

These examination regulations have been worded carefully to be up to date; however, errors cannot be completely excluded. The official German text available from L1 – Legal Affairs and Academic Quality Management is the version that is legally binding.

Note: Students who started their studies before the latest amendment came into effect are requested to also comply with previous amendments and the respective transitory provisions.

Degree Program and Examination Regulations for the Elite Master’s Degree Program in Advanced Optical Technologies at the Faculty of Engineering of Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU)

**– FPO MAOT–
dated October 2, 2007**

amended by statutes of
September 3, 2009
August 11, 2010
March 9, 2011
July 26, 2013
July 8, 2014
March 8, 2016
January 16, 2018
August 6, 2019
July 26, 2022

Based on Section 13 (1)(2), Section 43 (5), Section 58 (1) and Section 61 (2)(1) of the Bavarian Higher Education Act (Bayerisches Hochschulgesetz, **BayHSchG**), FAU enacts the following degree program and examination regulations:

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Part 1: General Provisions

Preamble

FAU offers an Elite Master's degree program in Advanced Optical Technologies (MAOT) as part of the Elite Network of Bavaria.

Section 34 Scope

The degree program and examination regulations for the Elite Master's degree program in Advanced Optical Technologies complement the current version of the General Examination Regulations for the Bachelor's and Master's degree programs at the Faculty of Engineering of FAU (**ABMPO/TechFak**) from September 18, 2007.

Section 35 ECTS Credits, Standard Duration of Study, Start of Degree Program, Related Degree Programs

(1)¹120 ECTS credits shall be required in order to pass the Elite Master's degree program in Advanced Optical Technologies (MAOT). ²The standard duration of study shall be four semesters.

(2) The degree program may only be started in the winter semester.

(3) The provisions in Section 30 (3)(2) **ABMPO/TechFak** do not apply to related degree programs.

Section 36 Degree Title for the Elite Master's Degree Program

The student is conferred the degree Master of Science (abbreviated MSc) after passing the Master's examination of the Elite Master's degree program.

Section 37 Teaching and Examination Language

¹Notwithstanding Section 4 (5) **ABMPO/TechFak**, the teaching and examination language in the Elite Master's degree program in Advanced Optical Technologies shall be English; individual teaching units and examinations may be held in German. ²The Master's thesis shall usually be written in English. ³Exceptions shall require the Examination Committee's approval.

Section 38 Admissions Committee, Degree Program Committee

(1) ¹An Admissions Committee shall be formed pursuant to Section 11 **ABMPO/TechFak** to review whether applicants meet the qualification and admission requirements for the Elite Master's degree program pursuant to Section 39. ²It shall consist of one representative each from specialization areas 1 to 7 of the MAOT. ³The representatives shall be university lecturers or full-time research associates; at least four of these shall be professors. ⁴The members of the admissions committee select a speaker from their midst who must be a university lecturer.

(2) ¹Together with a student representative and the degree program manager acting as a study advisor, the Admissions Committee shall also assume the tasks of a Degree

Program Committee for the Elite Master's degree program. ²A deputy shall be appointed for the student representative.

Section 39 Qualification for the Elite Master's Degree Program

(1) ¹In order to qualify for the Master's degree program, applicants must have completed a degree program within the meaning of Section 29 (1) (1) **ABMPO/TechFak** in a relevant engineering or scientific subject as defined in sentences 2 and 3 with an above-average grade and have passed the qualification assessment process pursuant to **Appendix 4** in connection with the **Appendix to ABMPO/TechFak**. ²Completed Bachelor's degrees in physics, optical technologies or electrical engineering shall generally be considered relevant. ³The same applies for degrees obtained at a faculty of engineering or sciences for which at least 20 ECTS credits had to be achieved in the areas of optics or optical technologies.

(2) ¹Applicants should have completed this degree with an overall grade of at least 2.00 (good). ²Section 12 (3) sentences 1 to 3 of **ABMPO/TechFak** shall apply accordingly.

Section 40 Structure of the Elite Master's Degree Program, Failure at the Final Attempt

(1) ¹The Elite Master's degree program shall comprise 17 modules as listed in **Appendix 2**. ²The modules M4 to M9 shall be chosen from two of the major topics listed in 1 to 7 in **Appendix 1**. ³Modules worth at least 15 ECTS credits must be taken for both major topics. ⁴Modules M10 to M12 can be selected from any of the major topics listed in **Appendix 1**. ⁵Modules with a lower or higher number of ECTS credits can replace modules with 5 ECTS credits accordingly. ⁶The number of examinations can either increase or decrease accordingly. ⁷Students shall complete the laboratory courses of modules M13 and M14 pursuant to sentences 2 and 3.

(2) ¹The modules M1 and M2 must be completed by the end of the second semester by all students; otherwise the Elite Master's degree program shall be regarded as having been failed at the final attempt, unless the reasons for failing to complete the modules in due time are beyond the student's control. ²Section 7 (3) **ABMPO/TechFak** shall apply accordingly.

Section 41 Choice of Major Topics

[revoked]

Section 42 Examination and Course Achievements

[revoked]

Section 43 Research Project

(1) ¹Students shall carry out a research project as part of the module group M15. ²This is intended to teach students how to independently solve scientific problems such as those dealt with in a Master's thesis. ³The research project shall have a workload of approximately 300 hours. ⁴It shall be approximately 15-25 pages in length. ⁵The research project period should generally not exceed six months.

(2) The research project shall be carried out under the supervision of a university lecturer teaching the subject in question.

Section 44 Research Laboratory Course

¹The research laboratory course (M16) shall have a minimum duration of five weeks and shall preferably be completed in a research area at FAU's Faculty of Engineering, Faculty of Sciences or Faculty of Medicine that is relevant to the degree program. ²If the research laboratory course is completed outside FAU, the internship guidelines set forth by MAOT shall apply.

Section 45 Admission to the Master's Thesis

Students shall successfully complete modules worth a minimum of 80 ECTS credits to gain admission to the Master's thesis.

Section 46 Master's Thesis

(1) ¹The Master's thesis is intended to demonstrate students' ability to solve problems independently in one of their major topics. ²The thesis shall have a workload of approximately 900 hours to be completed within six months. ³As part of the Master's thesis module, students shall give an additional presentation on the results of the Master's thesis followed by a discussion. ⁴The date of the presentation shall be determined by the supervising lecturer either after the student has submitted their Master's thesis or during the final stage of thesis work.

(2) ¹The Master's thesis shall deal with a scientific subject at the intersection of two of the student's major topics. ²The subject of the Master's thesis shall be allocated by a full-time university lecturer teaching the degree program who represents one of the chosen major topics. ³Deviations from this shall be subject to the Degree Program Committee's approval.

Section 47 Evaluation of Achievements in the Master's Degree Program, Resit Examinations, Withdrawal from the Degree Program

(1) The Master's degree program shall have been passed if all modules of the module groups M1–M17 have been passed pursuant to **Appendix 2**.

(2) ¹The overall grade for the Master's degree program is calculated from the grades for modules M1 and M2, M4 to M12, M15 and M17. ²The module grades shall be weighted according to the modules' ECTS credits.

(3) ¹Notwithstanding the respective provisions in **ABMPO/TechFak**, examinations in the Elite Master's Degree Program Advanced Optical Technologies can be resat in accordance with the following provisions: ²Examination achievements in modules M1, M2 and M15 can be repeated twice. ³Examination achievements in modules M4 to M12 and M16 can be repeated once. ⁴Notwithstanding Section 28 (2)(2) **ABMPO/TechFak**, failed attempts in modules M4 to M12 shall not be counted when changing to alternative modules. ⁵In the event of a failure to pass there is no obligation to repeat the failed examination within the legally stipulated period pursuant to Section 28 (1)(5) **ABMPO/TechFak**. ⁶Examination achievements in modules M3 and M14 can be repeated without restriction.

(4) ¹Students who are obliged to withdraw from the Elite Master's degree program as a result of the provision set forth in paragraph (3)(3) shall be offered the option of entering a Master's degree program at the Faculty of Engineering, provided the relevant qualification assessment process is passed successfully. ²Examination and course

achievements from the Elite Master's degree program shall be recognized in the subsequently studied degree programs unless the relevant **degree program and examination regulations** state otherwise. ³The relevant Master's degree program shall be proposed by the Admissions Committee with the approval of the degree program representatives on the Admissions Committee.

Part 2: Final Provisions

Section 48 Legal Validity and Transitory Provisions

(1) ¹These degree program and examination regulations shall come into effect on the day after their publication. ²They shall apply to all students who enter the Elite Master's degree program in Advanced Optical Technologies in the winter semester 2007/2008 or later.

(2) ¹The amendment statute of August 11, 2010 shall come into effect on October 1, 2010. ²It shall apply to students who enter the Elite Master's degree program in the winter semester 2010/2011 onwards.

(3) ¹The seventh amendment statute shall come into effect on the day after its publication. ²It shall apply to all students starting a degree program from winter semester 2018/2019 onward.

(4) ¹The eighth amendment statute shall come into effect on October 1, 2019. ²Notwithstanding sentence 1, the amendments in section 39(1)(4) shall apply to all students starting the Master's degree program from the winter semester 2019/2020 onwards. ³Notwithstanding sentences 1 and 2, the amendments in Section 37 (2) (old), Section 40, Section 43 (1)(3), **Appendix 1** (9) and the changes to the foundation subjects in **Appendix 2** only apply to examination procedures commenced as of winter semester 2019/2020 (first attempt).

(5) ¹The ninth amendment statute shall come into effect on October 1, 2022. ²It shall apply to all students starting a degree program from winter semester 2022/2023 onward. ³Examinations according to the previously valid degree program examination regulations shall be offered for the last time in winter semester 2025/2026. ⁴From the date stated in sentence 3, those students who are affected by the respective version of the examination regulations becoming invalid shall take their remaining examinations in accordance with the version of the degree program and examination regulations valid from this date on.

Appendix 1: Major Topics

(1) ¹The learning outcome of the major topics is to allow students to specialize in a specific subject area by choosing from the modules offered. ²Whilst complying with the provisions stipulated in Section 40 (1) sentences 2 to 4 and Section 3, students can choose from the following major topics:

1. Optical Metrology
2. Optical Material Processing
3. Optics in Medicine
4. Optics in Communication
5. Optical Materials and Systems
6. Computational Objects
7. Physics of Light
8. Related Fields.

³Modules which can be chosen are listed in **Appendix 3**; further modules may be added in future.

(2) ¹The learning outcome of the major topic Optical metrology is for students to become familiar with optical measuring methods and acquire the ability to use them adequately in practice. ²Students acquire specialized knowledge in the properties of light, light-matter interaction and common sensors and analysis methods.

(3) The learning outcome of the major topic Optical material processing is for students to learn how to process matter using light, focusing in particular on the necessary properties of light and light-material interaction.

(4) The learning outcome of the major topic Optics in medicine is for students to explore how and where light is used in the field of medicine, both for diagnosis and therapy.

(5) The learning outcome of the major topic Optics in communication is for students to obtain advanced knowledge of using optics in communication systems.

(6) The learning outcome of the major topic Optical materials and systems is for students to gain advanced knowledge about characteristics of materials which determine the optical properties of the material.

(7) The learning outcome of the major topic Computational objects is for students to become familiar with mathematical methods for analyzing data in the field of optical technologies and methods for simulating optical components and systems.

(8) The learning outcome of the major topic Physics of light is for students to acquire knowledge in the physics on which optical technologies are based going beyond the foundation modules (geometrical optics, wave optics, Fourier optics, quantum optics).

(8a) The learning outcome of the major topic Related fields is for students to acquire knowledge in the fundamental principles of physics, mathematics, engineering or medicine in major topics 1 to 7 at a more advanced level.

(9) ¹The type and scope of the examination are dependent on the competencies for the chosen module in accordance with paragraphs (1) to (8) and the module handbook.

²Possible examination achievements are: written examination (60, 90 or 150 mins) or

oral examination (approx. 30 mins). ³The module handbook is published before the beginning of the semester in accordance with local practice.

(10) ¹Modules generally consist of two teaching units (lecture and tutorial), each with a workload of 2 semester hours (SWS). ²Further provisions shall be set forth in the module handbook.

Appendix 2: Structure of the Degree Program

Module group	Module number	Module name	SWS (semester hours)				Total ECTS credits	Workload per semester in ECTS credits				Type and scope of the examination
			L	T	P	S		1st Sem.	2nd Sem.	3rd Sem.	4th Sem.	
Basic subjects	1	Fundamentals of optics	8	4			15	15				EA (written examination 150 min.)
	2	Basics of laser technology	2	1	1		5	5				EA (written examination 90 mins), 80% + EA: LA (lab report, 5–7 pages), 20%
	3	Numerical methods and topics in optical technologies	4				5	5				CA (SL)
Major Topic 1 pursuant to Appendices 1 and 3	4	Major topic 1 – Module 1	2	2			5		5			pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	5	Major topic 1 – Module 2	2	2			5		5			pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	6	Major topic 1 – Module 3	2	2			5			5		pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
Major Topic 2 pursuant to Appendices 1 and 3	7	Major topic 2 – Module 1	2	2			5			5		pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	8	Major topic 2 – Module 2	2	2			5		5			pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	9	Major topic 2 – Module 3	2	2			5		5			pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
Free Modules	10	Free module 1	2	2			5			5		pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	11	Free module 2	2	2			5		5			pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
	12	Free module 3	2	2			5			5		pursuant to Appendix 1 (9) or Section 40 (1) sentence 5
Lab courses	13	Lab course Major Topic 1			2		2,5	2,5				CA (Lab report log, approx 10-15 pages)
	14	Lab course Major Topic 2			2		2,5		2,5			CA (Lab report log, approx 10-15 pages)
Project report	15	Project report					10			10		EA (written assignment, approx. 15–25 pages)
Internship	16	Internship	at least 5 weeks				5		5			CA (internship report)

Master's thesis	17	Master's thesis					30				30	Master's thesis and seminar (approx. 30 mins) (90 % and 10 %)
		Total semester hours and ECTS credits	32	23	5		120	27.5	32.5	30	30	
			60									

Explanations

CA = ungraded course achievement, see Section 6 (3) sentence 8 **ABMPO/TechFak**.

EA = graded examination achievement, see Section 6 (3)(7) **ABMPO/TechFak**.

LA = laboratory achievement, see Section 6 (3) sentences 3 and 5 **AMBPO/TechFak**.

SA = seminar achievement, see Section 6 (3) sentence 4 and 5 **ABMPO/TechFak**.

Appendix 3: Catalog of subjects covered in major topics

Major topic	Module	ECTS credits	semester	Examination format
Optical metrology	Modern optics: Advanced optics	5	SS	pursuant to Appendix 1 para. 9
	Optical technologies in life sciences	5	WS	
	Product analysis	5	WS	
Optical material and systems	Advanced laser technology	5	SS	
	Semiconductor technology IV – Optical Lithography	5	SS	
	Non-linear optics	5	TBA	
Computational optics	Computational optics	5	SS	
	Medical image processing for interventional applications	5	SS	
	Medical image processing for diagnostic applications	5	WS	
Optical material processing	Laser technology	5	WS	
	Laser-tissue interaction	5	SS	
	Optical lithography	5	WS	
	Advanced laser technology	5	SS	
Optics in communication	Non-linear fibre optics	5	SS	
	Advanced optical communication systems	5	WS	
	Non-linear optics	5	TBA	
Optics in Medicine	Laser tissue-Interaction	5	SS	
	Photonics in medical engineering	5	WS	
	Fundamentals in anatomy and physiology for engineers	5	SS	
	Optical technologies in life sciences	5	WS	
Physics of light	Advanced laser technology	5	SS	
	Non-linear optics	5	TBA	
	Quantum optics	5	TBA	

Appendix 4: Qualification Assessment Process

(1) Applicants for admission to the Master's degree program shall submit the following documents:

1. A certificate proving that the applicant holds a qualification according to Section 39 (1) (certificate, transcript of records, diploma supplement or comparable documents) or a transcript of records showing at least 140 ECTS credits in the case set forth in Section 29 (3),
2. An English-language CV with proof of any relevant professional activity or placements which are relevant with regard to the subject of the Master's degree program.
3. If the applicant did not complete their university entrance qualifications or first degree in English: proof of English language skills equivalent at least to Level B2 of the Common European Framework of Reference (CEFR). Proof of language skills shall be provided either with school reports or certificates obtained for having completed a language course stating that the student has attended English lessons up to a level equivalent to B2; evidence of having successfully completed the Test of English as a Foreign Language (TOEFL) with at least 85 points in the iBT; or having passed the International English Language Testing System (IELTS) with a grade of 5.0 or above.

(2) Applications must have been received by July 15 at the latest.

(3) ¹In accordance with Section 11 **ABMPO/TechFak** in conjunction with Section 38, qualification assessment shall be the responsibility of the Admissions Committee of the Master's degree program. ²The admissions committee may transfer the task of coordinating and carrying out the process to individual members unless otherwise stated.

(4) ¹Applicants with a degree within the meaning of (1) (1) or in the case of Section 29 (3) **ABMPO/TechFak** with an average grade of their achievements to date of 2.0 (= gut, good) or better or an average module grade in the areas of optics and optical technologies of 2.5 (= gut, good) or better shall be invited to a 20-minute interview, which may also be conducted as a video conference. ²The interview shall be conducted by at least one member of the Admissions Committee and an observer. ³In the interview, the applicant shall outline their qualifications and previous papers on subjects relevant to the degree program and answer questions regarding their papers and topics relevant to the Elite degree program at an appropriate level. ⁴The applicant's qualification for the Elite Master's degree program will be assessed based on:

1. Standard of previous knowledge in physics, in particular in the areas of electromagnetism and optics (50%)
2. Standard of knowledge of the mathematical processes required for the previous knowledge in physics as stipulated in (1), such as matrix operations and complex numbers (20%)
3. Standard of knowledge of important technical applications, in particular lasers and optical fibers (30%).

(5) It will not be possible to repeat the qualification assessment process on the basis of the documentation submitted with the first application.