



# **ASIIN Seal & Euro-Inf Label**

## **Accreditation Report**

**Master's Degree Programme**  
***Computer Science***

Provided by  
**Ho Chi Minh City University of Technology (HCMUT)**

Version: 24 September 2024

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## A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for <sup>1</sup>	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC) <sup>2</sup>
Khoa học máy tính	Master of Computer Science	ASIIN, Euro-Inf	-	04
<p><b>Date of the contract:</b> 09.08.2022</p> <p><b>Submission of the final version of the self-assessment report:</b> 16.12.2022</p> <p><b>Date of the onsite visit:</b> 08.-09.02.2023</p> <p><b>at:</b> campus 1 HCMUT</p>				
<p><b>Peer panel:</b></p> <p>Prof. Dr. Olaf Zukunft, Hamburg University of Applied Sciences</p> <p>Prof. Dr.-Ing. Helena Szczerbicka, Leibniz University Hannover</p> <p>Thien Nguyen, SGH-Asia, Head of Software Development</p> <p>Tong Vo Anh Thuan, student at Ho Chi Minh City University of Information Technology</p>				
<p><b>Representative of the ASIIN headquarter:</b> David Witt</p>				
<p><b>Responsible decision-making committee:</b> Accreditation Commission for Degree Programmes</p>				
<p><b>Criteria used:</b></p> <p>European Standards and Guidelines as of May 15, 2015</p> <p>ASIIN General Criteria, as of December 7, 2021</p> <p>Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of March 29, 2018</p>				

<sup>1</sup> ASIIN Seal for degree programmes; Euro-Inf®: Label European Label for Informatics

<sup>2</sup> TC: Technical Committee for the following subject areas: TC 04 - Informatics/Computer Science

## B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF <sup>3</sup>	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Computer Science	Thạc sĩ khoa học máy tính (Master of Engineering in Computer Science)	- Computer Science - Data Science, - Network Security - Software Engineering	7	Full time	.	4 semesters	60 Vietnamese credits (120 ECTS)	Annually / 2014

For the Master's degree programme Computer Science, Ho Chi Minh City University of Technology (HCMUT) has presented the following programme profile in the Self-Assessment Report:

“The Master's program in Computer Science at the Faculty of Computer Science and Engineering, Ho Chi Minh City University of Technology (HCMUT), Vietnam National University Ho Chi Minh City (VNU-HCM). Followed the master training regulations of the university [...], this program provides fundamental knowledge and skills in Computer Science and specialized majors such as Data Science, Network Security, and Software Engineering. The program's mission is to educate highly-qualified and specialized human resources in the fields of and related to Computer Science as well as enhance research capability and science and technology development towards solving scientific and practical problems at various levels: domestic, regional, and internationally. In particular, the objectives (Program Educational Objectives, P.E.O) of our program are defined as follows. Within a few years of graduation, graduates of the Master's program in Computer Science are expected to:

- PO 1: Have sufficient knowledge and skills to solve problems in the fields related to educational programs.
- PO 2: Have the right awareness of professional ethics.
- PO 3: Have the right awareness of leadership skills.
- PO 4: Have abilities to engage in continuing professional development.”

Furthermore, HCMUT has presented the following programme learning outcomes (PLOs) in the Self-Assessment Report:

- “PLO 1: Have background knowledge and skills in Computer Science and in-depth knowledge and skills in a major related to Computer Science.

<sup>3</sup> EQF = The European Qualifications Framework for lifelong learning

## B Characteristics of the Degree Programmes

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- PLO 2: Be able to analyze a complex computing problem in the context of the program's discipline.
- PLO 3: Be able to develop an appropriate solution to a complex computing problem that meets user's requirements in the context of the program's discipline.
- PLO 4: Be able to apply state-of-the-art or innovative methods, techniques, tools, etc. in problem solving.
- PLO 5: Be able to identify legal, ethical, commercial, industrial, economic and/or social contexts relevant to a computing problem in its area of study.
- PLO 6: Be able to recognize professional, ethical, legal, security and social issues and responsibilities.
- PLO 7: Be able to work independently or in team as a member or leader of a team engaged in activities appropriate to the program's discipline.
- PLO 8: Be able to communicate effectively with a range of audiences in a variety of professional contexts.
- PLO 9: Be able to engage in lifelong learning and continuing professional development.”

## C Peer Report for the ASIIN Seal

### 1. The Degree Programme: Concept, content & implementation

**Criterion 1.1 Objectives and learning outcomes of a degree programme (intended qualifications profile)**

#### **Evidence:**

- Self-Assessment Report
- Study plan of the degree programme
- Module descriptions
- Objective-module-matrix
- Webpage HCMUT
- Webpage Faculty of Computer Science and Engineering
- Discussions during the audit

#### **Preliminary assessment and analysis of the peers:**

The experts base their assessment of the learning outcomes on the information provided in the module descriptions and in the Self-Assessment Report of the Master's degree programme under review. For Master's degree programme in Computer Science, HCMUT has described Programme Educational Objectives (PEO), Programme Learning Outcomes (PLO), and Qualification Profiles. The PEO and PLO are published on the programme's website and easily accessible for students as well as other stakeholders. Furthermore, there are regular revision processes in place that take into account feedback by external and internal stakeholders.

The experts refer to the Subject-Specific Criteria (SSC) of the Technical Committee Informatics/Computer Science and use the objective-module-matrix and the module descriptions as a basis for judging whether the intended learning outcomes correspond with the competences as outlined by the SSC.

The experts note that the relationship between PEOs and PLOs has been established in a comprehensible and logical manner. The development of PLOs of the study programme involves both internal and external stakeholders so that the curricula can be adapted and modified according to the needs of the industry and the graduates on a regular basis. For example, HCMUT regularly conducts surveys, through which the different stakeholders get the chance to assess the programmes and their main objectives and adapt them if necessary. Internal stakeholders include all of HCMUT members (students, teaching staff, and non-academic employees), while the external stakeholders include the industry, alumni, the government, and society. A major revision including consultations of stakeholders takes place every two years.

For the Master's degree in Computer Science, HCMUT defines the following programme learning outcomes:

- "PLO 1: Have background knowledge and skills in Computer Science and in-depth knowledge and skills in a major related to Computer Science.
- PLO 2: Be able to analyze a complex computing problem in the context of the program's discipline.
- PLO 3: Be able to develop an appropriate solution to a complex computing problem that meets user's requirements in the context of the program's discipline.
- PLO 4: Be able to apply state-of-the-art or innovative methods, techniques, tools, etc. in problem solving.
- PLO 5: Be able to identify legal, ethical, commercial, industrial, economic and/or social contexts relevant to a computing problem in its area of study.
- PLO 6: Be able to recognize professional, ethical, legal, security and social issues and responsibilities.
- PLO 7: Be able to work independently or in team as a member or leader of a team engaged in activities appropriate to the program's discipline.
- PLO 8: Be able to communicate effectively with a range of audiences in a variety of professional contexts.
- PLO 9: Be able to engage in lifelong learning and continuing professional development."

In addition, the Master's degree programme is also intended to qualify students for a doctorate and further academic career.

In the experts' opinion, the intended qualification profiles of the programme are clear, plausible and allow students to take up an occupation, which corresponds to their qualification. They learn that the graduates of HCMUT are much sought after in the labor market.

The representatives of industry emphasize the high quality of the graduates of this programme under review and students as well as graduates are satisfied with and well aware of their good job perspectives.

However, HCMU offers two different pathways, "coursework programme" and "research programme" (see 1.3), which have different emphases. According to the experts, this leads to (slightly) different learning outcomes, which should also be reflected in the Diploma Supplement. Currently, however, no differentiation is made in the Diploma Supplement, which is why the experts argue that the listed learning outcomes should be adapted to the corresponding pathways and contents.

In summary, the experts confirm that the Master's degree programme in Computer Science adequately reflects EQF level 7. The programme learning outcomes are consistent with the respective ASIIN Subject-Specific Criteria of the Technical Committees of Informatics/Computer Science. They aim at the acquisition of specific competences and are well-anchored and binding.

<b>Criterion 1.2 Name of the degree programme</b>
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**Evidence:**

- Self-Assessment Report
- Sample Diploma Supplement

**Preliminary assessment and analysis of the peers:**

The experts confirm that the English translation and the original Vietnamese names of the degree programme under review correspond with the intended aims and learning outcomes as well as the main course language (Vietnamese).



<b>Criterion 1.3 Curriculum</b>
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**Evidence:**

- Self-Assessment Report
- Academic Guidelines
- Guidelines for the recognition of externally acquired academic achievements
- Cooperation agreements (MoU)
- Study plans of the degree programmes
- Module descriptions
- Webpage HCMUT
- Webpage Faculty of Computer Science and Engineering
- Discussions during the audit

**Preliminary assessment and analysis of the peers:**

The curricula of the Master's degree programme under review is structured for four semesters and 60 Vietnamese credits (equivalent to 120 ECTS points) need to be achieved by the student. An academic year at HCMUT consists of two semesters and a short summer term which lasts for ten weeks. The summer term is normally used for conducting the internship. Some courses are offered in the summer term, based on the demands of students. A regular semester consists of sixteen weeks for learning and teaching, one week for mid-term tests, and two to three weeks for final exams. The mid-term tests are normally given at the ninth week of a semester.

“As per instructions, the maximum number of credits is specified for each semester in the curriculum and students are not allowed to make any registration of more than 20 credits per semester. [...] Using an academic credit system, HCMUT encourages students to study any programme flexibly. In particular, students can select and study modules up to their own plan using the curriculum as a reference framework. In addition to flexible credit-based registration, the required general and fundamental knowledge, skills, and competences are included in the modules in the earlier semesters while those for graduation in the latter ones. Above all, specialized knowledge section is prepared with many various modules in a wide range of study fields so that students can choose the modules appropriate for their interest and career development.”

All courses of the Master's degree programme are generally divided into four blocks: General Knowledge, Foundation Knowledge, Specialized Knowledge, Graduation Knowledge.

The Computer Science programme is defined with two main branches: coursework and research, which are characterised by different ECTS proportions of the respective blocks. HCMUT presents this in its self-report through the following two tables:

**Table 1.4:** ECTS distribution of the coursework programme branch

Courses	Number of Credits	Number of ECTS Credits	Percentage (%)
A. General Knowledge	9	18	15
B. Foundation Knowledge	12	24	20
C. Specialized Knowledge	24	48	40
D. Graduation Knowledge	15	30	25
All	60	120	100

**Table 1.5:** ECTS distribution of the research programme branch

Courses	Number of Credits	Number of ECTS Credits	Percentage (%)
A. General Knowledge	6	12	10
B. Foundation Knowledge	12	24	20
C. Specialized Knowledge	15	30	25
D. Graduation Knowledge	27	54	45
All	60	120	100

In the Self-Assessment report, HCMUT states: “For both coursework and research programmes, B and C sections focus on foundation and specialized knowledge in Computer Science and its related fields in breadth and depth. Soft skills and technical skills are also included in their modules. Besides, D section aims at graduation knowledge so that students can work for more difficult and complex problems both in practice and in research in Computer Science and its related fields under the supervision of their supervisors.”

The main difference between the two branches is the different weighting of "specialised knowledge" and "graduation knowledge" courses. Students in the coursework programme have to choose more courses that are assigned to the area of "specialised knowledge" and have two "internship" courses that are assigned to "graduation knowledge". In contrast, students in the "research programme" have to take fewer courses that are assigned to the area of "specialised knowledge", but have to take the two extensive courses “Advanced Methodology of Scientific Research” and “Alternative Scientific Research” in the area of "graduation knowledge". Both branches include a final thesis, whereby the thesis in the coursework programme is only carried out in the last semester and comprises nine Vietnamese credits, while the thesis in the research programme is carried out in the last two semesters and comprises 15 Vietnamese credits. Before preparing the final thesis, students need to design a proposal for their Master’s thesis with the support of their supervisor. The

result should be presented and defended in front of a panel, which consists of two lecturers. The members of the teaching staff explain on demand of the peers that they offer possible topics for the final projects related to their own research projects. All members of the teaching staff supervise theses. Students have to design a research proposal with a time schedule for the project, which is discussed with the supervisor. If agreed on, the students apply formally for being allowed to work on the suggested topic.

The different areas are assigned to the respective semesters in the two branches of the programme as follows:

Branch	Semester 1	Semester 2	Semester 3	Semester 4
Coursework	- Foundation knowledge (12 credits)	- General knowledge (9 credits) - Specialized knowledge (3-6 out of 24 credits) - Graduation knowledge (3 out of 15 credits)	- Specialized knowledge (12-15 out of 24 credits) - Graduation knowledge (3-6 out of 15 credits)	- Specialized knowledge (3-6 out of 24 credits) - Graduation knowledge (9-12 out of 15 credits)
Research	- Foundation knowledge (12 credits) - Graduation knowledge (3 out of 27 credits)	- General knowledge (6 credits) - Specialized knowledge (0-9 out of 15 credits) - Graduation knowledge (0-9 out of 27 credits)	- Specialized knowledge (0-9 out of 15 credits) - Graduation knowledge (9-24 out of 27 credits)	- Specialized knowledge (0-3 out of 15 credits) - Graduation knowledge (15 out of 27 credits)

The expert group is very convinced of the structuring of the submitted curriculum and the corresponding content level of the Master's degree programme in Computer Science. This is also matched by the impressive research activities of the professors, which also find influence in the individual modules. The experts' only recommendation is that more courses could be offered in the field of theoretical computer science in order to provide students with further competences in this area.

In summary, the experts gain the impression that the content and the structure of the curriculum ensure that the intended learning outcomes of the degree programme can be achieved and that the students are well prepared for entering the labour market and can find adequate jobs.

*International mobility*

The peers learn that the university provides various mobility opportunities for students. These include semesters abroad, short programmes, internships, and international conferences. To foster these, there are cooperation agreements with hundreds of partner institutions worldwide, with a certain focus on Asia (for instance Korea, Japan), but also including many institutions in Europe and United States. Partly due to the COVID-19 pandemic, the number of students participating in mobility programs in 2020 and 2021 was relatively

low, but is expected to markedly increase again after the pandemic. An international office has been established in order to coordinate HCMUT's efforts and to support the students in the planning and administration of international mobility. Moreover, the university provides scholarships for international mobility programmes and manages various external scholarships sponsored for instance by the Vietnamese government.

According to a regulation from the Ministry of Education and Training, a course taken at an international university can be considered equivalent to a course at the home university by a Scientific Academic Committee. Before a stay abroad, the university concludes a learning agreement with the respective student to ensure that the courses taken are relevant to the study programme and can thus be recognised.

As the students confirm, there are no problems with credit transfer or the organization of student mobility. They emphasize that the international office as well as their academic advisors are eager to support them and to find adequate study programmes and courses.

The experts appreciate the efforts undertaken by the university to foster student mobility and they are very satisfied with the structures and support mechanisms for international mobility.

#### **Criterion 1.4 Admission requirements**

##### **Evidence:**

- Self-Assessment Report
- Admission Regulations
- Study plans of the degree programmes
- Webpage HCMUT
- Webpage Faculty
- Discussions during the audit

##### **Preliminary assessment and analysis of the peers:**

In its Self-Assessment Report, HCMUT states the admission requirements for the Master's degree programme in Computer Science as follows: "For each period of admission, a committee is established at the institution level for all the programs and a program committee at the program level for each programme. The program committee consists of a chairman and 2-3 other members in charge of verifying the candidate's qualifications in relevant areas of knowledge. Candidates may be tested on technical skills (writing test or interview)

and tested on foreign language (writing test). Based on the candidate's results and the ability to gain knowledge, the institution-level committee will decide the level of eligible scores in terms of technical skill and foreign language for successful candidates. The candidates who wish to participate in the postgraduate studies with Computer Science programme must hold a bachelor degree with the same or equivalent major listed as follows: Computer Science, Computer and Data Communication, Software Engineering, Information Systems, Computer Engineering, Information Technology, Information Security, Electrical Engineering, Electronic Engineering, Telecommunications Engineering, Control and Automation Engineering, Mechatronics Engineering. The admission has been usually evaluated on the results from an entrance examination that will be bi-annually organized. Those who do not have an above major degree must attend two supplemental courses, Foundation of Mathematics and Informatics and Introduction to Computing, before taking the entrance examination. Besides, candidates with outstanding undergraduate academic records are exceptionally passed depending on the interviews with academic staff of HCMUT without taking any entrance examination.”

There are different levels for the tuition fees, depending on the amount of credits the student registered to fulfil in each semester and the tuition fee rate. Furthermore, the Academic Affairs Office awards scholarships to the students with excellent performance based on the student’s academic performance. In addition, students at HCMUT can also receive scholarships from external sources such as companies, non-government organisations, faculty alumni, and individuals.

In addition, HCMUT has a policy to award tuition fee waivers for students who are orphaned by both parents, students with disabilities in poor or near-poor households or students from remote areas.

In summary, the experts find the terms of admission to be binding and transparent. They confirm that the admission requirements support the students in achieving the intended learning outcomes.

<b>Criterion 1.5 Workload and Credits</b>
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**Evidence:**

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Academic Guidelines
- Discussions during the audit

**Preliminary assessment and analysis of the peers:**

According to the legal requirements, the total credit load is 60 Vietnamese credits (equivalent to 120 ECTS) for the Master's degree programme Computer Science. The workload is spread relatively evenly over the semesters. Moreover, the effective number of credits the students can take depends on their achievements in the previous semester. The workload of the last semester, respectively the last two semesters, in the Master's degree programme is slightly reduced to give the students enough time for their theses as well as to already start looking for a job. This mechanism is supposed to ensure that the students can really handle the workload. It also means that theoretically, students can finish their studies in less than 8 or 4 semesters respectively, although this is relatively rare due to the high workload in general.

In the Vietnamese system, each credit is equivalent to 15 periods of theoretical lecture in class or 30 periods of practical laboratory work with additional 30 periods of self-study. In the internship, it is equivalent to 60 periods, whereas in the project work and the thesis, it is worth 45 periods. One period lasts for 50 minutes.

According to the ECTS credit system, 1 ECTS equals 25-30 hours of students' workload. As a result, there cannot be the same conversion rate between Vietnamese credits and ECTS points for all courses. For theoretical lectures, the rate would be 1 to 1.25 and for practical work 1 to 1.67.

However, the module descriptions mention a different workload. For example, the module descriptions for "Mathematical Foundation for Computer Science", "Advanced System Architectures" and "Machine Learning Applications" all state that 3 credits are awarded in each case, while the total workload stated at the same time varies between 69 and 75. Therefore, the experts underline that the workload and credit calculation is inconsistent. The experts point out that it is necessary to eliminate the inconsistencies in the workload and credit calculation of the Vietnamese as well as the ECTS system. HCMUT should follow

the ECTS Users' Guide and define how many hours of students' total workload are required for one ECTS point (including lecture hours and self-study hours).

During the discussions with the programme coordinators and the students, the experts learn that so far there has been no specific survey asking the students to evaluate the amount of time they spend outside the classroom for preparing the classes and studying for the exams. Since this is necessary in the ECTS framework, the experts suggest asking the students directly about their experiences. This could be done by including respective questions in the course questionnaires. The experts point out that the faculty should follow the ECTS Users' Guide, while determining the students' total workload. This is the time students typically need to complete all learning activities (such as lectures, seminars, projects, practical work, self-study and examinations).

In other words, a seminar and a lecture may require the same number of contact hours, but one may require significantly greater workload than the other because of differing amounts of independent preparation by students. Typically, the estimated workload will result from the sum of:

- the contact hours for the educational component (number of contact hours per week x number of weeks),
- the time spent in individual or group work required to complete the educational component successfully (i.e. preparation beforehand and finalising of notes after attendance at a lecture, seminar or laboratory work; collection and selection of relevant material; required revision, study of that material; writing of papers/projects/dissertation; practical work, e.g. in a laboratory),
- the time required to prepare for and undergo the assessment procedure (e.g. exams).

Since workload is an estimation of the average time spent by students to achieve the expected learning outcomes, the actual time spent by an individual student may differ from this estimate. Individual students differ because some progress more quickly, while others progress more slowly. Therefore, the workload estimation should be based on the time an "average student" spends on self-study and preparation for classes and exams. The initial estimation of workload should be regularly refined through monitoring and student feedback.

However, during the audit, the students emphasise that they consider the workload high but manageable and that it is possible to finish the degree programmes within the expected two years.

<b>Criterion 1.6 Didactic and Teaching Methodology</b>
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**Evidence:**

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Discussions during the audit

**Preliminary assessment and analysis of the peers:**

Various teaching and learning methods (including lectures, computer training and classroom and lab exercises, individual and group assignments, seminars and projects, etc.) have been implemented. Structured activities include tutorials, homework, assignments (reading or problem exercises) and practical activities. Group project assignments are given in some courses to develop students' skills in teamwork, communication, and leadership. The assignments and exercises should help students to develop their abilities with respect to critical thinking, written/oral communication, data acquisition, problem solving, and presentations.

The most common method of learning is class session. Lecturers generally prepare presentations to aid the teaching process. With individual or group assignments, such as discussions, presentations, or written tasks, students are expected to improve their academic as well as their soft skills. In addition, practical activities should enable students to be acquainted with practical activities for research.

To help students achieving the intended learning outcomes and to facilitate adequate learning and teaching methods, HCMUT has developed an e-learning platform (My BK System), where students and teachers can interact.

In summary, the expert group considers the teaching methods and instruments to be suitable to support the students in achieving the intended learning outcomes. In addition, they confirm that the study concept of all three programmes under review comprises a variety of teaching and learning forms as well as practical parts that are adapted to the respective subject culture and study format. It actively involves students in the design of teaching and learning processes (student-centred teaching and learning).

**Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 1:**

**The experts consider criterion 1 to be not completely fulfilled.**



## 2. Exams: System, Concept and Organisation

<b>Criterion 2 Exams: System, concept and organisation</b>
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### **Evidence:**

- Self-Assessment Reports
- Module descriptions
- Examination Regulation
- Samples of exams, project works and theses
- Academic Guidelines

### **Preliminary assessment and analysis of the peers:**

Each course has to determine objectives, which support the achievement of the Programme Learning Outcomes of the respective programme. Accordingly, each course must assess whether all defined learning outcomes stated in the module descriptions have been achieved. For this purpose, HCMUT utilises various types of examination.

In each course, short class assignments/quizzes, a mid-term and a final examination are employed. There are different assessment methods in the programmes, such as quizzes, written tests, practical performances, assignments, small projects and presentations. In most courses, mid-term and final exam consist of written tests and additional quizzes or assignments are used. However, the other assessment methods are also used to a certain degree. Via the Academic Calendar, the students are informed about mid-term and final exams. The form and length of each exam is mentioned in the module descriptions that are available to the students via the internal university system known as My Bach Khoa system (MyBK). It is common to hold small quizzes every two or three weeks, but there are generally no unscheduled tests.

Although, it seems as the total number of tests taken during a semester is comparatively high, during the audit discussions, the students do not complain about this workload and instead appreciate that there are several short exams instead of one big exam as this requires them to continuously study during the entire semester and not having to solely work for one final exam at the end of the semester. The students also confirm that they are well informed about the examination schedule, the examination form and the rules for grading. The peers appreciate their perception.

The final grade of each module is calculated based on the score of these individual kinds of assessment, whereby the lecturer determines the ratio between them in accordance with the Academic Guidelines. The exact formula is given in the module handbook. At the first meeting of a course, the students are informed about what exactly is required to pass the module and about how the final grade is determined through the teaching and learning plan. HCMUT uses a grading system with the grades A+, A, B+, B, C+, C, D+, D and F, where a C (equivalent to a Grade Point of 2) is necessary to pass a module.

Based on the university regulation, the students must retake the whole course if they fail. However, students can request to postpone the final exam due to important reasons (such as accidents, health problems, etc.). In these cases, students will take the final exam in the next semester without repeating the whole course. The reason, why there are no re-sits of the final exam is that the final grade depends on the assessment of the learning activities that will be carried out continuously through the semester and not only on the final exam. Students who fail a course must attend the course again in the next semesters. The number of repetitions is unlimited. Students who have passed a course and want to improve the score, may also take the course again. The experts appreciate that corresponding rules are in place.

Students who underperform will receive academic warnings. The warning system has three levels: “Academic warning level 1”, “Academic warning level 2”, and “Suspension”. The academic warning is issued if the student violates one of the regulations, such as not affording the minimum number of required credits, finishing the semester with the average grade less than 3.0 (scale 10) or less than 4.0 in the last two consecutive semesters. Students who already have received “Academic warning level 1” would receive “Academic warning level 2” if their performance does not improve in the following semester. In those cases, the students will be suspended. As the student’s academic advisor receives the notifications during the course as well, help and support can be given in time to improve the student’s academic performance.

Every student is required to do a thesis in the last year of study. Prior to the actual research work, the students are required to write a research proposal and present it in a seminar attended by lecturers and other students who form a research group. The research proposal has to be accepted by the Dean and the supervisor committee who will then appoint the research supervisors. Usually, there are one or two research supervisors for each student. One will act as the principal supervisor and the other act as co-supervisor. In case the thesis is written in collaboration with the industry, a supervisor from the industry is assigned as well. After completing the work on the thesis, the student has to present and defend the results in front of teachers and fellow students.

The peers discuss with the programme coordinators, the members of the teaching staff, and the students about the process of finding suitable topic of the final project or thesis.

There are two possibilities: either students can propose their own ideas or they can ask their academic advisor or other teachers for suggestions.

During the on-site visit, the peers had access to a selection of exams and final projects. They confirm that these represent an adequate level of knowledge as required by EQF-Level 7. The forms of exams are oriented in-line with the envisaged learning outcomes of the respective courses, and the workload is allocated in an acceptable way.

The experts conclude that the criteria regarding the examinations system, concept, and organization are fulfilled and that the examinations are suitable to verify whether the intended learning outcomes are achieved or not.

**Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 2:**

**The experts consider criterion 2 to be fulfilled.**

### 3. Resources

#### Criterion 3.1 Staff and Development

**Evidence:**

- Self-Assessment Reports
- Staff Handbooks
- Study plans of the degree programmes
- Module descriptions
- Discussions during the audit

**Preliminary assessment and analysis of the peers:**

At HCMUT, the staff members have different academic positions. There are full professors, associate professors, and lecturers. The academic position of each staff member is based on research activities, publications, academic education, supervision of students, and other supporting activities.

The faculty of Computer Science and Engineering “has 49 full-time teaching staff, 6 clerical staff and 4 technicians. Among the teaching staff, there are 29 full-time and 3 part-time members who possess PhD degrees and can participate in teaching of the programme. In addition to full-time staff, the university also employs part-time teaching staff.”

The following table depicts the number of teachers who are involved in the Master's degree programme in Computer Science:

No.	Faculty Name	The Highest Degree, Earned-Field, Year	Full-time/ Part-time	Years of Experience	
				Teaching	This Institution
1	Pham Hoang Anh	PhD, CE, 2014	Full-time	17	17
2	Duong Tuan Anh	PhD, CS, 1998	Part-time	46	46
3	Tran Tuan Anh	PhD, CS, 2017	Full-time	11	5
4	Truong Tuan Anh	PhD, CS, 2015	Full-time	14	11
5	Nguyen Thanh Binh	PhD, CS, 2011	Full-time	17	14
6	Vo Thi Ngoc Chau	PhD, IS, 2008	Full-time	14	14
7	Pham Quoc Cuong	PhD, CE, 2015	Full-time	15	11
8	Nguyen Duc Dung	PhD, CS, 2014	Full-time	7	7
9	Nguyen Van Hiep	PhD, CS, 1991	Full-time	40	40
10	Tran Van Hoai	PhD, CS, 2005	Full-time	27	27
11	Nguyen Quang Hung	PhD, CS, 2020	Full-time	17	17
12	Dang Tran Khanh	PhD, CS, 2003	Part-time	24	24
13	Nguyen An Khuong	PhD, Math, 2008	Full-time	22	7
14	Nguyen Le Duy Lai	PhD, CS, 2017	Full-time	13	13
15	Thoai Nam	PhD, CS, 2003	Full-time	27	27
16	Nguyen Tran Huu Nguyen	PhD, CE, 2017	Full-time	14	14
17	Huynh Tuong Nguyen	PhD, CS, 2009	Full-time	13	13
18	Le Trong Nhan	PhD, CE, 2014	Full-time	14	14
19	Phan Trong Nhan	PhD, CS, 2016	Full-time	7	7
20	Nguyen Hua Phung	PhD, CS, 2006	Full-time	30	28
21	Tran Minh Quang	PhD, CS, 2012	Full-time	21	21
22	Le Thanh Sach	PhD, CS, 2010	Full-time	24	24
23	Le Lam Son	PhD, CS, 2008	Full-time	8	8
24	Nguyen Duc Thai	PhD, CS, 2005	Full-time	13	13
25	Bui Hoai Thang	PhD, CS, 2010	Full-time	24	24
26	Nguyen Tien Thinh	PhD, Math, 2018	Full-time	11	3
27	Tran Ngoc Thinh	PhD, CE, 2009	Full-time	23	23
28	Quan Thanh Tho	PhD, CS, 2006	Full-time	24	24
29	Le Hong Trang	PhD, Math, 2014	Full-time	16	6
30	Phan Thi Tuoi	PhD, CS, 1985	Part-time	45	45
31	Le Thanh Van	PhD, CS, 2008	Full-time	13	11

32	Pham Tran Vu	PhD, CS, 2006	Full-time	23	23
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Note: CS (Computer Science), CE (Computer Engineering), IS (Information Systems), Math (Mathematics)

Open positions are announced on HCMUT's webpage. Candidates have to do a presentation on their research activities and their teaching abilities are verified. Most of the lecturers are graduates of HCMUT, who were hired after finishing their undergraduate studies and were conducting their Master's and PhD studies parallel to working as a lecturer or a supporting staff member. However, several teachers have graduated from international universities (for example, from USA, UK, France, Germany, Australia, Japan, Korea, Thailand, and Taiwan).

All full-time members of the teaching staff are obliged to be involved in teaching/advising, research, and administrative services. However, the workload can be distributed differently between the three areas from teacher to teacher and also depends on the academic position. For example, associate professors spend more time on research activities and less on teaching than lecturers. HCMUT expects staff members to conduct research activities and has issued a policy, which offers some financial support for publishing papers in international journals. In addition, students are encouraged to participate actively in scientific research activities.

Every year, associate professors or lecturers can apply for promotion to associate professor or full professor, respectively. The candidates are considered based on three main criteria such as: years of working, hours of teaching graduate students, quantity and quality of scientific published papers.

During the on-site interviews, the experts want to know how the teachers assess their own workload. They state that they are occupied with many tasks and that their workload should not increase any further. This applies above all to balancing teaching, research and administrative activities. The experts are also of the opinion that the workload of the teaching staff is relatively high. Therefore, the experts emphasize that despite this relatively high workload of the teaching staff, very high quality research is conducted at the faculty. However, the experts believe that a workload that is permanently too high can lead to a decline in the quality of teaching and/or research if there is no longer sufficient time for either, which could ultimately have an impact on the quality of the study program. Therefore, they recommend reducing the teaching staff's workload in order to ensure the quality of the degree programme.

#### *Staff development*

According to the self-assessment report and the discussions during the on-site audit, HCMUT encourages the continuing professional development of its staff. For this purpose,

various opportunities are provided. Faculty members regularly participate in didactic training that encompasses curriculum design, teaching material, and innovative teaching and learning methods. Moreover, workshops related to subject-specific fields are held to refresh and to deepen various didactic competences in each semester. The lecturers can also regularly participate in external didactical trainings offered and funded by the government.

The teaching staff is encouraged to study abroad or to participate in international research projects and conferences in order to enhance their knowledge, increase their English proficiency and to build international networks. For this purpose, the university informs about possible scholarships to support academic mobility. In general, the exchange programmes are funded by international partner universities and organizations. Particularly, for junior lecturers with a master's degree, the programmes offer systematic training to prepare them for acquiring a PhD abroad, for instance through English courses, information on foreign education systems, administrative support, and supporting (international) research collaborations. Teachers involved in a staff exchange programme are generally assigned to a partner university abroad that has a MoU with HCMUT and the relevant faculty.

In summary, the peers highlight the highly engaged and motivated staff members and confirm that the composition and scientific orientation of the teaching staff are suitable for successfully implementing and sustaining the degree programmes. Furthermore, they appreciate the university's efforts in the further development of its employees and consider the support mechanisms for the continuing professional development of the teaching staff adequate and sufficient.

### *Support and assistance*

Students can receive assistance from the Student Activity Office and the Career Office about career guidance and consultancy, career development training, soft skill training, and job opportunities. The Offices provide information on training and job seeking to help students develop career plans and workplace understanding. The Offices are also a bridge between students, staffs, lecturers and businesses in searching for scholarships, factory visits, internships, and employment opportunities. They are also responsible for keeping in contact with alumni associations, employers, and professional organizations. In addition, HCMUT supports its graduates to find suitable jobs by annually conducting a job fair and by forwarding job vacancies to the students. Moreover, during the internship, students are introduced to professional life and acquire additional skills that help them finding an adequate position after graduation. In summary, good job perspectives for the graduates of all three programmes arise from these activities.

The experts notice that there are enough resources available to provide individual assistance, advice and support for all students. The support system helps the students to achieve the intended learning outcomes and to complete their studies successfully and

timely. The students are well informed about the services available to them. In summary, the comprehensive tutorial and support system for students is one of the strong points of the degree programmes.

### Criterion 3.2 Funds and equipment

#### Evidence:

- Self-Assessment Reports
- On-site visit of the facilities
- Discussions during the audit

#### Preliminary assessment and analysis of the peers:

Basic funding of the degree programmes and the facilities is provided by HCMUT and the different faculties. The financial sources are government funding, tuition fees from students, and industry funding. The figures presented by the university show that the faculties' income is stable and the funding of the degree programmes is secured. The academic staff emphasise that from their point of view, the programme under review receive sufficient funding for teaching and learning activities as well as research, which results in well-equipped facilities and good access to literature, databases and modern software. The students confirm this positive impression and state their satisfaction with the available resources.

In the self-assessment report, HCMUT gives an extensive overview of the available learning spaces and libraries. Moreover, they list detailed information of all laboratories available per study programme. During the on-site visit, the peers take a look at some central facilities, relevant research and teaching facilities and, in particular, a selection of different laboratories available for the three study programmes. Furthermore, the university has licensed Microsoft Office and other standard software and provides the students full access to this software.

The students express their satisfaction with the library and the available literature. The library offers direct access to international literature, scientific journals, and publications e.g. via Springer Online. From the students' point of view, there is sufficient access to current international literature and databases and a remote access is possible. In addition, it is possible to access all resources of all member universities of the Vietnam National University Ho Chi Minh City so that it is possible to get books from other universities if HCMUT is not able to provide them.

The experts appreciate the range of learning tools and resources available to the students and consider the university's facilities and available equipment in the labs to be of appropriate standards. In summary, the expert group judges the available funds, the technical equipment, and the infrastructure (laboratories, library, class rooms etc.) to comply with the requirements for adequately sustaining the degree programmes.

**Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 3:**

**The experts consider criterion 3 to be fulfilled.**

## 4. Transparency and documentation

### Criterion 4.1 Module descriptions

**Evidence:**

- Self-Assessment Report
- Module descriptions
- Webpage HCMUT
- Webpage Faculty of Computer Science and Engineering

**Preliminary assessment and analysis of the peers:**

The experts observe that the module descriptions contain the necessary information about the persons responsible for each module, the Vietnamese credit points awarded, the intended learning outcomes, the applicability, the admission and examination requirements, the forms of assessment, and details explaining how the final grade is calculated.

However, the peers note that the module descriptions do not make the calculation of the students' total workload and the conversion into ECTS points transparent. Moreover, HCMUT has to define how many hours of students' workload is required for one ECTS point. This issue is discussed in more detail under criterion 1.5.

Furthermore, the peers realise that the module descriptions of some modules, as for instance the thesis module, the internship and the methodology course, are missing. For those reasons, it is necessary that HCMUT submits the complete and latest version of the corresponding module descriptions and makes them accessible for students and teaching staff.



#### Criterion 4.2 Diploma and Diploma Supplement

**Evidence:**

- Self-Assessment Report
- Sample Diploma for each degree programme
- Sample Diploma Supplement for each degree programme
- Sample Transcript of Records for each degree programme

**Preliminary assessment and analysis of the peers:**

The experts confirm that the students of all three degree programmes under review are awarded a Diploma and a Diploma Supplement after graduation. The Diploma consists of a Diploma Certificate and a Transcript of Records. The Transcript of Records lists all courses that the graduate has completed, the achieved credit points, grades, and cumulative GPA. The Diploma Supplements are bilingual (Vietnamese and English). The Diploma Supplement and the Transcript of Records contain almost all necessary information about the respective degree programme. However, the Diploma Supplement needs to include statistical data about the distribution of final grade according to the ECTS Users' Guide. This allows the reader to categorise the individual result.

#### Criterion 4.3 Relevant rules

**Evidence:**

- Self-Assessment Report
- Academic Guidelines
- Webpage HCMUT
- Webpage Faculty of Computer Science and Engineering

**Preliminary assessment and analysis of the peers:**

The experts confirm that the rights and duties of both HCMUT and the students are clearly defined and binding. The students receive all relevant course material in the language of the degree programme at the beginning of each semester. In addition, all rules and regulations are published on the university's website in Vietnamese as well as in English and hence available to all stakeholders

**Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 4:**

The experts consider criterion 4 not to be completely fulfilled.

## **5. Quality management: quality assessment and development**

### **Criterion 5 Quality management: quality assessment and development**

**Evidence:**

- Self-Assessment Report
- Academic Guidelines
- Discussions during the audit

**Preliminary assessment and analysis of the peers:**

The programme under review are managed by the Faculty of Computer Science and Engineering, which is both part of the Ho Chi Minh City University of Technology (HCMUT). Ho Chi Minh City University of Technology is a member of Vietnam National University – Ho Chi Minh City (VNUHCM), which is a ministerial-level university. Each programme has a Science and Academic Committee (SAC), whose members are suggested by the Dean of the relevant faculty and approved by the Rector of HCMUT and a Quality Assurance Team (QAT) whose members are also assigned by the Dean of the relevant faculty. The QAT analyses the data, writes reports and offers suggestions to SAC. The SAC reviews the suggestions from QAT and makes the final decisions to all academic concerns in the faculties.

The experts discuss the quality management system at HCMUT with the programme coordinators and the students. They learn that HCMUT has an extensive quality management system, which is aimed at constantly improving the quality of the degree programmes and the experience of students and faculty members. The central unit responsible for quality management is the Testing and Quality Assurance Office. Every year, HCMUT develops a quality assurance plan on the basis of regular tasks and the university's general quality policy. The individual faculties are obliged to follow these plans and carry out self-assessment tasks such as the revision of the curricula. The process of curriculum development is divided into three major steps. First, at the end of every academic year lecturers of the individual faculty meet in order to assess and discuss the courses syllabi. The lecturers hereby consider among other things the students' learning results, inspiration from other institutions,

and new trends in the technical fields. The second step consists of conducting surveys and analysing the feedback from students, alumni, employers, and other stakeholders. Finally, the SAC, which receives the results of surveys and reports from other groups, suggests improvements to the individual programmes. According to HCMUT, all surveys are carried out on a regular basis. Alumni, for instance, are asked for their feedback at the time of their graduation as well as a year after their graduation. General student feedback regarding their study experience is collected once per academic year. Teaching evaluations are conducted shortly after the middle of each semester for each module. Via an online tool, students can give their feedback anonymously on aspects such as the teaching quality, the course content and their learning progress. Afterwards, the results of the surveys are sent to the teachers for further improvement of the courses and teaching. In the audit, the experts inquire whether the results of the surveys are also shared and discussed with the students. The programme coordinators explain that students receive the survey results. The discussion with the students revealed that those in charge are always eager and open for feedback aside from the official evaluations and that students have the impression that their comments are taken into consideration with regard to the further improvement of the programmes. This becomes apparent in the already mentioned constant curricular revision process that is performed under participation of students and industry partners. The peers are glad to hear that students are satisfied with the programmes and included in the feedback loop.

HCMUT also regularly consults the industry for the assessment and development of the programmes. In extensive surveys, companies are asked among other things about changes in the labour market, expected qualifications of the graduates, and their satisfaction with interns and graduates from HCMUT. On this basis, the Board of Deans discusses whether the curricula and the learning objectives of the individual programmes need to be revised. In the audit discussions, the industry partners report to be satisfied with the students from HCMUT, especially in terms of their work ethic. Furthermore, the industry partners confirm that their suggestions are generally adopted by HCMUT. The experts appreciate that HCMUT has a close relationship with the industry partners and regularly collects feedback from them. Thus, the peers agree that the quality management circles at HCMUT are well established and work under participation of all stakeholders.

In summary, the experts are satisfied with the quality management system at HCMUT, especially with the continuous feedback loops and the involvement of important stakeholder groups such as students, alumni and representatives from the industry.

**Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 5:**

**The experts criterion 5 to be fulfilled.**

## D Additional Documents

No additional documents needed.

## E Summary: Expert recommendations

The experts summarize their analysis and **final assessment** for the award of the seals as follows:

<b>Degree Programme</b>	<b>ASIIN Seal</b>	<b>Maximum duration of accreditation</b>	<b>Subject-specific label</b>	<b>Maximum duration of accreditation</b>
Ma Computer Science	With requirements for one year	30.09.2029	Euro-Inf®	30.09.2029

### Requirements

- A 1. (ASIIN 1.1) The learning outcomes stated in the Diploma Supplement must be adjusted to the actual contents of the program, respectively of the respective paths "coursework program" and "research program".
- A 2. (ASIIN 1.5) [Verify the students' total workload and award the ECTS points accordingly. Define how many hours of students' workload is required for one ECTS point according to the ECTS Users' Guide.
- A 3. (ASIIN 4.1) Submit the complete, consistent and latest version of the module descriptions and make them accessible for students and teaching staff, especially regarding the thesis, internship and the methodology course.
- A 4. (ASIIN 4.1) The Diploma Supplement needs to include statistical data about the distribution of final grade according to the ECTS Users' Guide.

### Recommendations

- E 1. (ASIIN 1.3) It is recommended to expand competencies in the field of theoretical computer science.
- E 2. (ASIIN 3.1) It is recommended to reduce the teaching staff's workload in order to ensure the quality of the degree programme.

## **F Comment of the Technical Committee 04- Informatics/Computer Science (14.09.2023)**

*Assessment and analysis for the award of the ASIIN seal:*

The TC discusses the procedure and follows the assessment of the experts without any changes

*Assessment and analysis for the award of the Euro-Inf® Label:*

The Technical Committee deems that the intended learning outcomes of the degree programme comply with the Subject-Specific Criteria of the Technical Committee 04 – Informatics/Computer Science.

The Technical Committee 04 – Informatics/Computer Science recommends the award of the seals as follows:

<b>Degree Programme</b>	<b>ASIIN Seal</b>	<b>Maximum duration of accreditation</b>	<b>Subject-specific label</b>	<b>Maximum duration of accreditation</b>
Ma Computer Science	With requirements for one year	30.09.2029	Euro-Inf®	30.09.2029

## G Decision of the Accreditation Commission (22.09.2023)

*Assessment and analysis for the award of the ASIIN seal:*

The AC discusses the procedure and is in favour of an editorial change to requirement A 1. Otherwise, the AC agrees with the assessment of the experts and the technical committees without any changes.

*Assessment and analysis for the award of the Euro-Inf® Label:*

The Accreditation Commission deems that the intended learning outcomes of the degree programme do comply with the Subject-Specific Criteria of the Technical Committee 04 – Informatics/Computer Science.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ma Computer Science	With requirements for one year	30.09.2029	Euro-Inf®	30.09.2029

### Requirements

- A 1. (ASIIN 1.1) The learning outcomes stated in the Diploma Supplement must be adjusted to the actual contents of the program and differentiate between the respective paths "coursework program" and "research program".
- A 2. (ASIIN 1.5) Verify the students' total workload and award the ECTS points accordingly. Define how many hours of students' workload is required for one ECTS point according to the ECTS Users' Guide.
- A 3. (ASIIN 4.1) Submit the complete, consistent and latest version of the module descriptions and make them accessible for students and teaching staff, especially regarding the thesis, internship and the methodology course.



- A 4. (ASIIN 4.1) The Diploma Supplement needs to include statistical data about the distribution of final grade according to the ECTS Users' Guide.

**Recommendations**

- E 1. (ASIIN 1.3) It is recommended to expand competencies in the field of theoretical computer science.
- E 2. (ASIIN 3.1) It is recommended to reduce the teaching staff's workload in order to ensure the quality of the degree programme.

## H Fulfilment of Requirements (24.09.2024)

### Analysis of the experts and the Technical Committee (05.09.2024)

#### Requirements

- A 1. (ASIIN 1.1) The learning outcomes stated in the Diploma Supplement must be adjusted to the actual contents of the program and differentiate between the respective paths "coursework program" and "research program".

Initial Treatment	
Peers	Fulfilled. Justification: The Diploma Supplement has been extended by the required information and two different exemplary Diploma Supplements were submitted for the two study paths.
TC 04	Not completely fulfilled. Vote: unanimous Justification: The TC follows the assessment of the experts.
AC	Fulfilled. Vote: unanimous Justification: The AC follows the assessment of the experts.

- A 2. (ASIIN 1.5) Verify the students' total workload and award the ECTS points accordingly. Define how many hours of students' workload is required for one ECTS point according to the ECTS Users' Guide.

Initial Treatment	
Peers	Fulfilled. Justification: The university provides rules for calculation of the workload. Also the equivalence between Vietnamese credits to ECTS has been defined: All courses in the master's program in computer science require 150 hours in total for a 3-credit (Vietnamese) course, which is equivalent to 6 ECTS.
TC 04	Not completely fulfilled. Vote: unanimous Justification: The TC follows the assessment of the experts.
AC	Fulfilled. Vote: unanimous Justification: The AC follows the assessment of the experts.

- A 3. (ASIIN 4.1) Submit the complete, consistent and latest version of the module descriptions and make them accessible for students and teaching staff, especially regarding the thesis, internship and the methodology course.

Initial Treatment	
Peers	Not completely fulfilled. Justification: The university has submitted the latest module descriptions and the experts consider these to be well structured and largely complete. However as yet, most of the module descriptions do not provide any information under the point "Required and recommended prerequisites for joining the module". There are also no information on prerequisites for elective courses. The indication of prerequisites is intended to help students understand what knowledge is required for participation in the course. This can also mean that it is stated that no specific knowledge or courses are required. In addition, there are individual module descriptions (e.g. Philosophy, Management and Leadership, Project Management, Applied Data Science and others) in which no information is provided on teaching methods. Therefore, the experts are of the opinion that the requirement has not yet been fully met and that the university should add the relevant information on prerequisites and teaching methods to the module descriptions.
TC 04	Not fulfilled. Vote: unanimous Justification: The TC follows the assessment of the experts.
AC	Not fulfilled. Vote: unanimous Justification: The AC follows the assessment of the experts.

- A 4. (ASIIN 4.1) The Diploma Supplement needs to include statistical data about the distribution of final grade according to the ECTS Users' Guide.

Initial Treatment	
Peers	Fulfilled. Justification: The Diploma Supplement has been extended by the required information.
TC 04	Not completely fulfilled. Vote: unanimous Justification: The TC follows the assessment of the experts.
AC	Fulfilled. Vote: unanimous Justification: The AC follows the assessment of the experts.

## Decision of the Accreditation Commission (24.09.2024)

<b>Degree programme</b>	<b>ASIIN-label</b>	<b>Subject-specific label</b>	<b>Accreditation until max.</b>
Ma Computer Science	Requirement 3 not fulfilled	Euro-Inf <sup>®</sup>	6 months prolongation

## Appendix: Programme Learning Outcomes and Curricula

According to the Diploma Supplement the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Master's degree programme Computer Science:

- Ability to perform steps in data analysis, typically applications in natural language processing, image processing and computer vision, or non-time data series processing.
- Ability to propose solutions of intelligent computing for practical problems.
- Having solid knowledge and skills to participate effectively to the development process of systems that require data analytics, including analyzing problems, selecting appropriate techniques and technologies, designing and implementing systems in data analytics.
- Be able to recognize potentials, advantages and disadvantages of the utilization of data analytics in real life.
- Having scientific methodology and good critical thinking to support finding efficient solutions in data analytics.
- Conduct research independently and develop perspectives; define scientific ideas; identify, explore, design and experiment on new knowledge, products of Computer Engineering and related fields.
- Function as researchers, instructors, consultants, policy planners or other positions in Computer Engineering or related fields.
- Recognize security threats and issues, and apply security techniques and tools to secure computer networks, databases, software and hardware systems.
- Understand and apply cryptography techniques such as encryption, public key infrastructures, digital signatures to develop secure applications.
- Understand national laws, policies, procedures and standards with respect to cybersecurity.
- Administrate security systems, including planning, designing and implementing security measures, managing correspondences with management and staff.
- Ability to construct software-intensive systems that deliver business values to customers.
- Demonstrate ability to maintain evolving software systems.
- Able to manage software projects and effectively communicate in software development.

The following **curriculum** is presented:

## B.2 Structure of the coursework program

No.	Course Title	Study hours					Semester
		Credits	Lecture Hours	Lab Hours	Assignment Hours	Essay Hours	
<b>A</b>	<b>General knowledge</b>	<b>9</b>					
<i>A.1</i>	<i>Compulsory general knowledge</i>	<b>3</b>					
1	Philosophy	3	30	0	0	45	2
<i>A.2</i>	<i>Elective general knowledge</i>	<b>6</b>					
2	Methodology of Scientific Research	3	30	0	0	45	2
3	Innovation and Entrepreneurship	3	30	0	0	45	2
4	Management and Leadership	3	30	0	0	45	2
5	Business Ethics and Corporate Social Responsibility	3	30	0	0	45	2
6	Service Management	3	30	0	0	45	2
7	Project Management	3	30	0	0	45	2
8	Analyzing, Writing, Publishing Scientific Papers	3	30	0	0	45	2
9	Multivariate Analysis	3	30	0	0	45	2
10	Applied Data Science	3	30	0	0	45	2
<b>B</b>	<b>Foundation Knowledge</b>	<b>12</b>					1
1	Mathematical Foundation for Computer Science	3	30	0	12	27	1
2	Advanced System Architectures	3	30	0	6	36	1
3	Data Engineering	3	30	0	9	31.5	1
4	Advanced Algorithms	3	30	0	0	45	1
<b>C</b>	<b>Specialized Knowledge</b>	<b>24</b>					

**0 Appendix: Programme Learning Outcomes and Curricula**

<b>C.1</b>	<b>Compulsory major knowledge</b>	<b>12</b>					
<b>C.1.1</b>	<b>Specialized Knowledge in Computer Science major</b>						
1	Intelligent Systems	3	30	0	0	45	2, 3,4
<b>No.</b>	<b>Course Title</b>	<b>Study hours</b>					<b>Semester</b>
		<b>Credits</b>	<b>Lecture Hours</b>	<b>Lab Hours</b>	<b>Assignment Hours</b>	<b>Essay Hours</b>	
2	Natural Language Processing	3	30	0	0	45	2, 3,4
3	Machine Learning and Applications	3	30	0	12	27	2, 3,4
4	Data Mining	3	30	0	6	36	2, 3,4
<b>C.1.2</b>	<b>Specialized Knowledge in Data Science major</b>						
1	Machine Learning and Applications	3	30	0	12	27	2, 3,4
2	Programming Foundation For Data Analytics And Visualization	3	30	0	0	45	2, 3,4
3	Deep Learning and Its Applications In Computer Vision	3	30	0	0	45	2, 3,4
4	Big Data	3	30	0	0	45	2, 3,4
<b>C.1.3</b>	<b>Specialized Knowledge in Network Security major</b>						
1	Network Security	3	30	0	6	36	2, 3,4
2	Applied Cryptography	3	30	0	12	27	2, 3,4
3	Laws, Policies and Standards in Cyber-Security	3	30	0	0	45	2, 3,4
4	Laws, Policies and Standards in Cyber-Security	3	30	0	0	45	2, 3,4
<b>C.1.4</b>	<b>Specialized Knowledge in Software Engineering major</b>						
1	Software Architecture	3	30	0	0	45	2, 3,4
2	New Gen Software Engineering	3	30	0	0	45	2, 3,4
3	Software Testing	3	30	0	0	45	2, 3,4
4	Software Security	3	30	0	0	45	2, 3,4

**0 Appendix: Programme Learning Outcomes and Curricula**

<b>C.2</b>	<b><i>Elective major knowledge</i></b> <b><i>(Complete at least 12 credits)</i></b>	<b>12</b>					
1	New Trends in ICT	3	30	0	0	45	2, 3,4
2	Program Analysis	3	30	0	0	45	2, 3,4
3	IoT Application Development	3	30	0	0	45	2, 3,4
<b>No.</b>	<b>Course Title</b>	<b>Study hours</b>					<b>Semester</b>
		<b>Credits</b>	<b>Lecture Hours</b>	<b>Lab Hours</b>	<b>Assignment Hours</b>	<b>Essay Hours</b>	
4	Modern Approaches for Speech Processing	3	30	0	0	45	2, 3,4
5	Security In Modern Computing Platforms	3	30	0	0	45	2, 3,4
6	Modern Approaches for Natural Language Processing	3	30	0	0	45	2, 3,4
7	Custom Software Engineering For Smart Cities	3	30	0	0	45	2, 3,4
8	Communication For Software Engineers	3	30	0	0	45	2, 3,4
9	Logic and Constraint Programming	3	30	0	0	45	2, 3,4
10	Database Security	3	30	0	0	45	2, 3,4
11	Analysis Of Software Artifacts	3	30	0	0	45	2, 3,4
12	Hardware Design Methodologies	3	30	0	0	45	2, 3,4
13	Embedded System Design	3	30	0	0	45	2, 3,4
14	Experiment Design and Analysis	3	30	0	0	45	2, 3,4
15	Real-Time Systems	3	30	0	0	45	2, 3,4
16	Parallel Computing	3	30	0	0	45	2, 3,4
<b>D</b>	<b><i>Graduation Knowledge</i></b>	<b>15</b>					
1	Internship 1	3	30	135	0	0	2, 3
2	Internship 2	3	30	135	0	0	3,4
3	Thesis	9	0	0	0	405	4
<b>Total</b>		<b>60</b>					



### B.3 Structure of the research program

No.	Course Title	Study hours					Semester
		Credits	Lecture Hours	Lab Hours	Assignment Hours	Essay Hours	
<b>A</b>	<b>General knowledge</b>	<b>6</b>					
<i>A.1</i>	<i>Compulsory general knowledge</i>	<b>3</b>					
1	Philosophy	3	30	0	0	45	2
<i>A.2</i>	<i>Elective general knowledge</i>	<b>3</b>					
2	Methodology of Scientific Research	3	30	0	0	45	2
3	Innovation and Entrepreneurship	3	30	0	0	45	2
4	Management and Leadership	3	30	0	0	45	2
5	Business Ethics and Corporate Social Responsibility	3	30	0	0	45	2
6	Service Management	3	30	0	0	45	2
7	Project Management	3	30	0	0	45	2
8	Analyzing, Writing, Publishing Scientific Papers	3	30	0	0	45	2
9	Multivariate Analysis	3	30	0	0	45	2
10	Applied Data Science	3	30	0	0	45	2
<b>B</b>	<b>Foundation Knowledge</b>	<b>12</b>					1
1	Mathematical Foundation for Computer Science	3	30	0	12	27	1
2	Advanced System Architectures	3	30	0	6	36	1
3	Data Engineering	3	30	0	9	31.5	1
4	Advanced Algorithms	3	30	0	0	45	1
<b>C</b>	<b>Specialized Knowledge</b>	<b>15</b>					
	<i>Select 15 credits from the Compulsory and Elective Subjects listed in the relevant Coursework Program</i>						2, 3, 4
<b>D</b>	<b>Graduation Knowledge</b>	<b>27</b>					
1	Advanced Methodology of Scientific Research	3	30	0	0	0	1
2	Alternative Scientific Research	9	0	0	0	405	2,3

**0 Appendix: Programme Learning Outcomes and Curricula**

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3	Thesis	15	0	0	0	675	3,4
	<b>Total</b>	<b>60</b>					

