

**Subject Examination Regulations for the  
Master's Program in  
Earth Oriented Space Science and Technology  
at the Technische Universität München  
dated October 23, 2009**

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 Subject Examination and General Academic Regulations (*Fachprüfungs- und Studienordnung, FPSO*):

Preliminary statement 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. Only the German hardcopy version of these regulations is legally binding!  
In case of vagueness please refer to the German document!**

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### **§ 34**

#### **Applicability, Academic Titles**

- (1) These Subject Examination and General Academic Regulations (FPSO) for the Master's Program in Earth Oriented Space Science and Technology 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 academic 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 Period of Study, ECTS**

- (1) The Master's program in Earth Oriented Space Science and Technology at the Technische Universität München commences, as a rule, in the winter semester.
- (2) The number of classes in required, required elective subjects needed to obtain the Master's degree is 90 credits (70 weekly hours per semester) spread over three semesters. Added to this is a maximum of six months for the completion of the Master's Thesis pursuant to § 46. The number of examinations in the required, required elective subjects to be completed in the Earth Oriented Space Science and Technology Master's Program according to Appendix 1 is a minimum of 120 credits. The standard period 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 Earth Oriented Space Science and Technology is demonstrated by
  1. the following degrees:
    - a) a qualified Bachelor's Degree in natural or engineering sciences 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] which 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;

2. passing of the application review procedure pursuant to Appendix 2.

3. 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 such as “Test of English as a Foreign Language“ (TOEFL), “International English Language Testing System” (IELTS), or “Cambridge Main Suite of English Examinations”; alternatively adequate language skills may be proven through a good grade in English (corresponding to at least 10 out of 15 points) awarded by a domestic higher education entrance qualification. If, in the undergraduate program, 30 credits were obtained for examinations administered in English language examination modules, adequate proficiency in English is deemed proven.

- (2) The comparability of programs as well as the equivalence of degrees acquired from foreign institutions of higher education will be decided upon by the Examination Board in compliance with Art. 63 of the Bayerisches Hochschulgesetz [Bavarian Higher Education Act].
- (3) The assessment according to paragraph 1 section 1 will be performed on the basis of the required modules of a scientifically oriented Bachelor’s Program at the Technische Universität München and on the fulfillment of the academic/subject requirements of the Master’s Program Earth Oriented Space Science and Technology. Should these requirements not be fulfilled, the Examination Board can request additional tests from the student. The candidate must be informed thereof after review of the documentation during the first stage of the application review.
- (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 Par.2, Nr. 2.

### **§ 37**

#### **Modular Structure, Module Examination, Courses, Fields of Study, 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, required elective and elective courses is included in Appendix 1.
- (3) In the Master’s program in Earth Oriented Space Science and Technology, one of the following areas of concentration must be selected:
  - Earth System Science from Space
  - Remote Sensing
  - Navigation
- (4) The language of instruction in the Master’s program in Earth Oriented Space Science and Technology is English. Pursuant to § 5 Abs. 3 Nr. 11 of the Immatrikulations-, Rückmelde-, Beurlaubungs- und Exmatrikulationssatzung [§ 5 (3) no. 11 of the Statutes governing Enrollment, Re-Enrollment, Leave of Absence and Un-enrollment] of the Technische Universität München of 30 March 2007 as amended, therefore proof of proficiency in the German language is not required for enrolment.

### **§ 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) At least seven of the basic module examinations listed in Appendix 1 must be successfully completed by the end of the second semester. In the event of failure to meet deadlines § 10 (5) of the APSO shall apply.

### **§ 39**

#### **Examination Board**

Pursuant to § 29 of the APSO the board responsible for all decisions concerning examination matters shall be the Master's Examination Board for Earth Oriented Space Science and Technology. The Master's Examination Board (Examination Board) consists of five members: four members from the Faculty of Civil and Geodetic Engineering and one from the Faculty of Mechanical Engineering.

### **§ 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) However, at least half of the component parts of the Master's examination, assessed in accordance with ECTS, must be completed in the Master's program in Earth Oriented Space Science and Technology at the Technische Universität München. The Master's Thesis must be prepared in the Master's program in Earth Oriented Space Science and Technology at the Technische Universität München.

### **§ 41**

#### **Continuous Assessment Procedure**

- (1) The module examinations will, as a rule, be taken concurrently with the program. Type and duration of module examinations are provided for in Appendix 1. In the event of derogation from those provisions, § 12 (8) of the APSO must be complied with. The assessment of the module examination is governed by § 17 of the APSO.
- (2) Upon request of a student and with the agreement of the examiners, English-language class examinations may be taken in the German language.

### **§ 42**

#### **Registration for and Admission to the Master's Examination**

- (1) Students who are enrolled in the Master's program in Earth Oriented Space Science and Technology are deemed admitted to the module examinations of the Master's examination.

- (2) Registration requirements for required and required elective module examinations are stipulated in § 15 (1) of the APSO. The registration requirements for repeat examinations for failed required and required elective modules are stipulated in § 15 (3) of the APSO.
- (3) In derogation of subsection (2), students are deemed registered for those examinations to be taken concurrently with the required modules of the Master's program in Earth Oriented Space Science and Technology that belong to the classes stipulated in Appendix 1 for that semester of the program. In the event of failure to appear at an examination, the module examination is deemed taken and not passed unless conclusive grounds are given pursuant to § 10 (7) 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.
  3. the Master's Colloquium pursuant to § 46a
- (2) The module examinations are listed in Appendix 1. 64 credits in required modules, a minimum of 24 credits in required elective modules. In this are 18 credits from a main specialization and 6 credits from one of the other two specializations. The selection of modules must be in compliance with § 8 (2) of the APSO.

### **§ 44**

#### **Repetition of 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**

In addition to the examination results specified in § 43 (1), successful completion of coursework in the modules in the amount of 2 credits according to Appendix 1 must be evidenced.

### **§ 45 a**

#### **Multiple Choice Test**

- (1) Pursuant to § 12 (11) sentence 1 of the 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 (4) sentence 4 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, defining which answers are deemed correct.

- (3) This examination component is deemed passed
1. if at least 60 percent of all questions have been answered correctly; or
  2. if at least 50 percent of all answers are correct and the number of correct answers does not fall by more than 15 percent below the average examination results achieved by students taking this examination for the first time.
- (4) 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 component 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.
- (5) The students will receive an examination report listing
1. the grade;
  2. the passing limit;
  3. the number of questions asked;
  4. the number of correctly answered questions and the average of the reference group mentioned in subsection (3).

### **§ 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) The period of time between topic selection and submission of the completed Master’s Thesis must not exceed six months.
- (4) The Master’s Thesis is to be written in the English language.

### **§ 46 a Master’s Colloquium**

- (1) A student is deemed registered for the Master’s Colloquium if he/she has achieved a minimum of 90 credits in the Master’s program and has successfully completed the Master’s Thesis. The examination should take place no later than two months after the registration date specified in sentence 1.
- (2) The Master’s Colloquium is to be held by the Master’s Thesis supervisor together with a competent observer.
- (3) The Master’s Colloquium is to be held in the English language.

- (4) The Master's Colloquium will, as a rule, last 60 minutes. The student has approx. 30 minutes to present his/her Master's Thesis. This will be followed by a disputation that, based on the subject of the Master's Thesis, will extend to the broader discipline to which the Master's Thesis belongs.
- (5) The Master's Colloquium is deemed successfully completed if it is graded with at least "Sufficient" (4.0). If the Master's Colloquium is failed, § 24 (6) of the APSO shall apply.
- (6) 6 credits will be awarded for the Master's Colloquium.

### **§ 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) The grade for a module will be calculated according to § 17 of the APSO. The overall grade for the Master's Examination will be calculated as the weighted grade average of the modules according to Appendix 1 and the Master's Thesis. The grade weights of the individual modules correspond to the credits assigned to each module.

### **§ 48**

#### **Degree Certificate, Master's Diploma, Diploma Supplement**

If the Master's Examination is passed, a Degree Certificate, a Master's Diploma and a Diploma Supplement including a Transcript of Records are to be issued in compliance with § 25 (1) and § 26. The date to be entered on the Degree Certificate is the day when all examination requirements have been fulfilled.

### **§ 49**

#### **Entry into Force**

- (1) These Subject Examination and General Academic Regulations shall enter into force on October 1, 2009.

They shall apply to all students who commence their studies at the Technische Universität München as of the Winter Semester 2009/10. Appendix 1 also applies to those students who in are in their third semester during the Winter Semester 2009/10.
- (2) At the same time the Subject Examination Regulations for the Master's Program in Earth Oriented Space Science and Technology at the Technische Universität München from April 10, 2006, last changed via the amendment from September 9, 2008 shall cease to be in effect subject to the provision set forth in subsection (1) sentences 2 and 3.

**Appendix 1: Examination Modules**

Nr.	Module Name	Instructio -n Type (L LB P)	Sem.	SWS	Credits	Exam Type	Exam Duration	Language of Instruction
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**Required Modules**

1	Introduction to Earth System Science	L	1	4	6	Written exam	120	english
2	Introduction to Satellite Navigation	L+LB	1	3	4	Written exam	75	english
3	Spacecraft Technology 1	L+LB	1	3	4	Written exam	90	english
4	Orbit Mechanics 1 Studienleistungen – Orbit Mechanics 1	L LB	1	2	3 (2+1)	Written exam	60	english
5	Numerical Modeling	L+LB	1	4	6	Written exam	120	english
6	Signal Processing	L+LB	1	3	4	Written exam	60	english
7	Information Technology 1	L+LB	1	2	3	Written exam	60	english
8	Introduction to Photogrammetry, Remote Sensing and GIS	L	2	4	6	Written exam	120	english
9	Image Processing	L	2	2	2	Written exam	60	english
10	Orbit Mechanics 2 Studienleistungen – Orbit Mechanics 2	L LB	2	2	3 (2+1)	Written exam	60	english
11	Spacecraft Technology 2	L+LB	2	3	4	Written exam	90	english
12	Orbit and Attitude Control	L	2	2	3	Written exam	90	english
13	Estimation Theory	L	2	2	3	Written exam	60	english
14	Electrodynamics	L+P	2	2	3	Written activities		english
15	Information Technology 2	P	2	2	3	Oral and written activities	m	english
16	Seminar	P	2	2	3	Oral and written activities	m	english
17	Ground and User Segment	L	3	2	3	Written exam	90	english
18	Project	P	3	2	3	Oral and written activities	m	english



**Required Elective Modules:** 24 credits must be earned from the following list:

18 credits must be earned from the chosen specialization and 6 credits must be earned from one of the remaining two specializations.

**Specialization 1 (Earth System Science from Space)**

1	Atmosphere and Ocean	L	3	4	6	Oral exam	m	english
2	Earth System Dynamics	L+LB+P	3	4	6	Oral exam and written activities	m	english
3	Earth Observation Satellites	L+LB+P	3	4	6	Oral exam and written activities	m	english

**Specialization 2: Remote Sensing**

1	Photogrammetry	L+P	3	4	6	Oral exam	m	english
2	Remote Sensing	L+LB	3	4	6	Written exam, written and oral activities	60	english
3	Geo-Information	L	3	4	6	Oral exam	m	english

**Specialization 3: Navigation**

1	Precise GNSS	L+LB	3	4	6	Oral exam	m	english
2	Advanced Aspects of Navigation Technology	L	3	4	6	written exam	120	english
3	Navigation Labs	P	3	4	6	Oral and written activities	m	english

**Credit balance of each semester:**

Semester	Required Module Credits	Required Module Coursework Credits	Required Elective Module Credits	Master's Thesis and Master's Kolloquium Credits	Total Credits
1	29	1			30
2	29	1			30
3	6		24		30
4				30	30

**Explanation:**

Sem. = Semester; SWS = Weekly hours per semester (“Semesterwochenstunden”); L = Lecture (“Vorlesung”); LB = Exercise course (“Übung”); P = Practicum (“Praktikum”)

In the column Duration of Examination the duration in minutes is entered for written examinations; „m“ is entered for oral examinations.

The examination board may decide to change required elective subjects within the specializations in accordance to an altered lecture. Changes must be made known in a suitable manner to students by the beginning of the semester at the latest.

Through petition and an exception made by the Examination Board, a student can, as an alternative to the above mentioned Required Elective Subjects, choose a subject-relevant class in the area of an examination subject from the entire TUM's and Ludwig-Maximilian University's lecture offerings.

**APPENDIX 2:** Application review procedure**Application review procedure for the Master's Program in Earth Oriented Space Science and Technology at the Technische Universität München****1. Purpose of the Assessment**

Eligibility for the Master's Program, in addition to the requirements pursuant to § 36 (1) no(s). 1 and 3, requires proof of aptitude pursuant to § 36 (1) no. 2 in accordance with the following provisions. The special qualifications and skills of the candidates should correspond to the Satellite Application Engineering profession. 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 mathematics, physics, informatics, which are in the context of TU Munich acquired abilities of equal subject matter.

**2. Application review procedure**

- 2.1 The aptitude test will be held annually by the Faculty of Civil Engineering and Surveying.
- 2.2 Applications for admission to the aptitude test must be filed with the dean of studies of Earth Oriented Space Science and Technology no later than 31 May for the winter semester using the forms issued by the Faculty/Studienfakultät (absolute deadline). Documentation pursuant to no. 2.3.2 may be filed for the winter semester by 15 August.
- 2.3 The application must include:
  - 2.3.1 curriculum vitae formatted as a table;
  - 2.3.2 certification of a degree certificate in accordance with § 36; if this certification cannot be provided at the time the application is filed, complete certification of the first degree coursework and examination results (transcript of records) must be submitted; certification of a degree certificate must be submitted immediately upon receipt, and in any case not later than at the time of enrolment;
  - 2.3.3 a written statement (no more than 1 to 2 DIN A4 pages) of the reason for choosing Earth Oriented Space Science and Technology at the Technische Universität München in which the candidate explains those specific abilities and interests that make him/her particularly qualified for the Earth Oriented Space Science and Technology Master's Program at the Technische Universität München; further criteria are provided in the aptitude parameters listed in no. 1 sentence 3.
  - 2.3.4 a letter of recommendation from two university faculty members who participated in the candidate's final examination;

- 2.3.5 a written essay, in English or German, 500 to 700 words in length. The chairperson of the commission 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 March 1.
- 2.3.6 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.

2.4 For candidates who received a Bachelor's or Diplom Degree from the Technische Universität München there is no need to enclose the documentation specified in no. 2.3.2

### **3. Application Review Commission**

- 3.1 The aptitude review will be administered by a commission that, as a rule, will consist of the chairperson of studies in charge of the Earth Oriented Space Science and Technology Master's program, at least two lecturers and at least one research associate (wissenschaftlicher Mitarbeiter). At least half of the commission members must be university faculty. A representative of the student body will be a part of the commission, in an advisory capacity
- 3.2 The members of the commission will be appointed by the faculty council (Fachbereichsrat) in consultation with the dean of studies. At least one faculty member will be appointed as deputy member of the commission. As a rule, the commission will be chaired by the chairman of the study commission. Procedural regulations will be in accordance with Art. 41 of the BayHSchG as last amended.

### **4. Admission through the Application Review Procedure**

- 4.1 Admission through the application review procedure requires that all documentation specified in no. 2.3 has been submitted in a timely fashion and that all documentation must be complete.
- 4.2 Applicants who have fulfilled the requirements will be tested orally 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 Application Review Procedure.*

- 5.1.1 *The commission will assess, on the basis of the submitted written application documents, whether or not an applicant has an aptitude for a program pursuant to no. 1 (First stage of the Application Review Procedure). For this purpose the candidate's documentation will be reviewed and independently evaluated by two members of the commission. The commission will then determine, on the basis of the application documents, whether or not the applicant, judging from his/her proven qualifications and documented specific abilities and skills, is suitable for the program in question. The commission will grade the documentation on a scale from 0 to 10 points, 0 being the worst and 10 being the best possible result.*
- 5.1.2 *The applicant's points total will be calculated on the basis of the arithmetic average of the individual grades. Decimal places must be rounded up.*
- 5.1.3 *Applicants who have achieved 7 points will receive confirmation that they have passed the application review procedure.*
- 5.1.4 *Unsuitable applicants with an overall grade of fewer than four points will receive a rejection notice, signed by the university administration and specifying the reasons for rejection and providing information on legal remedies. Signatory power may be delegated to the chairperson of the Commission.*

#### *5.2 Second stage of the Application Review Procedure*

- 5.2.1 *The remaining applicants will be invited for an application review interview.*

Interview appointments will be announced at least one week in advance. Time slots for interviews must be scheduled before expiration of the application deadline. The interview appointment must be kept by the applicant. If the applicant is unable to attend an application review interview due to reasons beyond his/her control, a later appointment may be scheduled upon a student's well-grounded request, but no later than two weeks before the beginning of classes.

- 5.2.2 The application review interview is to be held individually for each candidate. The interview lasts at least 20 but not more than 30 minutes for each candidate and should reveal whether or not the candidate may be expected to attain the goals of the program in question independently, responsibly, and in a scholarly manner. The aptitude assessment interview covers the applicant's motivation for the program in Earth Oriented Space Science and Technology and the aptitude parameters listed in no. 1. Any subject-specific academic knowledge which is to be taught in the Master's program in Earth Oriented Space Science and Technology will not affect the decision. In the interview, the applicant must support the impression that he/she is suitable for the program in question. With the applicant's agreement, a representative of the student body may sit in on the interview.
- 5.2.3 The application review interview will be conducted by at least two members of the Commission. Each member will grade the result of the interview on a scale from 0 to 10, 0 being the worst and 10 being the best possible result.
- 5.2.4 The applicant's point total will be calculated on the basis of the arithmetic average of the individual grades as specified in no. 5.2.3. Decimal places must be rounded up. Applicants with 7 or more points will be deemed suitable.
- 5.2.5 The applicant will be notified of the result of the aptitude test in writing. The notice must be signed by the university administration. Signatory power may be delegated to the chairperson of the Commission. 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 Earth Oriented Space Science and Technology shall apply to all subsequent applications for this program.

## 6. Record

For the application review procedure a record must be kept showing the date, duration and location of the review, the names of the commission members, the applicant's name, and the decision of the members of the commission 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 application review for the Master's program in Earth Oriented Space Science and Technology may register for one repetition of the Application Review Procedure.

Issued upon the decision of the Academic Senate of the Technischen Universität München from 6. October 2009 as well as the approval of the president of the Technischen Universität München from 23. October 2009.

Munich, the 23. October 2009

Technische Universität München

Wolfgang A. Herrmann  
Präsident

These articles were stipulated on 23. October 2009 at the university; the records were made known on 23. October 2009. Hence is the day of announcement 23. October 2009.