHY students taking a minor) (CO13, CO14, **CO15**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO15-200203	Analytical Mechanics	Lecture	5	28	75	35
CO15-200202	Quantum Mechanics	Lecture	5	28	75	35
CO15-200223	Quantum Mechanics – Advanced Lab	Lab	5	12	255	51

Module Data Sheet

Module Name **Core Mathematics**	*Module Code* **CO16-CoreMaths**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH07-FundMath Fundamental Mathematics ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 16 average grade: 2.6 (1.0=best) passing rate: 75% student rating: 3.8/5 (5=best) feedback rate: 33%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module Core Mathematics contains the courses which are taken by all second year mathematics students. It continues the education in Linear Algebra into the second year of study and develops the theory of integration with elements of Functional Analysis and Fourier Methods. In addition, the module complements the second year education in the Jacobs track by providing additional courses in Numerical Methods and Probability.

Module Aims

This module provides core material which every working mathematician must know, and is a sufficient prerequisite for most, but not all of the third year specialization classes. Together with the complementary Jacobs track courses in Numerical Methods and Probability, students who complete this module will have learned the minimum requirements according to the German KmathF recommendations in those fields.

Intended Learning Outcomes (ILOs)

- Have an advanced knowledge in Linear Algebra
- Be familiar with the Lebesgue theory
- Have a basic knowledge in Numerical Methods and Probability

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MATH (mandatory elective for MATH students taking a minor) (**CO16**, CO17, CO18)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO16-100231	Linear Algebra	Lecture	5	28	75	35
CO16-100232	Introductory Real Analysis	Lecture	5	28	75	35
CO16-100242	Numerical Methods II	Lecture	2.5	14	75	17.5
CO16-100241	Elements of Stochastic Processes	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Core Pure Mathematics**	*Module Code* **CO17-CorePureMath**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH07-FundMath – Fundamental Mathematics ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 11 average grade: 2.1 (1.0=best) passing rate: 100% student rating: n.a. feedback rate: 41%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module Core Pure Mathematics contains a set of courses that are central to an education in pure mathematics. It contains an introduction to Geometry and Topology including differential forms, manifolds, and tensors, a first course in Complex Analysis, and a first course in Algebra.

Module Aims

This module, together with Core Mathematics, enables students to study any specialization in Mathematics, and provides the necessary skills for independent research work in pure mathematics at the Bachelor level.

Intended Learning Outcomes (ILOs)

Develop skills in the area of Geometry, Topology, Algebra, and Complex Analysis which every student in pure mathematics should know, independent of (but a prerequisite for) future specialization.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MATH (mandatory elective for MATH students taking a minor) (CO16, **CO17**, CO18)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO17-100251	Introduction to Complex Analysis	Lecture	5	28	75	35
CO17-100341	Introductory Topology	Lecture	5	28	75	35
CO17-100252	Introduction to Algebra	Lecture	5	28	75	35

Module Data Sheet

Name **Core Applied Mathematics**	*Module Code* **CO18-CoreAppMath**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Module CH07-FundMath – Fundamental Mathematics ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 13 average grade: 2.4 (1.0=best) passing rate: 78% student rating: 3.8/5 (5=best) feedback rate: 24%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module Core Applied Mathematics contains a set of core courses which should be taken by all students interested in applications and mathematical modeling. It comprises a first hands-on introduction to theory and applications of dynamical systems, and an introduction to stochastic modeling and mathematical finance.
A crucial component of this module will be the use of computer experiments to foster intuitive understanding and develop students' skills in using the computer to bridge between mathematical idea and concrete implementation and application.

Module Aims

The module aims at teaching fundamental concepts of mathematical modeling, both deterministic and stochastic, which are widely applicable across the sciences and engineering. This module is particularly designed as a fitting additional CORE choice for students of Physics, Computer Science, Electrical Engineering, IMS, and possibly GEM (if prerequisites are satisfied). Moreover, this module plays a central role in the education of students interested in Quantitative Finance and Mathematical Economics.

Intended Learning Outcomes (ILOs)

- use fundamental concepts of deterministic and stochastic modeling
- be able to implement and use standard mathematical software
- be familiar with the idea of designing, conducting, and interpreting controlled in-silico scientific experiments

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for MATH (mandatory elective for MATH students taking a minor) (CO16, CO17, **CO18**)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO18-110231	Applied Dynamical Systems	Lecture	5	28	75	35
CO18-110221	Stochastic Methods	Lecture	5	28	75	35
CO18-110233	Applied Dynamical Systems Lab	Lab	2.5	18	75	22.5
CO18-110222	Stochastic Methods Lab	Lab	2.5	18	75	22.5

Module Data Sheet

Module Name **Applied Computer Science**	*Module Code* **CO19-ApplCS**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH08-GenCS (General Computer Science) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 36 average grade: 2.9 (1.0=best) passing rate: 80% student rating: n.a. feedback rate: 25%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Applied Computer Science module familiarizes you with core components used by many modern computer applications such as relational databases and associated query languages. You will learn how to use web application frameworks and you will learn the foundations of computer graphics, such as rendering, shading, lighting, or textures. The module also introduces you to tools and techniques that can be used to develop software in a structured way in order to control development efforts and costs while improving the overall software quality.

Module Aims

The module introduces conceptual data models, relational databases, associated query languages, and data model normalization. It also covers web-based application frameworks. The foundations of computer graphics are discussed and in particular the use of graphics rendering libraries. Software engineering is covered by introducing to software design pattern, development tools, and modeling frameworks that assist in the different phases of a software development process.

Intended Learning Outcomes (ILOs)

- Can design and normalize data models for relational databases
- Understands how to use the Structured Query Language (SQL)
- Knows how to use web application frameworks to create dynamic web sites
- Understands foundations of computer graphics (rendering, shading, lighting, textures)
- Can program graphics rendering engines using the Open Graphics Library (OpenGL)
- Understands and applies object-oriented design pattern
- Knows how to read and write Unified Modeling Language (UML) diagrams
- Understands the benefits and drawbacks of different software development models
- Applies tools that assist in the software development process

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CS (mandatory elective for CS students taking a minor) (**CO19**, CO20, CO21)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO19-320302	Databases and Web Services	Lecture	5	28	75	35
CO19-320322	Computer Graphics	Lecture	5	28	75	35
CO19-320212	Software Engineering	Lecture	5	28	75	35

Module Data Sheet

Module Name **Technical Computer Science**	*Module Code* **CO20-TechCS**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Module CH08-GenCS General Computer Science ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 39 average grade: 3.0 (1.0=best) passing rate: 88% student rating: n.a. feedback rate: 28%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Technical Computer Science module introduces you to systems-oriented aspects of computer science. You will learn how an operating system kernel organizes a collection of hardware components into useful programming abstractions. Concurrent programming will be introduced and the various techniques to prevent race conditions and to coordinate concurrent activities. You will learn how computer programs can communicate. You will understand the purpose of the different layers of computer networks and how the Internet works. Basic distributed algorithms will be introduced that allow you to build robust and scalable distributed applications.

Module Aims

The module introduces concurrent programming and the different mechanisms to synchronize concurrent threads. It discusses core abstractions used by operating systems and how an operating system kernel manages resources. The module introduces interprocess communication and communication over the Internet. The module finally discusses how to build distributed systems that can scale and improve robustness.

Intended Learning Outcomes (ILOs)

- Understand race conditions and techniques to deal with them
- Familiar with core abstractions provided by operating systems and how they are implemented
- Knowing different interprocess communication abstractions
- Understand network concepts such as forwarding, routing, naming, addressing, flow control, or congestion control
- Familiarity with protocols used by local area networks and the Internet
- Insights into security limitations of network protocols
- Knowledge about basic distributed algorithms (logical clocks, election algorithms, decision algorithms, …)
- Familiarity with abstractions used by cloud computing infrastructures

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CS (mandatory elective for CS students taking a minor) (CO19, **CO20**, CO21)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO20-320202	Operating Systems	Lecture	5	28	75	35
CO20-320241	Computer Architecture and Programming Languages	Lecture	5	28	75	35
CO20-320301	Computer Networks	Lecture	5	28	75	35

Module Data Sheet

Module Name **Theoretical Computer Science**	*Module Code* **CO21-TheoCS**	*ECTS* **15**
Pre-requisites ☒Corresponding CHOICE Module CH08-GenCS General Computer Science ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 32 average grade: 2.8 (1.0=best) passing rate: 96% student rating: n.a. feedback rate: 48%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Theoretical Computer Science module covers the formal foundations of computer science. You will learn about different classes of formal languages and how they relate to discrete automata. You will learn what it means for a function to be computable and that there are functions that are impossible to compute. You will learn how to classify computable problems according to their inherent difficulty. Finally, you will learn how to use first-order logic to reason about programs and how to write programs using programming languages that are based on first-order logic.

Module Aims

The module covers the theoretical foundations of computer science. It introduces formal languages and their relation to discrete automata. It discusses techniques to show that certain functions are not computable and it introduces complexity classes in order to compare the inherent complexity of certain problems. The module finally introduces first-order logic and how to use it to reason about programs.

Intended Learning Outcomes (ILOs)

- Provide examples of different classes of formal languages
- Be able to classify a given formal language
- Recap how language classes relate to discrete automata
- Know examples of functions that are not computable
- Understand the different complexity classes (P, NP, …)
- Be able to apply reduction techniques
- Understand different computational models
- Know first-order logic and machine oriented inference calculi
- Program using a logic programming language

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for CS (mandatory elective for CS students taking a minor) (CO19, CO20, **CO21**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO21-320211	Formal Languages and Logic	Lecture	5	28	75	35
CO21-320203	Secure and Dependable Systems	Lecture	5	28	75	35
CO21-320352	Computability and Complexity	Lecture	5	28	75	35

Module Data Sheet

Module Name **Intelligent Systems**	*Module Code* **CO22-IntelSys**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Module CH09-IntroIMS Introduction to Intelligent Mobile Systems ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 18 average grade: 2.4 (1.0=best) passing rate: 86% student rating: 4.2/5 (5=best) feedback rate: 24%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module teaches you about core technologies and algorithms which endow a man-made system with intelligence. You will learn how machines can process sensor data, including visual data, to perceive and represent their surroundings. Once an environment representation is available, an intelligent machine, such as a robot, can act on and change its environment after deliberate planning. Utilizing its accumulated experience, the machine can learn and adapt its behavior in the future. This module covers all of these aspects and thus gives you an in-depth understanding of machine perception and learning, as well as robotics.

Module Aims

This module aims to teach you a comprehensive list of techniques and algorithms which make any machine intelligent and even autonomous. The core underlying subject areas covered will be robotics, perception, and machine learning. Not only do these subjects possess a remarkable theoretical beauty, but they also provide very practical and usable solutions for real-world problems.

Intended Learning Outcomes (ILOs)

- Process image and RGB-D data for object-recognition
- Calibrate cameras and use them to generate 3D models
- Use popular vision software libraries to program your application
- Use probabilistic techniques and algorithms in machine learning
- Select classification and pattern recognition algorithms for various real-world problems
- Understand mobile robots and robotic manipulators
- Understand autonomous mapping and self-localization of mobile robots
- Use popular robotics software frameworks to program your application

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IMS (mandatory elective for IMS students taking a minor) (**CO22**, CO23, CO24)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO22-320671	Computer Vision	Lecture	5	28	75	35
CO22-320311	Robotics	Lecture	5	28	75	35
CO22-320372	Machine Learning	Lecture	5	28	75	35

Module Data Sheet

Module Name **Automation and Control**	*Module Code* **CO23-AutoControl**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH09-IntelSys Introduction to Intelligent Mobile Systems ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 16 average grade: 2.2 (1.0=best) passing rate: 90% student rating: 5.0/5 (5=best) feedback rate: 7%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module builds on top of the material learnt in the "Introduction to IMS" module and covers the general areas of control and automation, including also a course in embedded systems with an accompanying lab. Topics covered include (but are not limited to): state-space modeling of systems, controllability and observability, nonlinear control analysis, microcontrollers, as well as sensors and actuators used in industrial automation.

Module Aims

The module aims to prepare students for a full understanding of the mechanical, electrical and mechatronic sub-systems that are an integral part of all intelligent mobile systems. In a way, the module gives the background of the "systems" part of an IMS, leaving the "intelligence" and "mobility" aspects to the other accompanying core modules.

Intended Learning Outcomes (ILOs)

- Understanding of the state-space based linear control theory and basic nonlinear control analysis.
- Familiarity with the sensors and actuators used in industrial automation.
- Understanding of the hardware and programming of microcontrollers.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IMS (mandatory elective for IMS students taking a minor) (CO22, **CO23**, CO24)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO23-320301	Control Systems	Lecture	5	28	75	35
CO26-300312	Embedded Systems Lab	Lab	5	18	75	35
CO23-320203	Automation	Lecture	5	28	75	35

Module Data Sheet

Module Name **Planning and Optimization**	*Module Code* **CO24-PlanOpt**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Module CH09-IntroIMS Introduction to Intelligent Mobile Systems ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 9 average grade: 2.2 (1.0=best) passing rate: 100% student rating: 4.0/5 (5=best) feedback rate: 17%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module is focused on developing the mathematical and engineering skills required to plan for and optimize complex systems such as Intelligent Mobile Systems. It contains two courses on optimization: one focusing on quantitative methods and techniques for effective decision making, and the other dedicated to broader optimization problems, covering topics such as Lagrange multipliers, convex, and nonlinear programming. A third course focuses on planning and decision-making algorithms for autonomous systems.

Module Aims

This module aims to provide a solid theoretical and practical foundation in solving the various planning, optimization, and decision-making problems which are commonly encountered in industrial and logistics-related settings. Optimization techniques for both discrete (combinatorial) and continuous domains will be covered. Special emphasis is given to techniques which enable intelligent mobile systems to operate autonomously.

Intended Learning Outcomes (ILOs)

- Formulate and solve optimization problems of both theoretical and practical natures, both in continuous and discrete settings
- Use various software tools available to solve optimization problems
- Implement and use various planning and decision-making algorithms which enable intelligent mobile systems to function autonomously.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IMS (mandatory elective for IMS students taking a minor) (CO22, CO23, **CO24**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO29-080202	Operations Research	Lecture	5	28	75	35
CO24-300491	Optimization	Lecture	5	28	75	35
CO24-320521	Artificial Intelligence	Lecture	5	28	75	35

Module Data Sheet

Module Name **Communications**	*Module Code* **CO25-Communic**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH10-IntroEE (Introduction to Electrical Engineering) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 12 average grade: 2.8 (1.0=best) passing rate: 86% student rating: 3.5/5 (5=best) feedback rate: 33%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module comprises the essential contents of digital communications. Starting from first steps to understand modulation and demodulation procedures with and without noise, students will learn the basics for modern wireless communications starting from wireless channel properties to wireless transmission and system aspects. Additionally, the information theoretic foundation is provided that determines the possibilities and methods for error analysis, data compression, communications, and encryption.

Module Aims

Students will be taught the essentials of digital communications, including the theoretical foundation. The module is the basis for all further communications-oriented courses.

Intended Learning Outcomes (ILOs)

- Ability to model information and communication mathematically
- Understanding of the interworking of various communications systems
- Understanding of the impact of environmental conditions onto the performance of communications systems
- Ability to design fundamental components (compression, coding, modulation, detection mechanisms, etc.) of communications systems in order to improve their performance
- Analysis and modeling skills which transcends information and networks (digital systems) to other types of networks

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for ECE (mandatory elective for ECE students taking a minor) (**CO25**, CO26, CO27)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO25-300202	Communications Basics	Lecture	2.5	14	75	17.5
CO25-300203	Communications Lab	Lab	2.5	6	255	25.5
CO25-300341	Information Theory	Lecture	5	28	75	35
CO25-300311	Wireless Communications	Lecture	5	28	75	35

Module Data Sheet

Module Name **Electronics and Noise**	*Module Code* **CO26-ElectroNoise**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH10-IntroEE (Introduction to Electrical Engineering) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 16 average grade: 3.3 (1.0=best) passing rate: 80% student rating: n.a. feedback rate: 13%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module offers a solid background in electromagnetic theory, circuit analysis & design and the theory of noise. To this end, the concepts of electric and magnetic fields are introduced, followed by Maxwell's equations in vacuum and matter, and a discussion of how these lead to lumped element models on the one hand and field-based descriptions on the other. The design course (lecture+ lab) treats a variety of combinations of linear and non-linear circuit elements (resistors, capacitors, inductors, diodes, transistors, operational amplifiers, logic gates, and flip-flops) from a modular design perspective (supplies, amplifiers, switches, triggers, registers, counters and timers). Noise as a ubiquitous challenge, in particular to mobile technology, is presented based on a focused introduction to probabilities, random variables, their distribution functions leading to a discussion of random voltages and rules for their treatment in electrical circuits.

Module Aims

The aim of the module is to prepare the students for a systematic understanding and module oriented analysis & design of electronic devices. Rooted in fundamental electromagnetic theory, a conceptual framework will be established that allows a coherent and goal-driven approach in practice considering a variety of design goals ranging from input- and output-impedance to trigger thresholds and noise robustness.

Intended Learning Outcomes (ILOs)

- Understand and explain the role of electric and magnetic fields in vacuum and electronic devices
- Ability to analyze and design electronic circuits based on a modular approach in particular, supplies, amplifiers, switches, triggers, registers, counters, and timers
- Analyze probabilistic relations, in particular the amount and influence of noise in electronic circuits and communications
- Ability to do some standard circuit design together with use of standard lab equipment (oscilloscopes, electric sources, voltmeters), knowledge that is also utilized in other areas
- Analytical and mathematical modeling skills of electric networks, which transcend application to electric circuits and can also be used to study other physical systems (such as mechanical systems and control systems)

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for ECE (mandatory elective for ECE students taking a minor) (CO25, **CO26**, CO27)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO26-300321	Probability and Random Signal Processing	Lecture	5	28	75	35
CO26-300211	Electromagnetics	Lecture	5	28	75	35
CO26-300212	Introduction to Electronics	Lecture	2.5	14	75	17.5
CO26-300222	Electronics Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Signal Processing**	*Module Code* **CO27-SigProcess**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH10-IntroEE (Introduction to Electrical Engineering) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 15 average grade: n.a. passing rate: 60/ student rating: 3.4/5 (5=best) feedback rate: 24%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Signal Processing module covers Signals & Systems and Digital Signal Processing together with their corresponding labs, which summarizes knowledge standard for all EE / ECE programs worldwide plus some additional introduction into digital communications as a possible DSP application. The module comprises in depth treatment of all linear transforms, such as Fourier series, Fourier transform, Laplace and z-transforms (one- and two-sided), Discrete Fourier Transform (DFT) and its fast counterpart FFT. Furthermore, digital filters are discussed in detail and methods that are essential for speech, audio, and video processing, such as subband coding, linear prediction, Discrete Cosine Transform to name just a few.

In the digital communications part, the description and components of baseband, single-carrier, and multicarrier transmission are described, including matched filter, whitening filter, and equalizer structures.

Labs will provide practical aspects starting from simple signal processing tasks, up to programing a signal processor, including computer architectural aspects.

Module Aims

The module can be considered to be central to EE or ECE education and is the basis for all further signal processing and communications.

Intended Learning Outcomes (ILOs)

- Ability to model and analyze signals mathematically, enabling their manipulation (filtering, recovery, sampling, etc.) and the design of various engineering applications
- Analytical and mathematical modeling skills regarding electric signals that transcend applications to communications systems and are applicable to speech, audio, and video signal processing, automation, and control systems.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for ECE (mandatory elective for ECE students taking a minor) (CO25, CO26, **CO27**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO27-300201	Signals and Systems	Lecture	5	28	75	35
CO27-300221	Signals and Systems Lab	Lab	2.5	6	255	25.5
CO27-300302	Digital Signal Processing	Lecture	5	28	75	35
CO27-300231	Digital Signal Processing and Communications Lab	Lab	2.5	6	255	25.5

Module Data Sheet

Module Name **Finance, Lean and Project Management**	*Module Code* **CO28-FinLeanProMan**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH12-GenMan (General Management) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 61 average grade: 1.9 (1.0=best) passing rate: 97% student rating: 3.1/5 (5=best) feedback rate: 19%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module "Finance, Lean and Project Management" deals with International Finance, Lean Management and Project Management. The finance course examines the principles, techniques, and uses of international standards in the steering (planning and control) of business organizations in general, and in projects and in financial and investment activities. The course surveys international financial topics emphasizing the analysis of financial statements and managerial decision techniques. It exposes students to theory and techniques used for solving many different investment problems in firms and on the financial market. Lean management engages with Lean Production and Lean Management This course examines the nature of organizations in a changing context and applies theories and strategies for managing change in business environment. Real-life projects with firms will be conducted in the course "Project Management" to experience how to plan, monitor, control and proceed in projects. The course will base on the techniques if the world most famous PMI Standard.

Module Aims

The aim of this module is to prepare students to be able to apply fundamental management skills in finance, lean and project management, such as task assignment and resource allocation, budgeting, financing, tracking, and scheduling techniques as well as with project leadership and team processes.

Intended Learning Outcomes (ILOs)

- They know about theories and practice of international finance, financial management and investment
- They know about international capital markets and investment strategies
- Students develop an understanding of the phenomenon of change and factors which facilitate and hinder change
- Students will learn how to set up, organize, manage, and control projects by applying the MPI standard
- Students will learn key skills for managing a firm: task assignment and resource allocation, budgeting, tracking, controlling, and scheduling techniques as well as with project leadership and team processes
- Students learn to work in real projects and to work together with companies
- They learn to analyze companies and project performances
- They learn about internationally accepted standards and procedure to run and control a company and projects

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IBA (mandatory elective for IBA students taking a minor) (CO31, **CO28**, CO32)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO28-990221	Applied Project Management	Seminar	5	28	75	35
CO28-930232	Lean Management	Seminar	5	28	75	35
CO28-930242	Corporate Finance and Investment	Seminar	5	28	75	35

Module Data Sheet

Module Name **Process Engineering**	*Module Code* **CO29-ProcessEng**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH11-GenIEM (General Industrial Engineering and Management) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 52 average grade: 2.5 (1.0=best) passing rate: 97% student rating: 3.9/5 (5=best) feedback rate: 13%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Process Engineering Module is an advanced module building on the knowledge acquired from the General IEM courses. The students will learn to model business processes, to apply various quantitative techniques for optimizing logistics processes in networks and for assessing the involved risks, as well as to employ advanced lean methods for the elimination of waste in the manufacturing processes. The module is heavily focused on the applicability of all the tools learned, enabling the students to apply theory in practice by solving case studies, homework assignments and game-based activities.

Module Aims

This module aims at providing students with an in-depth understanding of processes and techniques to optimize them. The students will be equipped with tools for modeling, simulating, optimizing, and managing business processes.

Intended Learning Outcomes (ILOs)

- Model business processes and develop simulation studies for them
- Find optimal or near-optimal solutions to complex decision-making problems using operations research methods
- Employ techniques such as mathematical modeling, statistical analysis, and mathematical optimization
- Solve problems in supply chain design
- Understand the notion of lean and related practices: elimination of waste, one-piece flow, pull principle, value stream mapping, 6 sigma and zero defects
- Conduct business impact analysis and risk assessments

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 2nd year CORE modules for IEM (**CO29**, CO30)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO29-080202	Operations Research	Lecture	5	28	75	35
CO29-050212	Process Modelling & Simulation	Lab	5	28	75	35
CO29-050332	Advanced Lean Methods	Seminar	2.5	14	75	17.5
CO29-050252	Supply Chain Management	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Production and Engineering**	*Module Code* **CO30-ProductEng**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH11-GenIEM (General Industrial Engineering and Management ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 58 average grade: 2.6 (1.0=best) passing rate: 97% student rating: 3.6/5 (5=best) feedback rate: 25%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Production and Engineering module is an advanced module building on the knowledge acquired from the General IEM courses. This module takes an in-depth look into production systems, providing the students with understanding product development and design activities, production planning and control methods, as well as the co-ordination of the entire manufacturing processes. Hands-on experience in the practical sessions will ensure an understanding of the complexity and challenges of the various production systems. In addition, the module focuses on the practical application of the taught theoretical concepts in industrial companies.

Module Aims

This module introduces how companies produce goods and services, and how they manage their technological developments to create competitive advantage. It aims to teach students production planning and control methods and their coherences with the essential processes of the order management. The module also develops the students' understanding of the engineering mind-set and the various product design phases.

Intended Learning Outcomes (ILOs)

- Understand the problems production companies are confronted with
- Learn the targets of production systems and their trade-offs and to manage them effectively
- Apply the production planning and control (PPC) methods
- Manage innovation and create competitive advantage by means of design, planning and application of technological products, processes and services
- Fully comprehend and apply the "Product Development" framework: from clarification of the requirements, through development of the product, to the actual manufacturing
- Gain experience in working with CAx systems

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory 2nd year CORE modules for IEM (CO29, **CO30**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO30-050232	Production Planning & Control	Lecture	5	28	75	35
CO30-050131	Fundamentals of Engineering Design	Lab	2.5	14	75	17.5
CO30-052102	Production & Technology Management	Lecture	5	28	75	35
CO30-050222	Advanced Production System Design	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Strategy and Management**	*Module Code* **CO31-StratMan**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH12-GenMan (General Management) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 24 average grade: 1.7 (1.0=best) passing rate: 100% student rating: 4.6/5 (5=best) feedback rate: 34%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module "Strategy and Management" examines the process, problems, and consequences of creating, implementing, and evaluating business strategy on a global scale and within an internet-driven business-eco-systems. Emphasis is given to detailed case studies of a variety of firms, global e-commerce, marketing, supply chains, networks, innovation, customer relationship management, and future developments in business models.

Module Aims

This module aims to describe, analyze, and explain process, problems, and consequences of creating, implementing, and evaluating business strategy on a global scale.

Intended Learning Outcomes (ILOs)

- Be able to examine the development of and future prospects for electronic business
- Understand and develop business models and strategies adopted by firms for the "new economy"
- Know and understand international management theories, concepts, and applications
- Discusses how the political, economic, social, technological, ecological, and legal environments affect the business functions, including finance/accounting, marketing, human resources/organizational behavior, and ethical behaviors of the company in a globalized world.
- The course will use experiential learning, including case studies, simulations and/or "live cases" and engage students in formal presentations, situational analysis, formulation of objectives and strategies, implementation of action plans, and evaluation of results.

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IBA (mandatory elective for IBA students taking a minor) (**CO31**, CO28, CO32)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO31-930224	Global E-Business	Seminar	5	28	75	35
CO31-930214	International Management	Seminar	5	28	75	35
CO31-930204	Strategic Management	Seminar	5	28	75	35

Module Data Sheet

Module Name **Managing Diversity**	*Module Code* **CO32-ManDivers**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH12-GenMan (General Management) or CH13-GenEcon (General Economics) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 49 average grade: 2.2 (1.0=best) passing rate: 97% student rating: 4.4/5 (5=best) feedback rate: 19%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The Module "Managing Diversity" addresses the opportunities and challenges that the diversity of human needs and resources poses for modern enterprises, especially international and internationalizing companies. Inside the firm, Leadership and Human Resource Management need to build on the latest evidence in Organizational Behavior and Cross-Cultural Management in order to motivate and monitor a diverse workforce successfully and responsibly. Outside the firm, Marketing practices must reflect the differentiated needs of customers and business partners for creating unique offerings tailored to specific segments in dynamic, globalized markets. The module provides a holistic view of how companies manage diversity to create value for firms' stakeholders.

Module Aims

This module equips students with the essential knowledge of Organizational Behavior and Human Resource Management, including Leadership, Cross-Cultural Management and Corporate Social Responsibility issues, as well as the foundations of Marketing with an emphasis on segmentation, customization and customer relationship management. Students will be able to analyze diverse internal and external environments and devise appropriate organizational strategies.

Intended Learning Outcomes (ILOs)

- Identify factors that produce conflict or cooperation within firms
- Reflect on leadership styles and their effectiveness in different circumstances
- Define appropriate policies for recruiting and developing a diverse workforce
- Recognize relevant dimensions of diversity inside and outside the firm
- Manage relationships with internal and external partners/customers
- Develop differentiated marketing strategies and programs

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IBA (mandatory elective for IBA students taking a minor) (CO31, CO28, **CO32**)
- One of three mandatory 2nd year CORE modules for GEM (mandatory elective for GEM students taking a minor) (CO33, CO34, **CO32**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO32-930352	Marketing	Seminar	5	28	75	35
CO32-930231	Organization and Human Resource Management	Seminar	5	28	75	35
CO32-930232	Diversity and Cross-Cultural Management	Seminar	5	28	75	35

Module Data Sheet

Module Name **Economic Policy Challenges**	*Module Code* **CO33-EconPolicy**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH13-GenEco (General Economics) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 30 average grade: 2.3 (1.0=best) passing rate: 100% student rating: 3.9/5 (5=best) feedback rate: 33%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The world's economic policy challenges are many-facetted. In this module students learn about critical challenges in two different fields. The course Development Economics focusses not only on the economic policy issues faced by large parts of the world population living in developing countries but also seeks to evaluate the consequences of these challenges for industrialized countries. The course Environmental and Resource Economics is devoted to the overarching question of environmental and resource security, which concerns all country groups. The third course, Innovation Economics, helps students to understand the vital role that research and development plays in solving a broad range of challenges in firms, industries, and national economies.

Module Aims

The aim of this module is to enable students to identify and critically evaluate current economic challenges for individual economic actors, country groups and the world. Students will learn how to employ theoretical and empirical methods of analysis to make policy proposals on how to solve these challenges.

Intended Learning Outcomes (ILOs)

- Identify and explain critical policy challenges in various country groups and the world and what they mean for various economic actors and governments
- Analyze economic interests of various stakeholders and how they collide
- Identify and explain best practices from other countries and their suitability for the country under consideration
- Identify and apply suitable theoretical and empirical methods of analysis
- Explain regulatory, technological, political and societal aspects of the challenge
- Understand the crucial importance of Research and Development for many economic policy challenges
- Evaluate the costs and benefits of suggested policy measures
- Analyze the distributional effects of suggested policy measures and their implications for the feasibility of suggested measures

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for GEM (mandatory elective for GEM students taking a minor) (**CO33**, CO34, CO32)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO33-930112	Development Economics	Seminar	5	28	75	35
CO33-040122	Environmental and Resource Economics	Seminar	5	28	75	35
CO33-930202	Innovation Economics	Seminar	5	28	75	35

Module Data Sheet

Module Name **Economic Institutions and Organization**	*Module Code* **CO34-EconInstOrg**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH13-GenEco (General Economics) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 20 average grade: 2.5 (1.0=best) passing rate: 94% student rating: 4.1/5 (5=best) feedback rate: 48%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module gives an overview of the many ways in which value creation can be organized in economic institutions on international, national and sub-national levels. The course Interorganizational Relations provides an overview of the theory and practice of organizational and institutional change and their management, not only in the private sector, but also in public and non-profit sectors. The course Comparing Economic Systems introduces the many different forms of market capitalism and their different performances. The course International Economics does not only show how international trade, capital movements and labor migration help to maximize welfare in a liberal world order, but in some instances also lead to significant welfare losses, as for example in the case of international financial crises.

Module Aims

This module equips students with essential knowledge of the role that political institutions and the organization of economic activities play in the creation of economic value. Students will understand the specific organizational opportunities and challenges of private and public, profit-seeking and non-profit organizations on international, national and sub-national levels. They will be able to use this knowledge to understand the remarkable differences in the performance of economic actors including firms and governmental institutions that they might be working for in their later careers in different regions of the world.

Intended Learning Outcomes (ILOs)

- Analyze diverse contextual forces and dynamic organization-environment relationships, especially in political economy and socio-economic contexts
- Assess the potential and limitations of economic regimes for value creation
- Evaluate the effects of international economic regimes on economic dynamics and policy outcomes on the national level
- Apply competing and complementary theories of organizational and institutional effectiveness
- Understand the specific character and recent developments of Public Management
- Evaluate the opportunities and requirements of Social Entrepreneurship ventures
- Reflect on one's own roles as member, partner or client of various economic institutions

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for GEM (mandatory elective for GEM students taking a minor) (CO33, **CO34**, CO32)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO34-930203	Comparing Economic Systems	Seminar	5	28	75	35
CO34-930213	International Economics	Seminar	5	28	75	35
CO34-930202	Interorganizational Relations	Seminar	5	28	75	35

Date of Revision: 09/2018

Module Data Sheet

Module Name **International Politics and Policy**	*Module Code* **CO35-IntPolitics**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 33 average grade: 1.5 (1.0=best) passing rate: 100% student rating: 4.4/5 (5=best) feedback rate: 25%
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module has three aims: first, it focuses on international politics, particularly on war, peace and violence; second, it examines how foreign policy and diplomacy can avert or quell conflict; and, third, it offers insights into the tools employed by diplomats and teaches students practical skills in policy work and analysis. In this regard, the three courses in the module use historical and more contemporary perspectives to examine several interrelated questions and topics: What are the main theoretical approaches to understanding and advancing international security? What role has the quest for resources played in shaping geopolitics and triggering conflicts? How can diplomacy and foreign policy bring about a prosperous, equitable and peaceful international system? As these questions are of interest to public and private actors, including potential employers, students will constructively analyze both past and contemporary international challenges and learn to write briefing memos (policy papers) and conduct political risk analysis.

Module Aims

This module focuses on international politics—particularly on war, peace and violence—and introduces students to theories of foreign policy-making and international security. It offers students insights into the tools employed by diplomats and international civil servants and teaches practical skills in policy work and analysis.

Intended Learning Outcomes (ILOs)

Discipline Specific Skills:

- Attain an in-depth understanding of international relations theory
- Learn to critically and creatively analyze international problems
- Gain insights into the work of diplomats, international civil servants and foreign policy-makers
- Understand the role of resources in international conflicts
- Attain skills in writing briefing memos and conducting political risk analysis

Module Function (in Study Programs)

- One of three mandatory 2nd year CORE modules for IRPH (mandatory elective for IRPH students taking a minor) (**CO35**, CO38, CO39)
- One of three mandatory 2nd year CORE modules for ISS (mandatory elective for ISS students taking a minor) (**CO35**, CO36, CO37)
- Elective for: all other study programs

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO35-830213	International Resource Politics	Seminar	5	28	75	35
CO35-910201	Diplomacy and Foreign Policy	Lecture	5	28	75	35
CO35-970301	Advanced International Relations Theory	Seminar	5	28	75	35

Date of Revision: 08/2018

Module Data Sheet

Module Name **Communication, Culture and Consumption**	*Module Code* **CO36-CommCultCom**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 10 average grade: 1.7 (1.0=best) passing rate: 100% student rating: 4.5/5 (5=best) feedback rate: 49%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Communication, Culture and Consumption is an advanced module which focuses on the pervasive role mass communication and consumerism play in contemporary societies globally. Starting from sociological conceptions of capitalism and consumer society, you will learn to assess the value and problems of modern consumerism, the choices and constraints of humans in societies that have been increasingly shaped by consumption behavior. Recently, due to digital globalization, social network sites and the spread of technological tools easy to use for lay people, consumers become ever more competent in not only passively consuming goods and services, but actively shaping these products and services through the cultural practice of *"prosumption"*, a fusion of formerly separated social roles of producer and consumer. You will further analyze mass communication systems from a production, consumption, and *prosumption* perspective. Finally, the module provides you with the methodological tools and research skills to analyze communication systems and consumption, based on a variety of data sources. The module combines rich theoretical insights with many empirical examples and exercises.

Module Aims

This module aims to teach you in-depth how mass media and consumption shape modern (and post-modern) societies. The module also enables you to conduct own empirical research on the mass media and on consumption-related attitudes and behavior.

Intended Learning Outcomes (ILOs)

Discipline Specific Skills

- Understand theories of consumerism and mass communication
- Identify and critically evaluate advantage and disadvantages of mass consumption and consumerism
- Apprehend how mass media systems and communication work, and to what effect
- Know about empirical tools for analyzing mass communication and consumption

Module Function (in Study Programs)

- - One of three mandatory 2nd year CORE modules for ISS (mandatory elective for ISS students taking a minor) (CO35, **CO36**, CO37)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO36-940212	Consumer Culture & Society	Seminar	5	28	75	35
CO36-940202	Communication, Culture & Digitization I	Seminar	2,5	14	75	17,5
CO36-940201	Comparing Mass Communication Systems	Seminar	5	28	75	35
CO36-940203	Communication, Culture & Digitization II	Seminar	2,5	14	75	17,5

Module Data Sheet

Module Name **Crisis & Conflict Management**	*Module Code* **CO37-CrisisConf**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 27 average grade: 1.6 (1.0=best) passing rate: 100% student rating: 4.0/5 (5=best) feedback rate: 28%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Crises and conflicts are characteristics of our time. This module addresses current questions of war and peace, of man-made and natural disasters, and how societies, political systems and media respond to these challenges in a complex networked and globalized international environment. The courses introduce to theoretical approaches in political science, sociology, communication science, and their interdisciplinary interfaces. Both, global crises and conflicts as well as the key demands of liberal democracy, civil society and mass beliefs are analysed and potential solutions to these key issues in the 21st century are being developed. A particular emphasis is also placed on the role traditional mass media and digital social media play interacting with political power, social, cultural and religious forces, shaping the world for current and future generations.

Module Aims

- Strengthening critical analytic skills
- Developing research questions and designs in the area of crisis and conflict management
- Applying qualitative, quantitative and mixed-method approaches
- Developing creative solutions for conflict and crisis management

Intended Learning Outcomes (ILOs)

Discipline Specific Skills

- Understand key concepts and theories of sociology, political science and mass communication
- Apply social scientific theories and methods to complex problems in crisis and conflict management
- Analyse intertwined causes and factors of crises and conflicts
- Understand the affordances and contextual requirements for peaceful representative democracies
- Develop transdisciplinary solution strategies and recommendation for action
- Deepen transdisciplinary academic understanding for complex social scientific issues and topics
- Analyse the role of traditional mass media and digital communication in cultural, political and social spheres related to crises and conflicts

Module Function (in Study Programs)

- One of three mandatory 2nd year CORE modules for ISS (mandatory elective for ISS students taking a minor) (CO35, CO36, **CO37**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO37-920203	Conflict & Crisis: Political and Sociological Approaches	Lecture	5	14	150	35
CO37-920202	Mass Beliefs & Civil Society	Seminar	5	28	75	35
CO37-920211	Crisis and Conflict Communication	Seminar	5	14	150	35

Module Data Sheet

Module Name **Global Dynamics in Historical Perspective**	*Module Code* **CO38-GlobDynHist**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 13 average grade: 1.7 (1.0=best) passing rate: 100% student rating: n.a. feedback rate: 32%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module discusses the importance of the historical forces underlying contemporary politics, economies and societies and lays the foundation for thinking about future developments and challenges. The course "Social and Economic History in the Age of Globalization" provides students with a historical perspective on global interconnectedness and teaches them how economic developments interact with political, social and cultural factors. The course "Empires and Nation States" examines the past trajectories of great powers, the emergence of new types of states, and other key forces in world politics. The rise of Asia and the importance of regional differences in a globalizing world are accentuated in the course "Modern Asian History". Throughout the module, students are invited to pose challenging questions: for instance, how can we balance the need for global thought and action with the appreciation of societal diversity? What might the rise and fall of past empires tell us about future dynamics?

Module Aims

This module aims to introduce students to thinking about globalization and global politics in historically informed ways. This means widening one's regional competence and training the ability to think globally without chiefly relying on Eurocentric paradigms. Students will be exposed to the frontiers of thinking in a variety of fields – frontiers that are also of utmost importance to international organizations and global corporations.

Intended Learning Outcomes (ILOs)

- Think about globalization/global politics from regional perspectives; question Eurocentric thinking
- Understand the history, challenges, and dilemmas of greater interconnectedness
- Analyze the reasons for the rise and fall of empires and the emergence of nation states
- Understand the interaction of economic developments with political, social and cultural factors

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IRPH (mandatory elective for IRPH students taking a minor) (CO35, **CO38**, CO39)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO38-820222	Empires and Nation States	Lecture	5	28	75	35
CO38-820201	Modern Asian History	Seminar	5	28	75	35
CO38-820212	Globalization in the Modern Era	Seminar	5	28	75	35

Module Data Sheet

Module Name **Arenas of Political Life**	*Module Code* **CO39-ArenaPolLife**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 31 average grade: 2.0 (1.0=best) passing rate: 100% student rating: 4.2/5 (5=best) feedback rate: 31%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module presents an interdisciplinary combination of courses covering the ways in which ideas, structures, and actors shape political life on the domestic, regional, and international levels and how these levels interact. The course "International Political Economy" focuses on the relationship between economics and international relations by examining how domestic policies and politics interact with and are influenced by international economic issues and governance, and vice versa. "Regional Integration" investigates the efforts of different political actors to overcome the boundaries of the nation state and forge new relations, be it for political, cultural, or economic reasons. Finally, "International Law" focuses on the principles governing the international conduct of states and nonstate actors and on the prospects and limits of international law for addressing current and future issues in world politics.

Module Aims

The module aims to allow students to understand how ideas, structures, and actors shape domestic, regional, and international politics and processes and how these different levels interact. It trains students in thinking across disciplinary boundaries and to understand the complexity of modern political life.

Intended Learning Outcomes (ILOs)

- Become aware of how the domestic, regional and international levels interact
- Understand the relationship between domestic policies and the global political economy
- Identify key issues and challenges in integration processes
- Assess the capacity of international norms and laws to resolve issues in world politics

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for IRPH (mandatory elective for IRPH students taking a minor) (CO35, CO38, **CO39**)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO39-830210	International Political Economy	Seminar	5	28	75	35
CO39-830211	Regional Integration	Seminar	5	28	75	35
CO39-830212	International Law	Lecture	5	28	75	35

Module Data Sheet

Module Name **Biology, Brain, and Cognition**	*Module Code* **CO40-BioBrainCog**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH16-IntroPsych (Introduction to Psychology) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 16 average grade: 2.1 (1.0=best) passing rate: 90% student rating: 3.9/5 (5=best) feedback rate: 36%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

The module provides an introduction to what is known about the link between the brain, cognitive processes and behavior. Starting from the organization of the neural systems and the neuroanatomy of the brain, the module focuses on the neurobiological bases of cognitive processing in the areas of perception, motor control, attention, emotion, memory, learning, language etc. What is the social brain? How is the brain involved in making decisions? What is neuro-economics? What do drugs do to the brain and how do they alter behavior? These and other questions as well as critical perspectives are addressed in this module. The methods to study the link between brain, mind, and behavior, as well as their pros and cons, will also be discussed.

Module Aims

The module gives you a basic review of the brain as a biological organ, including its basic structure and operations, and will teach you how the brain gives rise to a wide variety of complex behaviors. You will learn to evaluate the challenges and limits of modern, neuro-oriented psychology.

Intended Learning Outcomes (ILOs)

- Explain the basic brain structure and processes
- Relate brain structures to psychological processes
- Understand the rationale of neuroscientific methods
- Critically evaluate the neuroscience approach to psychology

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PSYCH (mandatory elective for PSYCH students taking a minor) (**CO40**, CO41, CO42)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO40-710201	Neurobiological Foundations of Psychology	Lecture/ Seminar	5	28	75	35
CO40-710212	Attention, Sensation & Perception	Lecture	5	28	75	35
CO40-710102	Learning and Memory	Lecture (with lab component)	5	28	75	35

Module Data Sheet

Module Name **Humans in Social Context**	*Module Code* **CO41-HumanSoCo**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH16-IntroPsych (Introduction to Psychology) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 21 average grade: 1.7 (1.0=best) passing rate: 100% student rating: 4.0/5 (5=best) feedback rate: 31%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

Humans are profoundly social beings, and their thinking, feeling, and action is fundamentally shaped by the social context. Both proximal factors in the current social context (such as the presence or absence of others), as well as distal ones (such as evolution or culture) affect how people perceive themselves and others and how they interact with others. Specific questions addressed in this module include: How do we perceive ourselves and others? How can we change others' behavior through social influence? Which factors predict conformity or deviance in groups? What is the role of stereotypes in intergroup conflicts? The answers to these questions contribute to improving the interactions of individuals from diverse backgrounds.

Module Aims

This module seeks to acquaint you with individual-focused as well as group-oriented analyses of the social and cultural embeddedness of human experience and behavior. It aims to generate a thorough understanding of this social and cultural embeddedness through an emphasis on social psychological theories, scientific methods, and empirical research findings.

Intended Learning Outcomes (ILOs)

- Understand the social and cultural context of individual behavior
- Understand how group and intergroup processes influence individuals
- Understand how individuals influence groups
- Critically apply and evaluate social psychological research methods

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PSYCH (mandatory elective for PSYCH students taking a minor) (CO40, **CO41**, CO42)
- Elective for: all other study programs

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**Number of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO41-730102	Social Cognition	Lecture	5	28	75	35
CO41-701101	Group Processes and Intergroup Relations	Lecture	5	28	75	35
CO41-730222	Current Debates in Social Cognition	Seminar	2.5	14	75	17.5
CO41-701102	Current Debates in Group Processes and Intergroup Relations	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Applied Psychology**	*Module Code* **CO42-ApplPsych**	*ECTS* **15**
Pre-requisites ☒ Corresponding CHOICE Modules CH16-IntroPsych (Introduction to Psychology) ☐ None	*Module Contact Person* See overview on page 3	*Past study year info* # participants: 22 average grade: 1.5 (1.0=best) passing rate: 100% student rating: 3.3/5 (5=best) feedback rate: 29%
Frequency Every year	*Duration* 1 year	*Level (type)* Year 2 (CORE)

Module Description / Content

This module focuses on implications of the biological and cognitive processes, as well as social and cultural factors, which underlie human behavior for applications in domains such as business, education, health, politics, and society. Three processes are central across these domains: (a) decision making (of individuals, in groups, in institutions), (b) behavioral change (in terms of marketing approaches; maintenance and restoration of health; in organizations) and (c) conflict analysis & resolution (e.g., mediation, negotiation). In all these domains, diversity plays a major role, therefore the impact of age, gender and cross-cultural variance will be addressed. The module also covers applied methods (intervention, training, evaluation).

Module Aims

The module focuses on the transfer of theories and methods of psychological research to solving practical problems. It provides you with the core knowledge, hands-on methods and skills necessary for successful applications of psychological findings in areas that are relevant for the individual and for society.

Intended Learning Outcomes (ILOs)

- Acquire skills to diagnose where and how to intervene
- Perform a needs-assessment
- Use the Intervention Mapping approach to plan and implement an intervention
- Perform decision analysis
- Consider ethical aspects

Module Function (in Study Programs and within the Curricular Structure)

- One of three mandatory 2nd year CORE modules for PSYCH (mandatory elective for PSYCH students taking a minor) (CO40, CO41, **CO42**)
- Elective for: all other study programs

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CO42-710302	Judgement and Decision Making	Seminar	5	28	75	35
CO42-710231	Business Psychology (Industrial and Organizational psychology)	Seminar	5	28	75	35
CO42-710232	Current Topics in Applied Psychology	Seminar	5	28	75	35

Module Data Sheet

Module Name **Specialization Area Biochemistry and Cell Biology**	*Module Code* **CAS-BCCB**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module allows students to individualize their course portfolio on an advanced level in a research area they would like to specialize in. Hence the only restrictions that apply are that the specialization courses need to be either third year specific courses offered by the undergraduate programs BCCB or MCCB or graduate courses from a HEALTH focus-associated master program. It is recommended that at least 7.5 ECTS are earned from the BCCB-specific specialization courses as they specifically build on and complement the BCCB CORE modules by emphasizing knowledge transfer and skills development within BCCB-related research areas.

Module Aims

Exposure to state-of-the-art research approaches through specialized lectures, literature work, presentations and seminars. The module provides courses on the theoretical basis for successful experimental design, allows to gain practical experience in ongoing research. Furthermore, the module offers an intensive insight into scientific research and literature, as well as specialized lectures on advanced research topics.

Intended Learning Outcomes (ILOs)

- Familiarity with a selection of cutting-edge techniques in the molecular life sciences and biotechnology
- Understanding of scientific papers
- Scientific reasoning skills (e.g., how to test hypotheses from experiments, and how to support conclusions with experimental data)
- Planning and evaluation of experiments
- Presentation of scientific data in front of an audience; general presentation skills

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for BCCB

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-520361	Experimental Strategy Design (Intersession)	Lecture	2.5	14	75	17.5
CAS-520301	Research Approaches in Molecular Life Science (CT)	Project	2.5	14	75	17.5
CAS-520302	Research Approaches in Molecular Life Science (WT)	Project	2.5	14	75	17.5
CAS-520332	Current Topics in Molecular Life Science	Seminar	5	14	75	35
CAS-520362	Ribogenetics	Lecture	2.5	14	75	17.5
CAS-530591	Microbial Pathogenicity	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Medicinal Chemistry & Chemical Biology**	*Module Code* **CAS-MCCB**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

In MCCB, the third year is extremely important for students to gain advanced knowledge in a few areas of specialization while deepening their practical experience in the laboratory and their connections to industry and/or prospective graduate schools.
In this context, the Specialization module offers a series of specialized courses that are mainly targeted towards understanding technologies and methodologies in drug design. The module allows individualized course selection.

Module Aims

Exposure to state-of-the-art techniques and research approaches through specialized lectures, literature work, presentations and seminars.

Intended Learning Outcomes (ILOs)

- Familiarity with a selection of cutting-edge techniques in the molecular life sciences and biotechnology
- Understanding of scientific papers
- Scientific reasoning skills (e.g., how to test hypotheses from experiments, and how to support conclusions with experimental data)
- Planning and evaluation of experiments
- Presentation of scientific data in front of an audience; general presentation skills
- General assessment of career opportunities for MCCB graduates

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for MCCB

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-500301	Project /Thesis Seminar MCCB (CT)	Seminar	2.5	14	75	17.5
CAS-500302	Project /Thesis Seminar MCCB (WT)	Seminar	2.5	14	75	17.5
CAS-500313	Introduction to Biophysical Chemistry	Lecture	2.5	14	75	17.5
CAS-520312	Binding and Enzyme Assays	Lecture	2.5	14	75	17.5
CAS-530481	Concepts and Applications of Metabolism	Lecture	2.5	14	75	17.5
CAS-500324	Pharmaceutical Formulation and Targeting Technology	Lecture	2.5	14	75	17.5
CAS-400314	Structure Elucidation of Biomolecules (from Chemistry)	Lecture	2.5	14	75	17.5
CAS-400251	Drug Design	Lecture	2.5	14	75	17.5
CAS-500323	Natural Product Chemistry	Lecture	2.5	14	75	17.5
CAS-500311	Big Data in Life and Natural Sciences	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Chemistry**	*Module Code* **CAS-CHEM**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The module deepens and widens the contents of the CHOICE and CORE modules of Chemistry.

Module Aims

The module gives deeper insight into selected areas of Chemistry beyond the education of year 2. The selected areas include synthesis, organometallics, application of chemistry and chemical knowledge in biochemically relevant fields including analytical chemistry, and physical chemistry.

Intended Learning Outcomes (ILOs)

- Familiarity with a selection of cutting-edge techniques in Chemistry and its adjacent fields
- Understanding of scientific papers
- Scientific reasoning skills (e.g., how to test hypotheses from experiments, and how to support conclusions with experimental data)
- Planning and evaluation of experiments
- Presentation of scientific data in front of an audience; general presentation skills

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for CHEM

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-400312	Advanced Synthesis	Lecture	2.5	14	75	17.5
CAS-400342	Organometallic Chemistry	Lecture	2.5	14	75	17.5
CAS-400313	Methods for Bioconjugation	Lecture	2.5	14	75	17.5
CAS-400314	Structure Elucidation of Biomolecules	Lecture	2.5	14	75	17.5
CAS-500313	Introduction to Biophysical Chemistry (from MCCB)	Lecture	2.5	14	75	17.5
CAS-500312	Binding and Enzyme Assays (from MCCB)	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Earth and Environmental Sciences**	*Module Code* **CAS-EES**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The courses in this module provide in-depth knowledge of and practical skills in specific fields in Earth and Environmental Sciences.

Module Aims

The module aims at familiarizing the students with issues and research questions currently debated in Earth and Environmental Sciences and provides practical expertise in techniques used in geophysical, oceanographical and geological field work.

Intended Learning Outcomes (ILOs)

- Familiarity with skills and techniques used in field work
- Knowledge of currently debated topics in geology, oceanography, geophysics, and geochemistry
- Improvement of presentation skills

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for EES

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-210361	Earth, Ocean and Environmental Sciences FieldLab	Lecture	5	28	75	35
CAS-210304	Current Topics in Earth and Marine Sciences	Lecture	2.5	14	75	17.5
CAS-210305	Current Topics in Earth and Environmental Sciences	Lecture	2.5	14	75	17.5
CAS-210334	Theoretical and Computational Physical Oceanography	Lecture	2.5	14	75	17.5
CAS-210315	Resources and Environmental Behaviour of Critical High-Technology Metals	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Physics**	*Module Code* **CAS-PHY**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module contains major specific specialization courses that build on the first and second year physics modules. These courses provide deeper insights into various important areas of physics and serve as a preparation for research, graduate studies and/or professional careers. Some of the courses cover interdisciplinary fields of research. The specialization courses can involve short projects and student presentations in addition to regular lectures. The topics of the courses will be adjusted whenever it is indicated by new developments and discoveries.

Module Aims

The module aims to prepare students for their further professional, research or academic career in physics and related fields with lectures on important advanced topics in physics, an introduction to scientific research methods and tools, and an exposure to original scientific research literature.

Intended Learning Outcomes (ILOs)

- Acquire knowledge in important advanced topics in physics and neighboring fields.
- Be able to read, write and understand original scientific literature (publications in scientific journals)
- Preparation for research in physics, improved presentation skills.
- Apply fundamental knowledge from the core physics courses and adapt the generic methods to the special ones

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for PHY

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-201321	Biophysics	Lecture	2.5	14	75	17.5
CAS-200302	Particles and Fields	Lecture	2.5	14	75	17.5
CAS-200323	Solid-State Electronic Devices	Lecture	2.5	14	75	17.5
CAS-200312	Advanced Optics	Lecture	2.5	14	75	17.5
CAS-201332	Advanced Quantum Physics	Lecture	2.5	14	75	17.5
550434	Theoretical and Computational Biophysics	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Mathematics**	*Module Code* **CAS-MATH**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

Courses on a broad spectrum of topics involving modern themes of mathematics and its applications to the natural sciences and computer science are offered. Techniques of algebra are introduced in order to shed light on fundamental geometric objects. Powerful methods of analysis are implemented to solve important partial differential equations and these are in turn used in mathematical modeling. Following the introduction of basics of classical number theory, the mathematics of cryptography is presented.

Module Aims

The primary goal is to expose students to a wide range of important mathematical topics on both the pure and applied sides, and in particular to enhance their abilities in abstract thinking as well as dealing with interdisciplinary challenges.

Intended Learning Outcomes (ILOs)

- Basics of commutative algebra and first applications to algebraic geometry
- Foundations of analysis used in the solution of partial differential equations, solution techniques for partial differential equations and first applications to modeling.
- Classical number theory, more modern considerations, e.g., of elliptic curves, with applications to cryptography.

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for MATH

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-100311	Foundations of Mathematical Physics I	Lecture	2.5	14	75	17.5
CAS-100312	Foundations of Mathematical Physics II	Lecture	2.5	14	75	17.5
CAS-100361	Differential Equations I	Lecture	2.5	14	75	17.5
CAS-100472	Differential Equations II	Lecture	2.5	14	75	17.5
CAS-100431	Number Theory I	Lecture	2.5	14	75	17.5
CAS-100432	Number Theory II	Lecture	2.5	14	75	17.5
CAS-100332	Discrete Mathematics	Lecture	5	28	75	35

Module Name **Specialization Area Computer Science**	*Module Code* **CA-S-CS**	*ECTS* **10-15**
Pre-requisites ☒ Depends on course (see requirements there) ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The Computer Science Specialization module offers a specialization in a selected set of topics. Students can choose from courses specifically offered as part of this specialization module (see table below). In addition, they can select 2nd year CS core courses that they have not yet taken and they can select from the following courses offered by related study programs that they have not yet taken:

- CO22-320372 Machine Learning (5 ECTS, IMS, Spring)
- CO22-320311 Robotics (5 ECTS, IMS, Spring)
- CO23-320203 Automation (5 ECTS, IMS, Spring)
- CO24-300491 Optimization (5 ECTS, IMS, Spring)
- CO27-300302 Digital Signal Processing (5 ECTS, ECE, Spring)

Students taking the Campus Track can also choose from these courses:

- CO22-320671 Computer Vision (5 ECTS, IMS, Fall)
- CO24-320521 Artificial Intelligence (5 ECTS, IMS, Fall)
- CO25-300341 Information Theory (5 ECTS, ECE, Fall)

Please note these lists are subject to change.

Module Aims

The Computer Science Specialization Area module aims at allowing students to choose specialization courses covering topics in which they want to obtain a deeper understanding.

Intended Learning Outcomes (ILOs)

Deeper understanding of the chosen specialization area.

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for CS

Module Assessment

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-320341	Programming in Java	Lecture	2.5	14	75	17,5
CAS-320303	Distributed Algorithms	Lecture	2.5	14	75	17,5
CAS-320342	Data Technologies	Lecture	5	28	75	35
CAS-320321	Image Processing	Lecture	5	28	75	35
CAS-320343	Visualization	Lecture	5	28	75	35

Module Data Sheet

Module Name **Specialization Area Intelligent Mobile Systems**	*Module Code* **CAS-IMS**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module provides courses which deepen the knowledge acquired during the second year. At the same time, students get the opportunity to broaden their horizons by taking relevant courses from other neighboring programs such as Computer Science, Electrical and Computer Engineering, Industrial Engineering and Management, and Mathematics.

Module Aims

The module aims to provide depth of knowledge in certain specialization-areas which are of practical importance and which are of interest to the IMS faculty. These include control-systems, dynamics, electronics, automation, machine-learning, and robotics.

Intended Learning Outcomes (ILOs)

- To acquire and develop further the understanding of digital electronics
- To deepen the understanding of automation in manufacturing industry
- To learn to use advanced techniques in control-system design and dynamic modeling
- To develop complementary skills from neighboring engineering disciplines

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for IMS

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-300313	Marine Robotics	Lecture	5	28	75	35
CAS-300351	Advanced Digital Design (from Electrical and Computer Engineering)	Lecture	5	28	75	35
CAS-050324	Nonlinear Dynamics for Industrial Engineering (from Industrial Engineering and Management)	Lecture	2.5	14	75	17.5
CAS-320343	Visualization (from Computer Science)	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Electrical and Computer Engineering**	*Module Code* **CAS-ECE**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course components ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The module rounds up the knowledge in communications and some hardware implementations. It provides detailed knowledge of error-correcting codes, such as convolutional, block, Turbo, and LDPC codes that determine all current communications and storage media. Additionally, following the basic wireless course, which handled channel properties and point-to-point transmission methods, here, the higher levels of the communications infrastructure will be explained, with a focus on multi-access techniques. To prepare for actual implementations, a design course complements the more theoretical courses.

Module Aims

The module is set up to advance knowledge in communications and hardware realization to a point that fully prepares students to work in a communications environment, be it in industry or following this track further in a master's program. To a great extent, the courses already have master's level and are hence directed to the edge of current developments.

Intended Learning Outcomes (ILOs)

- Knowing current error protection technology and algorithms that are used in everyday communications and storage system
- Understanding wireless network access methodologies (TDMA, CDMA, OFDMA and MIMO) and protocols
- Knowing the internals and programming of field-programmable gate arrays (FPGA), the standard platform for quick designs and small to midsize system realizations

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for ECE

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-300362	Coding Theory	Lecture	5	28	75	35
CAS-300441	Wireless Communications II	Lecture	5	28	75	35
CAS-300351	Advanced Digital Design	Lecture	5	28	75	35

Module Data Sheet

Module Name **Specialization Area Industrial Engineering & Management**	*Module Code* **CAS-IEM**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The students extend and specialize the contents and methods covered by the core modules. In particular, latest trends in production and distribution are addressed, including digitalization, automation, new technologies as well as ethics and sustainability.

Module Aims

The students train to apply the methods and contents covered in the core modules to new and specialized environments. Theoretical knowledge is applied in various practice settings.

Intended Learning Outcomes (ILOs)

- Extended modelling and simulation skills
- Understanding of framework conditions and challenges of digitalization and automation in production systems
- Knowledge about latest production technologies
- Capability to evaluate and balance traditional and innovative performance indicators in production and distribution

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for IEM

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-050311	Distribution & E-Commerce	Lecture	2.5	14	75	17.5
CAS-050324	Nonlinear Dynamics for Industrial Engineering	Lecture	2.5	14	75	17.5
CAS-050362	Integrated Decision Making in Supply Chain Management	Lecture	2.5	14	75	17.5
CAS-050323	Supply Chain Design	Lecture	2.5	14	75	17.5
CAS-050313	Industry 4.0 Technologies	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area International Business Administration**	*Module Code* **CAS-IBA**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The Module "**Specialization Area IBA**" gives an overview of the contemporary phenomena and issues of enterprises, which are operating on a global scale. The course deals with
- new phenomena such as "born globals" and ethical behavior of multinational enterprises in the course "Current Issues of International Organizations",
- discuss the impact of the globalization on accounting, standard setting in accounting and the interpretation of accounting standards in the course "Contemporary Issues in Accounting"
- discuss and analyze latest developments on the financial markets, in corporate finance, and banks, in particular with respect to ethical behavior in the course "Contemporary Issues in Finance"
- highlight, explain and analyze latest developments in Marketing, in particular with a focus on internet marketing in the course "Contemporary Research Issues in Marketing".

Special emphasis is placed on ethical business behavior and global presence of organizations, in their social, cultural, institutional and economic context. Latest Innovation Methods, i.e. Design Thinking will be experienced.

Module Aims

This module equips students with the essential knowledge of contemporary issues of global firms (multinational, international, and global enterprises, born globals) with a special emphasis on 21st-century advances in theory and practice. Students will understand the specific opportunities and challenges of private and public, profit-seeking and non-profit organizations. Students will be able to use this knowledge to build their careers in a variety of international business contexts.

Intended Learning Outcomes (ILOs)

- Understand contemporary phenomena in key areas of international business
- Develop ability to identify key problems in key areas of international business
- Be able to apply an in-depth analysis case studies and apply well-known business concepts and frameworks
- Be able to apply an in-depth analysis on contemporary theories

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for IBA

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-930334	Current Issues of International Organizations	Seminar	2.5	14	75	17.5
CAS-930331	Contemporary Issues in Finance and Accounting	Seminar	2.5	14	75	17.5
CAS-930333	Contemporary Research Issues in Marketing	Seminar	2.5	14	75	17.5
CAS-	Design Thinking (Intersession)	Seminar	2.5	14	75	17.5
CAS-730302	Managing Demographic Change in Organizations	Lecture	2.5	14	75	17.5
CAS-032303	Innovation Seminar	Seminar	2.5	14	75	17.5

Date of Revision: 09/2018

Module Data Sheet

Module Name **Specialization Area Global Economics and Management**	*Module Code* **CAS-GEM**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

The Module *Specialization Area GEM* deepens the knowledge acquired in the first two years of study. It offers students to study in more depth topics of special relevance (a) to current economic policy making and (b) to the individual interests of students who are preparing for their entry into the labor market or for continuing their studies on the graduate level. Specialization courses focus either on specific policy challenges as introduced in the CORE and CHOICE modules or on the concurrence of diverse economic challenges in specific countries, country groups, and world regions. A variety of courses that can be chosen from neighboring disciplines and study programs enables students to better understand and deepen their knowledge of the trans-disciplinary nature of economic challenges with respect to social, societal and technological dimensions.

Module Aims

This module equips students with skills of how to apply academic knowledge to real world problems and phenomena. Students learn not only how to apply textbook-knowledge, but also how to go beyond this knowledge and to critically evaluate it. They learn how to formulate and defend economic arguments and how to prepare papers and empirical studies on their way to graduate studies and employment outside academia.

Intended Learning Outcomes (ILOs)

- Improve empirical skills knowledge
- Improve professional writing skills
- Become fluent in economic reasoning
- Identify and build areas of interest and specialization
- Learn to evaluate and give input into economic topics and issues outside of area of specialization
- Understand the difference between intra-academic and academic-real-word communication

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for GEM

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-032312	Country Seminar I	Lab	2.5	14	75	17.5
CAS-032321	Development Seminar	Lab	2.5	14	75	17.5
CAS-032323	Environment and Resource Seminar	Lab	2.5	14	75	17.5
CAS-032322	Econometrics Seminar	Lab	2.5	14	75	17.5
CAS-032303	Innovation Seminar	Lab	2.5	14	75	17.5
CAS-850312	China: Politics, Economy, Society	Lab	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Integrated Social Sciences**	*Module Code* **CAS-ISS**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

In this module students will broaden and intensify their knowledge and skills in the three social sciences: Political Science, Sociology and Communication Science. A particular focus will be on advanced mixed-methods research designs, covering both, standardized ("quantitative") and non-standardized ("qualitative") methods and their combination. Additionally, in this module the close supervision of the BA-thesis writing process with respect to content, methods, timing and academic writing will be provided. Individual courses will be adapted from year to year to cover current issues of interest to both, faculty teaching the course, and students requesting a focus on particular political, sociological and media and communication topics.

Module Aims

This module aims at deepening the understanding of complex social science problems, developing individual as well as collaborative research questions and designs, and providing the necessary advanced methodology tools and skills to conduct research in the social sciences, and thus qualify for excellent graduate programs in global academia. Additionally, the trained skills and know-how should enable the module students to apply those skills to various professional contexts from e.g., governmental and non-governmental institutions and organizations, to local, national and global media, to business contexts.

Intended Learning Outcomes (ILOs)

- Understanding the core theories and approaches in political science, sociology and communication science
- Comprehension of the complexity of social scientific problems
- Problem-solution skills
- Advanced qualitative, quantitative and mixed-method skills and their implementation
- Academic writing and research project development
- Debating and oral communication skills
- Professional presentation and visualization of social scientific research

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for ISS

Module Assessment: Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-930301	Advanced Methods in the Social Sciences	Seminar	2.5	14	75	17.5
CAS-930311	Cooperation and Conflict: Russo-European Social, Economic and Political Relations	Seminar	2.5	14	75	17.5
CAS-930303	From Theory to Practice: Sociological Theory and its Application to Reality	Seminar	2.5	14	75	17.5
CAS-xxxxxx	Democracy and Populism	Seminar	2.5	14	75	17.5
CAS-xxxxxx	Plural Perspectives on Public Policy	Seminar	2.5	14	75	17.5
CAS-850313	Oppression, Conformity and Resistance under Dictatorships	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area International Relations: Politics and History**	*Module Code* **CAS-IRPH**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module allows students to delve deeper into a variety of topics relevant to international relations, politics and history. Each year, students have the opportunity to explore a range of issues in small groups taught at the graduate-school level. Emphasis is placed on critical thinking and on further developing conceptual, analytic and writing skills. The specific courses may change each year, but the module will follow particular themes such as theories of international relations, critical junctures in history, current events in international affairs and global politics, national and transnational trends, policy analysis and practical skills.

Module Aims

This module aims to teach students how to work at an advanced, graduate-school level by furthering their conceptual and analytic abilities and honing their writing skills. Students will draw upon the knowledge and capacities gained during their CHOICE and CORE courses to critically examine complex issues and forge interconnections between different perspectives and disciplines.

Intended Learning Outcomes (ILOs)

- Analytical skills, especially with regards to reading and interpreting scholarly texts
- Conceptual thinking, identification of connections and underlying issues
- Critically assess (potentially divergent) historiographical interpretations
- Research and academic writing skills
- Ability to participate in an intensive, seminar environment

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for IRPH

Module Assessment
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-850303	Women in History and International Politics	Seminar	2.5	14	75	17.5
CAS-850313	Oppression, Conformity and Resistance under Dictatorships	Seminar	2.5	14	75	17.5
CAS-850302	The Problem of Power: An Introduction to Modern Political Philosophy	Seminar	2.5	14	75	17.5
CAS-032321	Development Seminar	Seminar	2.5	14	75	17.5
CAS-xxxxxx	Democracy and Populism	Lecture	2.5	14	75	17.5
CAS-xxxxxx	Plural Perspectives on Public Policy	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Specialization Area Psychology**	*Module Code* **CAS-PSYCH**	*ECTS* **10-15**
Pre-requisites ☒ Depends on the individual course component ☐ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module is designed to deepen students' understanding of psychology and broaden their knowledge and skills by focusing on selected areas in psychology. It provides content specialization courses and/or advanced methods training aimed at transfer and career preparation.

Module Aims

Improve students' knowledge and enhance their career prospects.

Intended Learning Outcomes (ILOs)

- Gain a deeper knowledge of specific areas of psychology
- Apply psychological knowledge to specific topics or practical settings
- Acquire transferable skills, such as critical thinking, independent learning, oral presentation, and written communication.

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory 3rd year CAREER module for PSYCH

Module Assessment

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAS-xxxxxx	Neuropsychology of Aging	Seminar	5	14	75	17.5
CAS-730301	Psychology of Food	Seminar	2.5	14	75	17.5
CAS-730311	Psychology of Happiness	Seminar	2.5	14	75	17.5
CAS-500314	Human Neuroscience Advanced Lab	Lab	2.5	14	75	17.5
CAS-930303	From Theory to Practice: Sociological Theory and its Application to Reality	Seminar	2.5	14	75	17.5

Module Data Sheet

Module Name **Internship**	*Module Code* **CA02-Internship**	*ECTS* **20**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* Pellegrino Favuzzi Christin Klähn Predrag Tapavicki	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every Fall Semester	*Duration* 16 consecutive weeks	

Module Description / Content

The internship program is an option for all undergraduate students within the World Track program. It enables students to gain practical experience in a semester-long internship during their fifth semester.
Requirements:

- be related to the major area of study
- take place off-campus
- last at least 16 full-time consecutive weeks

The module is related to the "Career Advising", which starts in the first year of studies of all undergraduate students (except MedNat students).

Module Aims

The module aims to provide insight into the labor market as well as practical work experience in the respective area of study. Successful internships may initiate career opportunities for students.

Intended Learning Outcomes (ILOs)

- **Improve** professional and career related skills for the modern labour market
- **Reflect** upon and further develop your knowledge, skills, interests and values (personality building)
- **Experience** the working environment and get on the job training
- Better **plan** future studies and career

Module Function (in Study Programs and within the Curricular Structure)

- One of two mandatory elective 3rd year CAREER modules for all undergraduate students following the **World Track**. Students choose between the *Internship* module or the *Study Abroad* module.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CA02-100001	Internship	Internship	20	N/A	N/A	16 weeks

Module Data Sheet

Module Name **Study Abroad**	*Module Code* **CA03-StudyAbroad**	*ECTS* **20**
Pre-requisites ☒ Minimum GPA 2.0 ☒ B2 completed level of foreign language (for non-English courses)	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

Study Abroad module allows students to spend a semester at one of the partner universities worldwide. During this period students are expected to take courses relevant for their study program of min. 20 ECTS in total. The selection of courses is approved by respective study program coordinator, academic advisor and student records officer to assure academic quality and transferability of credits. Mandatory informational sessions conducted prior to the envisioned study abroad semester provide students with an overview of the study abroad opportunities available, guide them through application and selection processes as well as give useful tips for defining a matching study abroad institution and composing a feasible academic plan.

Module Aims

- Cultural immersion and acquisition of intercultural skills
- Acquisition and development of foreign language skills
- Immersion into new academic culture
- Expansion of the academic profile

Intended Learning Outcomes (ILOs)

Individual learning outcomes based on academic interests, personal development plans and intercultural competencies already acquired.

Module Function (in Study Programs and within the curricular structure)

- One of two mandatory elective 3rd year CAREER modules for all undergraduate students following the **World Track**. Students choose between the *Internship* module or the *Study Abroad* module.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CA03-100004	Study Abroad	Study Abroad	20	N/A	N/A	N/A

Module Data Sheet

Module Name	*Module Code*	*ECTS*
Project / Thesis MCCB / BCCB / CHEM / EES / PHY ***(Generic for the focus area Health)***	***CA04-MCCB*** ***CA05-BCCB*** ***CA06-CHEM*** ***CA07-EES*** ***CA08-PHY***	**15**
Pre-requisites ☒ Two Program-specific CORE-Modules ☐ None	*Module Contact Person* Respective Study Program Chair	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module is a mandatory graduation requirement for all undergraduate students. It consists of two components, a Jacobs faculty-guided research Project and a Bachelor of Science (BSc) Thesis in the major study program and involves a high degree of independence. 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, and interpretation of the results.

According to the regular study plan, World Track students engage in both components in the 6th semester, while Campus Track students engage in the Project component in the 5th and in the BSc Thesis component in the 6th semester. Both module components can be performed with the same Jacobs faculty member, or different ones, the latter in order to allow a broader research experience. Research results obtained from the Project can be embedded in the BSc Thesis.

For detailed complementary requirements please consult the respective individual course descriptions.

Module Aims

Introduce undergraduate students to independent research work. Provide students with the skills to review, critically assess and discuss research projects.

Intended Learning Outcomes (ILOs)

Show the ability of a student to analyze and solve a well-defined problem with scientific approaches, a critical reflection of the status quo in scientific literature, and an original development of his/her own ideas.

Module Function (in Study Programs)

- Mandatory for all undergraduate students who aim for a degree in one of the study programs within the focus area Diversity (MCCB, BCCB, CHEM, EES, PHY)

Module Assessment

Thesis 66,6%, Project Assessment 33,3%.

Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAXX-xxxxxx	Project XXXX	Project	5	N/A	N/A	125
CAXX-xxxxxx	Thesis XXXX	Thesis	10	N/A	N/A	250

Module Data Sheet

Module Name **Project / Thesis IMS / CS / ECE / MATH / IEM** ***(Generic for the focus area Mobility)***	*Module Code* **CA09-IMS** **CA10-CS** **CA11-ECE** **CA12-MATH** **CA17-IEM**	*ECTS* **15**
Pre-requisites ☒ Two Program-specific CORE-Modules ☐ None	*Module Contact Person* Respective Study Program Chair	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module is a mandatory graduation requirement for all undergraduate students. It consists of two components, a Jacobs faculty-guided research Project and a Bachelor of Science (BSc) Thesis in the major study program and involves a high degree of independence. 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, and interpretation of the results.

According to the regular study plan, World Track students engage in both components in the 6th semester, while Campus Track students engage in the Project component in the 5th and in the BSc Thesis component in the 6th semester. Both module components can be performed with the same Jacobs faculty member, or different ones, the latter in order to allow a broader research experience. Research results obtained from the Project can be embedded in the BSc Thesis.

For detailed complementary requirements please consult the respective individual course descriptions.

Module Aims

Introduce undergraduate students to independent research work.

Intended Learning Outcomes (ILOs)

Show the ability of a student to analyze and solve a well-defined problem with scientific approaches, a critical reflection of the status quo in scientific literature, and an original development of his/her own ideas.

Module Function (in Study Programs)

- Mandatory for all undergraduate students who aim for a degree in one of the study programs within the focus area Diversity (IMS, CS, ECE, MATH, IEM)

Module Assessment

Thesis 66,6%, Project Assessment 33,3%.
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAXX-xxxxxx	Project XXXX	Project	5	N/A	N/A	125
CAXX-xxxxxx	Thesis XXXX	Thesis	10	N/A	N/A	250

Module Data Sheet

Module Name	*Module Code*	*ECTS*
Project / Thesis GEM / IBA / PSYCH / ISS / IRPH ***(Generic for Diversity focus)***	**CA13-GEM** **CA14-IBA** **CA15-PSYCH** **CA16-ISS** **CA18-IRPH**	**15**
Pre-requisites ☒ Two Program-specific CORE Modules ☐ None	*Module Contact Person* Respective Study Program Chair	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☒Year 3 (CAREER) ☐Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module is a mandatory graduation requirement for all undergraduate students. It consists of two components, a Jacobs faculty-guided research Project and a Bachelor of Arts (BA) Thesis in the major study program and involves a high degree of independence. 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, and interpretation of the results.

According to the regular study plan, World Track students engage in both components in the 6th semester, while Campus Track students engage in the Project component in the 5th and in the BA component in the 6th semester. Both module components can be performed with the same Jacobs faculty member, or different ones, the latter in order to allow a broader research experience. Research results obtained from the Project can be embedded in the BA Thesis.

For detailed complementary requirements please consult the respective individual course descriptions.

Module Aims

Introduce undergraduate students to independent research work.
Provide students with the skills to review, critically assess and discuss research projects.

Intended Learning Outcomes (ILOs)

Show the ability of a student to analyze and solve a well-defined problem with scientific approaches, a critical reflection of the status quo in scientific literature, and an original development of his/her own ideas.

Module Function (in Study Programs and within the Curricular Structure)

- Mandatory for all undergraduate students who aim for a degree in one of the study programs within the focus area Diversity (GEM, IBA, PSYCH, ISS, IRPH)

Module Assessment

Thesis 66,6%, Project Assessment 33,3%.
Module re-assessment options are regulated in the Undergraduate Student Policy.

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
CAXX-xxxxxx	Project XXXXX	Project	5	N/A	N/A	125
CAXX-xxxxxx	Thesis XXXXX	Thesis	10	N/A	N/A	250

Module Data Sheet

Module Name **Language**	*Module Code* **JTLA-Language**	*ECTS* **10**
Pre-requisites According to the undergraduate language policy (i.e., valid placement test result or valid language course certificate)	*Module Contact Person* See overview on page 3	*Level (type)* ☒ Any (Jacobs Track)
Frequency Every year	*Duration* 2-3 years	

Module Description / Content

The Language Skills Module contains language courses in languages such as German, Spanish, French or Chinese (the range of languages offered may vary) taught along the Common European Framework of Reference for Languages (CEFR), which enable students to acquire (at least) basic language skills in one of these languages. Students progress along the CEFR levels A1-C1 by taking interactive and consecutive language courses based on their individual language proficiency. German language courses are mandatory except for native speakers who may choose any other language taught at Jacobs University.

Module Aims

This module aims at equipping students with (at least) basic language skills in German or (only in case of German native speakers) any other language offered at Jacobs University. Communicative skills and foreign language competence foster students' intercultural awareness and enhance their employability in a globalized and interconnected world. Students will acquire (at least) proficiency level A 2.1 which enables them to engage in simple conversations and understand basic texts.

Intended Learning Outcomes (ILOs)

- Become familiar with patterns in order to communicate in familiar everyday situations
- Deal with short, simple texts in a foreign language.
- Learn to understand the most relevant facts in conversations and texts
- Make and react to suggestions
- Learn to express desires and preferences in German or (only for German native speakers) in any other taught language.

Module Function (in Study Programs and within the Curricular Structure)

- One of four Jacobs Track (General Education) modules: Methods/Mathematics, Skills, Triangle Area, **Language**
- Mandatory for **all** undergraduate study programs

Module Components and Types

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours per course)
0100XX	German (A1 – C1)	Language Course	2.5	28	75	35
0110XX	French (A1 – C1)	Language Course	2.5	28	75	35
0120XX	Spanish (A1 – C1)	Language course	2.5	28	75	35
0130XX	Chinese (A1 – A2)	Language Course	2.5	28	75	35

Module Data Sheet

Module Name			*Module Code*	*ECTS*
Methods / Mathematics			**JTME-MethodsMath**	**15**
Pre-requisites	*Frequency*	*Duration*	*Module Contact Person*	*Level (type)*
☒ None	Every year	2 years	See overview page 3	☒ Any (Jacobs Track)

Module Description / Content

This module will provide you with general mathematical and analytical skills that are fundamentally necessary for any graduate. Accessible to all students, these courses consist of mathematics, statistics, and other quantitative and qualitative research methods. While a strong integration of math and methods courses is intended, study programs will define the mathematics and methods courses that are mandatory for the respective degree. You will study theoretical concepts as well as relevant applications in mathematics and methods. The courses include rigorous training in the selection, application and interpretation of different analytical techniques fostered by practical training with state-of-the-art analysis software.

Module Aims

This module aims in supplying the mathematical and methodological skills relevant to the different disciplines in engineering, in natural and in social sciences. Mathematics courses will lay the foundation in formal and logical deduction on which is built upon in all sciences. The methods courses generate familiarity with the empirical research paradigm and the empirical research process common to all scientific disciplines.

Intended Learning Outcomes (ILOs)

- Know about fundamental principles and procedures in empirical research; Be familiar with the main procedures for data collection; Have practical experience in relevant data analysis approaches and techniques
- Have a broad knowledge in calculus and linear algebra
- Have study program relevant knowledge in mathematics and methods

Module Function (in Study Programs and within the Curricular Structure)

- One of 4 Jacobs Track (General Education) modules: **Methods/Mathematics**, Skills, Triangle Area, Language
- Mandatory for **all** undergraduate study programs

Module Components and Types (for individual Study Program Requirements see Mandatory Course Plan)

Course Nr.	**Course Name**	**Type**	**ECTS**	**Sessions** (per Sem.)	**Session Duration** (min)	**Total** (hours)
JTME-120101	Mathematical Concepts in the Sciences	Lecture	2.5	14	75	17.5
JTME-120103	Calculus I	Lecture	2.5	14	75	17.5
JTME-120104	Calculus II	Lecture	2.5	14	75	17.5
JTME-120106	Applied Calculus I	Lecture	2.5	14	75	17.5
JTME-120107	Applied Calculus II	Lecture	2.5	14	75	17.5
JTME-120112	Foundations of Linear Algebra I	Lecture	2.5	14	75	17.5
JTME-120113	Foundations of Linear Algebra II	Lecture	2.5	14	75	17.5
JTME-120201	Elements of Probability	Lecture	2.5	14	75	17.5
JTME-120202	Numerical Methods I	Lecture	2.5	14	75	17.5
JTME-120203	Elements of Analysis I	Lecture	2.5	14	75	17.5
JTME-120204	Elements of Analysis II	Lecture	2.5	14	75	17.5
JTME-120205	Matrix Algebra	Lecture	2.5	14	75	17.5
JTME-210213	Geo-Information Systems (GIS-Lab)	Lab	2.5	14	75	17.5
JTME-400203	Methods in Life Sciences and Chemistry Research I	Lab	2.5	14	75	17.5
JTME-400204	Methods in Life Sciences and Chemistry Research II	Lab	2.5	14	75	17.5
JTME-550201	Introduction to Bioinformatics	Lecture	2.5	14	75	17.5
JTME-990103	Empirical Research Methodology	Lecture	2.5	14	75	17.5
JTME-990104	Qualitative Research: Methods & Design	Lecture	2.5	14	75	17.5
JTME-990113	Data Analysis & Statistical Inference with R	Lecture	2.5	14	75	17.5
JTME-990114	Survey and Questionnaire Design	Lecture	2.5	14	75	17.5
JTME-990115	Case Study Design	Seminar	2.5	14	75	17.5
JTME-990116	Data Analysis Project	Seminar	2.5	14	75	17.5
JTME-990123	Data Analysis & Statistical Inference with SPSS	Lecture	2.5	14	75	17.5
JTME-990124	Statistics for Experimental Sciences	Lecture	2.5	14	75	17.5
JTME-990203	Statistical Modeling with R	Lecture	2.5	14	75	17.5
JTME-990204	Qualitative Research: Analysis of Text & Images	Lecture	2.5	14	75	17.5
JTME-990213	Statistical Modeling with SPSS	Lecture	2.5	14	75	17.5
JTME-990222	Econometrics	Lecture	2.5	14	75	17.5
JTME-990242	Meta-Analysis	Lecture	2.5	14	75	17.5

Module Name **Skills**	*Module Code* **JTSK-Skills**	*ECTS* **15**
Pre-requisites ☐Corresponding CHOICE Modules ☒None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☐Year 3 (CAREER) ☒Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

This module covers a wide range of professional, academic and interpersonal skills that you will acquire in workshops offered by faculty, staff (including Career Services Center, Counseling Center), external instructors and trainers. You will be introduced to general academic skills, such as access to online resources, scientific and professional writing, different learning strategies, ethics and academic integrity. You will also learn professional competencies such as time and stress management, team work, communication skills, presentation training and entrepreneurial skills. Furthermore, coaching and workshops on career orientation, personal development and application tactics are part of this module.

Module Aims

This module aims in equipping students with key qualifications necessary for both an academic and a professional career. It fosters employability and supports students in developing the skills necessary to get access to and to compete effectively in an international job market.

Intended Learning Outcomes (ILOs)

- Be competent in scholarly writing
- Understand and adhere to ethical principles of academic conduct
- Display relevant practical skills
- Display rhetoric and presentation skills
- Display interpersonal skills
- Display management skills
- Understand job application processes and how to organize the job search

Module Function (in Study Programs and within the Curricular Structure)

- One of four Jacobs Track (General Education) modules: Methods/Mathematics, **Skills**, Triangle Area, Language
- Mandatory for **all** undergraduate study programs

Module Components and Types **(for individual Study Program Requirements see Mandatory Course Plan)**

Course Nr.	**Course Name**	**Type**	**ECTS**	**No. of Sessions** (per Semester)	**Duration of Session** (min)	**Total** (hours)
JTSK-320111	Programming in C I	Lecture	2.5	14	75	17.5
JTSK-320112	Programming in C II	Lecture	2.5	14	75	17.5
JTSK-350111	Programming in Python	Lecture	2.5	14	75	17.5
JTSK-350112	Advanced Programming in Python	Lecture	2.5	14	75	17.5
JTSK-990100	Academic and Professional Skills	Lecture	2.5	14	75	17.5
JTSK-990103	Scientific and Experimental Skills	Lecture	2.5	14	75	17.5
JTSK-990104	Advanced Scientific and Experimental Skills	Lecture	2.5	14	75	17.5
JTSK-990110	Advanced Academic and Professional Skills	Lecture	2.5	14	75	17.5

Module Data Sheet

Module Name **Triangle Area**	*Module Code* **JTTA-TriArea**	*ECTS* **15**
Pre-requisites ☐ Corresponding CHOICE Modules ☒ None	*Module Contact Person* See overview on page 3	*Level (type)* ☐Year 1 (CHOICE) ☐Year 2 (CORE) ☐Year 3 (CAREER) ☒Any (Jacobs Track)
Frequency Every year	*Duration* 1 year	

Module Description / Content

One of the key features of undergraduate education at Jacobs University is the problem-oriented trans-disciplinary approach. The triangle courses provide students across all disciplines with general foundations as well as an overview of current global challenges in the three areas business, technology and societal context. There will be general lectures that present the major challenges and activities in applied research in business, technology and societal context. Additionally, you will be able to select generally accessible courses within the three areas that will enrich your personal and professional profile.

Module Aims

This module aims in opening your mind to trans-disciplinary problem solving and to foster critical thinking. It aims at providing an insight into fields outside your core discipline and at enabling successful communication with professionals in other areas. It also offers specific knowledge in business, technology and societal context that is relevant for any graduate in order to become an informed and responsible global citizen.

Intended Learning Outcomes (ILOs)

Alongside knowledge on certain topics from the three areas business, technology and societal context, students will acquire transferable and key skills in this module.

Module Function (in Study Programs and within the Curricular Structure)

- One of four Jacobs Track (General Education) modules: Methods/Mathematics, Skills, **Triangle Area**, Language
- Mandatory for **all** undergraduate study programs

Module Components and Types (example offerings that can vary from year to year)

Course Nr.	Course Name	Type	ECTS	No. of Sessions (per Sem.)	Duration of Session (min)	Total (hours)
JTTE-020006	How things work	Lecture	2.5	14	75	17.5
JTTE-020003	Topics in Modern Computer Science	Lecture	2.5	14	75	17.5
JTTE-020009	Hormones and Behavior (Intersession)	Lecture	2.5	14	75	17.5
JTSC-020008	Global Health - historical context and future challenges	Lecture	2.5	14	75	17.5
JTBU-020008	Design Thinking (Intersession)	Seminar	2.5	14	75	17.5
JTBU-020059	Biotechnology: From Science to Business	Lecture	2.5	14	75	17.5
JTBU-020003	Big Data: Big Boon and Big Brother!?	Lecture	2.5	14	75	17.5
JTSC-020009	Extreme Natural Hazards, Disaster Risks & Societal Implications	Lecture	2.5	14	75	17.5
JTBU-020006	Occupational health promotion	Lecture	2.5	14	75	17.5
JTTE-020084	Off-Shore Wind Energy (Intersession)	Lecture	2.5	14	75	17.5
JTTE-020008	Coding for Entrepreneurs (Intersession)	Lecture	2.5	14	75	17.5
JTBU-020007	Digital Entrepreneurship (Intersession)	Lecture	2.5	14	75	17.5
JTSC-040121	Ethics in Science and Technology	Lecture	2.5	14	75	17.5
JTSC-020010	War and Culture (Intersession)	Lecture	2.5	14	75	17.5
JTSC-020004	Human Trafficking: An International Perspective(Intersession)	Seminar	2.5	14	75	17.5
JTBU-080201	SAP Lab (Intersession)	Lecture	2.5	14	75	17.5
JTTE-020010	Global Existential Risks	Lecture	2.5	14	75	17.5
JTTE-020004	Molecular Detection - Potential, Benefit & Challenge for Society	Lecture	2.5	14	75	17.5
JTBU-020009	Information Economics (Intersession)	Lecture	2.5	14	75	17.5
JTBU-020010	Energy Efficiency in Production	Lecture	2.5	14	75	17.5
JTBU-020011	Successful Project Management	Lecture	2.5	14	75	17.5
JTSC-020002	Free Expression, Humor and Terror (Intersession)	Lecture	2.5	14	75	17.5
JTSC-020011	History, Memory and Memory Politics	Lecture	2.5	14	75	17.5
JTSC-970271	Radical Perspective in Literature – Anarchy (Intersession)	Lecture	2.5	14	75	17.5

Major Minor Combinations
Study Year 2018/2019

	Minor	Health					Mobility					Diversity				
		BCCB	MCCB	Chem	EES	Phys	Math	CS	IMS	ECE	IEM	GEM	IBA	IRPH	ISS	Psych
Health	BCCB	-	x	x	x	x		x	x	x		x	x		x	x
	MCCB	x	-	x	x	x			x	x	x	x	x	x		x
	Chem	x	x	-	x	x	x			x	x	x	x	x		x
	EES	x	x	x	-	x	x	x	x		x	x	x	x	x	
	Phys	x	x	x	x	-	x	x		x		x	x		x	x
Mobility	Math	x	x	x	x	x	-	x	x	x	x	x	x	x	x	x
	CS	x	x	x	x	x	x	-	x	x	x	x	x	x		x
	IMS	x	x	x	x	x	x	x	-	x	x	x	x	x	x	x
	ECE	x	x	x		x	x	x	x	-	x	x	x	x	x	
	IEM	x	x	x	x	x	x	x	x	x	-	x	x		x	x
Diversity	GEM	x	x	x	x	x		x		x	x	-	x	x	x	x
	IBA	x	x	x	x	x		x		x	x	x	-	x	x	x
	IRPH	x	x	x	x	x	x	x	x	x		x	x	-	x	x
	ISS	x	x	x	x	x	x		x	x	x	x	x	x	-	x
	Psych	x	x	x		x	x	x	x		x	x	x	x	x	-

1) See separate regulations for module combintations between GEM and IBA.

2) For minors from the Health area, as well as GEM and IBA, the selection of accessible CORE modules (for minors) may be less than 3, because students may have attended only one of the two associated CHOICE modules.