

Examination and Academic Regulations for the Master's Program in Biomedical Computing at the Technische Universität München.

(The German version from May 21, 2013 incl. the modifications 1 to 6 of the Examination and Academic Regulations)

21 May 2013

In accordance with Art. 13 (1) sentence 2 in conjunction with Art. 58 (1) sentence 1, Art. 61 (2) sentence 1 and Art. 43 (5) of the Bayerisches Hochschulgesetz (BayHSchG) [Bavarian Higher Education Act] the Technische Universität München issues the following Examination and Academic Regulations (*Fachprüfungs- und Studienordnung, FPSO*):

Introductory note on linguistic usage

In accordance with Art. 3 (2) of the German Constitution, women and men have equal rights. Any terms relating to persons and functions mentioned in the following regulations are equally valid for women and men.

The English version is provided merely as a convenience and is not intended to be a legally binding document.

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§ 34

Applicability, Academic Titles

- (1) ¹These Examination and Academic Regulations for the Master's program in Biomedical Computing (FPSO) complement the General Academic and Examination Regulations for Bachelor's and Master's programs at the Technische Universität München (APSO) as amended. ²The APSO shall have precedence.
- (2) ¹Upon successful completion of the Master's examination the degree "Master of Science" ("M.Sc.") is awarded. ²The academic title may also be used with the name of the university "(TUM)".

§ 35

Commencement of Studies, Standard Duration of Study, ECTS

- (1) Commencement of the Master's program in Biomedical Computing at the Technische Universität München is possible in the winter semester.
- (2) ¹The number of classes in required and elective subjects needed to obtain the Master's degree is 90 credits spread over three semesters. ²Furthermore, a maximum of six months (30 credits) is added for the completion of the Master's thesis pursuant to § 46. ³The number of examinations in required and elective subjects to be completed in the Biomedical Computing Master's program according to Appendix 1 is a minimum of 120 credits. ⁴The standard duration of study for the Master's program will be a total of four semesters.

§ 36

Eligibility Requirements

- (1) Eligibility for the Master's program in Biomedical Computing is demonstrated by
 1. the following degrees:
 - a) a qualified Bachelor's degree in Informatics, Mathematics, Physics, Electrical Engineering or comparable programs obtained from a domestic university; or
 - b) an internationally recognized qualified Bachelor's degree in the programs stated in lit. a) obtained from a foreign university; or
 - c) a qualified Diplom, Bachelor's or Master's degree in the programs stated in lit. a) obtained from a domestic Fachhochschule [university of applied sciences]; or
 - d) a Diplom, Magister, state examination or Master's degree in the programs stated in lit. a) obtained from a domestic university; or
 - e) a degree obtained from a foreign institution of higher education which is equivalent to the degrees listed in lit. c) and d); or
 - f) a Diplom degree in the programs specified in a) obtained from a domestic Berufsakademie [vocational college] that corresponds to the criteria stipulated in the KMK-Beschluss [Decision of the Standing Conference of Ministers of Education] of 29 September 1995; or
 - g) an accredited Bachelor's or Master's degree in the programs stated in a) obtained from a domestic Berufsakademie [vocational college];

2. passing of the Aptitude Test for the Master's program Biomedical Computing pursuant to Appendix 2,
 3. applicants who obtained their first degree in one of the following countries, must demonstrate specialized knowledge through a "Graduate Record Examination (GRE) General Test" or a "Graduate Aptitude Test in Engineering" (GATE): China, Bangladesh, India, Iran, Pakistan; for applicants with a first degree from a country that is not a signatory state of the Convention on the Recognition of Qualifications concerning Higher Education in the European Region from 11 April 1997 (henceforth referred to as Lisbon Convention) a submission of the test pursuant to sentence 1 is recommended as it will be requested in case of substantial differences in regard to the competencies proven by the first degree pursuant to subsection 2; the request will not be necessary in case of degrees from the signatory states of the Lisbon Convention; details concerning the completion of the test will be announced in time on the webpages of the examination board,
 4. an adequate knowledge of the English language; students whose native language or language of instruction is not English must demonstrate proficiency through an acknowledged language test (Competence level C1 according to the Common European Framework of Reference) such as "Test of English as a Foreign Language" (TOEFL), "International English Language Testing System" (IELTS).
- (2) A degree is considered a qualified degree within the meaning of subsection 1 if such degree requires the successful completion of examinations that are equivalent to the examinations specified in subsection 1, no. 1, and correspond to the subject-specific requirements of the Master's program in Biomedical Computing.
- (3) ¹The assessment according to subsection 2 will be performed on the basis of the required modules of the corresponding Bachelor's programs. ²If certain examination results are missing for the assessment, the Aptitude Test Committee pursuant to Appendix 2 no. 3 may require that the candidates demonstrate eligibility pursuant to subsection 1 by taking those examinations as additional Fundamentals Exams pursuant to Appendix 2 no. 5.1.3. ³The candidate must be informed thereof after review of the documentation during the first stage of the Aptitude Test.
- (4) The comparability of programs, the subject-specific aptitude as well as the equivalence of degrees acquired from foreign institutions will be decided upon by the examination board in compliance with Art. 63 of the Bayerisches Hochschulgesetz [Bavarian Higher Education Act].

§ 37

Modular Structure, Module Examination, Courses, Course Specialization, Language of Instruction

- (1) ¹General provisions concerning modules and courses are set forth in §§ 6 and 8 of the APSO. ²For any changes to the stipulated module provisions § 12 (8) of the APSO shall apply.
- (2) The curriculum listing the required and elective courses is included in Appendix 1.
- (3) The language of instruction of the Master's program Biomedical Computing is English.

- (4) ¹Courses taught in the German language may also be attended. ²In case specific modules are taught in German, this is indicated in Appendix 1.

§ 38

Examination Deadlines, Progress Monitoring, Failure to Meet Deadlines

- (1) Examination deadlines, progress monitoring, and failure to meet deadlines are governed by § 10 of the APSO.
- (2) ¹At least one of the module examinations listed in Appendix 1 must be successfully completed by the end of the second semester. ²In the event of failure to meet deadlines § 10 (5) of the APSO shall apply.

§ 39

Examination Board

¹The Master's Examination Board (Examination Board) consists of seven members. ²In particular, four members of the Examination Board shall belong to the Department of Informatics and three members to the School of Medicine.

§ 40

Recognition of Periods of Study, Coursework and Examination Results

- (1) The recognition of periods of study, coursework and examination results is governed by the provisions of § 16 of the APSO.
- (2) ¹Examinations that were successfully completed in the course of a semester abroad at a foreign institution of higher education may, up to a total of 13 credits, be recognized and counted as electives toward the Master's examination if they, even if there is no corresponding module in the module catalog of the Technische Universität München, comply with the remaining requirements of the Biomedical Computing Master's program and have a reasonable disciplinary connection to the contents of the Biomedical Computing Master's program. ²The examination Board, in consultation with the international student advisers of the Department of Informatics, shall decide on the recognition of these examinations.

§ 41

Continuous Assessment Procedure

- (1) ¹The module examinations will, as a rule, be taken concurrently with the program. ²Type and duration of module examinations are provided for in Appendix 1. ³In the event of divergence from those provisions, § 12 (8) of the APSO must be complied with. ⁴The assessment of the module examination is governed by § 17 of the APSO.
- (2) Where Appendix 1 provides that a module examination is either in written or oral form, the examiner must inform the students in appropriate form, no later than the first day of classes, of the type of examination to be held.

§ 42

Registration for and Admission to the Master's Examination

- (1) ¹Students who are enrolled in the Master's program in Biomedical Computing are deemed admitted to the module examinations of the Master's examination. ²If successful completion of Additional Examination Requirements (Fundamental Exams as additional restriction) pursuant to Appendix 2 no. 5.1.3 is required, the examination board has to inform the student in written form which module examinations differing from sentence 1 require proof of successful completion of these Fundamentals Exams.
- (2) ¹Registration requirements for required and required elective module examinations are stipulated in § 15 (1) of the APSO. ²The registration requirements for elective module examinations are stipulated in § 15 (2) of the APSO. ³The registration requirements for repeat examinations for failed required and required elective modules are stipulated in § 15 (3) of the APSO.

§ 43

Scope of the Master's Examination

- (1) The Master's examination consists of:
 1. The module examinations in the corresponding modules pursuant to subsection 2,
 2. The Master's thesis pursuant to § 46.
- (2) ¹The module examinations are listed in Appendix 1. ²41 credits in required modules and at least 49 credits in elective modules must be completed. ³The selection of modules must be in compliance with § 8 (2) of the APSO and Appendix 1.

§ 44

Repeat Examinations, Failed Examinations

- (1) The repetition of examinations is governed by § 24 of the APSO.
- (2) Failure of examinations is governed by § 23 of the APSO.

§ 45

Coursework

¹Instead of the examinations to be taken in elective modules pursuant to § 43 (2) sentence 2, successful completion of coursework may be required. ²In this case the number of credits to be earned through examinations in elective courses pursuant to § 43 (2), sentence 2 will be reduced accordingly.

§ 45 a

Multiple-Choice Test

The accomplishment of Multiple-Choice Procedures is governed by § 12a of the APSO.

- (1) ¹In Bachelor's and Master's programs, a written examination may, subject to

approval of the Department Council (Fakultätsrat), be administered in the form of a multiple choice test in individual cases. ²Pursuant to § 12 (11) sentence 1 APSO, parts of a written examination may be administered in the form of a multiple choice test. ³If this type of examination is chosen, students must be notified in a timely manner. ⁴§ 6 (5) sentence 2 of the APSO shall apply accordingly.

- (2) ¹At least two individuals authorized to administer examinations pursuant to the APSO will prepare the list of questions and answers. ²As part of the preparation, they have to define which answers are deemed correct.
- (3) When a student has achieved the minimum number of correct answers required to pass the examination pursuant to subsection (3), the grades for the examination administered as multiple choice test are as follows:
 1. “very good” – at least 75%;
 2. “good” – at least 50%, but less than 75%;
 3. “satisfactory” – at least 25%, but less than 50%;
 4. “sufficient” – 0% or less than 25% of correct answers to additional questions posed.
- (4) The students will receive an examination report listing
 1. the grade;
 2. the minimum passing score;
 3. the number of questions asked;
 4. the number of correctly answered questions and the average of the reference group mentioned in subsection (4).

§ 46 Master’s Thesis

- (1) As part of the Master’s examination, each student must write a Master’s thesis pursuant to § 18 of the APSO.
- (2) Work on the Master’s thesis should commence after successful completion of all module examinations.
- (3) Master’s thesis should be written in the English language.
- (4) ¹The completion of the Master’s thesis consists of a written composition and a lecture on its content. ²The lecture does not affect the grading.
- (5) ¹If the Master’s thesis was not graded with at least “sufficient” (4.0), it may be repeated once with a new topic. ²Students must renew their application for admission within six weeks from receipt of the notification of the result (Bescheid).

§ 47 Passing and Assessment of the Master’s Examination

- (1) The Master’s examination is deemed passed when all examinations required for the Master’s examination pursuant to § 43 (1) have been passed and a plus credits account of at least 120 credits has been achieved.

- (2) ¹The grade for a module will be calculated according to § 17 of the APSO. ²The overall grade for the Master's examination will be calculated as the weighted grade average of the modules according to § 37 and the Master's thesis. ³The grade weights of the individual modules correspond to the credits assigned to each module. ⁴The overall grade will be expressed by the attribute according to § 17 of the APSO.

§ 48

Degree Certificate, Diploma, Diploma Supplement

¹If the Master's examination was passed, a degree certificate, a diploma, and a diploma supplement including a transcript of records are to be issued in compliance with § 25 (1) and § 26 APSO. ²The degree certificate will be dated on the day when all examination and coursework requirements have been fulfilled.

§ 49

Entry into Force

¹These Examination and Academic Regulations shall enter into force on 1 April 2013. ²They shall apply to all students who commence their studies in the Biomedical Computing Master's program at the Technische Universität München as of the summer semester 2014.

Appendix 1: Required Modules

Required Modules from Informatics

A total of 25 Credits must be earned from the following required modules:

ID.	Module Name	Type of Instruction	Sem	SWS	ECTS	Type of exam.	Exam. duration	Language
IN2021	Computer Aided Medical Procedures	4V	WS	4	6	w/o	90/30-40 min	English
IN2022	Computer Aided Medical Procedures2	2V+2Ü	SS	4	5	w/o	90/30-40 min	English
IN2107	Master's Seminar	2S	WS/SS	2	4	Examinations are written elaborations or presentations		German/English
IN2249	Clinical Internship	6P	WS	6	10	Examinations are written elaborations or presentations		English
Total					25			

Required Modules from Medicine

A total of 16 Credits must be earned from the following required modules:

ID.	Module Name	Type of Instruction	Sem	SWS	ECTS	Type of exam.	Exam. duration	Language
ME???	Medical Instrumentation and Computer Aided Surgery	4V	WS	4	6	written	120 min	English
ME156	Imaging in Radiology, Nuclear Medicine and Radiation Therapy	2P	SS	2	4	written	90 min	English
ME???	Medical Information Processing and Pathophysiology	4V	WS	4	6	written	120 min	English
Total					16			

Elective Modules from Imaging

A total of 7 Credits must be earned from the following elective modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN2273	Interventional Imaging and Image Processing	2V	WS	3	w/o	30/60 min	English
IN2286	Image Guided Surgery	2V+2P	SS	6	w/o	30/60 min	English
EI3999	Introduction to Biological Imaging	2V+2Ü	WS	6	written	90 min	English
ME030	Case Studies on Modern Imaging	2V+2Ü	SS	6	written	90 min	English
PH2001	Biomedical Physics 1	2V	WS	5	written	90 min	German
PH2002	Biomedical Physics 2	2V	SS	5	written	90 min	German

Elective Modules from Mathematical Methods and Scientific Computing

A total of 8 Credits must be earned from the following elective modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN2001	Algorithms for Scientific Computing	4V+2Ü	SS	8	w/o	120/30 min	English
IN2002	Algorithms for Scientific Computing II	2V+1Ü	WS	4	w/o	60-100/30 min	English
IN2005	Scientific Computing I	2V+2Ü	WS	5	w/o	90/30 min	English
IN2124	Basic Mathematical Methods for Imaging and Visualization	2V+2Ü	Irreg.	5	written	120 min	English
IN2141	Scientific Computing II	2V+2Ü	SS	5	w/o	90-120/30 min	English
IN2156 MA330 5	Numerical Programming	4V+2Ü	WS	8	written	120 min	English
IN2012	Parallel Numerics	2V+2Ü	WS	5	w/o	72-125/30 min	English
IN3400	Selected Topics in Algorithms and Scientific Computing	-	-	-	-	-	German/ English

Elective Modules from Programming and Software Engineering

A total of 3 Credits must be earned from the following elective modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN1503	Advanced Programming	2V+2Ü	WS	5	w/o	90-120/30 min	English
IN2003	Efficient Algorithms and Datastructures	4V+2Ü	WS	8	w/o	60-100/30 min	English
IN2081	Patterns in Software Engineering	2V+2Ü	WS	5	written	75-125 min	English
IN2126	Software Engineering I: Software Technology	3V+2Ü	WS	6	written	90-150 min	German/ English
IN2147	Parallel Programming	2V+2Ü	SS	5	written	90 min	English
IN3050	Selected Topics in Software Engineering	-	Irreg.	-	-	-	German/ English
IN4102	Advanced Practical Course: GPU Programming in Computer Vision	6P	WS	10	w/o	60-100/20-30 min	German/ English

Elective Modules from Machine Vision, Computer Vision and Pattern Recognition

A total of 3 Credits must be earned from the following elective modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN2023	Image Understanding I: Machine Vision Algorithms	2V	SS	3	oral	30 min	German
IN2057	3D Computer Vision	2V+2Ü	SS	5	w/o	90/30 min	English
IN2061	Introduction to digital signal processing	3V+3Ü	SS	7	w/o	75/20-30 min	English
IN2064	Machine Learning	4V+2Ü	WS	8	written	90 min	English
IN2065	Machine Learning II	3V	Irreg.	4	oral	25 min	German
IN2071	Knowledge-based Systems for Industrial Applications	3V	SS	4	w/o	60-100/20-30 min	English

IN2106	Advanced Practical Course: Machine Learning in Medical Imaging	6P	WS	10	Examinations are written elaborations or presentations		English
IN2123	3D Computer Vision II	2V+2Ü	WS	5	w/o	90/30 min	English
IN2133	Principles of Computer Vision	3V	WS	4	w/o	75/20 min	English
IN2210	Tracking and Detection in Computer Vision	2V+2Ü	WS	5	written	90-120 min	English
IN2228	Multiple View Geometry	4V+2Ü	Irreg.	8	w/o	120-180 min	English
IN2237	Variational Methods and Convex Optimization in Computer Vision II	2V+1Ü	WS	4	written	90 min	English
IN2238	Analysis of Three-Dimensional Shapes	2V+1Ü	WS	4	written	90 min	English
IN2240	Statistical Methods and Learning in Computer Vision	2V+1Ü	Irreg.	4	w/o	90-125/20-30 min	English
IN2245	Combinatorial Optimization in Computer Vision	2V+1Ü	Irreg.	4	w/o	90-125/20-30 min	English
IN2246	Variational Methods for Computer Vision	3V+3Ü	Irreg.	7	w/o	90-125/20-30 min	English
IN3200	Selected Topics in Computer Graphics and Vision	-	Irreg.	-	-	-	German/English
EI7120	Computer Vision	2V+1Ü	SS	4	w/o	60-100/20-30 min	German/English
	Introduction to Surgical Robotics	2V+2Ü	SS/WS	6	w/o	60-100/20-30 min	German/English

Elective Modules from Computer Graphics, Augmented Reality and Visualization

A total of 4 Credits must be earned from the following elective modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN2015	Image Synthesis	3V	WS	4	oral	30-45 min	German
IN2016	Image Understanding II: Robot Vision	3V	WS	4	w/o	60-100/30-45 min	German/English
IN2017	Computer Graphics	4V	SS	6	w/o	60-100/30-45 min	German/English
IN2018	Augmented Reality	2V+2Ü	WS	5	w/o	90/20 min	English
IN2023	Image Understanding I: Machine Vision Algorithms	2V	SS	3	oral	30 min	German
IN2024	Model based Evaluation of images and image sequences	2V	SS	3	w/o	60-100/20-45 min	German/English
IN2025	Simulation and Animation	3V	SS	4	oral	20-60 min	German
IN2026	Scientific Visualization	3V	WS	4	w/o	60-100/30-45 min	English
IN2067	Robotics	3V+2Ü	WS	6	w/o	90-125/20-30 min	English
IN2111	3D User Interfaces	2V+2Ü	SS	5	w/o	90/20 min	English

IN2112	2D graphical User Interfaces for Desktop-based and Mobile Computer Applications	2V+2Ü	Irreg.	5	w/o	90/20 min	English
IN2124	Basic Mathematical Methods for Imaging and Visualization	2V+2Ü	Irreg.	5	written	120 min	English
IN2138	Robot Motion Planning	3V	SS	4	w/o	60-100/20-30 min	German/English
IN2139	Information Visualization	2V+2Ü	Irreg.	5	w/o	90/20 min	English
IN2210	Tracking and Detection in Computer Vision	2V+2Ü	WS	5	written	90-120 min	English
IN2222	Cognitive Systems	3V	SS	4	w/o	60-100/20-30 min	English
IN2238	Analysis of Three-Dimensional Shapes	2V+1Ü	WS	4	written	90 min	English
IN4102	Advanced Practical Course: GPU Programming in Computer Vision	6P	WS	10	w/o	60-100/20-30 min	German/English
EI5017	Image and Video Compression	2V+1Ü	SS	4	w/o	60-100/20-30 min	German/English
EI7234	3D data analysis and visualization for robotics and computer graphics	1V+1Ü	WS	3	w/o	60-100/20-30 min	German/English

Elective Modules from Support Electives

A total of 4 Credits must be earned from the following electives modules:

ID.	Module Name	Extent	Sem	ECTS	Type of exam.	Exam. duration	Language
IN2163	Information Systems in Health Care	2V	Irreg.	3	written	60 min	German
IN9038	Medical Imaging Entrepreneurship	2V	WS/SS	4	Examinations are written elaborations or presentations		English
SZ0406	English – Writing Academic Research Papers C2	2S	WS	4	Examinations are written elaborations or presentations		English

Moreover, all modules from the Support Electives Catalog from the Informatics Master's program may also be taken.

Explanations:

Sem = Semester; SWS = Semesterwochenstunden (weekly hours per semester); V = Vorlesung (lecture); Ü = Übung (exercise); S = Seminar; P = Praktikum (practical course); WS = winter semester; SS = summer semester; w/o = written/oral exam

For written exams, the "Examination duration" is mentioned in minutes.

Each module can just be counted to one group of Elective Modules.

Appendix 2: Aptitude Assessment

Aptitude Assessment for the Master's Program in Biomedical Computing at the Technische Universität München

1. Purpose of the Assessment

¹Eligibility for the Master's program in Biomedical Computing, in addition to the requirements pursuant to § 36 (1) no(s) 1 to 3, requires proof of aptitude pursuant to § 36 (1) no. 4 in accordance with the following provisions. ²The special qualifications and skills of the candidates should correspond to the Biomedical Computing profession. ³Individual aptitude parameters are:

- 1.1 ability to do research work and/or basic research and methodological work;
- 1.2 specialized knowledge from undergraduate studies in respective subjects in accordance with the Bachelor's programs at the Technische Universität München;
- 1.3 ability to solve complex and difficult problems;
- 1.4 interest in solving problems for applications.

2. Aptitude Assessment Process

2.1 The aptitude test will be held twice a year by the Department of Informatics of the Technische Universität München.

2.2 ¹Applications for admission to the aptitude test including the documents set out in no. 2.3.1 through 2.3.5 as well as set out in § 36 (1) no. 2 must be filed online by 31 May for the winter semester to the Technische Universität München (absolute deadline). ²Documents set out in no. 2.3.1 through 2.3.5 as well as set out in § 36 (1) no. 2 which could not be delivered until this deadline due to reasons beyond the applicant's responsibility, may be filed later: for the winter semester by 15 August. ³Degree certificate and diploma as proof of Bachelor's degree obtained must be filed no later than five weeks after the beginning of lectures. ⁴Otherwise, pursuant to § 36 the enrollment to the Master's program is not yet possible.

2.3 The application must include:

- 2.3.1 a transcript of records containing modules of at least 120 credits, or resp. of two-thirds of the examinations necessary for the undergraduate degree in case of degrees not being subject to the "European Credit Transfer and Accumulation System" (ECTS); the transcript of records must be issued by the responsible examining authority or the responsible office of academic affairs;
- 2.3.2 a curriculum vitae formatted as a table;
- 2.3.3 a written statement of no more than 2 DIN A4 pages in English of the reasons for choosing the Biomedical Computing program at the Technische Universität München in which the candidate explains those specific abilities and interests that make him/her particularly qualified for the Biomedical Computing Master's program at the Technische Universität München; a candidate's exceptional motivation and commitment can e.g. be demonstrated by details on program-related vocational training, practica, stays abroad, or program-related further education beyond the attendance and course requirements of the Bachelor's program, if necessary by appropriate documentation;
- 2.3.4 an essay written in English, of approx. 1000 words in length; the chairperson of the committee may provide one topic or a selection of several topics for this essay; the candidates must be informed of the topic(s) not later than 1 January resp. 1 September;

- 2.3.5 a declaration that both the statement of the reasons for choosing the program and the essay are the candidate's own work, and that the candidate has clearly identified any ideas taken from outside sources.

3. Aptitude Assessment Committee

3.1 ¹The aptitude test is administered by a committee that, as a rule, consists of the Dean of Studies in charge of the Biomedical Computing Master's program, at least one member of the professorial faculty of the department of Informatics, at least one member of the professorial faculty of the department of Medicine and at least one member of the academic staff (wissenschaftlicher Mitarbeiter) from either of the two departments. ²At least half of the committee members must be professorial faculty. ³A representative of the student body will be a part of the committee, in an advisory capacity.

3.2 ¹The members of the committee are appointed by the department council (Fakultätsrat) in consultation with the Dean of Studies. ²At least one member of the professorial faculty is appointed as deputy member of the committee. ³As a rule, the committee is chaired by the Dean of Studies. ⁴Procedural regulations will be in accordance with Art. 41 of the BayHSchG as last amended.

4. Admission to the Aptitude Assessment

4.1 Admission to the aptitude assessment requires that all documentation specified in no. 2.3 has been submitted in a timely and complete fashion.

4.2 Applicants who have fulfilled the requirements will be tested according to no 5.

4.3 Applicants who are not admitted will receive a notification specifying the reasons and providing information on legal remedies.

5. The Aptitude Assessment Process

5.1 First stage of the Aptitude Assessment Process

5.1.1 ¹The committee will assess, on the basis of the written application documents required under no. 2.3, whether or not an applicant is suitable for a program pursuant to no. 1 (First stage of the aptitude assessment process). ²For this purpose, the committee evaluates and grades the candidate's documentation on a scale ranging from 0 to 100 points, 0 being the worst and 100 the best possible result:

The following criteria will be applied to the evaluation:

1. Academic qualification

¹The curricular analysis is not conducted in the form of a schematic comparison of the modules, but rather on the basis of competencies. ²It will encompass the fundamental subject groups of the Bachelor's programs in Informatics, Mathematics, Physics or Electrical Engineering at the Technische Universität München listed in the tables below.

Subject group Informatics	Credits TUM
Informatics Fundamentals (Introduction to Informatics, Programming, Computer Architecture, Software Engineering, Algorithms and Data Structures, Databases, Operating Systems and System Software, Computer Networks and Distributed Systems, Theory of Computation)	71
Mathematics Fundamentals (Discrete Structures, Linear Algebra, Calculus, Discrete Probability Theory)	30

or

Subject group Mathematics	Credits TUM
Calculus, Linear Algebra, Discrete Mathematics, Numerics, Probability Theory, Mathematical Model Building, Abstract Mathematics, Applied Mathematics	91

or

Subject group Physics	Credits TUM
Physics Fundamentals (Experimental Physics, Theoretical Physics, Beginners Practical Course)	74
Mathematics and other fundamentals: Mathematics for Physicists, Algorithms and Data Structures, Physics for Electrical Engineers	42

or

Subject group Electrical and Computer Engineering	Credits TUM
Fundamental Electrical Engineering (Circuit Theory, Practical Course Programming C, Digital Technology, Electricity and Magnetism, Measurement Systems and Sensor Technology, Signals, Materials Science for Electrical Engineering, Theory of Electromagnetic Fields)	78
Mathematics and other fundamentals: Mathematics, Algorithms and Data Structures, Physics for Electrical Engineers	42

³For this purpose, the candidate has to assign the modules from his/her Transcript of Records to the according subject group, list them in the application and confirm the accuracy of the information presented in writing.

⁴Where a candidate's competencies are at least equivalent to those listed above, he or she will be awarded a maximum of 55 points. ⁵Missing competencies will be deducted in accordance with the credits of the corresponding modules of the respective Bachelor's program at the Technische Universität München. ⁶There will be no negative points. ⁷Where a GRE or Gate test has to be submitted pursuant to § 36 (1) no. 3, it is assumed that, in case of successful demonstration, there are no substantial differences regarding the level of competencies demonstrated by the undergraduate degree compared to the reference criteria set out in 5.1.1 no. 1 sentence 2 and that the curricular analysis will be conducted according to the abovementioned criteria.

2. Final grade

¹For each tenth of a grade that the average grade determined for the examinations amounting to 120 credits (resp. two-thirds of the examinations necessary for the undergraduate degree) is better than 3.0, the applicant will be awarded one point.

²The maximum number of points is 20. ³There will be no negative points. ⁴Where a degree was obtained outside of Germany, the grade will be converted according to what is referred to as „Bavarian formula“ (bayerische Formel). ⁵If the applicant, at the time he or she files the application, submits a final degree certificate showing more than 120 credits, the assessment will be made on the basis of the modules that were awarded the best grades, up to 120 credits (resp. two-thirds of the examinations necessary for the undergraduate degree). ⁶The applicant must list them in the application and confirm the accuracy of the information presented in writing. ⁷The grade average is calculated from the graded module examinations up to 120 credits (resp. two-thirds of the examination necessary for the undergraduate degree). ⁸The overall grade average will be calculated as the weighted grade average of the modules. ⁹The grade weights of the individual modules correspond to the credits assigned to each module. ¹⁰For the calculation of grade, one decimal place will be taken into account, all further decimal places will be dropped without rounding.

3. Letter of Motivation

¹The applicant's written statement of purpose will be evaluated by two committee members and graded on a scale of 0 – 10 points. ²The motivation letter will be assessed using the following criteria:

1. Exceptional motivation and commitment:
The applicant has relevant qualifications which exceed the knowledge and qualifications obtained at undergraduate degree level.
2. Specific Capabilities:
The applicant is able to provide convincing arguments and examples related to his formation (and additional qualifications if applicable) for showing his /her special qualification.
3. Interest:
The applicant is able to illustrate the connection between personal interests and the content of the degree program and to provide convincing arguments and examples for showing his/her special motivation for the Master's degree program.
4. Capability of expression in the English language, style of writing, form
5. Program-related vocational training or outstanding academic achievements (awardings, prizes, scientific publications) of the applicant which give reason to expect a special research and learning performance.

³The committee members assess each of the five criteria independently. The criteria will be weighted equally. ⁴The points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

4. Essay

¹The applicant's written essay will be evaluated by two committee members and graded on a scale of 0 – 15 points. ²The essay will be assessed using the following criteria:

1. formal and coherent structure
2. complete and correct in content, coherent argumentation

3. academic foundation
4. Capability of expression the English language.

³The committee members assess each of the four criteria independently whereas the criteria will be weighted equally. ⁴The points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

- 5.1.2 ¹The applicant's points total will be calculated as sum of the individual points awarded. ²Decimal places must be rounded up.
- 5.1.3 ¹Applicants who have achieved at least 70 points will receive confirmation that they have passed the aptitude assessment test. ²In those cases where it was determined pursuant to § 36 (4) that only some subject-specific requirements from undergraduate studies are missing for the Master's program, the committee may make admission subject to successful completion of Fundamentals Exams from the Bachelor's program in Informatics, Mathematics, Physics and Electrical Engineering (so-called Brückenkurse) in the amount of a maximum of 30 credits. ³These Fundamentals Exams must be taken in the first year of study. ⁴Failed Fundamentals Exams may be repeated only once and at the next examination date. ⁵The examination board may make the admission to individual module examinations dependent on the successful completion of the Fundamentals Exams.
- 5.1.4 ¹Unsuitable applicants with a points total of fewer than 50 points will receive a rejection notice, signed by the TUM Board of Management and specifying the reasons for rejection and providing information on legal remedies. ²Signatory power may be delegated.

5.2 Second stage of the Aptitude Assessment Process

- 5.2.1 ¹The remaining applicants will be invited for an aptitude assessment interview. ²In the second stage of the aptitude assessment process, the applicant's qualification at undergraduate level and the result of the assessment interview will be evaluated, taking at least equal consideration of the qualification obtained at undergraduate level. ³In cases where the points set out in 5.1.3 sentence 1 have not been achieved, this will also apply to applicants whose admission is subject to the requirement stipulated in 5.1.3 sentence 2. ⁴Interview appointments will be announced at least one week in advance. ⁵Possible time slots for interviews must be announced before expiration of the application deadline. ⁶The interview appointment must be kept by the applicant. ⁷If the applicant is unable to attend an aptitude assessment interview due to reasons beyond his/her control, a later appointment may be scheduled upon a applicant's well-grounded request, but no later than two weeks before the beginning of classes.
- 5.2.2 ¹The aptitude assessment interview is to be held individually for each applicant. ²The interview lasts at least 20 but not more than 30 minutes for each applicant. ³The interview will focus on the following topics:
 1. Motivation for the Master's program in Biomedical Computing considering the under No. 5.1.1.3 listed criteria for the assessment of the letter of motivation.
 2. Self-evaluation of the personal suitability profile
 3. Comprehension of the leading questions in Biomedical Computing (basic research and application-related questions from the subjects listed in 5.1.1.1 for assessment of the academic qualification).
 4. Use of scientific terminology.

⁴The above topics may cover the documentation submitted pursuant to 2.3. ⁵Any subject-specific academic knowledge that is to be taught in the Master's program in Biomedical Computing will not affect the decision. ⁶With the applicant's approval, a representative of the student body may sit in on the interview.

- 5.2.3 ¹The aptitude assessment interview will be conducted by at least two members of the committee. ²The committee members will grade each of the three topics set out in no. 5.2.2 independently, each with the same weighting. ³Each member will grade the result of the interview on a scale from 0 to 45, 0 being the worst and 45 being the best possible result. ⁴The points total will be calculated as the arithmetic means of the individual points. ⁵The result will be rounded up to the nearest full point.
- 5.2.4 ¹The applicant's points total in the second stage will be calculated as the sum of all points obtained under 5.2.3 and the points under 5.1.1.1 (academic qualification) and 5.1.1.2 (grade). ²Applicants with 70 or more points will be deemed suitable.
- 5.2.5 ¹The applicant will be notified of the result of the aptitude test determined by the committee in writing - where applicable, subject to the requirements determined in stage 1, 5.1.3 sentence 2. ²The notice must be signed by the TUM Board of Management. ³Signatory power may be delegated. ⁴A rejection notice must specify the reasons for the rejection and provide information on legal remedies.
- 5.2.6 Admissions to the Master's program in Biomedical Computing shall apply to all subsequent applications for this program.

6. Record

¹The aptitude assessment process must be documented, including the date, duration and location of the assessment, the names of the committee members, the applicant's name, and the decision of the members of the committee as well as the complete results. ²This record must contain the essential reasons for the decision and the topics discussed at the interview held with the applicants; these reasons and topics may be recorded in note form.

7. Repetition

Applicants who have failed the aptitude test for the Master's program in Biomedical Computing may register for one repetition of the Aptitude Assessment Test.