
Subject Examination Regulations for the Master's Program in Earth Oriented Space Science and Technology at the Technische Universität München

dated 04.02.2005

Hereafter the Technische Universität München issues the following Examination Regulations based on Article 6 in conjunction with Article 81, Section 1, and Article 86a of the Bayerisches Hochschulgesetz (BayHSchG) and based on §57, Section 1 of the Qualifikationsverordnung (BayRS 2210-1-1-32-UK/WF).

Preliminary remark to linguistic usage:

In accordance with Article 3, Section 2, of the German Constitution, women and men have equal rights. All persons and functions described in the following rules are therefore equally valid for both women and men.

**The English version is provided merely as a convenience and is not intended to be a legally binding document. Legally binding is only the German hardcopy version of these regulations !
In case of vagueness it is referred to the German document !**

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§ 1

Applicability, Academic Titles

- (1) Except as otherwise provided for hereinafter, the regulations of the *Allgemeine Diplomprüfungsordnung der Technischen Universität München (ADPO)* [general diploma examination regulations of the Technische Universität München] shall apply as amended.
- (2) Upon successful completion of the Master's examination the academic degree "Master of Science"*) (M.Sc.) is awarded. This academic title may be used with the name of the university "(TUM)" as well.

§ 2

Purpose of the Master's Examination

The Master's Examination is the final component of the Master's program in Earth Oriented Space Science and Technology, qualifying the graduate for entry into professional practice or research. The Master's Examination is designed to determine whether or not the student has acquired the thorough knowledge of the discipline that is necessary for transition into a professional career; has a comprehensive view of the discipline's interrelated issues; and has the ability to work independently according to academic principles.

§ 3

Credits Required, Standard Period of Study, ECTS

- (1) The maximum number of classes in required and required elective subjects needed to obtain the Master's degree is 90 Credits (70 weekly hours per semester) spread over three semesters plus a maximum of six months for the completion of the Master's Thesis pursuant to § 11. Thus the standard period of study for the Master's program will be a total of four semesters.
- (2) The number of examinations to be completed successfully is calculated on the basis of the number of courses and class hours measured in credits pursuant to the European Credit Transfer System (ECTS). Each class hour is converted with a weighting of a minimum of one and a maximum of two credits. The only intermediate value to be allocated is 1.5 credits. For each semester 30 credits may be allocated.
- (3) The number of examinations in required and required elective subjects to be completed in the Earth Oriented Space Science and Technology Master's program according to Appendix 1 is 120 credits.

§ 4

Qualification Requirements

- (1) The following qualifications are required for enrollment for the Master's course in Earth Oriented Space Science and Technology:
 1. one of the following university degrees:

- a) an Above Average Bachelor's degree in natural or engineering sciences from a German university or
 - b) an internationally recognised Above Average Bachelor's degree in natural or engineering sciences from an international university or
 - c) an Above Average diploma, Bachelor's or Master's degree in natural or engineering sciences from a German Fachhochschule or
 - d) a diploma or Master's degree in natural or engineering sciences from a German university or
 - e) a degree from an international university equivalent to the degrees described in c and d.
2. passing of the Assessment of Aptitude for the Master's course Earth Oriented Space Science and Technology according to appendix 2,
3. sufficient knowledge of English language, demonstrated by the results of an internationally recognised English language test like „Test of English as a Foreign Language“ (TOEFL). Test results are waived for native-speakers or for applicants with a grade of 2 or better in the German Abitur.
- (2) An Above Average result pursuant to subsection 1 no. 1 is awarded when a minimum of Level C was obtained for the undergraduate degree according to the ECTS Grading System. Examination results which have not been assessed according to the ECTS Grading System will be converted accordingly.
- (3) 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. 82 of Bayerisches Hochschulgesetz [Bavarian Higher Education Act]. The degrees mentioned in subsection 1 no. 1 lit. b must be at least equivalent to a Bachelor's Degree in natural or engineering sciences from the Technische Universität München. In connection with admission to the Master's program, the Examination Board may consult the Zentralstelle für ausländisches Bildungswesen [Central Office for Foreign Education] and may grant admission to the program subject to the student's passing of additional examinations.

§ 5

Examination Board

The competent body for any decisions regarding examination issues pursuant to § 5 of ADPO is the Master's Examination Board for Earth Oriented Space Science and Technology.

The Master's Examination Board (Examination Board) consists of 3 members. 2 representatives of the faculty of Civil and Geodetic Engineering and 1 representative of the faculty of Mechanical Engineering will be members of the Examination Board.

§ 6

Acceptance of Examination Results

- (1) Examination results from a university program will as a rule be recognized unless they are not equivalent.

The Examination Board in consultation with the examiner in charge will decide upon the acceptance of examination results.

- (2) Examination results are deemed equivalent if they correspond in essence to those of the Master's Program in Earth Oriented Space Science and Technology at the Technische Universität München with regard to content, scope and requirements, whereby the assessment thereof shall not be a schematic comparison, but rather an overall consideration and assessment.

Examination results will be accepted only if the majority of the work for the Earth Oriented Space Science and Technology program is done at the Technische Universität München.

A diploma thesis [equivalent to a *Diplomarbeit*] on a relevant topic written at a university in an academic higher education program will be accepted as a Master's Thesis.

In the absence of equivalence, the Examination Board may consult the Central Office for Foreign Education and may request that a student pass additional examinations.

§ 7

Ongoing Examination Procedure

- (1) The subject examinations will generally be taken along with the coursework.
- (2) Subject examinations will be held either in writing or orally in the form of several examinations or as one final examination. The examiners in charge of the respective subject, in coordination with the Examination Board, will decide in which manner a subject examination will be administered. The student must be appropriately informed of both the type and duration of the examination at least 14 days prior to the examination, and in no event later than 14 days before the end of classes for that term.
Oral individual examinations will last at least 20 and not more than 60 minutes, written examinations at least 60 and no more than 180 minutes. Oral group examinations will last at least 15 minutes for each candidate.
- (3) The credits listed in Appendix 1 will be allocated to each examination subject as appropriate; the assessment of these credits must comply with § 3 subsection 2. These credits reflect the workload that a student will encounter when enrolled in classes in this particular subject. The credits are deemed achieved if the respective subject examination has received at least the grade of „Sufficient“ (4.0).
- (4) Examinations will as a rule take place within the first three weeks after the end of classes for a given term.

§ 8

Admission to and Registration for the Master's Examination

Admission

- (1) Upon matriculation in the Master's program in Earth Oriented Space Science and Technology, a student is deemed admitted to the subject examinations of the Master's Examination.

Registration

- (2) A student is deemed registered for those ongoing examinations in the required subjects of the Master's Program in Earth Oriented Space Science and Technology that are a part of the classes stipulated in the curriculum for that semester of the program.

§ 9

Scope and Repetition of the Master's Examination

- (1) The Master's Examination consists of:
 1. The subject examinations pursuant to subsection 2.
 2. The Master's Thesis pursuant to § 11.
 3. The Master's Colloquium (with reference to § 11b).
- (2) The subject examinations are listed in Appendix 1. In addition to the required subjects listed in Appendix 1, 26 credits (20 weekly hours) of required elective subjects from the modules 1-3 pursuant to Appendix 1 must be chosen. Thereby 19.5 credits (15 weekly hours) must be chosen from one single module and 6.5 credits (5 weekly hours) from one of the remaining two modules.
- (3) A subject examination is deemed passed if it has been graded at least "Sufficient" (4.0).
- (4) A subject examination that was not passed may be repeated once at the next possible date. A repeat examination must be offered every semester. In coordination with the Examination Board duration and manner of the repeat examination can be defined different from duration and manner of the original examination. Thereby §7 section 2 must be adhered.
- (5) If a repeat examination is failed, the subject examination receives the final classification of "Not Passed". A second repetition is not possible. In particular cases the Examination Board can agree to deviate from this rule.
- (6) In the event of failure to appear at an examination, the subject examination is deemed taken and not passed unless conclusive grounds are given pursuant to § 13 of ADPO.
- (7) If the Examination Board accepts the grounds that have been furnished for failure to appear at examinations, the examinations must be taken on the next possible date to the extent that these grounds do not preclude this. § 13 subsection 3 sentence 2 of ADPO shall remain unaffected.

§ 10

Course Work

- (1) In the Master's program in Earth Oriented Space Science and Technology there will be no evaluation of course work.

§ 11**Master's Thesis**

- (1) As part of the Master's Examination, each candidate must write a Master's Thesis.
- (2) Work on the Master's Thesis must commence immediately after successful completion of the subject examination.
- (3) The period of time between topic selection and submission of the completed Master's Thesis must not exceed 6 months. Upon a student's written request, the period of time for writing the Master's Thesis may, in especially justified cases, be extended by a maximum of 3 months, subject to the approval of the Examination Board and the agreement of the person who proposed the topic of the Master's Thesis.
- (4) The Master's Thesis should be written in the English language. The Master's Examination Board may permit that the Thesis be written in a language other than English if it can be guaranteed that there will be expert assessment of the Thesis in that other language pursuant to § 12 subsection 10 of ADPO. In this case an English summary of the results must be enclosed.
- (5) The Master's Thesis will be assessed within two months of the date of submission, as a rule by the supervisor and one other examiner. The appointment of a second examiner may be waived if there is no second expert examiner available, or if his/her appointment would unduly delay the examination procedure. If the Master's Thesis is assessed as Not Passed by the supervisor, it must be assessed by a second examiner who should be from an area of expertise as close as possible to the subject of the Master's Thesis.
- (6) The Master's Thesis is deemed successfully completed if it was graded at least "Sufficient" (4.0). The grade for the Master's Thesis will be calculated as unweighted arithmetic mean of the individual grades awarded by the examiners and will be adjusted to the grade scale of § 16 subsections 1 and 2 of ADPO. 24 credits will be awarded for a passed Master's Thesis.
- (8) If the Master's Thesis is failed, it may be repeated once with a new subject.

§ 11a**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 examiners for the Master's Colloquium should be the same as for the Master's Thesis.

- (3) The Master's Colloquium is to be held in the German or the English language, according to the student's request.
- (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 receives at least the grade of "Sufficient" (4.0).
- (6) For the Master' Colloquium 6 credits will be awarded.

§ 12

Assessment of the Master's Examination

- (1) The Master's Examination is deemed passed if all subject examinations were passed and the Master's Thesis as well as the Master's Colloquium received at least a grade of "Sufficient" (4.0).
- (2) The overall grade for the Master's Examination will be calculated as the weighted grade average of the subject examinations according to § 9, of the Master's Thesis and of the Master's Colloquium. The grade weights of the individual examination results correspond to the awarded credits.

The overall assessment is expressed by the rating pursuant to § 16 of ADPO.

§ 13

Degree Certificate, Master's Diploma, Diploma Supplement

- (1) If the Master's Examination was passed, a degree certificate in the English language with a German translation is to be issued which lists the individual examination subjects and the grades achieved in these subjects, subject and grade of the Master's Thesis und Master's Colloquium and the overall grade.
- (2) Together with the degree certificate an instrument which documents the awarding of the academic degree "Master of Science" (M.Sc.)* is bestowed upon the graduate. The Master's Diploma will be signed by the President of the Technische Universität München, the Degree Certificate by the chairperson of the Master's Examination Board or his/her proxy. The date to be entered on the Degree Certificate is the day when all examination requirements have been fulfilled.
- (3) In addition an English language Diploma Supplement will be bestowed.

§ 14

Date of Entry into Force

These examination regulations shall enter into force on May 1st, 2005.

They shall apply to all students who take up their studies at the Technische Universität München as of the Winter Semester 2005/06.

Appendix 1: Examination Subjects

No.	Name of Subject	Sem.	SWS	Credits
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Required Subjects:

1	Introduction to Earth System Science	1	4	6
2	Spacecraft Technology 1	1	3	4
3	Elements of Mathematics	1	3	4
4	Elements of Mathematical Physics	1	3	4
5	Introduction to Orbit Mechanics	1	2	2
6	Signal Processing	1	3	4
7	Information Technology 1	1	3	4
8	Project 1	1	2	2
9	Introduction to Photogrammetry, Remote Sensing and GIS	2	4	6
10	Introduction to Navigation	2	4	5
11	Spacecraft Technology 2	2	3	4
12	Orbit and Attitude Control	2	2	2.5
13	Advanced Orbit Mechanics	2	3	4
14	Parameter Estimation	2	2	3
15	Image Processing	2	1	1.5
16	Information Technology 2	2	2	2
17	Seminar	2	2	2
18	Ground and User Segment	3	2	2
19	Project 2	3	2	2

Required Elective Subjects:

Modul 1 (Earth System Science from Space)

1	Earth Rotation and Solid Earth Physics	3	5	6.5
2	Geophysical Fluids	3	5	6.5
3	Gravity and Magnetic Field Analysis	3	5	6.5

Modul 2 (Remote Sensing)

1	Photogrammetry	3	5	6.5
2	Remote Sensing	3	5	6.5
3	Geo-Information	3	5	6.5

Modul 3 (Navigation)

1	Precise GNSS	3	5	6.5
2	Advanced Aspects of Navigation Technology	3	5	6.5
3	Sensor Integration and Signal Analysis	3	5	6.5

Upon resolution of the Examination Board, required elective subjects may be changed in the amount of one class per module. Any changes must be announced to the students in appropriate form no later than at the beginning of the semester.

Appendix 2: Aptitude Assessment Test [Eignungsfeststellungsverfahren]

Aptitude Assessment for the Master's Program in Earth Oriented Space Science and Technology at the Technische Universität München

1. Purpose

Eligibility for the Master's Program in Earth Oriented Space Science and Technology, in addition to the requirements pursuant to § 4 subsection 1 no(s). 1 and 3 requires proof of aptitude pursuant to § 4 subsection 1 no. 2 in accordance with the following provisions. The special qualifications and skills of the candidates should correspond to the Earth Oriented Space Science and Technology profession. Individual aptitude parameters are:

- 1.1 Ability to do research work, basic research and methodological work
- 1.2 Specialized knowledge in the necessary foundations of science and engineering.

2. Aptitude Assessment Process

- 2.1 The aptitude assessment test will be administered annually by the Faculty of Civil Engineering and Surveying.
- 2.2 Applications for admission to the aptitude assessment test must be filed with the Dean or Studiendekan of the Faculty not later than May 31 for the Winter Semester, using the forms issued by the Faculty. Documentation for no. 2.3.2 may be filed later: for the Winter Semester by August 15.
- 2.3 The application must include:
 - 2.3.1 Curriculum vitae formatted as a table;
 - 2.3.2 Certification of a degree obtained from an institution of higher education in accordance with § 4;
 - 2.3.3 A written statement of the reason for choosing Earth Oriented Space Science and Technology program 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. This statement may consist of no more than 2 DIN A4 pages; 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 in German, 500-700 words in length. The chairperson of the commission may provide one topic or a selection of several topics for this essay and the candidates must be informed of the topic/s not later than May 15;
 - 2.3.7 A declaration that the candidate wrote both the statement of the reasons for choosing the program and the essay independently and without outside help, and that he/she 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 with the application.

3. Aptitude Assessment Commission

- 3.1 The aptitude assessment test will be administered by a commission that, as a rule, will consist of the Studiendekan in charge of the Earth Oriented Space Science and Technology Master's program, and at least two members of the university faculty and at least one research associate. 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 (exception: continuing education programs).
- 3.2 The members of the commission will be appointed by the Faculty Council in consultation with the Studiendekan. At least one faculty member will be appointed as deputy member of the commission. As a rule, the commission will be chaired by the Studiendekan. Procedural regulations will be in accordance with Art. 48 of BayHSchG as last amended.

4. Admission to the Aptitude Assessment Process

- 4.1 Admission to the aptitude assessment process 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 advice on legal options.

5. The Aptitude Assessment Process

- 5.1 First stage of the Aptitude Assessment process
- 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 Aptitude Assessment process). 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 15 points, 0 being the worst and 15 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 9 points will receive confirmation that they have passed the aptitude assessment test. Unsuitable applicants with an overall grade of fewer than 5 points will receive a rejection notice, signed by the university administration and specifying the reasons for the rejection and providing advice on available legal options. Signatory power may be delegated to the chairperson of the commission.

5.2 Second stage of the Aptitude Assessment process

5.2.1 The remaining applicants will be invited for an aptitude assessment interview (Second stage of Aptitude Assessment Process)

5.2.2 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 aptitude assessment 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.

5.2.3 The aptitude assessment 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.

5.2.4 The aptitude assessment 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 15, 0 being the worst and 15 being the best possible result.

5.2.5 The applicant's points total will be calculated on the basis of the arithmetic average of the individual grades as specified in 5.2.3. Decimal places must be rounded up. Applicants with 9 or more points will be deemed suitable.

5.2.6 The applicant will be notified of the result of the aptitude assessment test in a letter signed by the university administration. Signatory power may be delegated to the chairperson of the commission. A rejection must specify the reasons and provide advice on legal options.

5.2.7 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 first and second stage of the aptitude assessment process, a record must be kept showing the date, duration and location of the assessment, 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 aptitude assessment test for the Master's program in Earth Oriented Space Science and Technology may register for one repetition of the Aptitude Assessment Test.