UNIVERSITY OF PASSAU

Faculty of Computer Science and Mathematics

Subject-specific Study and Examination Regulation for the degree programme M.Sc. Artificial Intelligence Engineering

of 17 May 2021

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Subject-specific Study and Examination Regulation for the degree programme M.Sc. Artificial Intelligence Engineering leading to the award of a Master of Science degree at the University of Passau

of 17 May 2021

On the basis of Art. 13(1) sentence 2 in conjunction with Art. 43(5) sentence 2, Art. 58(1) sentence 1 and Art. 61(2) sentence 1 of *Bayerisches Hochschulgesetz* (BayHSchG; Bavarian higher education act), the University of Passau lays down the following statute:

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§ 1 Scope

[1]This subject-specific study and examination regulation (FStuPO, *Fachstudien- und -prüfungsordnung*) supplements the general study and examination regulation (AStuPO, *Allgemeine Studien- und Prüfungsordnung*) for the master's degree programmes of the Faculty of Computer Science and Mathematics of the University of Passau, as amended. [2]Where a provision of the present statute is inconsistent with the provisions of the AStuPO, the regulation set forth in the AStuPO shall take precedence.

§ 2 Subject of study and aim of the degree programme

(1) The consecutive degree programme in Artificial Intelligence Engineering, which leads to the degree of Master of Science, is offered by the Faculty of Computer Science and Mathematics at the University of Passau.

(2) [1]Artificial intelligence is a subject area at the interface between computer science and mathematics with an enormous potential for the future and an impact on all areas of economic and social life. [2]The development of AI-based systems is an important part of

realising this potential. [3]AI-based systems comprise computer-aided systems that make decisions automatically on the basis of uncertain or incomplete information or information that is difficult to formulate, or assist users in making such decisions. [4]Examples include automated processing of natural language, software for autonomous driving and support for making decisions based on data analysis. [5]New methods of machine learning, high-performance hardware and the availability of large data volumes are responsible for the rapid development of artificial intelligence. [6]Mathematical-algorithmical inference techniques at symbolic or sub-symbolic level, parameterisation of mechanical learning techniques and sophisticated optimisation procedures and mathematical modelling techniques form the core of AI-based systems – mathematics and theoretical computer science provide the bases for understanding and developing core AI techniques. [7]Like software engineering in conventional computer science, new AI engineering techniques are being developed which, based on the fundamental mathematical-algorithmical characteristics of AI methods, take account of the security, reliability, reproducibility and robustness of overall systems in real-world application. [8]This includes, among other things, structured development processes and methods, such as verification and testing options, but also data engineering and operationalisation of AI-based systems (e.g. ML Ops and Model Ops, similar to Dev Ops). [9]In the 'Artificial Intelligence Engineering' master's programme, students acquire technical knowledge, skills and methods which enable them to carry out independent academic work in the area of artificial intelligence and introduce them to current research issues, both in artificial intelligence in general and in the development and use of AI-based systems. [10]Graduates from the programme are familiar with theories, models, algorithms and methods for the design and development of AI-based systems. [11]They are able to integrate artificial intelligence into existing real-world systems (e.g. autonomous vehicles, media systems, industrial plants, dialogue systems) and to develop systems of this sort. [12]They are familiar with robust procedural models and operationalisation options for AI-based systems (e.g. data holding systems, AI infrastructures, distributed AI systems). [13]They have the skills and abilities to evaluate such systems and to assess properties such as traceability, explicability and transparency. [14]This is complemented by knowledge of potential legal, ethical, social and economic background conditions for the use of AI-based systems and the capacity to reflect on the social impact of AI. [15]Graduates are able to communicate competently with users and professionals regarding problems and approaches, and present the results of their work. [16]They are able to work independently and take on demanding tasks in industry, administration and science and to hold managerial positions and contribute to research in the development of artificial intelligence.

(3) Teaching shall take place in English.

§ 3 Entry qualifications (subject component computer science/mathematics)

[1]A first degree pursuant to § 4(1) sentence 1 no. 1 of the General Study and Examination Regulation (AStuPO) must include a subject component of computer science and/or mathematics accounting for at least 120 ECTS credits. [2]The computer science component must account for at least 40 ECTS credits. [3]The mathematics component including the subject of theoretical computer science must account for at least 35 ECTS credits

§ 4 Contents of the degree programme and module groups

(1) [1]The programme is broken down into compulsory areas, elective areas and the master's thesis. [2]The elective area consists of six module groups. [3]If, when submitting the

application pursuant to § 24(1) sentence 1 AStuPO, more modules were completed than required to earn a total of 120 ECTS credits, the student shall indicate which of the modules are to be included in the final grade.

(2) [1]The compulsory area consists of the following modules:

Module	ECTS credits	hrs/wk	Learning outcome	Assessments
Seminar on AI Engineering	5	2	Independent familiarisation with a topic, written discussion, oral expression and presentation skills in relation to a specialist topic.	Written assignment (maximum of 10 pages) and its presentation (approx. 20 to 60 minutes); the exact examination duration shall be published on the noticeboards and on the faculty website at the start of the semester at the latest.
Presentation of the master's thesis	3	--	Capacity of the student to summarise the results of the master's thesis briefly and comprehensibly and to defend it in a technical discussion.	Oral exam (approx. 20 minutes or approx. 45 minutes); the exact duration of the examination shall be announced beforehand by the examiner
'Introduction to AI Engineering' lecture with exercise course	5	3	Knowledge of basic concepts of artificial intelligence and software engineering, interrelationships and distinctions between the individual sub-areas and acquisition of basic formal methodological skills in artificial intelligence.	Written exam (60 to 120 minutes) or oral exam (approx. 15 to 30 minutes); the exact duration of the examination shall be announced beforehand by the examiner.

[2]Registration for the module 'Presentation of the master's thesis' requires the master's thesis to have been submitted in accordance with § 21(7) AStuPO.

(3) The following module groups are available in the elective area:

1. 'Algorithm Engineering and Mathematical Modelling' module group

[1]This module deals with deterministic and stochastic algorithms and how they are implemented, evaluated and optimised, as well as modelling and complexity analysis of discrete and continuous problems using mathematical methods. [2]In addition, the basic principles of mathematical logic, stochastics, functional analysis and discrete mathematics are taught to allow a deeper algorithmic-mathematical understanding of AI-based systems. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 nos. 1–4.

2. 'Artificial Intelligence Methods' module group

[1]Methods and algorithms of symbolic and sub-symbolic artificial intelligence and machine learning are examined here (e.g. machine learning, reinforcement learning, representation of knowledge and deduction systems). [2]In addition, the module group teaches the underlying theories of learning systems and the application of algorithmical and mathematical principles for realisation of artificial intelligence. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 nos. 1–5.

3. ‘Artificial Intelligence Systems Engineering’ module group

[1]Methods and structured procedural models for the development of AI-based systems are examined. [2]This includes in particular test and evaluation strategies (e.g. generative adversarial testing and simulation), data and knowledge modelling methods, methods and systems for operationalisation of AI-based systems and evaluation and consideration of factors such as security, traceability, reliability, explicability and transparency. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 nos. 1–5.

4. ‘Artificial Intelligence Applications’ module group

[1]Various areas of application and application opportunities for artificial intelligence are examined, such as language, text and media analysis, operating information systems and energy informatics. [2]The specific characteristics of the areas of application and their impact on the selection of AI methods and development of AI-based systems are addressed. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 nos. 1–6.

5. ‘Cross-Cutting Concerns’ module group

[1]Knowledge of potential legal, ethical, social and economic background conditions for the use of AI-based systems and the capacity to reflect on the social impact of AI are covered here. [2]In addition, this module group covers non-subject-specific areas, such as language and writing training, soft skills and internships to support subject-specific study and prepare for professional work. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 nos. 16.

6. ‘Research Seminar’ module group

[1]Students learn to familiarise themselves independently with a current research area in the field of AI engineering, prepare it for presentation and deliver the presentation. [2]Detailed knowledge of academic work in the subject area of artificial intelligence is taught and students are prepared for further research work. [3]Modules in this module group have forms of examination according to § 5(1) sentence 1 no. 6.

§ 5 Forms of assessment

(1) [1]As a rule, modules have one of the following forms of assessment:

	Module type	ECTS credits	Assessments
1	Lecture with or without exercise course	5–9	Written exam (60 to 120 minutes); or Oral exam (between approx. 15 and approx. 30 minutes); or Presentation (approx. 20 minutes) and final report (approx. 20 pages); or Presentation (approx. 30 minutes) and follow-up oral exam (approx. 30 minutes); or Portfolio [1]Possible portfolio elements include: • Technical report • Documented source code for individual modules • Live system demonstration • Creation of video demonstrations • Presentations on individual work • Final presentation [2]Completion of the portfolio assessments is undertaken in parallel to teaching. [3]The allotted time for individual components of the portfolio assessment may not exceed 4 weeks. [4]The final work shall be delivered no later than 4 weeks after the end of lectures. [5]The scope of an individual technical report shall not exceed 10 pages. [6]If the technical report consists of several sub-reports, the scope of a sub-report shall be approx. 5 pages. [7]The scope of an individual presentation shall be approx. 10 minutes and it shall be supported by appropriate media and presentation formats. [8]The scope of the final presentation shall be approx. 15 minutes and it shall be supported by the use of suitable media and presentation formats.
2	Lecture with exercise course and lab course	5–9	Complete written documentation (10-15 pages) and presentation with discussion (approx. 30 minutes) on the selected task. Portfolio [1]Possible portfolio elements include: • Technical report • Documented source code for individual modules • Live system demonstration • Creation of video demonstrations • Presentations on individual work • Final presentation [2]Completion of the portfolio assessments is undertaken in parallel to teaching. [3]The allotted

			time for individual components of the portfolio assessment may not exceed 4 weeks. [4]The final work shall be delivered no later than 4 weeks after the end of lectures. [5]The scope of an individual technical report shall not exceed 10 pages. [6]If the technical report consists of several sub-reports, the scope of a sub-report shall be approx. 5 pages. [7]The scope of an individual presentation shall be approx. 10 minutes and it shall be supported by appropriate media and presentation formats. [8]The scope of the final presentation shall be approx. 15 minutes and it shall be supported by the use of suitable media and presentation formats.
3	Lecture with seminar	5–9	Final report (maximum of 20 pages) and presentation (approx. 20 to 60 minutes) on the project.
4	Exercise course	5–9	Portfolio (reports, a talk lasting approx. 15 minutes, a final presentation lasting approx. 60 minutes) (attendance is compulsory for laboratory work and talks held by fellow students); or Portfolio (practical work involving independent development and demonstration of experiments) (attendance is compulsory throughout) or Portfolio (source code, project report and presentation)
5	Lab course	5–9	Written exam (180 minutes); or Oral exam (approx. 60 minutes) or Portfolio [1]Possible portfolio elements include: • Documented and functioning source code for individual modules (both in the source code and also as a working application) • Live system demonstration • Creation of video demonstrations • written exam component • Technical report • Presentation of the materials created using suitable presentation techniques, e.g. PowerPoint • Presentations on individual work • Ongoing, rolling technical sub-reports to be compiled into a comprehensive document. • Final presentation [2]Completion of the portfolio assessments is undertaken in parallel to teaching. [3]The allotted time for individual components of the portfolio assessment may not exceed 4 weeks. [4]The final work shall be delivered no later than 4 weeks after the end of lectures.

6	Seminar	5	Written assignment (maximum of 10 pages) and its presentation (approx. 20 to 60 minutes). The exact presentation duration shall be published on the notice boards and on the faculty website at the start of the semester at the latest.

[2]If there are several forms of assessment available for one type of course, the exact form of assessment shall be specified in the module catalogue. [3]If the module catalogue specifies several alternative forms of assessment for a module, the exact form of assessment shall be published on the notice boards and on the faculty website at the start of the semester at the latest. [4]Other course formats and forms of assessment and deviations from the course formats and forms of assessment outlined in § 4(2) may be specified for elective modules in the module catalogue for legitimate exceptions, following a decision of the Board of Examiners. [5]The Board of Examiners shall ensure that portfolio assessments are restricted to a small number of essential modules and are not used for more than 5% of the modules offered.

(2) Course types usually involve the following ECTS credits per contact hour per week:

Contact teaching hours per week for each type of course	**ECTS credits**
Lecture: 1 hour per week	1–2
Exercise course: 1 hour per week	1–2
Lab: 1 hour per week	1–2
Seminar: 1 hour per week	1–3

§ 6 Master's examination (required compulsory and elective modules); examination deadlines

(1) In order to pass the master's examination, in addition to the master's thesis the following compulsory and elective modules shall be completed pursuant to § 9(2) AStuPO, and a total of at least 120 ECTS credits obtained:

1. the modules included in the compulsory area pursuant to § 4(2),

2. in the module groups under § 4(3) no. 1 to 5, modules accounting for a total of at least 70 ECTS credits,

   a) of those, in the module groups under § 4(3) no. 1 to 4 a total of at least 55 ECTS credits, of which at least 10 ECTS credits per module group shall be obtained for modules in each of the module groups under § 4(3) no. 2 to 4,

   b) in the module groups under § 4(3) no. 5, modules accounting for a total of at least 5 ECTS credits,

3. in the module groups under § 4(3) no. 6, modules accounting for a total of up to 10 ECTS credits.

(2) The module examination for the module 'Introduction to AI Engineering' must be included among the assessments to be completed in accordance with § 9(3) sentences 1 and 2 AStuPO (§ 9(3) sentence 3 AStuPO).

§ 7 Effective date

This statute takes effect on 1 October 2021.

Issued as per the resolution of the Senate of the University of Passau of 17 March 2021 and as approved by the President of the University of Passau on 17 May 2021, file ref.: IV/S.I-10.3930/2021.

Passau, 17 May 2021

UNIVERSITY OF PASSAU
The President

Professor Ulrich Bartosch

This statute was issued by the University on 17 May 2021 and announced on 17 May 2021 by posting on the noticeboards of the University.

The date of promulgation is 17 May 2021.