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.

Table of contents:

§ 34 Applicability, Academic Titles
§ 35 Commencement of Studies, Standard Duration of Study, ECTS
§ 36 Eligibility Requirements
§ 37 Modular Structure, Module Examination, Courses, Course Specialization, Language of Instruction
§ 38 Examination Deadlines, Progress Monitoring, Failure to Meet Deadlines
§ 39 Examination Board
§ 40 Recognition of Periods of Study, Coursework and Examination Results
§ 41 Continuous Assessment Procedure
§ 42 Registration for and Admission to the Master’s Examination
§ 43 Scope of the Master’s Examination
§ 44 Repeat Examinations, Failed Examinations
§ 45 Coursework
§ 45a Multiple-Choice-Procedure
§ 46 Master’s Thesis
§ 47 Passing and Assessment of the Master’s Examination
§ 48 Degree Certificate, Diploma, Diploma Supplement
§ 49 Entry into Force

Appendix 1: Examination Modules
Appendix 2: Aptitude Assessment
§ 34
Applicability, Academic Titles

(1) These 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. The APSO shall have precedence.

(2) Upon successful completion of the Master’s examination the degree “Master of Science” (“M.Sc.”) is awarded. The 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) The number of classes in required and elective subjects needed to obtain the Master’s degree is 90 credits spread over three semesters. Furthermore, a maximum of six months (30 credits) is added for the completion of the Master’s thesis pursuant to § 46. The 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. The 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 Berufskademie [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 Berufskademie [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) The assessment according to subsection 2 will be performed on the basis of the required modules of the corresponding Bachelor’s programs. If 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. The 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) General provisions concerning modules and courses are set forth in §§ 6 and 8 of the APSO. For 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.
Courses taught in the German language may also be attended. In 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

The Master’s Examination Board (Examination Board) consists of seven members. In 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. Pursuant to § 12 (11) sentence 1 APSO, parts of a written examination may be administered in the form of a multiple choice test. If this type of examination is chosen, students must be notified in a timely manner. § 6 (5) sentence 2 of the APSO shall apply accordingly.

(2) At least two individuals authorized to administer examinations pursuant to the APSO will prepare the list of questions and answers. As part of the preparation, they have to define which answers are deemed correct.

(3) If this type of examination is chosen, students must be notified in a timely manner. § 6 (5) sentence 2 of the APSO shall apply accordingly.

1. At least two individuals authorized to administer examinations pursuant to the APSO will prepare the list of questions and answers. As 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) The completion of the Master’s thesis consists of a written composition and a lecture on its content. The lecture does not affect the grading.

(5) If the Master’s thesis was not graded with at least “sufficient” (4.0), it may be repeated once with a new topic. Students 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:

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

### Required Modules from Medicine
A total of 16 Credits must be earned from the following required modules:

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

### Elective Modules from Imaging
A total of 7 Credits must be earned from the following elective modules:

<table>
<thead>
<tr>
<th>ID</th>
<th>Module Name</th>
<th>Extent</th>
<th>Sem</th>
<th>ECTS</th>
<th>Type of exam.</th>
<th>Exam. duration</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN2273</td>
<td>Interventional Imaging and Image Processing</td>
<td>2V WS</td>
<td>3</td>
<td></td>
<td>w/o</td>
<td>30/60 min</td>
<td>English</td>
</tr>
<tr>
<td>IN2286</td>
<td>Image Guided Surgery</td>
<td>2V+2P SS</td>
<td>6</td>
<td></td>
<td>w/o</td>
<td>30/60 min</td>
<td>English</td>
</tr>
<tr>
<td>EI3999</td>
<td>Introduction to Biological Imaging</td>
<td>2V+2Ü WS</td>
<td>6</td>
<td></td>
<td>written</td>
<td>90 min</td>
<td>English</td>
</tr>
<tr>
<td>ME030</td>
<td>Case Studies on Modern Imaging</td>
<td>2V+2Ü SS</td>
<td>6</td>
<td></td>
<td>written</td>
<td>90 min</td>
<td>English</td>
</tr>
<tr>
<td>PH2001</td>
<td>Biomedical Physics 1</td>
<td>2V WS</td>
<td>5</td>
<td></td>
<td>written</td>
<td>90 min</td>
<td>German</td>
</tr>
<tr>
<td>PH2002</td>
<td>Biomedical Physics 2</td>
<td>2V SS</td>
<td>5</td>
<td></td>
<td>written</td>
<td>90 min</td>
<td>German</td>
</tr>
</tbody>
</table>
## Elective Modules from Mathematical Methods and Scientific Computing
A total of 8 Credits must be earned from the following elective modules:

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

## Elective Modules from Programming and Software Engineering
A total of 3 Credits must be earned from the following elective modules:

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

## Elective Modules from Machine Vision, Computer Vision and Pattern Recognition
A total of 3 Credits must be earned from the following elective modules:

<table>
<thead>
<tr>
<th>ID.</th>
<th>Module Name</th>
<th>Extent</th>
<th>Sem</th>
<th>ECTS</th>
<th>Type of exam.</th>
<th>Exam. duration</th>
<th>Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN2023</td>
<td>Image Understanding I: Machine Vision Algorithms</td>
<td>2V</td>
<td>SS</td>
<td>3</td>
<td>oral</td>
<td>30 min</td>
<td>German</td>
</tr>
<tr>
<td>IN2057</td>
<td>3D Computer Vision</td>
<td>2V+2U</td>
<td>SS</td>
<td>5</td>
<td>w/o</td>
<td>90/30 min</td>
<td>English</td>
</tr>
<tr>
<td>IN2061</td>
<td>Introduction to digital signal processing</td>
<td>3V+3Ü</td>
<td>SS</td>
<td>7</td>
<td>w/o</td>
<td>75/20-30 min</td>
<td>English</td>
</tr>
<tr>
<td>IN2064</td>
<td>Machine Learning</td>
<td>4V+2U</td>
<td>WS</td>
<td>8</td>
<td>written</td>
<td>90 min</td>
<td>English</td>
</tr>
<tr>
<td>IN2065</td>
<td>Machine Learning II</td>
<td>3V</td>
<td>Irreg.</td>
<td>4</td>
<td>oral</td>
<td>25 min</td>
<td>German</td>
</tr>
<tr>
<td>IN2071</td>
<td>Knowledge-based Systems for Industrial Applications</td>
<td>3V</td>
<td>SS</td>
<td>4</td>
<td>w/o</td>
<td>60-100/20-30 min</td>
<td>English</td>
</tr>
</tbody>
</table>
### Elective Modules from Computer Graphics, Augmented Reality and Visualization

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

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

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

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

Moreover, all modules form 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

1 Eligibility 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. 2 The special qualifications and skills of the candidates should correspond to the Biomedical Computing profession. 3 Individual 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 1 Applications 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). 2 Documents 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. 3 Degree certificate and diploma as proof of Bachelor’s degree obtained must be filed no later than five weeks after the beginning of lectures. 4 Otherwise, 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 The 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. At least half of the committee members must be professorial faculty. A representative of the student body will be a part of the committee, in an advisory capacity.

3.2 The members of the committee are appointed by the department council (Fakultätsrat) in consultation with the Dean of Studies. At least one member of the professorial faculty is appointed as deputy member of the committee. As a rule, the committee is chaired by the Dean of Studies. Procedural 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 The 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). For 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

The curricular analysis is not conducted in the form of a schematic comparison of the modules, but rather on the basis of competencies. It 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.
<table>
<thead>
<tr>
<th>Subject group Informatics</th>
<th>Credits TUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Fundamentals (Discrete Structures, Linear Algebra, Calculus, Discrete Probability Theory)</td>
<td>30</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Subject group Mathematics</td>
<td>Credits TUM</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Subject group Physics</td>
<td>Credits TUM</td>
</tr>
<tr>
<td>Physics Fundamentals (Experimental Physics, Theoretical Physics, Beginners Practical Course)</td>
<td>74</td>
</tr>
<tr>
<td>Mathematics and other fundamentals: Mathematics for Physicists, Algorithms and Data Structures, Physics for Electrical Engineers</td>
<td>42</td>
</tr>
<tr>
<td>or</td>
<td></td>
</tr>
<tr>
<td>Subject group Electrical and Computer Engineering</td>
<td>Credits TUM</td>
</tr>
<tr>
<td>Mathematics and other fundamentals: Mathematics, Algorithms and Data Structures, Physics for Electrical Engineers</td>
<td>42</td>
</tr>
</tbody>
</table>

3 For 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.

4 Where a candidate’s competencies are at least equivalent to those listed above, he or she will be awarded a maximum of 55 points. 5 Missing competencies will be deducted in accordance with the credits of the corresponding modules of the respective Bachelor’s program at the Technische Universität München. 6 There will be no negative points.

7 Where 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

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

5.1.2 1 The applicant’s points total will be calculated as sum of the individual points awarded. 2 Decimal places must be rounded up.

5.1.3 1 Applicants who have achieved at least 70 points will receive confirmation that they have passed the aptitude assessment test. 2 In 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. 3 These Fundamentals Exams must be taken in the first year of study. 4 Failed Fundamentals Exams may be repeated only once and at the next examination date. 5 The examination board may make the admission to individual module examinations dependent on the successful completion of the Fundamentals Exams.

5.1.4 1 Unsuitable 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. 2 Signatory power may be delegated.

5.2 Second stage of the Aptitude Assessment Process

5.2.1 1 The remaining applicants will be invited for an aptitude assessment interview. 2 In 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. 3 In 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. 4 Interview appointments will be announced at least one week in advance. 5 Possible time slots for interviews must be announced before expiration of the application deadline. 6 The interview appointment must be kept by the applicant. 7 If 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 1 The aptitude assessment interview is to be held individually for each applicant. 2 The interview lasts at least 20 but not more than 30 minutes for each applicant. 3 The 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.
The above topics may cover the documentation submitted pursuant to 2.3. Any subject-specific academic knowledge that is to be taught in the Master’s program in Biomedical Computing will not affect the decision. With the applicant’s approval, a representative of the student body may sit in on the interview.

5.2.3 The aptitude assessment interview will be conducted by at least two members of the committee. The committee members will grade each of the three topics set out in no. 5.2.2 independently, each with the same weighting. Each 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. The points total will be calculated as the arithmetic means of the individual points. The result will be rounded up to the nearest full point.

5.2.4 The 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). Applicants with 70 or more points will be deemed suitable.

5.2.5 The 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. The notice must be signed by the TUM Board of Management. Signatory power may be delegated. A 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

The 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. This 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.