

# **Examination and Academic Regulations for the Master's Program in Informatics: Games Engineering at the Technische Universität München.**

(The German version from 15 October 2018)

**15 October 2018**

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*):

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

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## **§ 34**

### **Applicability, Academic Titles, Related Degree Programs**

- (1) <sup>1</sup>These Examination and Academic Regulations for the Master's program in Informatics: Games Engineering (FPSO) complement the General Academic and Examination Regulations for Bachelor's and Master's programs at the Technische Universität München (APSO) from 18 March 2011 as amended. <sup>2</sup>The APSO shall have precedence.
- (2) <sup>1</sup>Upon successful completion of the Master's examination the degree "Master of Science" ("M.Sc.") is awarded. <sup>2</sup>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 Informatics: Games Engineering at the Technische Universität München is possible in the winter or summer semester.
- (2) <sup>1</sup>The number of classes in required and elective subjects needed to obtain the Master's degree is 90 credits (63 weekly hours per semester) spread over three semesters. <sup>2</sup>Furthermore, a maximum of six months (30 credits) is added for the completion of the Master's thesis pursuant to § 46. <sup>3</sup>The number of examinations in required and elective subjects to be completed in the Informatics: Games Engineering Master's program according to Appendix 1 is a minimum of 120 credits (including the Master's thesis). <sup>4</sup>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 Informatics: Games Engineering is demonstrated by:
  1. a qualified Bachelor's degree of at least six semesters or an equivalent degree in Informatics: Games Engineering or comparable programs obtained from a domestic or foreign university,
  2. an adequate knowledge of the English language; students whose language of instruction is not English must demonstrate proficiency through an acknowledged language test such as "Test of English as a Foreign Language" (TOEFL) (at least 88 points), "International English Language Testing System" (IELTS) (at least 6.5 points), or "Cambridge Main Suite of English Examinations"; a Bachelor's thesis written in English can also be accepted as proof of adequate knowledge of the English language,
  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. passing of the Aptitude Assessment pursuant to Appendix 2.
- (2) A degree is considered a qualified degree within the meaning of subsection 1 if there are no essential differences with regard to the acquired competencies (learning outcomes) obtained through the Bachelor's program Informatics: Games Engineering at Technische Universität München specified in subsection 1, no.1, and if these acquired competencies correspond to the subject-specific requirements of the Master's program in Informatics: Games Engineering.
- (3) <sup>1</sup>The assessment according to subsection 2 will be performed on the basis of the required modules of the Bachelor's program in Informatics: Games Engineering. <sup>2</sup>If certain examination results are missing for the assessment, the Aptitude Assessment 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. <sup>3</sup>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 recognition of competencies in the course of the assessment of degrees acquired from foreign institutions will be decided upon by the Aptitude Assessment Committee 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) <sup>1</sup>General provisions concerning modules and courses are set forth in §§ 6 and 8 of the APSO. <sup>2</sup>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) <sup>1</sup>The language of instruction of the Master's program Informatics: Games Engineering is English. <sup>2</sup>In case specific modules are taught completely or partially in German, this is indicated in Appendix 1. <sup>3</sup>Students who did not provide a proof of proficiency in German for the application, are admitted on condition to complete at least one module providing integrative knowledge of the German language within the first two semesters of their studies. <sup>4</sup>The course offer will be published by the Examination Board according to local practice. <sup>5</sup>Voluntarily completed extra-curricular modules by the TUM Language Center will be recognized.

## § 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) <sup>1</sup>At least one of the module examinations listed in Appendix 1 must be successfully completed by the end of the second semester. <sup>2</sup>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 Examination Board of the Department of Informatics of the Technische Universität München.

## § 40

### Recognition of Periods of Study, Coursework and Examination Results

The recognition of periods of study, coursework and examination results is governed by the provisions of § 16 of the APSO.

## § 41

### Continuous Assessment Procedure, Forms of Examination

- (1) Pursuant to §§ 12 and 13 of the APSO valid types of examination in this program of studies are, besides written and oral exams, in particular laboratory exercises, practical exercises ("Testate", if applicable), reports, project works, presentations, learning portfolios, scientific elaborations and exam courses.
  - a) <sup>1</sup>A **written exam** is a supervised written test that shall prove the ability to recognize and understand problems and to find ways of their solution in a limited amount of time using specified methods and predefined auxiliaries. <sup>2</sup>The duration of written exams is governed by § 12 (7) of the APSO. <sup>3</sup>It shall be proven that (in a limited amount of time with given methods and predefined auxiliaries) problems can be recognized and understood, ways of their solution can be found and, if necessary, applied.
  - b) <sup>1</sup>**Laboratory exercises** are, depending on the respective discipline, experiments, measurements, fieldwork, field exercises etc. with the objective of implementation, analysis and gain of knowledge. <sup>2</sup>Elements are for example: description of the processes and the respective theoretical foundations including study of scientific literature, preparation and implementation of experiments, if applicable necessary calculations, their documentation, evaluation and interpretation of results in regard to acquirable knowledge. <sup>3</sup>Additionally a presentation may be part of the project in order to examine the communicative competence of presenting scientific topics to an audience. <sup>4</sup>Details concerning the particular laboratory exercise and the required qualifications are listed in the module description.
  - c) <sup>1</sup>A **practical exercise ("Testate", if applicable)** is the practical processing of given assignments (e.g. mathematical problems, programming exercises, modeling exercises etc.) with the objective of applying theoretical contents to solve application-

oriented problems. <sup>2</sup>It serves to prove knowledge of facts and details as well as knowledge of their application. <sup>3</sup>The practical exercise may be conducted in written, oral or electronic form. <sup>4</sup>Possible forms of examination are homework, exercise sheets, programming exercises, (electronic) tests, exercises as part of practical courses etc. <sup>5</sup>Details concerning the particular practical exercise and the required qualifications are listed in the module description.

- d) <sup>1</sup>A **report** is a written elaboration and summary of a study process with the objective of describing the acquired knowledge in a structured way and analyzing the results in the context of a module. <sup>2</sup>The report shall prove the ability to understand and reproduce the main aspects in a written form. <sup>3</sup>Possible forms of reports are for example field trip reports, practical course reports, labor reports etc. <sup>4</sup>Additionally a presentation may be part of the project in order to examine the communicative competence of presenting scientific topics to an audience.
- e) <sup>1</sup>In the course of a **project work**, a project assignment shall be completed as a defined objective within a predefined period of time and using suitable auxiliaries. This should be accomplished in several phases (initiation, problem definition, distribution of roles, idea generation, development of success criteria, decision-making, implementation, presentation, written evaluation). <sup>2</sup>Additionally a presentation may be part of the project to examine the communicative competence of presenting scientific topics to an audience. <sup>3</sup>The components of the project work and the required qualifications are listed in the module description. <sup>4</sup>The project work may also be conducted in form of teamwork. <sup>5</sup>This is intended to prove that exercises can be solved in a team. <sup>6</sup>The individual contribution to be assessed as an examination achievement must be individually recognizable and assessable. <sup>7</sup>The same applies to the individual contribution to the group performance.
- f) <sup>1</sup>A **scientific elaboration** is a written examination where a student autonomously works on a challenging scientific or respectively scientific-application-oriented problem with scientific methods of the particular discipline. <sup>2</sup>It is intended to prove that such problem in line with the intended study results of the respective module can be tackled on a scientific basis and according to the principles of academic work – from analysis to conception to realization. <sup>3</sup>Possible forms, differing in their aspiration level, are position paper, abstract, essay, study work, seminar paper etc. <sup>4</sup>A scientific elaboration may be supported by a presentation and a colloquium to check the communicative competence regarding presenting scientific topics to an audience. <sup>5</sup>In this case, also the involvement in the discussion about the work and presentation of other participants may be part of the evaluation. <sup>6</sup>Detailed components of the particular scientific elaboration and the required qualifications are listed in the module description.
- g) <sup>1</sup>A **presentation** is a systematic, structured oral performance visually supported by suitable media (e.g. beamer, slides, posters, videos) which illustrates and summarizes specific topics or results and reduces complex issues to the essential. <sup>2</sup>The presentation shall prove the capacity of working out a certain topic within a predefined time so that it may be presented in a clear and comprehensive way to an audience. <sup>3</sup>Also it shall be proven that questions, suggestions and points of discussion by the audience in reference to the particular topic are handled competently. <sup>4</sup>The presentation may be supported by a short written workup. <sup>5</sup>The presentation may be accomplished as team or single-person work. <sup>6</sup>The contribution assessed as examination must be individually recognizable and assessable. <sup>7</sup>This also must hold for the particular contribution to the group performance.
- h) <sup>1</sup>An **oral exam** is a time-limited examination dialogue about certain topics and concrete questions to be answered. <sup>2</sup>By oral examinations it shall be proven that the

qualification objectives listed in the module descriptions are achieved, that connections between the examination subjects were recognized and that particular problems can be classified with respect to these coherences. <sup>3</sup>The oral exam may be accomplished as individual or group examination. <sup>4</sup>The duration of oral exams is governed by § 13 (2) of the APSO.

- i) <sup>1</sup>A **learning portfolio** is a written exposition of the student's own works selected by predefined criteria with the object of proving the learning progress and the performance level at a specific time and regarding to a defined content. <sup>2</sup>The choice of the specific works as well as their connection to the learning progress and their informative content for achieving the qualification have to be explained. <sup>3</sup>By a learning portfolio it shall be proven that the learning progress is handled responsibly and that the qualification objectives listed in the module descriptions are achieved. <sup>4</sup>Depending on the module description, possible components of successful self-monitoring of the learning portfolio are especially application-oriented papers, websites, web blogs, bibliographies, analyses, discussion papers and graphic preparations of specific issues. <sup>5</sup>Detailed components of the particular learning portfolio and the required qualifications are listed in the module description.
  - j) <sup>1</sup>Within the **Exam Course**, several elements have to be completed within one examination. <sup>2</sup>Contrary to a partial module examination, the examination will be conducted in an organisationally (spatially resp. temporally) connected manner. <sup>3</sup>Examination elements are a number of different forms of examinations that in their entirety capture the overall competency profile of the module. <sup>4</sup>Examination elements can also be forms of examinations pursuant to the letters a) to i). <sup>5</sup>The entire duration of an examination shall be specified in the module catalogue, type of examination and duration of the individual examination elements shall be specified in the module description.
- (2) <sup>1</sup>The module examinations will, as a rule, be taken concurrently with the program. <sup>2</sup>Type and duration of module examinations are provided for in Appendix 1. <sup>3</sup>In the event of divergence from those provisions, § 12 (8) of the APSO must be complied with. <sup>4</sup>The assessment of the module examination is governed by § 17 of the APSO.
  - (3) 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.
  - (4) Upon request of a student and with the agreement of the examiners, examinations may be taken in a different language than the course language.

## § 42

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

- (1) <sup>1</sup>Students who are enrolled in the Master's program in Informatics: Games Engineering are deemed admitted to the module examinations of the Master's examination. <sup>2</sup>Also, a student is deemed admitted to certain individual module examinations if that student, during his/her consecutive Bachelor's program in Informatics: Games Engineering at the Technische Universität München, has taken additional examinations in accordance with § 46b of the Examination and Academic Regulations for the Bachelor's program in Informatics: Games Engineering of the Technische Universität München in its current version.
- (2) <sup>1</sup>Registration requirements for required and elective module examinations are stipulated in § 15 (1) of the APSO. <sup>2</sup>The registration requirements for repeat

examinations for failed required and required elective modules are stipulated in § 15 (2) 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) <sup>1</sup>The module examinations are listed in Appendix 1. <sup>2</sup>In addition to the module examinations in required modules in the scope of 30 credits as set out in Appendix 1 A, module examinations of at least 54 credits in elective modules from the Informatics: Games Engineering elective modules catalogue according to Appendix 1 C and module examinations of at least 6 credits in elective modules from the Support Electives modules catalogue according to Appendix 1 D must be completed. <sup>3</sup>The selection of modules must be in compliance with § 8 (2) of the APSO.

### **§ 44**

#### **Repeat Examinations, Failed Examinations**

- (1) <sup>1</sup>The repetition of examinations is governed by § 24 of the APSO. <sup>2</sup>The repeat examination for a module examination administered at the end of the lecture period and not passed, as a rule must be taken not later than by the end of the first week of the lecture period of the following semester. <sup>3</sup>In derogation of sentence 2, the date of repeat examinations of examinations which are not offered by the Department of Informatics, has to comply with the regulations of the offering department.
- (2) Failure of examinations is governed by § 23 of the APSO.

### **§ 45**

#### **Coursework**

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

### **§ 45a**

#### **Multiple-Choice-Procedure**

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

### **§ 46**

#### **Master's Thesis**

- (1) <sup>1</sup>As part of the Master's examination, each student must write a Master's thesis pursuant to § 18 of the APSO. <sup>2</sup>The Master's thesis may be assigned and supervised by thesis supervisors of the Department of Informatics of the Technische Universität

München (“Themensteller oder Themenstellerin”). <sup>3</sup>The thesis supervisors pursuant to sentence 2 are appointed by the Examination Board.

- (2) Work on the Master’s thesis should commence after successful completion of all module examinations.
- (3) <sup>1</sup>The period of time between topic assignment and submission of the completed Master’s thesis must not exceed six months. <sup>2</sup>The Master’s thesis is deemed taken and not passed, if it is not delivered in time and without accepted solid reasons pursuant to § 10 (7) of the APSO. <sup>3</sup>The Master’s thesis may be written in either the German or the English language.
- (4) <sup>1</sup>The completion of the Master’s thesis consists of a written composition and a lecture on its content. <sup>2</sup>The lecture does not affect the grading. <sup>3</sup>For the module Master’s thesis 30 Credits will be assigned.
- (5) <sup>1</sup>If the Master’s thesis was not graded with at least “sufficient” (4.0), it may be repeated once with a new topic. <sup>2</sup>The new Master’s thesis must be registered no later than six weeks after 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) <sup>1</sup>The grade for a module will be calculated according to § 17 of the APSO. <sup>2</sup>The overall grade for the Master’s examination will be calculated as the weighted grade average of the modules according to § 43 (2) and the Master’s thesis. <sup>3</sup>The grade weights of the individual modules correspond to the credits assigned to each module. <sup>4</sup>The final result will be expressed by an attribute according to § 17 of the APSO.

#### **§ 48**

#### **Degree Certificate, Diploma, Diploma Supplement**

<sup>1</sup>If 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. <sup>2</sup>The degree certificate will be dated on the day when all examination and coursework requirements have been fulfilled.

#### **§ 49**

#### **Entry into Force**

- (1) <sup>1</sup>These Examination and Academic Regulations shall enter into force on 1 October 2018. <sup>2</sup>They shall apply to all students who commence their academic studies at the Technische Universität München as of the winter semester 2018/19. <sup>3</sup>In derogation of sentence 1, the Appendix 2: Aptitude Assessment shall apply to all students who commence their studies at the Technische Universität München as of summer semester 2019.



- (2) <sup>1</sup>At the same time, the Examination and Academic Regulations for the Master's program in Informatics: Games Engineering of 2 April 2014, last amended by no. 35 of the Summary Changes concerning the aptitude assessment committee of the Master's program of 25 April 2018, shall cease to be in effect. <sup>2</sup>Students who started their academic studies at the Technische Universität München prior to winter semester 2018/19 will complete their studies according to the Examination and Academic Regulations pursuant to sentence 1.

## **Appendix 1: Examination Modules**

### Remarks:

SWS = Semesterwochenstunden = weekly hours per semester;

Teaching methods: V = Vorlesung = lecture, Ü = Übung = exercise,

P = Praktikum = practical course, S = Seminar;

Semesters: WS = Wintersemester = winter term, SS = Sommersemester = summer term

Types of Examination: s = Klausur = written exam, m = mündliche Prüfung = oral exam

The examination board can add further Elective Modules to the Elective Course Catalogue temporarily or permanently. Modifications will be made available on the websites of the Department of Informatics at the beginning of the semester.

In the column "Duration of examination", the duration of written examinations is specified in minutes.

ID	Module name	Teaching method	Sem	SWS	Credits	Type of Exam	Duration of Exam	Language
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### **A Required Modules (30 Credits):**

IN2015	Image Synthesis	V	WS	4	5	Written exam	75-125	EN
IN2107	Master Seminar	S	WS/SS	2	5	Scientific elaboration		DE/EN
IN2106	Master Practical Course	P	WS/SS	6	10	Project work		DE/EN
IN2257	Additional Master Practical Course	P	WS/SS	6	10	Project work		DE/EN

### **B Master's Thesis (30 Credits)**

IN2108	Master's Thesis		4.		30	Scientific elaboration		DE/EN
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### **C Elective Modules – Informatics: Game Engineering (54 Credits)**

<sup>1</sup>A total of 54 credits must be earned from the following elective modules. <sup>2</sup>Credits earned from modules already taken during the Bachelor's program cannot be contributed a second time. <sup>3</sup>The modules must meet the following conditions:

1. Fundamental structure (35 Credits):

A total of at least 5 credits must be earned from the area "Internet technologies", and at least 6 credits from the area "Databases". At least two of the following so called Lines of specialization have to be selected, and at least 10 credits have to be earned from each of them, with a total of at least 24 credits.

2. The remaining credits (up to 19) can be chosen freely

- additionally from the two areas and the two Lines of specialization chosen above
- or from the remaining lines of specialization
- or from the following additional Elective Modules
- or from the areas of specialization from the Catalogue of Elective Modules of the Master's program in Informatics.

<sup>4</sup>Each module can be contributed only once.

<b>Elective Modules from the area "Internet technologies":</b>								
IN2097	Advanced computer networking	V+Ü	WS	3+1	5	Exam	75-125	EN
IN2259	Distributed Systems	V+Ü	WS	3+1	5	Exam	75-125	EN

Elective Modules from the area "Databases":								
IN2031	Einsatz und Realisierung von Datenbanksystemen	V+Ü	SS	3+2	6	Exam	90-150	DE
IN2118	Database Systems on Modern CPU Architectures	V+Ü	SS	3+2	6	Exam	90-150	EN

Elective Modules from the Line of specialization "Computer graphics and animation":								
IN2297	Geometry Processing	V	SS	4	6	Exam	90-150	EN
IN2259	Advanced Deep Learning for Physics	V	SS	4	6	Exam	90-150	EN
IN2026	Visual Data Analytics	V+Ü	WS	3+1	5	Exam	60-90	EN

Elective Modules from the Line of specialization "Numerical mathematics and Simulation":								
IN2010	Modellbildung und Simulation	V+Ü	SS	4+2	8	Exam	120-180	DE
IN2252	High Performance Computing – Algorithms and Application	V+Ü	WS	2+1	4	Exam	60-100	EN
IN2001	Algorithms of Scientific Computing	V+Ü	SS	4+2	8	Exam	120-180	EN

Elective Modules from the Line of specialization "Embedded Programming":								
IN2076	Advanced Computer Architecture	V	WS	4	6	Exam	90-150	EN
IN2147	Parallel Programming	V+Ü	SS	2+2	5	Exam	75-125	EN
IN2075	Microprocessors	V+Ü	WS	2+2	5	Exam	90-150	EN

Elective Modules from the Line of specialization "Visual Computing":								
IN2246	Computer Vision I: Variational Methods	V+Ü	irreg.	4+2	8	Exam	120-180	EN
IN2228	Computer Vision II: Multiple View Geometry	V+Ü	irreg.	4+2	8	Exam	120-180	EN
IN2057	3D Computer Vision	V+Ü	SS	2+2	5	Exam	75-125	EN
IN2124	Basic Mathematical Methods for Imaging and Visualization	V+Ü	WS	2+2	5	Exam	75-125	EN

Elective Modules from the Line of specialization "Autonomous Systems":								
IN2222	Cognitive Systems	V+Ü	SS	3+1	5	Exam	75-125	EN
IN2138	Robot Motion Planning	V+Ü	SS	3+1	5	Exam	75-125	EN
IN2067	Robotics	V+Ü	WS	3+2	6	Exam	90-150	EN
IN2064	Machine Learning	V+Ü	WS	4+2	8	Exam	120-180	EN

Elective Modules from the Line of specialization "Game Theory & Algorithmic Economics":								
IN2239	Algorithmic Game Theory	V+Ü	SS	2+2	5	Exam	75-125	EN
IN2229	Computational Social Choice	V+Ü	WS	3+2	6	Exam	90-150	EN
IN2296	Games on Graphs	V+Ü	SS	2+2	5	Exam	75-125	EN

Elective Modules from the Line of specialization "Interaction and Communication":								
IN2018	Augmented Reality	V+Ü	SS	3+2	6	Exam	90-150	EN
IN2111	3D User Interfaces	V+Ü	SS	3+2	6	Exam	90-150	EN
IN2028	Business Analytics	V+Ü	WS	2+2	5	Exam	75-125	EN

Elective Modules from the Line of specialization "Internet models, Technologies, Applications":								
IN2045	Netzwerkanalyse – statistische und formale Modelle und Methoden	V+Ü	SS	3+1	5	Exam	75-125	DE
IN2087	Software Engineering for Business Applications – Master's Course	V+Ü	SS	2+2	8	Project work		EN
IN2194	Peer-to-Peer-Systems and Security	V+Ü	SS	3+2	6	Project work		EN
IN2101	Network Security	V+Ü	WS	3+1	5	Exam	75-125	EN

Additional Elective Courses								
IN2169	Guided Research		WS/S S		10	Scientific Elaboration		EN

### D Elective Modules – Support Electives (6 Credits):

<sup>1</sup>A total of 6 credits must be earned from the following elective modules. <sup>2</sup>Credits earned from modules already taken during the Bachelor's program cannot be contributed a second time.

IN9044	Data Privacy	S	irreg.	2	4	Scientific Elaboration	75-125	DE
WI0001 59	Business Plan – Basic Course (Business Idea and Market)	S	WS/S S	2	3	Project work		EN
IN9006	Entrepreneurship for Small Software-oriented Enterprises	S	SS	1	2	Presenta- tion		EN
IN9003	Informatics and Law	V	WS/S S	2	3	Exam	60-75	DE
IN9036	Master Your Thesis!	S	WS	2	4	Scientific Elaboration		EN

The Elective Module Catalogue of the Support Electives will be complemented by modules offered at TUM Language Center and the Carl von Linde-Academy which are published by the Examination Board on the Department's websites.

## **Appendix 2: Aptitude Assessment**

### **Aptitude Assessment for the Master's Program in Informatics: Games Engineering at the Technische Universität München**

#### **1. Purpose of the Assessment**

<sup>1</sup>Eligibility for the Master's program in Informatics: Games Engineering, 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. <sup>2</sup>The special qualifications and skills of the candidates should correspond to the Informatics: Games Engineering profession. <sup>3</sup>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 Informatics: Games Engineering in accordance with the Bachelor's program in Informatics: Games Engineering at the Technische Universität München;
- 1.3 Ability to solve complex and difficult problems;
- 1.4 Ability to abstract and transfer the Informatics methods in solving problems in the field of Games Engineering.

#### **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 Applications for admission to the aptitude test together with the documents pursuant to 2.3.1 to 2.3.8 and § 36 (1) no. 2 must be filed online by 31 May for the winter semester and by 30 November for the summer semester to the Technische Universität München (absolute deadlines). <sup>2</sup>Degree certificate and diploma as proof of Bachelor's degree obtained must be filed not later than five weeks after the beginning of lectures. <sup>3</sup>Otherwise, pursuant to § 36 (1) no. 1, 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 German or English of the reasons for choosing the Informatics: Games Engineering program at the Technische Universität München in which the candidate explains those specific abilities that make him/her particularly qualified for the Informatics: Games Engineering Master's program at the Technische Universität München; a candidate's exceptional commitment can e.g. be demonstrated by details on program-related vocational training, internships, 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. a written essay, in English or German, 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 March 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;

- 2.3.6. the underlying curriculum (e.g. module catalogue) of the undergraduate degree program;
- 2.3.7. the assignment of the applicant's modules derived from the transcript of records to the respective subject groups according to 5.1.1. no. 1 incl. a sworn statement of the correctness of the information provided;
- 2.3.8. a list of the applicant's best graded modules in the amount of 120 Credits (resp. two-thirds of the examinations necessary for the undergraduate degree) pursuant to 5.1.1 no. 2 incl. a sworn statement of the correctness of the information provided.

### **3. Aptitude Assessment Committee**

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

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

3.3 <sup>1</sup>When the Aptitude Assessment Committee takes up the assessment according to these Examination and Academic regulations, the revocable delegation of specific tasks to individual committee members is permitted. <sup>2</sup>When according to sentence 1 only one committee member exercises specific tasks, this member has to be a member of the professorial faculty. <sup>3</sup>When according to sentence 1 two or more committee members exercise specific tasks, at least half of the members have to be members of the professorial faculty. <sup>4</sup>The Aptitude Assessment Committee ensures the appropriate distribution of tasks. <sup>5</sup>In case of an assessment scope for a criterion of the aptitude assessment, and in case that at least two members of the Aptitude Assessment Committee take up the assessment of this criterion, those members assess independently according to the indicated weighting, unless otherwise specified; the points total will be calculated as the arithmetic means of the individual assessments, rounded up to the nearest full point.

### **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 <sup>1</sup>Applicants who are not admitted will receive a notification specifying the reasons and providing information on legal remedies. <sup>2</sup>Signatory power may be delegated.

### **5. The Aptitude Assessment Process**

#### **5.1 First stage of the Aptitude Assessment Process**

5.1.1 <sup>1</sup>The committee will assess, on the basis of the written application documents<sub>required</sub> 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). <sup>2</sup>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:

1. Academic qualification

<sup>1</sup>The curricular analysis is not conducted in the form of a schematic comparison of the modules, but rather on the basis of competencies. <sup>2</sup>It will encompass the fundamental subject groups of the Bachelor's program in Informatics: Games Engineering at the Technische Universität München listed in the table below.

Subject Group	Credits TUM
Games Engineering (Introduction to Informatics for Games Engineering, Game Engine Design, Interaction Methods and Devices, Social Gaming, Physical Basics for Computer Games)	38
Informatics Fundamentals (Introduction to Informatics and Programming, Software Engineering, Algorithms and Data Structures, Operating Systems and Hardware-/Software-orientated Programming for Games, Computer Networks and Distributed Systems, Theory of Computation)	44
Mathematics Fundamentals (Discrete Structures, Linear Algebra, Calculus, Numerical Programming)	30

<sup>3</sup>If there are no essential differences with regard to the acquired competencies (learning outcomes), the candidate will be awarded a maximum of 55 points. <sup>4</sup>Missing competencies will be deducted in accordance with the credits of the corresponding modules of the Bachelor's program in Informatics: Games Engineering at the Technische Universität München. <sup>5</sup>There will be no negative points. <sup>6</sup>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

<sup>1</sup>For 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. <sup>2</sup>The maximum number of points is 20. <sup>3</sup>There will be no negative points. <sup>4</sup>Where a degree was obtained outside of Germany, the grade will be converted according to what is referred to as „Bavarian formula“ (bayerische Formel). <sup>5</sup>If 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). <sup>6</sup>The grade average is calculated from the graded module examinations up to 120 credits (resp. two-thirds of the examinations necessary for the undergraduate degree). <sup>7</sup>The overall grade average will be calculated as the weighted grade average of the modules. <sup>8</sup>The grade weights of the individual modules correspond to the credits assigned to each module. <sup>9</sup>For the calculation of grade, one decimal place will be taken into account, all further decimal places will be dropped without rounding.

### 3. Statement of reasons

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

#### 1. Exceptional commitment:

Demonstration of relevant qualifications which exceed the knowledge and qualifications obtained at undergraduate degree level, e.g. program-related vocational training, internships, stays abroad (cf. no. 2.3.3)

#### 2. Specific Qualification:

Well-structured presentation of the connection between the specific personal qualification and the contents of the degree program.

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

### 4. Essay

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

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

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

5.1.2<sup>1</sup>The applicant's points total will be calculated as sum of the individual points awarded. <sup>2</sup>Decimal places must be rounded up.

5.1.3<sup>1</sup>Applicants who have at least 70 points will receive confirmation that they have passed the aptitude assessment test. <sup>2</sup>In those cases where it was determined pursuant to § 36 (3) 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: Games Engineering (so-called Brückenkurse) in the amount of a maximum of 30 credits. <sup>3</sup>These Fundamentals Exams must be taken in the first year of study. <sup>4</sup>Failed Fundamentals Exams may be repeated only once and at the next examination date. <sup>5</sup>The Examination Board may make the admission to individual module examinations dependent on the successful completion of the Fundamentals Exams.

5.1.4<sup>1</sup>Unsuitable applicants with a 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. <sup>2</sup>Signatory power may be delegated.

## 5.2 Second stage of the Aptitude Assessment Process

5.2.1<sup>1</sup>The remaining applicants will be invited for an Aptitude Assessment Interview. <sup>2</sup>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. <sup>3</sup>Interview appointments will be announced at least one week in advance. <sup>4</sup>Possible time slots for interviews must be announced before expiration of the application deadline. <sup>5</sup>The interview appointment must be kept by the applicant. <sup>6</sup>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 an applicant's well-grounded request, but not later than two weeks before the beginning of classes.

5.2.2 <sup>1</sup>The Aptitude Assessment Interview is to be held individually for each applicant. <sup>2</sup>The interview lasts at least 20 but not more than 30 minutes for each applicant and is held in both German and English, but may be completely in English upon request. <sup>3</sup>The interview will focus on the following topics:

1. Exceptional commitment that gives reason to expect that the level of capacity obtained at the undergraduate degree level in general or at least concerning the area of specialization is exceeded noticeably (0 to 15 points):

- Is there any specific qualification for a concrete specialization in the field of the degree program, proved by additional modules or non-university activities (e.g. membership or activities in relevant organizations) in that area?
- Is there evidence of outstanding determination in the curriculum vitae (e.g. additional subject-related internships, relation between previous occupations and the degree program)?
- Is there specific experience in research (e.g. specific research orientation in the previous academic studies, participation in research projects)?

2. Aptitude parameters according to no. 1.1 and 1.2 (0 to 15 points):

- Presentation of subject-related expertise, previous main study focus
- Qualifications acquired in the undergraduate degree program in the subject groups mentioned in 5.1.1.1
- Subject of the thesis

3. Communication skills (0 to 15 points):

- Ability to illustrate and discuss facts in a clear, fluent and adequate way,
- One's own thoughts and opinions are expressed precisely and comprehensive answers are structured logically during the interview,
- Questions relating to the first degree and / or the main study focus are answered terminologically correct and comprehensible at the same time,
- Statements are convincingly based on arguments and supported by reasonable examples,
- Questions regarding scientific topics as well as one's own competencies and expectations are understood without problem or if necessary clarified through further inquiry

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

5.2.3 <sup>1</sup>The Aptitude Assessment Interview will be conducted by at least two members of the committee. <sup>2</sup>The committee members will grade each of the three topics set out in no. 5.2.2 independently, each with the same weighting. <sup>3</sup>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. <sup>4</sup>The points total will be calculated as the arithmetic means of the individual points. <sup>5</sup>The result will be rounded up to the nearest full point.

5.2.4 <sup>1</sup>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). <sup>2</sup>Applicants with 70 or more points will be deemed suitable.

- 5.2.5 <sup>1</sup>The applicant will be notified of the result of the aptitude test in writing - where applicable, subject to the requirements determined in stage 1, 5.1.3 sentence 2. <sup>2</sup>The notice must be signed by the TUM Board of Management. <sup>3</sup>Signatory power may be delegated. <sup>4</sup>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 Informatics: Games Engineering shall apply to all subsequent applications for this program.

## 6. Record

<sup>1</sup>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. <sup>2</sup>This record must contain the essential reasons for the decision and the topics discussed in 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 Informatics: Games Engineering may register for one repetition of the Aptitude Assessment Test.

Issued due to the resolution of the Academic Senate of the Technische Universität München of 18 July 2018 and the approval of the President of the Technische Universität München of 15 October 2018.

Munich, 15 October 2018  
Technical University of Munich

Wolfgang A. Herrmann  
President

These Examination and Academic Regulations were recorded 15 October 2018 at the university; the recording was announced on 15 October 2018 by notice in the university. Therefore, the official date of announcement is 15 October 2018.