Please note that this English version of the study and examination regulations is nothing more than an aid to orientation. Solely the German version is legally binding.

Study Regulations for the Bachelor's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics at the Free University of Berlin and the Faculty of Charité University Medicine Berlin (Charité)

Preamble

On the basis of § 14 Par. 1 No. 2 of the Partial Basic Regulations (Trial Model) of the Free University of Berlin of 27 October 1998 (FU Announcements No. 24/1998) and §§ 71 Par. 1 No. 1 and 74 Par. 1, 4 of the Berlin University Medicine Law in the version of notification of the new version 26 July 2011 (GVBl. [Law and Ordinance Gazette] p. 378) and § 9 Par. 1 No. 1 of the Berlin University Medicine Law of 5 December 2005 (GVBl. p. 739), the Joint Commission on Bioinformatics established by the Faculty of Mathematics and Informatics of the Free University of Berlin, the Faculty of Biology, Chemistry and Pharmaceutics of the Free University of Berlin and the Faculty of Charité University Medicine Berlin (Charité) issued, on 10 July 2012, the following Study Regulations for the Bachelor's Program in Bioinformatics:[1]

Table of Contents

§ 1 Scope of application

§ 2 Qualification objectives

§ 3 Study contents

§ 4 Structure and outline

§ 5 Student advisory and course advisory service

§ 6 Forms of teaching and learning

§ 7 General professional skills

§ 8 Studies abroad

§ 9 Entry into force and transitional regulation

Annexes

Annex 1: Module descriptions

Annex 2: Example of course of studies

[1] The Senate Administration responsible for higher education took cognizance of the Study Regulations on 21 August 2012. The term of validity for the regulations ends on 30 September 2013.

§ 1
Scope of application

These regulations stipulate the objective, contents and structure of the Bachelor's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics of the Free University of Berlin and Faculty of Charité University Medicine Berlin (Bachelor's Program) based on the Examination Regulations for the Bachelor's Program of 10 July 2012.

§ 2
Qualification objectives

(1) Graduates of the Bachelor's degree course have a broad-based scientific qualification in the fields of study informatics, mathematics and statistics as well as biology/chemistry/biochemistry. They can interrelate the study contents of the different fields of knowledge and are in particular capable of applying mathematical and informatic methods in the field of life sciences. Graduates are capable of grasping and analyzing biological and medical problems. They are capable of applying the methods and knowledge of the field of bioinformatics as well as developing new methods and deriving new knowledge in the field.

(2) Graduates are capable of critical assessments as well as responsible and gender-sensitive procedures. They demonstrate excellent communication and cooperation skills and are able to document and present their results clearly.

(3) Graduates are qualified for higher level studies and they are prepared for work in different professional fields. Examples of suitable professional activities would be contributions to research and development work in the fields of pharmaceutics, medicine or bioengineering in corresponding industrial, scientific or administrative facilities.

§ 3
Study contents

(1) The core subject bioinformatics covers the fields of study informatics, mathematics and statistics as well as biology/chemistry/biochemistry.

(2) The field of study informatics comprises basic education in informatics and imparts basic knowledge and skills in programming, computer systems, algorithms and data structures. An overview of methods and operations in bioinformatics is also imparted.

(3) The field of study mathematics and statistics imparts basic knowledge and skills in analysis (differentiation, integration, normal differential equations), linear algebra (matrix calculation, eigenvalues, principle axis transformation), in statistics (elementary probability theory, basic statistical terminology, decision theories, test theories, estimation theories, linear statistical methods) and in computer-oriented mathematics (number representation, stability and condition, efficiency and complexity terminology, numeric linear algebra, numeric quadrature and integration).

(4) The field of study biology/chemistry/biochemistry serves to impart a basic knowledge of the following sub-areas of biology: Cell functions, their molecular basis and changes caused by viral infections and tumors, genetics and physiology/neurobiology (functional mechanisms of essential neuronal and vegetative systems: central nervous system, vegetative nervous system, heart, respiration, kidneys; principles of data processing, regulation, behavior and learning). Also covered is a basic knowledge of chemistry (atomic structure and the periodic system, molecules, bonds, chemical reactions and equilibria, reaction kinetics, energy and thermodynamics). The course of studies also imparts a basic knowledge of biochemistry: Structure and function of biologically relevant macromolecules including experimental methods, intermediary metabolic and regulatory mechanisms, cellular biochemistry and signal transduction.

§ 4
Structure and outline

(1) The Bachelor's degree course comprises

1. The core subject encompassing 150 credit points (CP) including the Bachelor's Thesis with oral presentation with 12 CP and

2. Modules from the field of study General Professional Skills (Ger.: ABV) encompassing 30 CP.

(2) The core subject bioinformatics comprises, besides the Bachelor's Thesis with oral presentation with a scope of 12 CP, the following parts with a total of 138 CP:

1. A mandatory part with a scope of 131 CP, covering the fields of study
   a) Informatics with 42 CP
   b) Mathematics and statistics with 40 CP
   c) Biology/chemistry/biochemistry with 49 CP and
2. An elective part with a scope of 7 CP.

(3) In the field of study informatics, with 42 CP, the following modules must be completed:

1. Informatics A (8 CP),
2. Informatics B (8 CP),
3. Algorithms and data structures (6 CP),
4. Algorithms and data structures - internship (6 CP) and
5. Algorithmic bioinformatics (14 CP).

(4) In the field of study mathematics and statistics, with 40 CP, the following modules must be completed:

1. Mathematics for bioinformaticians I (8 CP),
2. Mathematics for bioinformaticians II (8 CP),
3. Computer-oriented mathematics I (5 CP),
4. Computer-oriented mathematics II (5 CP),
5. Statistics for life sciences I (6 CP) and
6. Statistics for life sciences II (8 CP).

(5) In the field of study biology/chemistry/biochemistry, with 49 CP, the following modules must be completed:

1. General chemistry (7 CP),
2. General biology (6 CP),
3. Molecular biology and biochemistry I (6 CP),
4. Molecular biology and biochemistry II (6 CP),
5. Molecular biology and biochemistry III (6 CP),
6. Genetics and genome research (5 CP),
7. Medical physiology (8 CP) and
8. Neurobiology (5 CP).

(6) In the elective part with a scope of 7 CP, the basic education in the mandatory part is to be expanded and supplemented with in-depth specialist knowledge in one of the three fields of study informatics as per Par. 3, mathematics and statistics as per Par. 4 or biology/chemistry/biochemistry as per Par. 5. This part may include modules from the offerings of the bachelor's courses of studies informatics, mathematics, biochemistry and biology. The modules "Database systems" and "Basic principles of theoretical informatics" from the Bachelor's degree course informatics of the Faculty of Mathematics and Informatics of the Free University of Berlin.

(7) The modules of the elective part and credit points earned therein must not coincide with modules and credit points as per Pars. 2 - 5. The relevant regulations apply to the respective requirements and procedures for earning credit points. The Joint Commission on Bioinformatics determines which modules the students can select from with the announcement of course offerings for the respective semester. This decision is communicated to the students in due time an in an appropriate form.

(8) The module descriptions in Annex 1 provide information on content, qualification objectives, forms of teaching and learning, time requirements, forms of active participation, normal duration and frequency of offering for the modules of the core subject without the elective part as well as for the module "Software project management". For the modules "Informatics A" and "Informatics B", reference is made to the Study Regulations of the Faculty of Mathematics and Informatics of the Free University of Berlin for the Bachelor's degree course with core subject informatics, for the module offering with either 60 or 30 credit points in informatics as adjuncts to other courses of study. For the modules "Computer-oriented mathematics I" and "Computer-oriented mathematics II", reference is made to the Study Regulations for the Bachelor's Degree Course in Mathematics of the Faculty of Mathematics and Informatics of the Free University of Berlin. Reference is made to the respective Study Regulations applying to the modules of the elective part.

§ 5
Student advisory and course advisory service

The general student advisory service is provided by the Central Student Advisory and Psychological Advisory Office of the Free University of Berlin. The course advisory service is provided as needed by one of the full-time instructors.

§ 6
Forms of teaching and learning

(1) Lectures: The contents of each course are presented and explained by the instructor in lectures. The instructors impart teaching content accompanied by references to specialist literature and encourage students to work independently and think critically.

(2) Exercises: Exercises in small workgroups normally accompany the lectures. In the workgroups, the lecture contents are repeated in outline and practical application of the materials learned is realized based on assigned exercises.

(3) Seminars: Seminars serve the purpose of exemplary familiarization with contents, theories and methods of bioinformatics based on clearly defined thematic areas. Students formulate, present and discuss teaching content under the guidance of an instructor and based on specialist literature and empirical knowledge.

(4) Internships: Laboratory internships contribute to an understanding of biological and chemical processes. Students gain insights into the prerequisites for practical data collection. Software and programming internships are also offered in which students learn to use software in everyday bioinformatic practice and upgrade their programming skills.

§ 7
General professional skills

(1) In the field of study general professional skills (ABV), students supplement their specialist scientific studies with broader, general scientific content and acquisition of additional professional competencies to prepare them to assume positions after their studies that are adequate in terms of their qualification and may also be in an international setting.

(2) The modules of the field of study ABV are described in the Study Regulations and Examination Regulations for the Field of Study General Professional Skills in Bachelor's Degree Courses at the Free University of Berlin (StO-ABV and PO-ABV) as well as in these study and examination regulations.

(3) The field of study ABV includes a mandatory professional internship as well as different areas of competence covering professionally relevant subject matter. The following modules must be completed:

1. "Software project management" (10 CP) from the competence area Subject-Related Additional Qualifications,
2. Freely selectable modules with a total scope of 10 CP from other competence areas and
3. Professional internship (10 CP)

(4) The mandatory professional internship with a scope of 10 CP must be done in a suitable business or a scientific facility outside of the university. The objective is to provide students with insights into potential professions and fields of work and the demands of professional practice. internship positions must be approved by the Examination Committee or the internship advisor designated by the Committee. The internship advisor will provide advice related to the internship and support in the search for an internship position in cooperation with the Career Service.

(5) The modules as per Par. 3 and credit points earned therein must not coincide with modules and credit points of the core subject as per § 4 Pars. 2 - 5.

§ 8
Studies abroad

(1) it is recommended that students participate in studies abroad. Within the framework of study abroad, study and examination performances (credit points) are acquired that count towards the Bachelor's course of studies.

(2) Study abroad be preceded by conclusion of an agreement between the student, the Chairman of the Examination Committee and the competent office of the relevant foreign scientific institution regarding the duration of the period of studies abroad, the scope of performances expected during the studies abroad, which are to be equivalent to the performance items in the Bachelor's Program, and the credit points to be assigned to these performance items. Performance items completed as per the agreement are then credited accordingly.

(3) The scholarship advisor will help students plan and prepare for studies abroad.

(4) The fourth advanced semester is recommended as a suitable time for a period of study abroad.

(5) It is also possible to complete the professional internship during a stay abroad. The Career Service and the internship advisor designated by the Joint Commission on Bioinformatics will provide detailed advice.

§ 9
Entry into force and transitional regulation

(1) These regulations come into form on the day following their publication in the Official Gazette of the Free University of Berlin (FU Announcements).

(2) At the same time, the Study Regulations for the Bachelor's Program of 2 June 2010 (FU Announcements No. 32/2010, p. 610) become invalid.

(3) These regulations apply to students who matriculate following their entry into force for the Bachelor's Program at the Free University of Berlin. Students who matriculated for the course of studies at the Free University of Berlin before entry into force of these regulations continue their course of studies based on the Study Regulations as per Par. 2 unless they apply to the Examination Committee to continue based on the present regulations. In the latter case, on the occasion of the transcription resulting from said application, the Examination Committee shall make a decision regarding the scope of modules begun or completed when the application was made or regarding crediting of these performance items within the framework of these regulations, whereby the principles of legitimate expectation and equal opportunity are respected. The transcription cannot be revised.

(4) The opportunity to complete the course of studies according to the Study Regulations as per Par. 2 is to be upheld until the end of the 2015 summer semester.

Annex 1: Module descriptions

Explanations:

The following module descriptions refer to the module of the Bachelor's degree course unless reference is made to other regulations

- Designation of module
- Content and qualification objectives of module
- Teaching and learning forms of module
- Estimated student effort requirement to complete the module
- Forms of active participation
- Normal duration of module
- Applicability of the module to other courses of study

The information on time requirements refer in particular to

- Regular participation during on-campus study period
- Time required for completion of active participation tasks (study performance)
- Time for independent preparation and follow-up
- The time indicated for examination preparation includes the time required for the examination itself.

The information on time requirements for self-study (including preparation and follow-up, examination preparations, etc.) are guideline values to help students organize the time required for module-related work.

The information on work effort requirements corresponds to the number of credit points assigned to each module as the unit of measure for student work effort as an approximation of the work required to complete the module successfully.

The required study performance (active participation), as well as regular participation in the teaching and learning forms and successful completion of the examination requirements of a module, are the preconditions for acquiring the credit points assigned to each module.

Annex 1 to the Study Regulations of the Bachelor's Program lists the number of credit points and other examination-related information for each module.

I. Fields of study in the mandatory part of the core subject:

1. Field of study informatics

For the modules "Informatics A" and "Informatics B", reference is made to the Study Regulations of the Faculty of Mathematics and Informatics of the Free University of Berlin for the Bachelor's degree course with core subject informatics, for the module offering with either 60 or 30 credit points in informatics as adjuncts to other courses of study.

Module: Algorithms and data structures				
University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have acquired basic techniques of sequence analysis. They have acquired a level of competence that is adequate in terms of analyzing the techniques and applying them to problems in bioinformatics.				
Contents: The lectures address the following contents: Exact and approximative string matching, dynamic programming and scoring schemata, finite automata and formal languages, pairwise and multiple sequence alignment, multiples string matching, basic principles of Markov chains and hidden Markov models, rapid-search algorithms for sequence databases. In the exercises, the lecture contents are considered in depth and analytical and proof techniques are practiced.				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2	Participation in discussion	On-campus lecture Lecture preparation and follow-up	30 30
Exercise	2	Successful work on assigned exercises	On-campus exercise Exercise preparation and follow-up Examination preparation and examination	30 50 40
Course language		German		
Mandatory regular participation		Lecture: Participation recommended, exercise: yes		
Total working time requirement		180 hours		6 CP
Duration of module		one semester		
Frequency of course offering		each winter semester		
Applicability		Bachelor's degree course in bioinformatics		

Module: Algorithms and data structures - internship				
University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute				
Persons responsible for module: Module Instructors				
Admission requirements: none				
Qualification objectives: Students have acquired basic practical techniques of sequence analysis and imperative programming. They have acquired competence in implementing, commenting on and testing algorithms of sequence analysis as programs.				
Contents: The internship initially provides an introduction to programming tools and the program language used. This is followed by explanation and imparting of programming techniques based on the algorithms discussed in the lecture "Algorithms and Data Structures".				
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Internship	4	Successful creation of programs	On-campus time Preparation and follow-up Examination preparation and examination	60 80 40
Course language		German		
Mandatory regular participation		yes		

Total working time requirement	180	6 CP
Duration of module	one semester	
Frequency of course offering	each winter semester	
Applicability	Bachelor's degree course in bioinformatics	

Module: Algorithmic bioinformatics	
University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute	
Persons responsible for module: Module Instructors	
Admission requirements: none	
Qualification objectives: Students have a basic knowledge and understanding of algorithms of modern bioinformatics in theory and practice.	
Contents: • Advanced algorithms for pairwise and multiple sequence alignment • Practical database search algorithms and filtering methods • Statistical significance of sequence similarity and results of database searches • Statistical signal analysis using (hidden) Markov models, applications in pattern searches and gene prediction • Algorithms for reconstruction of phylogenetic trees • Algorithms for mapping and sequencing of genomes • Algorithms for RNA structure prediction and RNA comparison • Models and algorithms for protein structure analysis • Evaluation of data from current technologies of functional genomics	

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4	Participation in discussion	On-campus lecture Lecture preparation and follow-up	60 80
Exercise	2	Written work on assigned exercises	On-campus exercise Exercise preparation and follow-up	30 80
Internship	2	Successful implementation of programming tasks; final presentation of internship	On-campus internship Internship preparation and follow-up Examination preparation and examination	30 60 80

Course language	German	
Mandatory regular participation	Lecture: Participation recommended, exercise and internship: yes	
Total working time requirement	420 hours	14 CP
Duration of module	one semester	
Frequency of course offering	each winter semester	
Applicability	Bachelor's degree course in bioinformatics	

2. Field of study mathematics and statistics

Module: Mathematics for bioinformaticians I	
University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute	
Persons responsible for module: Module Instructors	
Admission requirements: none	
Qualification objectives: Students have gained insights into the basis concepts of logic, set theory and discrete mathematics. They are capable of abstraction, expressing facts mathematically and working with formal mathematical expressions. They are familiar with various proof techniques. They have a well-founded knowledge of linear algebra and are able to recognize application problems that can be solved with it, describe the problems in mathematical terms and apply suitable methods to solve them.	
Contents: • Propositional logic and mathematical proof techniques • Set theory: Sets, relations, equivalence and order relations, • Functions • Natural numbers and complete induction, countability • Combinatorial analysis: Counting principles, binomial coefficients, recursion equations, pigeonhole principle • Linear algebra: Bodies, vector space, base and dimension; linear transformation, • Matrix and rank; Gaussian elimination and linear systems of equations; • Determinants, eigenvalues and eigenvectors; Euclidean vector spaces and orthonormalization; principle axis transformation;	

- Applications of linear algebra in affine geometry

Forms of teaching and learning	On-campus studies (hours per semester week = SWH)	Forms of active participation	Work effort (hours)
Lecture	4		On-campus lecture 60 Lecture preparation and follow-up 60
Exercise	2	Written assigned exercises	30 On-campus exercise 60 Exercise preparation and follow-up 30 Examination preparation and examination
Course language		German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		240 hours	8 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Bachelor's degree course in bioinformatics	

Module: Mathematics for bioinformaticians II

University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: Students are familiar with the structure of numerical ranges (from natural to complex numbers). They have a knowledge of convergence of sequences, series and functions and are capable of using this knowledge to gain a deeper understanding of differential and integral calculus. They are capable of identifying suitable application problems and solving them using differential and integral calculus.

Contents:

- Structure of numerical ranges from natural to complex numbers, completeness property of real numbers
- Polynomials, zeroing and rational functions, polynomial interpolation
- Exponential and logarithm function, trigonometric functions
- Convergence of sequences and series, convergence and functional consistency,
- Differential calculus: Derivation of a function, its interpretation and applications
- Integral calculus: Definite and indefinite integral, fundamental theorem of differential and integral calculus, applications
- Taylor series
- Basic terminology of differential calculus with multiple variables: Partial derivative, gradient, Jacobi matrix
- Solving simple differential equations

Forms of teaching and learning	On-campus studies (hours per semester week = SWH)	Forms of active participation	Work effort (hours)
Lecture	4		On-campus lecture 60 Preparation and follow-up 60
Exercise	2	Written assigned exercises	On-campus exercise 30 Preparation and follow-up 60 Examination preparation and examination 30
Course language		German	
Mandatory regular participation		Lecture: Participation recommended, exercise: yes	
Total working time requirement		240 hours	8 CP
Duration of module		one semester	
Frequency of course offering		each summer semester	
Applicability		Bachelor's degree course in bioinformatics	

For the modules "Computer-oriented mathematics I" and "Computer-oriented mathematics II", reference is made to the Study Regulations for the Bachelor's Degree Course in Mathematics of the Faculty of Mathematics and Informatics of the Free University of Berlin.

Module: Statistics for life sciences I

University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: Students have a basic knowledge of probability theory and statistics and are familiar with statistical modeling.

Contents:

- Data visualization
- Frequency, mean and scatter
- Random experiments, combinatorial analysis
- Random variables, distribution and density, expected value and variance
- Statistical models and likelihood
- Maximum likelihood estimation method
- Special discrete and continuous distributions
- Test theory and significance, multiple testing
- Law of large numbers
- Central limit theorem
- Poisson approximation
- Applications in bioinformatics such as significance of sequence alignment, genetic mapping

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2		On-campus lecture Lecture preparation and follow-up	30 30
Exercise	2	Written assigned exercises and programming tasks	On-campus exercise Exercise preparation and follow-up Examination preparation and examination	30 60 30

Course language	German	
Mandatory regular participation	Lecture: Participation recommended, exercise: yes	
Total working time requirement	180 hours	6 CP
Duration of module	one semester	
Frequency of course offering	each winter semester	
Applicability	Bachelor's degree course in bioinformatics	

Module: Statistics for life sciences II	
University/Faculty/Institute: Free University of Berlin and Faculty of Charité – University Medicine Berlin	
Persons responsible for module: Module Instructors	
Admission requirements: none	
Qualification objectives: Students have a knowledge of statistical methods in applications typical of bioinformatics and are capable of algorithmic application of statistics.	

Contents:

- Linear and non-linear regression
- Variance analysis
- Markov chains
- Bayes statistics and Markov chain Monte Carlo methods
- Expectation maximization algorithm
- Clustering and classification
- Statistical learning methods
- Applications in bioinformatics such as gene prediction, phylogeny, gene expression analysis

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4		On-campus lecture Lecture preparation and follow-up	60 60
Exercise	2	Written assigned exercises, analysis of simple datasets	On-campus exercise Exercise preparation and follow-up Examination preparation and examination	30 60 30

Course language	German	
Mandatory regular participation	Lecture: Participation recommended, exercise: yes	
Total working time requirement	240 hours	8 CP
Duration of module	one semester	
Frequency of course offering	each summer semester	
Applicability	Bachelor's degree course in bioinformatics	

3. Field of study biology/chemistry/biochemistry

Module: General chemistry

University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Institute of Chemistry and Biochemistry

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: The students are sufficiently knowledgeable regarding the basic principles of chemistry and issues in chemistry relevant to biology / medicine. The grasp the basic laws and are familiar with chemical terminology and chemical formula expressions. They understand the meaning of chemical relationships in organisms, and thus in biology and medicine, and have mastered simple chemical laboratory techniques and rules.

Contents:

- Inorganic and general chemistry: Atomic structure, periodic system of the elements, medically / biologically relevant elements, chemical bonds (theories, boundaries, structural evidence), material states, material in interaction with thermal, electrical and radiation energy, chemical reactions and chemical equilibrium (law of mass action), acids and bases / buffer systems, salts (ions, solubility product, precipitation reactions), redox processes (oxidation and reduction), equilibria in multiphase systems (heterogenous equilibria), energetics (principles of thermodynamics) and kinetics of chemical reactions, metal complexes
- Organic chemistry: Structure and reaction types or organic compounds, structural formulae and nomenclature, hydrocarbons (aliphates and carbocycles, aromatic compounds), heterocycles, functional groups (amines, alcohols, aldehydes and ketones, carboxylic acids and carboxylic acid derivatives), spatial structure of organic molecules and stereoisomery
- Natural substances: Amino acids/peptides/proteins, saccharides (carbohydrates), lipids
- Internship: Practical experience in implementation and critical assessment of simple chemical experiments, chemical lab techniques (titration, pH measurement, substance separation), exercises involving chemical behavior of the substance classes presented, analytical detection reactions

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	4		On-campus lecture Preparation and follow-up Lecture	60 30
Internship	2	Assigned exercises, practical laboratory paper, written test	On-campus internship Internship preparation and follow-up Examination preparation and examination	30 45 45
Course language		German		
Mandatory regular participation		Lecture: Participation recommended, internship: yes		
Total working time requirement		210 hours		7 CP
Duration of module		one semester		
Frequency of course offering		each winter semester		
Applicability		Bachelor's degree course in bioinformatics		

Module: General biology

University/Faculty/Institute: Free University of Berlin/ Faculty of BCP/ Biological Institute

Currently responsible person(s): Module Instructors

Admission requirements: none

Qualification objectives: Students have a general knowledge of the plant cell, knowledge of plant morphology and basic plant development processes, physiological processes and plant diversity. They have a general knowledge of zoology. They are familiar with the essential organizational forms and their phylogenetic relationships in animals.

Contents: Lecture on botany and biodiversity:
Structure of the plant cell, principles of substance and energy metabolism, transport and development processes in plants, structural and functional relationships in seedbearing plants, characteristics, structures and interrelationships of the most important plant taxa, plant biodiversity.
Lecture on zoology and evolution:
Evolution as a historical process, diversity and classification of the most important animal groups and their characteristics, basic body plans and functions.

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Differentiated working time requirement** (hours)

Lecture A	2	Multiple choice test or interview. The multiple choice test or interview can also be done in electronic form.	On-campus time Preparation and follow-up	60 120
Lecture B	2			
Course language		German		
Mandatory regular participation		Participation recommended		
Total working time requirement		180 hours		6 CP
Duration of module		one semester		
Frequency of course offering		each winter semester		
Applicability		Bachelor's degree course in bioinformatics		

Module: Molecular biology and biochemistry I

University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Institute of Chemistry and Biochemistry

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: Students are familiar with the formation process and molecular structure of the most important cellular macromolecules and substance classes as well as their biological context. The focus is on a basic chemical understanding of them molecular structure of biomolecules as required in bioinformatic work.

Contents:

- Chemical and cytobiological principles
- Nucleic acids: Building blocks, structure of DNA and RNA, replication and transcription, protein biosynthesis, regulation of gene expression, genetic engineering methods
- Proteins: Amino acids and peptides, protein structure and protein folding, proteome, posttranslational modifications, methods of protein research
- Enzymes: Concepts and kinetics
- Carbohydrates, lipids and biomembranes
- Introduction to metabolism and metabolic regulation

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2		On-campus lecture	30
Exercise	2	Written assigned exercises; successful participation in written tests of learning success	Lecture preparation and follow-up On-campus exercise Exercise preparation and follow-up Examination and examination preparation	45 30 45 30
Course language		German		
Mandatory regular participation		Lecture: Participation recommended, exercise: yes		
Total working time requirement		180 hours		6 CP
Duration of module		one semester		
Frequency of course offering		each summer semester		
Applicability		Bachelor's degree course in bioinformatics		

Module: Molecular biology and biochemistry II

University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Institute of Chemistry and Biochemistry

Persons responsible for module: Module Instructors

Admission requirements: Successful completion of the module "Molecular biology and biochemistry I"

Qualification objectives: Students have a basic understanding of the following fields of knowledge:
- Interaction of anatomical, cytobiological and biochemical principles of gene expression and energy metabolism in mammals
- Regulation of gene expression at the levels of chromatin structure, transcription, processing and modification in mammals
- Cell morphology, mobility and adhesion in mammalian organ structures

Contents:

- Structural principles of nucleic acids and proteins
- Chaperone proteins and formation of biologically correct protein structures
- Principles of structure prediction
- Genome components and quantitative composition
- Remodeling of chromatin into transcribable and non-transcribable conformations
- Epigenetic histone code, CpG islands and DNA methylation
- Modular structure of promoters
- Protein: DNA interactions and structural domains in qualitative and quantitative transcription regulation
- snRNP and RNA processing, self-splicing introns, RNA editing
- Nucleus-cytoplasm, cyotoplasm-nucleus transport

- Anatomical, cytobiological and biochemical principles of generation of chemical reaction energy
- Protein degradation and autophagy
- Cytoskeleton, cell motility and adhesion

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2		On-campus lecture 30 Lecture preparation and follow-up 35
Exercise	2	Practical exercises, protocols, participation in written tests of learning success	On-campus exercise 30 Exercise preparation and follow-up 40 Examination and examination preparation 45

Course language	German	
Mandatory regular participation	Lecture: Participation recommended, exercise: yes	
Total working time requirement	180 hours	6 CP
Duration of module	one semester	
Frequency of course offering	each summer semester	
Applicability	Bachelor's degree course in bioinformatics	

Module: Molecular biology and biochemistry III

University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Institute of Chemistry and Biochemistry

Persons responsible for module: Module Instructors

Admission requirements: Successful completion of the module "Molecular biology and biochemistry I"

Qualification objectives: The grasp of principles achieved in Molecular biology and biochemistry II is placed within the context of complex biological systems. The systems:

- An understanding of receptor-mediated signal transduction and regulation of cell cycle and cell death.
- An understanding of molecular biological and cytobiological properties of metastasizing tumor cells
- An understanding of interactions of pathogens, host cells and immune system
- An understanding of the principles of DNA medicine

Contents:

- Growth factors, receptors and signal transduction in regulations of cell cycle and cell death
- Basic principles of immunology: congenital, acquired immune defenses
- Antigen-presenting cells, effector cells
- PAMP and DAMP concepts of antigen processing in infections and tumor combating
- DNA medicine and gene therapy

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	2		On-campus lecture 30 Lecture preparation and follow-up 35
Exercise	2	Practical exercises, protocols, participation in written tests of learning success	On-campus exercise 30 Exercise preparation and follow-up 40 Examination and examination preparation 45

Course language	German	
Mandatory regular participation	Lecture: Participation recommended, exercise: yes	
Total working time requirement	180 hours	6 CP
Duration of module	one semester	
Frequency of course offering	each winter semester	
Applicability	Bachelor's degree course in bioinformatics	

Module: Genetics and genome research

University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Biological Institute

Persons responsible for module: Module Instructors

Admission requirements: Successful completion of the module "Molecular biology and biochemistry II"

Qualification objectives: Students grasp the basic principles of genetics and genome research as important fields of activity in bioinformatics.

Contents:

- Chromosomes and chromosome aberrations
- Monogenic diseases and genealogical trees
- Population genetics
- Multifactorial diseases
- Gene mapping of monogenic and complex diseases
- Identification of disease genes and genetic risk factors
- Pathomechanisms of hereditary diseases
- Animal models
- Genome organization
- Genome evolution
- Tumor genetics
- Gene expression analyses
- Model organisms
- Genome projects in humans and model organisms

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	2		On-campus lecture Lecture preparation and follow-up	30 30
Exercise	1	Practical exercises, protocols, participation in written tests of learning success	On-campus exercise Exercise preparation and follow-up Examination and examination preparation	15 45 30
Course language		German		
Mandatory regular participation		Lecture: Participation recommended, exercise: yes		
Total working time requirement		150 hours		5 CP
Duration of module		one semester		
Frequency of course offering		each summer semester		
Applicability		Bachelor's degree course in bioinformatics		

Module: Medical physiology

University/Faculty/Institute: Free University of Berlin/Faculty of Charité – University Medicine Berlin/Institute for Physiology and Institute for Clinical Physiology

Persons responsible for module: Module Instructors

Admission requirements: none

Qualification objectives: Students are familiar with and understand the principles of the function and regulation of vegetative organ systems. This includes an understanding of the functional principles of biological regulation systems and a knowledge of investigation methods and principles of neurovegetative regulation of the heart, circulation, respiration, thermal balance and kidneys.

Contents: Basic principles of medical regulatory technology and biological regulatory systems. Regulation of vegetative organ systems by the vegetative nervous system.

- Heart: Basic principles of cardiac excitation physiology (resting potential, action potential, excitation propagation), causal relationships between electrical and mechanical processes. Clinical examination methods
- Circulatory system: Physical and biological principles (pressure / flow / resistance), regulation, substance exchange
- Respiration: Principles of ventilation and gas exchange in the lungs, respiratory regulation
- Thermal balance: Production, transport and delivery of heat, thermoregulation
- Renal function and regulation of plasma volume and osmolarity

Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)	
Lecture	1.5		On-campus lecture Lecture preparation and follow-up	23 27
Seminar	2	Discussion contributions, oral presentation	On-campus seminar Seminar preparation and follow-up	30 50
Internship	2	Practical exercises, protocols	On-campus internship Preparation and follow-up	30 50

			Examination and examination preparation 30
Course language		German	
Mandatory regular participation		Lecture: Participation recommended, internship: yes	
Total working time requirement		240 hours	8 CP
Duration of module		one semester	
Frequency of course offering		each summer semester	
Applicability		Bachelor's degree course in bioinformatics	

Module: Neurobiology			
University/Faculty/Institute: Free University of Berlin/ Faculty of Biology, Chemistry and Pharmaceutics/Biological Institute			
Persons responsible for module: Module Instructors			
Admission requirements: none			
Qualification objectives: Students are familiar with and thoroughly understand the formation and propagation of neuronal excitation, the function of the sensory organs and motor systems and function and modeling of biological neuronal networks.			
Contents: • Experimental and theoretical work on neurobiological learning objectives, protocols of own experiments including statistical processing • An understanding of molecular and cellular principles of excitation in sensory cells and neurons, propagation via dendrites and axons and further conduction via synapses • Basic principles of psychophysics and behavior control • Mechanisms of learning and memory formation • Modeling of simple neuronal circuits			
Forms of teaching and learning	**On-campus studies** (hours per semester week = SWH)	**Forms of active participation**	**Work effort** (hours)
Lecture	1.5		On-campus lecture 23 Lecture preparation and follow-up 27
Internship	2	Practical laboratory paper, protocols	On-campus internship 30 Internship preparation and follow-up 40 Examination and examination preparation 30
Course language		German	
Mandatory regular participation		Lecture: Participation recommended, internship: yes	
Total working time requirement		150 hours	5 CP
Duration of module		one semester	
Frequency of course offering		each winter semester	
Applicability		Bachelor's degree course in bioinformatics	

II. Field of study general professional skills

<table>
<tr><td colspan="4">Module: Software project management</td><td></td></tr>
<tr><td colspan="5">University/Faculty/Institute: Free University of Berlin/ Faculty of Mathematics and Informatics/ Informatics Institute</td></tr>
<tr><td colspan="5">Persons responsible for module: Module Instructors</td></tr>
<tr><td colspan="5">Admission requirements: none</td></tr>
<tr><td colspan="5">Qualification objectives: Students have a general knowledge of software applications in everyday professional life involving large user groups, in particular practical experience with typical software problems within a wider bioinformatics setting and approaches to finding solutions</td></tr>
<tr><td colspan="5">Contents:
• Use of typical software for a project typical of daily professional work
• Selection of suitable software from a set collection / adaptation or development of missing software modules
• Teamwork on solution strategies
• Attempt to achieve a solution based on software as assembled and documentation of results
• Oral presentation of project results</td></tr>
<tr><td>Forms of teaching and learning</td><td>On-campus studies (hours per semester week = SWH)</td><td>Forms of active participation</td><td colspan="2">Work effort (hours)</td></tr>
<tr><td>Practical seminar</td><td>4</td><td>Practical exercises with software, submission of written documentation</td><td colspan="2">On-campus practical seminar 60
Practical seminar, preparation and follow-up 150</td></tr>
<tr><td>Seminar</td><td>1</td><td>Contributions to discussion</td><td colspan="2">On-campus seminar 15
Seminar preparation and follow-up 45
Examination and examination preparation 30</td></tr>
<tr><td colspan="2">Course language</td><td colspan="3">German</td></tr>
<tr><td colspan="2">Mandatory regular participation</td><td colspan="3">yes</td></tr>
<tr><td colspan="2">Total working time requirement</td><td>300 hours</td><td colspan="2">10 CP</td></tr>
<tr><td colspan="2">Duration of module</td><td colspan="3">One semester (as a block course at the beginning of the semester)</td></tr>
<tr><td colspan="2">Frequency of course offering</td><td colspan="3">each summer semester</td></tr>
<tr><td colspan="2">Applicability</td><td colspan="3">Bachelor's degree course in bioinformatics</td></tr>
</table>

Annex 2: Example of course of studies

<table>
<tr><th>Semester</th><th colspan="2">Field of study
Informatics</th><th colspan="2">Field of study
Mathematics and statistics</th><th colspan="2">Field of study
Biology/chemistry/biochemistry</th><th colspan="2">Field of study ABV</th></tr>
<tr><td>1.
29 CP</td><td colspan="2">Informatics A
(8 CP)</td><td colspan="2">Mathematics for bioinformaticians I
(8 CP)</td><td>General biology

(6 CP)</td><td>General chemistry
(7 CP)</td><td colspan="2"></td></tr>
<tr><td>2.
32 CP</td><td colspan="2">Informatics B
(8 CP)</td><td colspan="2">Mathematics for bioinformaticians II
(8 CP)</td><td rowspan="2">Medical physiology
(8 CP)</td><td>Molecular biology and biochemistry I
(6 CP)</td><td colspan="2">ABV module (5 CP)</td></tr>
<tr><td>3.
32 CP</td><td>Algorithms and data structures
(6 CP)</td><td>Internship algorithms

(6 CP)</td><td>Computer-oriented mathematics I
(5 CP)</td><td>Statistics I
(6 CP)</td><td>Molecular biology and biochemistry II
(6 CP)</td><td colspan="2"></td></tr>
<tr><td>4.
31 CP</td><td colspan="2">Elective field of study, e.g.
database systems
(7 CP)</td><td>Computer-oriented mathematics II
(5 CP)</td><td>Statistics II
(8 CP)</td><td></td><td>Molecular biology and biochemistry III
(6 CP)</td><td colspan="2" rowspan="2">Professional internship
(10 CP)
[lecture-free period after 4th semester]</td></tr>
<tr><td>5.
29 CP</td><td colspan="2">Algorithmic bioinformatics
(14 CP)</td><td colspan="2"></td><td>Neurobiology
(5 CP)</td><td>Genetics and genome research
(5 CP)</td></tr>
<tr><td>6.
27 CP</td><td colspan="6">Bachelor's Thesis with oral presentation (12 CP)</td><td>Software project management
(10 CP)
[March-May]</td><td>ABV module (5 CP)</td></tr>
</table>

Examination Regulations for the Bachelor's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics at the Free University of Berlin and the Faculty of Charité University Medicine Berlin

Preamble

On the basis of § 14 Par. 1 No. 2 of the Partial Basic Regulations (Trial Model) of the Free University of Berlin of 27 October 1998 (FU Announcements No. 24/1998) and §§ 71 Par. 1 No. 1 and 74 Par. 1, 4 of the Berlin University Medicine Law in the version of notification of the new version 26 July 2011 (GVBl. [Law and Ordinance Gazette] p. 378) and § 9 Par. 1 No. 1 of the Berlin University Medicine Law of 5 December 2005 (GVBl. p. 739), the Joint Commission on Bioinformatics established by the Faculty of Mathematics and Informatics of the Free University of Berlin, the Faculty of Biology, Chemistry and Pharmaceutics of the Free University of Berlin and the Faculty of Charité University Medicine Berlin (Charité) issued, on 10 July 2012, the following Examination Regulations for the Bachelor's Program in Bioinformatics•:

Table of Contents

§ 1 Scope

§ 2 Examination Committee

§ 3 Standard study period

§ 4 Scope of performance

§ 5 Bachelor's Thesis

§ 6 Graduation

§ 7 Entry into force and transitional regulation

Annexes

Annex 1: Scope of performance, admission requirements, mandatory participation and credit points

Annex 2: Report of Grades (sample)

Annex 3: Diploma (sample)

• The Senate Administration responsible for higher education confirmed these regulations on 21 August 2012. The term of validity for the regulations ends on 30 September 2013.

§ 1
Scope of application

These regulations regulate, in supplementation of the Statute on General Matters Regarding Examinations of the Free University of Berlin (SfAP), requirements and procedures for examination in the Bachelor's Program in Bioinformatics of the Faculties of Biology, Chemistry, Pharmaceutics, Mathematics and Informatics of the Free University of Berlin and the Faculty of Charité – University Medicine Berlin (Bachelor's Program).

§ 2
Examination Committee

The Examination Committee established by the Joint Commission on Bioinformatics for the Bachelor's Program is responsible for organization of the examinations and other tasks listed in the SfAP.

§ 3
Standard study period

The standard study period is six semesters.

§ 4
Scope of performance

(1) A total of 180 credit points must be earned for examination and study work, including

1. 150 CP in the core subject including the Bachelor's Thesis with oral presentation with 12 CP and
2. 30 CP in the field of study General Professional Skills (ABV).

(2) Annex 1 provides information on the examination work required parallel to the individual modules, obligations regarding regular participation in the forms of teaching and learning and the credit points accorded to the individual modules. For the modules "Informatics A" and "Informatics B", reference is made to the Examination Regulations of the Faculty of Mathematics and Informatics of the Free University of Berlin for the Bachelor's degree course with core subject informatics, for the module offering with either 60 or 30 credit points in informatics as adjuncts to other courses of study. For the modules "Computer-oriented mathematics I" and "Computer-oriented mathematics II", reference is made to the Examination Regulations for the Bachelor's Degree Course in Mathematics of the Faculty of Mathematics and Informatics of the Free University of Berlin. Reference is made to the respective Examination Regulations applying to the modules of the elective part.

§ 5
Bachelor's Thesis

(1) The purpose of the Bachelor's Thesis is to demonstrate that the student is capable of working independently on a theme from the field of bioinformatics using scientific methods and of presenting and documenting the results competently in written form.

(2) Students are admitted to work on a Bachelor's Thesis upon application if they
1. have successfully completed modules for at least 120 CP including the module "Algorithmic bioinformatics" and
2. were most recently matriculated in the Bachelor's Program of the Free University of Berlin and

(3) The application for admission to the Bachelor's Thesis must be accompanied by proof of

fulfillment of the conditions as per Par. 2 as well as confirmation by an instructor entitled to administer examinations of intent to supervise the Bachelor's Thesis. The competent Examination Committee decides on the application.

(4) The Examination Committee assigns the theme of the Bachelor's Thesis in consultation with the supervisor. Assignment of the theme is to be recorded and the information kept on file. The theme and set tasks must be of such a nature that the work can be completed within the assigned period. Compliance with the submission deadline is to be recorded and the information kept on file. Students are given the opportunity to propose thesis themes, which may or may not be accepted.

(5) The Bachelor's Thesis is to be approx. 25 pages long with approx. 7,500 words. The assigned period for the thesis work is 12 weeks

(6) The assigned period begins on the date on which the theme is assigned by the Examination Committee. The theme can be returned once within the first three weeks and is then considered unassigned. Compliance with the submission deadline is to be recorded and the information kept on file.

(7) The Bachelor's Thesis must be submitted within the assigned period in three bound copies. The thesis is also to be submitted in electronic form (in a standard format as designated by the Examinations Office). When the thesis is submitted, the student must affirm in writing that he or she has written the paper independently, using only the sources and aids listed.

(8) The Bachelor's Thesis must be evaluated by two instructors entitled to administer examinations as assigned by the Examination Committee. The examination grade is determined by averaging the grades given by the two instructors entitled to administer examinations. (10) If the Bachelor's Thesis does not receive a grade of at least "sufficient" (4.0), it may be repeated once.

(9) The results of the Bachelor's Thesis are presented and scientifically defended in an oral presentation. The oral presentation lasts about 15 minutes and is followed by a discussion period that lasts about 15 minutes. The oral presentation is not graded. The appointment is announced well ahead of time in an appropriate form.

§ 6
Graduation

(1) The graduation requirements is provision of proof that the scope of study performance as required by § 4 Par. 1 of these regulations, in conjunction with § 4 Study Regulations, has been completed.

(2) Graduation is not permitted if the student has conclusively failed to complete a required scope of performance or conclusively failed to pass required examinations or is involved in a pending examination procedure at another university in the same course of studies, in the same subject or in a module that is identical or comparable to a module of the Bachelor's Program and the grade for which counts towards the overall grade.

(3) The application for admission to graduation must be accompanied by proof of satisfaction of the requirements as per Par. 1 and a statement confirming that none of the cases under Par. 2 applies to the person of the applicant. The competent Examination Committee decides on the application.

(4) On the basis of the passed examination, students receive a Report of Grades and a Diploma (Annexes 2 and 3) as well as a Diploma Supplement (in English and German). A further supplement to the Report of Grades is also issued that contains information on the individual modules (Transcript).

§ 7

Entry into force and transitional regulation

(1) These regulations come into form on the day following their publication in the Official Gazette of the Free University of Berlin (FU Announcements).

(2) At the same time, the Examination Regulations for the Bachelor's Program of 2 June 2010 (FU Announcements No. 32/2010, p. 634) become invalid.

(3) These regulations apply to students who matriculate following their entry into force for the Bachelor's Program at the Free University of Berlin. Students who matriculated for the course of studies at the Free University of Berlin before entry into force of these regulations complete their course work based on the Examination Regulations as per Par. 2 unless they apply to the Examination Committee to complete their course work based on the present regulations. In the latter case, on the occasion of the transcription resulting from said application, the Examination Committee shall make a decision regarding the scope of modules begun or completed when the application was made or regarding crediting of these performance items within the framework of these regulations, whereby the principles of legitimate expectation and equal opportunity are respected. The transcription cannot be revised.

(4) The opportunity to complete the course of studies according to the Examination Regulations as per Par. 2 is to be upheld until the end of the 2015 summer semester.

Annex 1: Scope of performance, admission requirements, mandatory participation and credit points

Explanations

The following information applies to each module unless references are made to other regulations, i.e.:

- requirements for admission to each module,
- examination forms,
- mandatory regular participation and
- credit points assigned to the modules.

To the extent the required study performance includes regular participation, this is established, as well as active participation in the teaching and learning forms and successful completion of the examination requirements of each module, as a precondition for acquiring the credit points assigned to the respective module. Regular participation compliance is when at least 85% of the on-campus study time scheduled in the teaching and learning forms of a module were attended, assuming no higher presence quota is prescribed below. Even if regular participation in the teaching and learning form of a module is not mandatory it is urgently recommended; in a deviation from this regulation, mandatory regular participation can be required as decided by the Joint Commission or the responsible instructorin for such cases as well.

The credit points assigned to a module reflect the hours of student study effort presumably required to complete the module successfully. These work time estimates include both on-campus courses and phases of self-study (preparation and follow-up, examination preparation, etc.). A credit point is equivalent to about 30 hours.

Module exams - if assigned - must be taken for each module. Modules are completed with only one examination (module exam). The module exam must reflect the qualification objectives of the module. It tests whether the objectives of the module have been reached based on an exemplary sampling. The scope of the examination is limited to what is required to achieve this. In modules for which alternative examination forms are planned, the examination form for each semester must be determined by the responsible instructor by the first course date at the latest. Credit points are awarded following successful completion of the entire module – that is following regular and active participation in the teaching and learning forms and successful completion of the module exam.

Annex 1 of the Study Regulations for the Bachelor's Program describes the contents and qualification objectives, teaching and learning forms of the module, the estimated student work effort requirement to complete a module, forms of active participation, the normal duration of the module and how frequently the module is offered.

I. Fields of study in the mandatory part of the core subject:

1. Field of study informatics

For the modules "Informatics A" and "Informatics B", reference is made to the Examination Regulations of the Faculty of Mathematics and Informatics of the Free University of Berlin for the Bachelor's degree course with core subject informatics, for the module offering with either 60 or 30 credit points in informatics as adjuncts to other courses of study.

Module: Algorithms and data structures		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Algorithms and data structures - internship		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Internship	Oral examination (approx. 20 min) Examination performance is not evaluated separately	yes
Credit points: 6		

Module: Algorithmic bioinformatics		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Internship		yes
Credit points: 14		

2. Field of study mathematics

Module: Mathematics for bioinformaticians I		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 8		

Module: Mathematics for bioinformaticians II		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 8		

For the modules "Computer-oriented mathematics I" and "Computer-oriented mathematics II", reference is made to the Examination Regulations for the Bachelor's Degree Course in Mathematics of the Faculty of Mathematics and Informatics of the Free University of Berlin.

Module: Statistics for life sciences I		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Statistics for life sciences II		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 8		

3. Field of study biology/chemistry/biochemistry

Module: General chemistry		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	none	Participation recommended
Internship		yes
Credit points: 7		

Module: General biology		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	none	Participation recommended
Lecture		Participation recommended
Credit points: 6		

Module: Molecular biology and biochemistry I		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Molecular biology and biochemistry II		
Admission requirements: Successful completion of the module "Molecular biology and biochemistry I"		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Molecular biology and biochemistry III		
Admission requirements: Successful completion of the module "Molecular biology and biochemistry I"		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes
Credit points: 6		

Module: Genetics and genome research		
Admission requirements: Successful completion of the module "Molecular biology and biochemistry II"		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Exercise		yes

Credit points: 5

Module: Medical physiology		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Internship		yes
Credit points: 8		

Module: Neurobiology		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Lecture	Written exam (90 minutes)	Participation recommended
Internship		yes
Credit points: 5		

II. Field of study general professional skills

Module: Software project management		
Admission requirements: none		
Forms of teaching and learning	**Module exam**	**Mandatory regular participation**
Practical seminar	Presentation with discussion (approx. 40 minutes)	yes
Seminar		yes
Credit points: 10		

Annex 2: Report of Grades (sample)

FREIE UNIVERSITÄT BERLIN
CHARITÉ – UNIVERSITY MEDICINE BERLIN

REPORT OF GRADES

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]
has successfully completed the Bachelor's Program in

Bioinformatics

on the basis of the Examination Regulations of 10 July 2012 (FU Announcements No. [XX]/year) with the overall grade

[grade as number and text]

and earned the required number of 180 credits.

Evaluation of examination results:

Fields of study	Credit points	Grade
• Core subject bioinformatics, therein	150 (…)	
• Field of study informatics	42 (36)	
• Field of study mathematics and statistics	40 (40)	
• Field of study biology/chemistry/biochemistry	49 (36)	
• Elective part	7 (…)	
• Bachelor's Thesis with oral presentation	12 (12)	
General Professional Skills (ABV)	30 (0)	

The them of the Bachelor's Thesis was: [XX]

Berlin, this day of [day/month/year] (seal)

Dean Chairman of the Examination Committee

Grading scale: 1.0 — 1.5 very good; 1.6 — 2.5 good; 2.6 — 3.5 satisfactory; 3.6 — 4.0 sufficient; 4.1 — 5.0 insufficient
The credit points are in accordance with the European Credit Transfer and Accumulation System (ECTS)
Some study work is not graded; the credit points in parentheses reflect the scope of graded performance levels that impact the overall grade.
ABV (courses in General Professional Skills) does not count towards the overall grade.

Annex 3: Diploma (sample)

FREIE UNIVERSITÄT BERLIN
CHARITÉ – UNIVERSITY MEDICINE BERLIN

DIPLOMA

Ms./Mr. [first name/last name]

Date of birth [day/month/year] in [place of birth]

has successfully completed the Bachelor's Program in

Bioinformatics

.

Based on the Examination Regulations of 10 July 2012 (FU Announcements No. [XX]/year)

the university degree

Bachelor of Science (B.Sc.)

is awarded.

Berlin, this day of [day/month/year] (seal)

Dean Chairman of the Examination Committee