ASIIN Seal

Accreditation Report

Bachelor's Degree Program
Mathematics
Statistics
Computer Science

PhD Program
Computer Science

Provided by
Universitas Gadjah Mada

Version: 22.09.2023

Table of Content

A About the Accreditation Process

Name of the degree program (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Matematika	Mathematics	ASIIN	ASIIN 23.03.2018-30.09.2023	12
Statistika	Statistics	ASIIN	ASIIN 23.03.2018-30.09.2023	12
Ilmu Komputer	Computer Science	ASIIN	ASIIN 23.03.2018-30.09.2023	04
Doktor Ilmu Komputer	Computer Science	ASIIN		04
Date of the contract: 27.06.2022 **Submission of the final version of the self-assessment report:** 07.11.2022 **Date of the onsite visit:** 16.05.2023 **at:** Campus Universitas Gadjah Mada, Yogyakarta, Indonesia				
Expert panel: Prof. Dr. Günter Gramlich, Ulm University of Applied Sciences Prof. Dr. Kalus, Berliner Hochschule für Technik Prof. Dr. Joko Lianto Buliali, Institut Teknologi Sepuluh Nopember Prof. Dr. Heribert Vollmer, University of Hannover Dr. Martin Witte, Siemens AG				

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[1] ASIIN Seal for degree programs.

[2] TC: Technical Committee for the following subject areas: TC 04 - Informatics/Computer Science; TC 12 - Mathematics.

Muhammad Alif Darmamulia, student at the Bandung Institute of Technology	
Representative of the ASIIN headquarter: Dr. Andrea Kern	
Responsible decision-making committee: Accreditation Commission for Degree Programs	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 10, 2015 Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of March 29, 2018 Subject-Specific Criteria of Technical Committee 12 – Mathematics as of December 9, 2016 ASIIN Additional Criteria for Structured Doctoral Programs as of March 15, 2021	

B Characteristics of the Degree Programs

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Mathematics	S.Si (Sarjana Sains) / Bachelor's degree in Science	Analysis Algebra Applied Mathematics Mathematical Computation	6	Full time	-	8 Semester	144 SKS / 216 ECTS	Annually in August / 1955
Statistics	S.Si (Sarjana Sains) / Bachelor's degree in Science.	Data Science Biostatistics Computational Statistics Statistical Machine Learning	6	Full time	-	8 Semester	144 SKS / 216 ECTS	Annually in August / 1987
Computer Science	S.Si (Sarjana Komputer) / Bachelor's degree in Computer Science	Computer Science Artificial Intelligence Software Engineering Data Science Cloud Engineering Digital Entrepreneurship	6	Full time	-	8 Semester	144 SKS / 216 ECTS	Annually in August / 1987
Computer Science	Dr. (Doktor) / Doctor Degree in Computer Science	Computer Science Artificial Intelligence Software Engineering Data Science	8	Full time	-	6 Semester	46 SKS / 172 ECTS	Biannually (August and February) / 2002

The Gadjah Mada University (Universitas Gadjah Mada or UGM) is one of the oldest universities of Indonesia. It was established as a national university in 1949 in Yogyakarta on the island Java with six faculties serving as an important institution to bring higher education forward in Indonesia. The university derives its name from a 14th century leader of the Majapahit Empire in Java, who is an important figure in the history of the Indonesian Nationalist movement.

Now, UGM has 18 faculties, one postgraduate school and one vocational school. It offers 278 study programs as well as 125 joint degrees including 43 doctoral degrees. The university has a total of 61,440 students in February 2023 of which 59% study to earn a bachelor's degree. In the new study year 2022/2023, UGM has admitted 17,276 new students and provided 13,031 degrees to fresh graduates. This, UGM is considered one of the largest higher education institutions in Indonesia and generally ranks as one of the top national

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[3] EQF = The European Qualifications Framework for lifelong learning

universities today. The academic activities of UGM are expressed in the form of Tri Dharma higher educational values, which requires all members to take part in education and teaching, research, and community service.

All four study programs under review are offered by the Faculty of Mathematics and Natural Sciences (FMNS). The faculty has four departments, Mathematics, Physics, Chemistry and Computer Science and Electronics, and offers 15 study programs consisting of seven undergraduate programs, four master programs and four doctoral programs. The three bachelor programs under review were previously accredited by ASIIN, whereas the doctoral program "Computer Science" is under review by ASIIN for the first time.

For the bachelor's degree program "**Mathematics**", UGM presents the following profile on their webpage:

"This study program produces bachelors of Mathematics who excel in mathematical theory and are able to apply them to problems related to differential equations and optimization. In addition, our graduates have been educated to be adaptive, are able to continue their studies in mathematics and other related fields, to keep up with the development of science and technology, literate in IT, skilled in mathematical computing, and have a sense of responsibility, confidence, emotional maturity, ethics and personality as lifelong learners.

Our graduates have strong logical thinking skills and adaptive abilities. Their mathematical skills are complemented by mathematical modeling abilities and basic Information Technology.

Our students learn the ethics and citizenship, the foundation of knowledge for the development of mathematics, basic applications in other fields, and solutions to real problems. They also learn skills in the field of information technology.

The strengthening of logic begins in the first semester and develops gradually in the following semesters. Our students consistently improve their mathematical abilities that enable them to find mathematical solutions (algebra, analysis, applied mathematics, computational mathematics, statistics, and actuarial mathematics) and their applications (modeling, differential equations, bio mathematics, optimization, financial, and actuarial mathematics), accompanied by an increase in understanding of Information Technology (Programming, Numerical, and Computing). The teaching-learning activities in our study program are supported by a reference room, a basic computer laboratory, and several research laboratories equipped with their supporting hardware and software. The increase in our students' soft skills is supported by the activities of HIMATIKA (Mathematics Student Association) in the faculty."

For the bachelor's degree program "**Statistics**", UGM presents the following profile on their webpage:

"Statistics Study Program (PS Statistics) was established in 1987 and is an educational institution that organizes undergraduate education. PS Statistics has a vision in line with UGM's vision of making PS Statistics nationally superior and known at the international level and creating graduates who are competent and full of service to the interests of the nation.

To accomplish the vision above, PS Statistics has a mission which is essentially to carry out the tri dharma of higher education with a professional management system, credible, transparent, accountable and responsible governance, and to make efforts for the sustainability of PS Statistics through cooperation in the fields of education, statistical science, applied research, community service and partnerships at the local, national and international levels.

Graduates of this study program master the statistical science and applied statistics, data analysis and processing, experimental design, database, computing, statistics and stochastic, and statistical quality control."

For the bachelor degree program "**Computer Science**", UGM presents the following profile on their webpage:

"The Undergraduate Program in Computer Science (UP-CS) was established in 1987. The UP-CS commits to provide students with education of the highest possible quality. The program offers overseas as well as Indonesian students the opportunity to study and obtain their bachelor's degree in Computer Science with international standard and excellent curriculum.

Graduates of this study program have the ability to create and improve system software, conduct and oversee network installation and service equipment activities, design, implement, and monitor databases within an organization, and apply the principles of software engineering in designing, developing, testing and evaluating the software."

For the doctoral degree program "**Computer Science**", UGM presents the following profile on their webpage:

"Doctor in Computer Science Study Program is an academic-oriented education that was established in 2002. The Computer Science Doctoral Program has been known nationally

and internationally, represented by students of multi-ethnicity coming from various islands in Indonesia (from Sabang to Merauke) as well as overseas.

The D-CS programme position itself among other sciences and programs (i.e., Doctor Program of Information Technology):

- The D-CS is a program that focuses on pure, fundamental, and applied research, applying the principles and latest discoveries in the field of science (i.e., mathematics, physics, and biology) to solve computational problems.
- The D-CS is a program that produces outputs in the form of new models or theories in the field of computer science based on intelligent computation.
- The D-CS not only explores basic and applied sciences, but also engineering studies, especially software.
- The D-CS at UGM emphasizes more theoretical studies in-depth in the field of computer than the use of information technology as the doctoral program in Electrical Engineering and Information Technology do.
- The D-CS at UGM has a high level of original regional distribution of students in, and the origin of S1/S2 is the largest compared to same/similar programs in all universities in Indonesia.
- The D-CS at UGM differs from others doctoral programs in Computer Science at big universities in Indonesia (i.e., UI, ITB, ITS, and private university Gunadarma) since the programme specializes in intelligent computing."

C Expert Report for the ASIIN Seal

1. The Degree Program: Concept, content & implementation

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

Evidence:

- Self-assessment report

- UGM Webpage https://ugm.ac.id/en/

- Webpage of the Ba „Mathematics" https://s1math.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Statistics" https://s1stat.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/un-dergraduate-computer-science/

- Webpage of the PhD "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/computer-science-doctoral-program/

- Diploma and diploma supplement

- Discussion during the audit

Preliminary assessment and analysis of the experts:

In their self-assessment report (SAR), UGM describes the vision and mission of all study programs under review. Based on these, the university has defined Program Educational Objectives (PEOs) and Program Learning Outcomes (PLOs). These consider the vision of UGM and all legal frameworks and endorsement. The PLOs are considering internal and external recommendations; the development involved faculty partnerships, professional associations, alumni and national and international principal and representative people. This includes the Indonesian Mathematical Society, the Forum of Indonesian Higher Education in Statistics, and the Association of Higher Education in Informatics and Computer Sciences in Indonesia. Inside UGM, each department has a Curriculum Committee Unit, who coordinate with the study program task force and the Quality Assurance Committee Unit at faculty level to improve the study programs. The final decision on the PEOs and PLOs of each study program is conducted by the faculty's senate plenary meeting. UGM compared

the defined PLOs of each program with the subject-specific criteria of the Technical Committees of ASIIN to match the outcomes. Since the last accreditation of the bachelor programs in 2016, updates of the PEOs and PLOs were minor, although the curricula were adapted to the new developments as well as the Independent Learning-Independent Campus or Merdeka Belajar-Kampus Merdeka program (MBKM).

For the bachelor program "Mathematics", the following vision and mission is described on their webpage:

"The vision of the Bc of Math

In 2037, the Bc Math to be an international standard mathematics study program and nationally excel in the field of theory and is advanced and strong in terms of applications.

The missions of the Bc Math

1. develop learning activities through new innovations to improve mathematics learning quality, efficiency, and relevance;
2. develop a research culture in expertise groups to support mathematical research and its applications;
3. develop the role and applications of mathematics in various fields to establish a mutually beneficial collaboration between the Bc Math and mathematics users;
4. make Bc Math a study program with a credible, transparent, accountable, responsible, and fair management system."

UGM has developed the following PEOs and PLOs for the bachelor program "Mathematics":

PEO 1	have profound knowledge of mathematical theory and are able to apply it to some problems related to differential equations and optimization
PEO 2	are adaptive and able to pursue a higher degree in mathematics or in other fields related to mathematics;
PEO 3	have the ability to keep up with the development of sciences and technology, are literate in information technology and excellent in computational mathematics;
PEO 4	have a responsibility, confidence, emotional maturity, ethics, and lifelong learner principle.

PLO 1	devote to the God Almighty, Pancasila minded, and are aware of the concerns of the nation;
PLO 2	are able to identify and solve mathematics-related problems;
PLO 3	are able to develop their mathematical and logical thinking and are able to make conjectures;
PLO 4	have sufficient knowledge in information technology and are skilled in using it to support mathematics learning and research;
PLO 5	have comprehensive knowledge in mathematical modeling and are able to formulate mathematical models of various problems, both in mathematics and in other fields such as science or daily life problems, and are able to determine its solving strategies;
PLO 6	are able to identify archetypes and forms of analogy and are able to perform generalizations and abstractions;
PLO 7	are able to communicate the mathematical language both orally and in writing appropriately, clearly, and in an organized manner;
PLO 8	have the responsibility, confidence, emotional maturity, ethics, and awareness of being a lifelong learner;
PO 9	are able to apply mathematical knowledge in a career related to the field of mathematics or to continue studies in post-graduate programs.

Graduates from the bachelor program in "Mathematics" have diverse opportunities to pursue their career. Alumni from this program mainly work in the field of education (teachers and lecturers), research, government institutions (e.g. ministries), banking, actuarial mathematics, information technology and private companies.

The vision and mission of the study program "Statistics" is described on the study program's webpage.

"Vision

In 2037 will be a reputable programme nationally and internationally, and produce graduates who are competent in statistical thinking, mathematical thinking, computational thinking in statistical field and data science, and have entrepreneurial spirit.

Missions

To fulfill the vision, the Bc Stat has the following four missions:

1. develop up-to-date learning process in order to improve the quality of statistical learning and data science which is relevant with real life problems;
2. develop research culture to support the application of Statistics and data science;
3. develop mutually beneficial collaboration in learning and research, between the Bc Stat and its partners;
4. develop community service programmes in education, research, training, and consultation in Statistics and its application."

For the bachelor program "Statistics", UGM has presented these PEOs and PLOs in their SAR:

PEO 1	Master the theoretical concepts, statistical methods, and data science, then formulate them for problem-solving;
PEO 2	Develop statistical and data science knowledge for the application and development of science and technology;
PEO 3	Apply statistics and data science in education, research, and community service in order to have beneficial impact on institution, community, and nation;
PEO 4	Make the right decision based on statistical and data science analysis';
PEO 5	Communicate scientifically, involve in collaboration, and be responsible.

PLO 1	Have a strong foundation of statistics and mathematics;
PLO 2	Have the ability of statistical thinking, mathematical thinking, computational thinking and able to develop it;
PLO 3	Have the ability to use technology and statistical software
PLO 4	Have experience in solving real cases in the field of statistics and data science;
PLO 5	Have the ability to communicate statistics and data science in writing and oral;
PLO 6	Have the ability to further study, and or lifelong learning
PLO 7	Have good professional ethics and soft skills

The bachelor program "Statistics" gives its graduates multiple job possibilities. Graduates of this program often work in government institutions, such as the Central Statistics Agency, Ministry of Education & Culture, Ministry of National Development Planning, and Bappeda (the regional development planning agency). Others pursue careers in statistical consulting firms, insurance companies, banks, and capital markets.

The bachelor program "Computer Science" is associated with the Department of Computer Science and Electronics. UGM considers the following vision and mission for this program according to the study program's webpage:

"Vision

The vision of the Undergraduate Program in Computer Science, Department of Computer Science and Electronics, Universitas Gadjah Mada is: "To become a Computer Science Study Program with a reputation for developing algorithms and intelligent computing for the betterment of society."

Mission

The mission of the Computer Science Study Program at Gadjah Mada University is to provide an environment that can develop computer science graduates who have a strong foundation of knowledge, are professional, think critically, scientifically, are always curious and open, adaptive and solution-oriented, and have social sensitivity."

The study program focusses on the following competences for their graduates based on the PEOs and PLOs:

PEO 1	International standard education that contains innovative, soft skills, and knowledge of the latest technology to produce graduates who are competitive, innovative, responsible and have high confidence.
PEO 2	Environmentally sound research that becomes a national and international reference and can provide solutions to the nation's problems based on the wealth of human and natural resources as well as local wisdom by involving stakeholders.
PEO 3	Community service based on science, appropriate technology, and advocacy that is able to encourage self-reliance and community welfare in a sustainable manner and make campus a vehicle for developing science and technology innovation for the community.

PEO 4	The development of human resources, organizations and governance that are professional, fair, transparent, and able to work together to support the implementation of a learning process that is adaptive to Industry 4.0.

PLO 1	Attitudes and Values Student possess a set of universal and fundamental values and principles: universal ethics, patriotism and world peace, social and environmental sensitivity, pluralism and fair play, and rule of law.
PLO 2	Foundational and theoretical knowledge Student master the foundational knowledge and theoretical concepts of the field of computer science, which include mathematics, logic, algorithms, computing, languages, data structures, programming, computer systems and networks, data processing, software, intelligent systems, and numerical analysis.
PLO 3	Applied knowledge Student master the applied concepts of computer science, which include modelling and optimization methods, efficient cloud infrastructure provision and management, data extraction and analysis, software deployment for algorithm development and intelligent computing systems.
PLO 4	Problem solving skills Student are able to apply the basic, theoretical, and applied knowledge that has been acquired, as well as adapt state-of-the-art developments through independent and group research to find constructive solutions to problems encountered in the form of systems or products.
PLO 5	Professional attitudes Graduates have good interpersonal, communication and learner skills. Specifically, graduates are able to work together in teams and have a sense of responsibility for their own work and can be assigned tasks to support the achievement of team work results; able to communicate with stakeholders from various backgrounds, use English, and write scientific papers according to the right rules; have the skills to keep up with state-of-the-art developments in the field of computer science in particular and to deepen previously acquired knowledge in the context of lifelong learning.

Graduates of the bachelor program "Computer Science" have great career prospects. Based on tracer studies, UGM states that graduates mainly work in governmental agencies, state-owned enterprises, banks, research institutes, in various industries and technology companies and as entrepreneurs in the computer field. Their occupations are software engineering, database administration, network analysis, web development, mobile application programming, IT project management, IT consulting or other fields of computer or data sciences.

The university defines the vision and mission of the doctoral program "Computer Science" on their webpage:

"Vision

To be a leading doctoral programme nationally in computer science especially intelligent computation, also a competitive doctoral programme in computer science internationally.

Mission

Providing the educational of doctoral programme in computer science at the forefront with international standard graduates for Indonesian citizens from all levels of citizens throughout the country, as well as for international communities, whose potential to lead.

Developing teaching staff and students as well as graduates of the D-CS Programme, DCSE, FMNS, UGM to be able to carry out basic and applied research in their fields in an integrated and international standard that supports the development of computer science and technology for the welfare of the nation and mankind.

Striving for teaching staff and students as well as graduates of the D-CS programme, DCSE, FMNS, UGM to be well known and appreciated by all levels of society through a series of research activities, and implementations of Computer Science to support the welfare and comfort of the community in material and spiritual aspects."

For the doctoral program in "Computer Science", UGM defines competences as the minimum qualification of the graduates.

UGM states the following PEOs and PLOs on their webpage:

PEO 1	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication,

	and able as well as reliable to adapt, both as development agents, managers of information system and technology, as well as in the development of computer science, as well as possessing high academic abilities.
PEO 2	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication, and can carry out and develop research that produces new theories, concepts, and methods in the field of computer science.
PEO 3	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication, and can serve as a teaching staff in related master and doctoral programmes.

PLO 1	A graduate should be devoted to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working around expertise independently.
PLO 2	A graduate should be up to date with the state-of-the-art especially in computer science field, able to take parts in the development of computer science field that is engaged in and relate it to other fields throughout life; work together within the organization, both as a leader and a member; communicate effectively and efficiently with stakeholders from various backgrounds; use English well.
PLO 3	A graduate should be able to formulate research problems through critical, exploratory, and innovative studies both independently and in groups of computer science field; analyse science and technology problems in the computer science field, develop alternative solutions through intra disciplinary, interdisciplinary, and trans disciplinary approaches to produce innovative, original, and tested works that is engaged in, and present research results in a scientific paper at regional or international level.
PLO 4	A graduate should be able to develop knowledge in the field of computer science that is engaged, which includes abstraction, complexity, evolution and philosophy of changes or developments in the field of science; develop theoretical, philosophical, and applied concepts in the field of computer science that is engaged in, and to represent them in a structured and systematic manner.

The career prospects of graduations with a PhD in Computer Science are in the field of education in computer science (lecturer/educator), as computer science researchers, intelligent system designer and consultants, as data scientists or as mangers of system and information technology.

In the discussions with the representatives of the rector's office, the experts ask about UGM's strategy to introduce the PhD program. They state that the rector supports these developments as they are closely monitoring the developments and demands of the markets. In their university strategy, internalization is one key aspect since they want to become the first university in Indonesia with comparable standards to top universities abroad. The postgraduate programs are a component with increasing importance for UGM. The number of students in postgraduate programs was constantly increasing during the last years; UGM's aim is that at least 45% of all students at UGM should be involved in postgraduate programs. To achieve a stronger internationalization, UGM is also further expanding their international collaborations in Asia and further abroad.

The program coordinators mention that the main improvements during the last years are based on a better management of the study programs. These include the improved collaboration with the industry, an increase in student mobility and a more efficient quality management system. The partners from the industry confirm their increased collaboration during the past year. They confirm to the experts that they are involved in improving the study programs by reviewing the curriculum and making suggestions on the demands from the industry on a regular basis. In the last years, their input focused on the improvement of the practical skills of students as in their opinion the students had already reached great level of technical knowledge. The partners from the industry consider that their suggestions were well integrated. The experts ask them for their opinion since the development in the technology sector is often faster than the updates of the curriculum. The partners from the industry support this statement; therefore, they use multiple opportunities to discuss the curriculum with the program coordinators. They have at least one annual official meet-up in person or online.

They are further satisfied with the competences and skills of the students during the internship as well as of the graduates they employed. In the opinion of the partners of the industry, the MBKM programs has given them a platform to strengthen the collaboration with the UGM, which they consider as very fortunate.

In conclusion, the experts confirm that the objectives and program learning outcomes (the intended competence profile) of the study programs as a whole are described briefly and concisely. They are transparently anchored and published on the webpage of the university

and thus are available to students, lecturers and interested third parties. In the opinion of the experts, the objectives and learning outcomes reflect the targeted academic qualification level, are feasible and equivalent to the relevant exemplary learning outcomes specified in the subject specific criteria of the technical committee 04 (Computer Science) and 12 (Mathematics). The intended competence profile represents the level of qualification of the bachelor programs "Mathematics", "Statistics" and "Computer Science" in the European Qualifications Framework 6; in addition, the doctoral program "Computer Science" matches the European Qualifications Framework 8. The qualifications are clearly represented in the diploma supplement to give information on the qualification profile to third parties. In opinion of the experts, the objectives and learning outcomes are relevant in the modern labor market and the society. They confirm that the study programs are regularly reviewed in a process that involves the relevant external and internal stakeholders and, if necessary, the objectives are revised accordingly.

Criterion 1.2 Name of the degree program

Evidence:
- Self-assessment report

- Diploma and diploma supplement

- Webpage of the Ba „Mathematics" https://s1math.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Statistics" https://s1stat.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/undergraduate-computer-science/

- Webpage of the PhD "Computer Science"
  https://dcse.fmipa.ugm.ac.id/site/en/computer-science-doctoral-program/

- Discussion during the audit

Preliminary assessment and analysis of the experts:
The bachelor programs "Mathematics" and "Statistics" award a bachelor's degree in science or Sarjana Sains (S.Si.). After graduating from the bachelor program "Computer Science", graduates receive a bachelor's degree in Computer Science. Likewise, graduates from the doctoral study program "Computer Science", graduates receive a doctor degree in computer science.

The auditors confirm that the English translation and the original Indonesian names of all study programs under review correspond with the objectives and learning outcomes as well as the main course language. The designation (both in the original language and in English) is used consistently in all relevant documents.

Criterion 1.3 Curriculum

Evidence:

- Self-assessment report

- Curricular overview of each study program

- Module handbooks for all study programs

- Webpage of the Ba „Mathematics" https://s1math.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Statistics" https://s1stat.fmipa.ugm.ac.id/en/

- Webpage of the Ba "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/undergraduate-computer-science/

- Webpage of the PhD "Computer Science"
  https://dcse.fmipa.ugm.ac.id/site/en/computer-science-doctoral-program/

- Objective-Module matrix

- Discussion during the audit

Preliminary assessment and analysis of the experts:

Structure of the programs & periodic reviews

The curricula of the bachelor programs were developed in 2021; the curriculum of the doctoral program was approved in 2022. The current curricula are the result of constant development and improvement with revision, changes, and reconstructions. After mapping the learning outcomes and the learning experiences in a study program, UGM starts to design the suitable courses, aligns those with in a curriculum structure and summarize those in a course handbook and course plan.

The curricula of the three bachelor study programs under review require the students to complete 144 credits (Indonesian credit points). The standard study time for the bachelor programs is eight semesters. The students can optionally participate in the MBKM program, which allows them to take 20 credits outside their university at other education institutions or at companies. The MBKM program can only be entered from the sixth semester after learning sufficient basics in the field of their students. To implement the MBKM program, the curricula from 2021 have a reduced number of compulsory courses in comparison to the previous accreditation in 2018. This gives the students new possibilities since only elective courses can be replaced with MBKM activities. The MBKM program allows the students to take part in (1) learning in other study programs at UGM, (2) learning is comparable

study programs at other national and international universities and (3) learning in non-university institutions (e.g. internships in companies). According to the SAR, the number of students participating in the MBKM program is constantly increasing with 80 participating students in the bachelor "Computer Science" in the most recent years.

Program	Module	S1	S2	S3	S4	S5	S6	S7	S8	total
Ba Mathematics	Compulsory	21	18	19	16	14	3	9		100
	Elective/MBKM	0	5	5	8	8	18	0		44
	total	21	23	24	24	22	21	9		144

Program	Module	S1	S2	S3	S4	S5	S6	S7	S8	total
Ba Statistics	Compulsory	22	24	21	13	10	3	3	6	102
	Elective/MBKM			3	9	12	18			42
	total	22	24	24	22	22	21	3	6	144

Program	Module	S1	S2	S3	S4	S5	S6	S7	S8	total
Ba Computer Science	Compulsory	21	20	19	18	9	3	2	6	98
	Elective/MBKM		3	3	6	15	19			46
	total	21	23	22	24	24	22	2	6	144

The curriculum of the bachelor programs consists of compulsory subjects of study programs offered by the respective departments (subject-specific courses), compulsory courses offered by the faculty (basics in natural sciences) and compulsory courses by the university (foundation courses). The structure of each curriculum starts with basics for all students before they learn advanced knowledge in their field of interest. The courses from one semester to the next consider the chain of subjects as the most suitable sequence. This shall avoid unnecessary overlaps between courses and present a best development for the competences of the students. The total amount of compulsory courses can reach up to 80% in one study program (100 out of 144 Indonesian credits). In the bachelor program "Mathematics", the compulsory courses reach 69.44%, in "Statistics" 69.44% and in the bachelor program "Computer Science"; they reach 68.06% of all modules. The remaining part are

elective modules. The compulsory courses shall provide the students insight and knowledge and allow the students to develop their skills. Elective courses represent advanced studies, which allow the students to deepen their competences and learn additional skills.

The curricula of all study programs consist of modules, where one module is equal to one course. UGM presents a correlation of the indented learning outcomes of each module in the study programs showing their contribution to the PLOs.

Intensive review of the curricula takes place every five years at the study programs under review. This review takes up to one year and evaluates the relevance of the curriculum to the new developments in the study field. A team conduct surveys, holds discussions and consultations and reviews comparative studies; they involve various stakeholders, alumni, and study program partners. UGM considers the PLOs of the study programs under review as relevant and therefore also the curriculum; the curricula updates from 2021 created a stronger focus on soft skills and certain hard skills as well as the MBKM program.

The curriculum of the doctoral study program "Computer Science" is based on a collaboration between internal and external factors. Internal factors consider the input of the students and staff, their research interests and expertise. Currently, the focus of the doctoral studies is closely associated with the five research laboratories at the Department of Computer Science and Electronics, the Laboratories of Intelligent Systems, Algorithms and Computation, Software and Data Engineering, Computer Systems and Networks, and Electronics and Instrumentation. External factors influencing the curriculum consider the feedback from alumni, the recent developments of science and technology as well as the current trends and demands in the industry and stakeholders. The review of the curriculum of the PhD program "Computer Science" takes place every five years and includes various discussion rounds, meetings, workshops, interviews, and surveys.

The curriculum of the doctoral program "Computer Science" is divided into six semesters; it can be extended to a maximum of ten semesters. It contains compulsory modules to ensure that the minimum qualifications are obtains by each student. In general, the curriculum is divided into compulsory modules, elective modules, and research work. The compulsory part contains two courses, "Research Methodology" and "Research Trends in Computer Sciences." The elective components can be selected by the students and their supervisor based on the skills, knowledge, and shortcomings of the student. The research work focuses on the development of scientific writing skills with a research proposal, followed by data collection, experiments and the evaluation of data. Furthermore, students learn how to write research publications as well as their thesis. The study programs require a total of 46 to 50 credits, of which 34 are associated with the research work of the students,

six credits belong to the compulsory courses and a minimum of six credits to the elective coursework. Within their doctoral studies, students are encouraged to participate in a so-called "sandwich-program" to go abroad for three to four months to work together with experts from other research institutes. This program allows the students to improve the quality of their research and allows them to improve their communication and collaboration skills.

The program coordinators state to the experts that the curriculum review takes places every five years. This review considers the input from students, alumni, and employers.

The experts confirm that each module represents a well-matched unit of teaching and learning, in which the students gain knowledge, skills and competences. In their opinion, the order of the modules ensures that the learning outcomes can be achieved and that the program can be completed within the standard period of study. In addition, the curriculum of each study program is periodically reviewed regarding the implementation of the program objectives; curricular changes are documented. This review also includes whether the order of modules enables students to graduate within the standard period of study.

Content

The representatives of the rector's office explain to the experts that a major change in the curriculum during the accreditation period was the implementation of the MBKM campus. Especially in the bachelor program "Computer Science", students frequently use this program to participate in internships, which is considered positive by all parties. The MBKM program requires that the curriculum has at least 30% of modules as elective, which shall give the students the opportunity to replace them with off-campus activities. The representatives of the rector's office specify that students can only participate in off-campus activities once they have completed a certain number of classes and finished their community service. The program coordinators acknowledge that there were severe changes in the curriculum to reduce the number of compulsory lecturers to integrate the MBKM requirements. This includes a shift in the number of credits in some courses while others were merged.

Other changes in the curriculum involve the change from the competence-based curriculum to an outcome-based curriculum since 2021. These included a revision of the module description and changed the focus in individual courses.

The experts discuss with the program coordinators if they consider the amount of basic science courses at the beginning of their studies as necessary. The program coordinators

confirm that they consider these courses as important since their work involves many interdisciplinary aspects. For understanding many applications, a basic knowledge of physics and chemistry is necessary. This is also supported by rector of UGM.

In the last accreditation, one recommendation concerned the English proficiency of the students. The program coordinators explain various initiatives to the expert panel to improve the level of English of the students. These include that the English course was increased from two to three credits. Within students' organizations, the students also offer activities in English to improve the oral competences among themselves. In addition, students are further encouraged to participate in courses outside the curriculum if they want to continue their improvement professionally. Languages courses at UGM are also offered in Chinese and German as well as several other languages if students are interested. In the bachelor program "Computer Science" several elective courses are already offered in English. They are still hesitant to offer mandatory classes in English as some students still have problems to fully learn in English. Besides, since 2012 UGM offers an international program fully organized in English in "Computer Science" which is available for students with excellent English skills and foreigners. Within the Department of Mathematics, there is a strong collaboration with universities in Malaysia including student exchange programs. During this incoming and outgoing exchange, courses are fully organized in English at UGM and their partner universities. The students support the need for more English during their studies including a full compulsory class in English. According to the students, an English module used to be mandatory, but this was recently changed. Considering the English proficiency of the average student, the students would recommend including the English class again into the curriculum to support those students, who still struggle with English. The experts agree with the students on this subject as the English competences are essential in the world today, especially in science and technology.

The experts discuss with various parties the soft skills of the students in the four programs under review. The partners from the industry support the great importance of soft skills for their day-to-day jobs, requiring especially teamwork, interaction, English proficiency, and determination. The partners from the industry value that the students from these programs under review are generally fast learners and very good in theoretical and logical thinking. They acknowledge that the soft skills of the students have improved during the last years; nevertheless, there is still room for improvement in their opinion. This includes more confidence to communicate in English, to present their ideas and show more initiative, such as asking questions.

The experts continue to discuss several individual modules. In the study program "Mathematics", they inquire why "logic and set" is mandatory while "set theory" is optional. As an explanation, the program coordinators state that previously both courses were obligatory,

but these changes were made to accommodate the higher number of electives required by the MBKM program. They still consider both courses equally important for students in "Mathematics", thus, they try to include the most important aspects in other modules when suitable. They confirm that still more than 50% of all students in the second year take the module "set theory" because they consider logic as essential in mathematics, which the experts consider as positive. The experts continue to ask about the competences of students in "Mathematics" and "Statistics" on programming. The program coordinators agree that programming skills are very important for students in these study programs, as many graduates working in the industry will use programming languages on a daily basis. They add that they use R and Python in several lectures, in which they combine theory and practice. Laboratory classes and internships give the students the opportunities to expand their skills. The program coordinators point out that the most recent changes in the curriculum included the new courses on data science and machine learning since they are aware that more than half of their graduates work in data science. The focus of the involved software lies on free and open source software while also considering recommendations of their alumni and industrial partners. The program coordinators from the program "Computer Science" add that they also consider input from their industrial partners. They also have collaborations, especially in the field of artificial intelligence and through partnerships with companies using supercomputers. The experts raise the topic also with the students; in particular, they want to know with development environment and digital infrastructure they use. Students from "Computer Science" state that they mainly use Eclipse for Java, Visual Studio Code as well as GIT as a source repository. They add that programming for android is also available at UGM and that they have access to a variety of software. Students from the bachelor program "Mathematics" are further asked about their standard programming languages, to which they list C++ as a basic and Python as the main programming language for their algorithms. In the study program "Statistics", the students mainly use R and Python. In the discussion with the experts, they students are very aware of the fast changes in the technology sector, especially in data science. In particular, students from the program "Statistics" express their wish to expand their courses on data mining, market analysis, technologies in artificial intelligence, and machine learning.

The experts continue to discuss the internships in the bachelor programs bachelor programs. Based on the MBKM program, in the bachelor programs "Mathematics" four different internships are offered which differ in duration and structure. The internships A and B are internships of one to two months, which is the most often used type of internships. Internships C and D are longer with a larger workload and more responsibility. While, the MBKM of bachelor program of "Computer Science" has eight types, with duration in one or two semester. These MBKM activities are: (1) Student Exchange; (2) internship or field

practice work activities; (3) school assistance activities; (4) research activities; (5) independent project activities; (6) village projects activities; (7) entrepreneurship activities; (8) humanitarian project activities. Although the university encourages students to take part in internships, not all students want to, as they are still optional. The lecturers provide a list of suitable partner companies in the area of interest of the students. The students receive two supervisors, one from UGM and one from the company. They need to write a report to present their performed tasks in the company and share their experience. Usually, students use a logbook to track their activities during the internship, which they use as a basis for writing their report. In addition to the student report, the UGM supervisor also receives a report from the company supervisor. For participating in the MBKM internships, UGM offers an additional webpage, which easily connects students with companies. This contributed to an increase in students joining internships. In the bachelor program "Mathematics" the number of students joining the MBKM internship still varies between 20 and 50%, whereas the numbers are higher in the programs "Statistics" and "Computer Science." The program coordinators add that they consider the internships as very important since the students do not only learn to practice their skills but also improve their soft skills. The partners from the industry confirm to the experts that they consider the internship as a positive development. They report that the duration of the internships recently prolonged from six weeks (taken in the summer break) to more than two months during regular study time. The experts consider this collaboration with the industry as very positive; they appreciate that the companies are from different regions of Indonesia since this offers different opportunities for the students. The experts ask especially the students from the program "Mathematics" and "Statistics" on their involvement in internships. They report that currently, almost 80% do an internship outside the campus in local companies and start-ups. Most of them take a short internship during the summer vacation. Students from the bachelor program "Computer Science" confirm to the experts that most of them take an internship in the 5th or 6th semester. For many, getting an internship is very easy; therefore, some have already taken multiple internships during the off-semester periods. The students add that they also take part in extracurricular activities and activities outside the campus to deepen their experience. Thus, the students describe a generally very positive opinion on the possibility to take part in internships.

In the discussion on the bachelor thesis, the students explain the experts that they are satisfied with the information they receive on their bachelor thesis. They get sufficient training in different courses, which prepares them for their bachelor thesis. The students all receive a supervisor, who accompanies them in the various steps through their final project. This includes a first seminar to choose the topics, a second seminar, which introduces them to

the suitable methods and ethics of scientific work and the following proposal seminar examination. Still, the students complain that they miss having a seminar on scientific writing. In their opinion, they receive sufficient information in how to analyze data but not on how to structure and write a thesis with good illustrations of their data. They mention that one course is offered, but usually this course is overbooks as they do not have a sufficient number of lecturers matching the high demand. In the doctoral studies, the sequence is similar consisting of various seminars and exams documenting personal and scientific progress.

The students describe the experts that for their final project, they have to first contact their supervisor to find someone who has capacity to take care of an additional student. This requires filling out a google form to support them in finding the most suitable lecturer. The online program in selecting the most suitable supervisor has several obstacles, which are unclear to the students. In some cases, they had to retake the selection, which took extra time. Some students also report, they wanted to write their bachelor thesis in one field of studies, but that this was not possible since these lecturers did not have any capacities left because too many students want to specialize in this area. According to the regulations, the supervisor needs to meet with the student at least five times to discuss the progress and results of their final project, which has to be documented with a form. The students consider the final thesis and the accompanying seminars good and graded fairly. Nevertheless, they are not satisfied with the organization with the supervision as it is sometimes too challenging to find supervisors while on the other hand, supervisors are too busy to give good advice to the students. They are aware that regulations are in place to organize the supervision but based on the students' comments, they see risk that these are not enforce properly. The experts support the opinion of the students and how issues might arise to prolong one's studies based on problems with the final thesis. In addition, there appear to be problems also concerning double supervision, especially across departments. This is supported by the teaching staff, who consider especially the bureaucracy as a threshold to provide joint supervision. Since in these scientific fields of mathematics, statistics and computer science, multi-disciplinary research is very common, the experts also recommend to reduce the threshold to enable students to receive double supervision with a low amount of bureaucracy.

The experts discuss with the students from the doctoral program "Computer Science" their curriculum, especially the number of mandatory courses in the first two semesters. The students confirm that these courses are very different to courses in their bachelor or master studies. Most modules involve reading literature and discussing scientific articles. Therefore, these courses are more like a seminar than a usual lecture. In some of their courses, they also need to do practical work whereas in others the practical work is the

final assessment as a take-home exam. These lectures should prepare them for their studies and ensure that all students have the necessary competences to perform their individual research, especially in working with research publication. However, the doctoral students mention that there are several studies, who have already taken courses on scientific writing and research methodology prior to their studies at UGM. These students have currently no opportunity to skip these courses in the first and second semester to start their research work earlier. In their opinion, it would be beneficial for those students to be able to move towards their research faster than the average student would.

The experts summarize that the curriculum of each study program under review enables students to achieve the intended learning outcomes. The experts confirm that the learning outcomes are defined for each module, which, in total, enable the achievement of the overarching program objectives. Based on the MBKM programs, the curricula offer the students internships, which are well-integrated into the curricula. The experts confirm that the higher education institution assumes responsibility for the quality of the internship in terms of its content and structure. To this end, the university coordinates with the participating companies and supervises the students during the internship. Nevertheless, the experts recommend improvements to the curricula. They advise the university to quickly implement of changes in technology to the curricula to meet the demand of the job market. This include topics such as artificial intelligence and machine learning for the program "Statistics", up-to-date software in the program "Mathematics" and "Computer Science." In addition they recommend that all student of the bachelor programs should have to attend a compulsory course in English to ensure each student has reached a sufficient level in English to be competitive on the job market in the sector of science and technology. Moreover, they recommend that all bachelor students should add one specific course in scientific writing, which should provide them with the knowledge of writing their bachelor thesis based on a thorough literature research and data analysis by considering the modern ethics in science and publishing. In addition, it is recommended to increase the international mobility among the bachelor students of "Mathematics" to match the outgoing activity in the other study programs. The experts further raise concerns about the supervision of the bachelor thesis to which they recommend ensuring a good supervision for all students in order to prevent a prolongation of the study time. The experts suggest to closely control the established number of students per supervisor and ensure that each supervisor has enough time to take care of the bachelor students besides their other responsibilities. In addition, the experts recommend reviewing their methods to allow double supervision, which would be beneficial for students and supervisors. Further, the experts consider it necessary to consider a flexibility to allow well-prepared students in the PhD thesis to advance fast in their studies towards research. In these cases, the students need to proof their

knowledge in the compulsory courses they want to skip and verify to their supervisors that they have reached qualification and skills to perform their scientific work.

Student mobility

The representatives of the rector's office describe to the experts that students mainly use the MBKM program for student exchange. Students can take part at other domestic and international universities or take part in internships at institutes and companies. Since the university follows the strategy to become more international, UGM supports student exchange. For the MBKM student exchange, UGM has established many agreements with their university partners. The university is continuously expanding their networks across Indonesia and abroad and are currently working on improved agreements with universities across Europe. The bachelor program of "Computer Science" had double degrees with the University of Birmingham and University of South Australia. The representatives of the rector's office remark that they have already established various double degrees with universities in Japan and Europe; they consider that the ASIIN seal has facilitated these collaborations abroad.

Besides the MBKM program, the government offers scholarships named IISMA (Indonesian International Student Mobility Award), which allows the students to go abroad. In this scholarship, the government covers all costs for the students exchange to all countries in the world. This program is limited for undergraduate students while graduate and postgraduate students have additional grants to travel internationally. Within UGM, around 100 students will go abroad this year with such a scholarship. In order to increase the number of outgoing students, UGM also has stated to offer courses in French, Korean, Japanese, and Arabic in addition to the already existing courses in English. According to the representatives of the rector's office, these languages are of main interest for the students as they represent the main countries of interest for student exchange. From the bachelor programs "Computer Science", twelve students are participating in an IISMA exchange in 2021, eleven students in 2022, and nine students in 2023. The students confirm to take part in IISMA to spend time outside Indonesia. They list countries like the Netherlands, New Zealand, or Korea as examples for their IISMA exchange. They mention that next to studying abroad, they also participated in events to introduce Indonesian culture abroad. Students from the bachelor program "Statistics" and "Mathematics" further tell the experts about the collaboration of their study program with the UTHM in Malaysia. However, the students from "Mathematics" report to the experts that spending time abroad is not very easy since they have a high number of compulsory modules, which prevents them from going abroad for a longer time. The teaching staff adds that within IISMA, the students can collect 20

credits abroad. Within this program, the students can also take courses outside their specific study program to technologies in artificial intelligence and machine learning to broaden their horizon. Good English is a requirement to take part in IISMA.

The partners from the industry describe to the experts that they also support the education of the students by offering courses and certificates. These include e.g. the Gojek data science university or google certificates. Others offers one-year programs, for example in data science.

The experts conclude that UGM promotes (international) student mobility through an appropriate framework (structural design of the degree program, recognition of qualifications and support services). Nevertheless, they identify differences between the bachelor programs; they recommend promoting student mobility among the students of the bachelor program "Mathematics" to match the activities in the other programs.

Criterion 1.4 Admission requirements

Evidence:
- Self-assessment reports
- Academic guidebook
- Regulations student admission graduate programs
- UGM Webpage https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
According to the Self-Assessment Report, the admission procedures and policies for new students in the bachelor programs follow the governmental regulations of Indonesia. The students need to have completed high school and passed a national and school final examination. The number of newly admitted students depends on the faculty and the study program based on their resources. The final number of students is determined each year in a faculty meeting attended by the dean, chair and secretary of the departments, and the chair and secretary of the study programs.

The admission is organized centrally by the university in cooperation with a national body for the entrance tests at the Ministry of Research, Technology, and Higher Education. There are three different ways by which students can be admitted to a bachelor study program at UGM:

1. National Entrance Selection of State Universities (Seleksi Nasional Masuk Perguruan Tinggi Negeri, SNMPTN), a national admission system, which is based on the academic performance during the high school (25 % of the students at UGM are admitted through this selection system).

2. Joint Entrance Selection of State Universities (Seleksi Bersama Masuk Perguruan Tinggi Negeri, SBMPTN). This national selection test is held every year for university candidates. It is a nationwide written test (subjects: mathematics, Bahasa Indonesia, English, physics, chemistry, biology, economics, history, sociology, and geography). It accounts for 35 % of the admitted students at UGM.

3. University written entrance test (Ujian Masuk; UM), students are selected based on a written test (similar to SBMPTN) and a psychology test specifically held by UGM (40 % of the students at UGM are admitted through this test).

In addition, UGM offers international classes since 2012 for national and international students. The admission to these programs follows different steps for domestic and foreign applicants. The submission of the application documents is through the UGM online system. The documents focus on legal documents and those who prove the suitable qualification to enroll in an international study program. In addition, applicants need to participatre in an interview and a written English and scholastic test. UGM offers one international class for a bachelor in "Computer Science."

During the first year, all students are going to study the same modules; after this first year; after one year, the GPA needs to exceed a certain value or students will drop out. The candidates will already choose with their application, in which study program they want to enroll in. However, after one year, they can newly apply to change their major.

Admission to the doctoral program "Computer Science" requires the students to have completed their master studies in computer science (informatics), information technology, or closely related fields. The admission quota is determined for each program during a faculty meeting based on the availability of various resources provided by the faculty, the department, and the study program. Admission to the PhD program is open every semester through the UGM webpage. Students needs to submit their documents also including two letters of recommendation. Suitable candidates will be invited to an interview, where they have to present their research proposal in front of at least five members of the faculty. A score is calculated based on the application, the interview, and the quality of the research proposal. The applicants need to reach at least 60 points in the application process to be admitted to the study program.

The experts inquire how the usual composition is for these entrance schemes. The representatives of the rector's office explain that they receive students from all over Indonesia. From the first scheme based on good high school achievements, around 30% of students are admitted each year. Around 30% are accepted based on their results from the national examination and around 30% enroll with the test conducted by UGM. In addition, UGM offers special programs for gifted students from rural areas of Indonesia, students from unfortunate families, students with disabilities as well as students to excel in sports or arts. This is part of UGM's program of inclusivity since they are aware that Indonesia does not offer equal opportunities to everyone. Between five to ten percent of accepted students each year are from this program of inclusivity. The representatives of the rector's office add that the current number of accepted students contains 56% female students. Although UGM has already established several international study programs in English, they still plan to expand this section of their offered programs to attract a larger number of international students.

The experts also raise the admission criteria for the PhD program. The representatives of the rector's office describe that the initial documents, qualifications, and research output of the students has to be verified and checked. The majority of applicants come from outside UGM. The students also need to submit a draft for their PhD research topic.

In discussion between the program coordinators and the experts, they also address the topics of admission for the doctoral program "Computer Science." The experts are interested, how the students compile their initial PhD research proposal. This varied according to the program coordinators; some students contact one professor in their field of interest and discuss the proposal whereas others develop their proposal fully independently. They accept more than 20 students each semester but receive twice as many applications on average. The program coordinators add that currently, 126 students have already graduated with a PhD in Computer Science from UGM. Additional 106 students are currently enrolled in this program.

In summary, the experts consider the admission requirements and procedures to be binding and transparent. They ensure that students are in principle able to successfully graduate from the program. The rules for the recognition of qualifications achieved externally (e.g. at other higher education institutions or outside the higher education sector) are clearly defined and clear to the students involved.

Criterion 1.5 Workload and Credits

Evidence:

- Self-assessment report

- Module handbook of each study program

- Curricular overview of each study program

  - Webpage of the Ba „Mathematics" https://s1math.fmipa.ugm.ac.id/en/

  - Webpage of the Ba "Statistics" https://s1stat.fmipa.ugm.ac.id/en/

  - Webpage of the Ba "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/undergraduate-computer-science/

  - Webpage of the PhD "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/computer-science-doctoral-program/

- Discussions during the audit

Preliminary assessment and analysis of the experts:

The study plan of the three bachelor programs under review consider the studies to be finished within four academic years or eight semesters. In the first and second semesters, students have to take at least 20 to 22 credits to form the foundation for all further studies. The definition of one credit or credit union (CU), UGM follows the regulation from the government (Ministerial Regulation No. 3/2020 about the National Standards of Higher Education). There, the definition describes that one CU represents 170 minutes of workload per week, which includes 50 minutes of lecture, 60 minutes of structured assignment and 60 minutes of independent study. One semester consists of 16 weeks; therefore, the workload of one CU equals 45.3 hours. UGM uses this as basis to calculate a conversion to ECTS credit points. Since one CU equals 45.3 hours, the total workload per year on average is 1632 hours. Considering that the total amount of CU for the three bachelor programs under review is 144 CU, this represents a workload of 6,542 hours. In comparison, the total workload of four-semester studies in ECTS credit points is usually between 6,000 and 7,200 hours. A conversion of approximately one CU to ECTS credit points uses a ratio from 1:1.66. As a result, the workload in one semester would equal around 28 ECTS credit points. UGM presents a detailed comparison for the three bachelor programs under review:

Program	General compulsory	study program compulsory	min. electives	total	MBKM
Ba Mathematics	22 (33 ECTS)	78 (117 ECTS)	44 (66 ECTS)	144 (216 ECTS)	Max 40 ECTS
	15.28%	54.17%	30.56%	100%	(Semester 6, 7)
Ba Statistics	22 (33 ECTS)	78 (117 ECTS)	44 (66 ECTS)	144 (216 ECTS)	Max 40 ECTS

	15.28%	54.17%	30.56%	100%	(Semester 6, 7)
Ba Computer Science	22 (33 ECTS)	76 (114 ECTS)	46 (69 ECTS)	144 (216 ECTS)	Max 40 ECTS
	15.28%	54.17%	30.56%	100%	(Semester 5,6, 7)

UGM reviews the workload and the assigned credit points every semester by the quality assurance measures.

The workload in the doctoral program "Computer Science" is set between 46 and 50 credits, which equal 172 ECTS credit points. The students have to collect at least 12 theoretical credits and 34 research credits. The average workload of one semester is seven SCUs.

Based on the types of teaching/learning activities and their respective workloads, there are two different conversions of SCU to ECTS:

1. Classroom based (coursework). One SCU for coursework consists of 50 minutes of lecture, 120 minutes of structured assignments, and 145 minutes of independent study in 16 activity units. This results in a combined workload of 315 minutes x 16 sessions = 5040 minutes (84 hours). Given that one ECTS is equivalent to 25–30 hours, we use a conversion of one ECTS equal to 28 hours. Therefore, 1 SCU of coursework is equivalent to 3 ECTS.

2. Laboratory based (research work). Students in doctoral programs engage in research activities for a longer duration compared to coursework. One SCU for research work comprises 90 minutes of scheduled consultation, 180 minutes of laboratory work (experimentation), and 150 minutes of independent group discussion over 16 sessions. This leads to an overall workload of 420 minutes x 16 sessions = 6720 minutes (112 hours). We utilize the conversion of one ECTS equal to 28 hours. Therefore, 1 SCU of research work is equivalent to 4 ECTS.

Table 3. SCU to ECTS Conversion Rule

No.	Semester	SCU	ECTS
1	I, II (Coursework)	1	3
2	III, IV, V, VI (Research work)	1	4

Table 4. The Study Plan of D-CS Programme together with ECTS equivalent

No.	Semester	Course	SCU	ECTS
1	I	Elective Courses	6 (min)	6 × 3 = 18 (min)
2	II	Compulsory Courses	6	6 × 3 = 18
3	III			
4	IV	Dissertation	34	34 × 4 = 136
5	V			
6	VI			
Total of ECTS of Doctor in Computer Science Programme				18 + 18 + 134 = **172**

The experts discuss the option to adapt the workload each semester based on the GPA (graded point average) of the previous semester. In the SAR, UGM states that students with a GPA equal or higher than 2.75 have taken up to 24 credits; however, during the discussion with the program coordinators, they clarify that this is an error. The GPA needs to be between 3.0 and 4.0 to take between 21 and 24 credit whereas students with a GPA of 2.75 and 2.99 should take between 18 and 21 credits only. The experts ask the students on their overall workload in the four programs under review. The students explain that they prefer to take the highest number of credits possible for them during each semester to ensure an early graduation. Therefore, they usually took between seven and eight modules per semester, which was difficult in their experience, in particular if they wanted to do also extracurricular activities or join the student organizations. The workload can get high in courses with a high amount of practical work, presentations, or assignments. Therefore, the students consider it essential to select a number of courses with distinguished assessment methods to avoid high peaks of workload, which depends on the courses offered in each semester. The students feel as there is an imbalance between courses with assignments between the summer and winter semester, which hinders learning without peaks in workload. In contrast, some students remark that it is also possible to finish the studies in less than the average time; e.g. some students finish the bachelor program in three years because the internships allow them to collect credits as they can work next to studying.

In the doctoral program "Computer Science", the students consider the workload generally as adequate. Nevertheless, they consider it challenging to accommodate the compulsory courses with their demanding research, which often spans across faculties or institutions.

The experts confirm that a credit system is based on the student workload is implemented. The workload includes contact hours and self-study time and compulsory components of the study program are included. The experts acknowledge that UGM awards credits for every module based on the respective workload. The estimated workload is realistic and well-founded, so that the study program can be completed in the standard period of study. The experts saw evidence that the workload is regularly monitored whether the credits

awarded for each module correspond to the actual student workload and whether the distribution of the workload across all semesters enables graduation within the standard period of study. Students are involved in these processes. If adjustments are made, they are well documented. However, the experts saw indication for differences in the workload between the semesters, in particular the bachelor programs "Statistics" and "Computer Science." The peaks in workload involve semesters with a high number of assignments and practical work, which could exceed the estimated workload of certain modules.

Criterion 1.6 Didactic and Teaching Methodology

Evidence:

- Self-assessment report

- Module handbook of each study program

- Discussions during the audit

Preliminary assessment and analysis of the experts:
All degree programs adopt outcome-based education as their main learning method, an approach that emphasizes the continuity of the learning process innovatively and interactively. Lecturers at UGM involved in the study programs under review employ various teaching methods. These include lectures, classroom and laboratory exercises, assignments, project work, and seminars. The courses involve group work to train the soft skills of the students. Students are supposed to attend classes and to work independently on their structured assignments. The laboratory takes place in the same semester to compliment the deeper understanding of the topic of one course.

While in some foundation courses, teacher-centered learning is still dominate, other courses focus on student-centered learning techniques targeting to develop their analytical and critical-thinking skills as well as their soft skills. Student-centered learning includes presentations, demonstrations, role-plays, and other methods, which bring the student in the focus of the lecture. Other class activities include in-class exercises and quizzes.

To ensure that students follow most teaching and learning activities, the faculty of agriculture requires students to meet a minimum of 75% of class attendance for each course they take. Students who fail to comply with the requirement will not be allowed to take the course exam. Furthermore, a failure in completing the required course component will also result in an incomplete grade for the course.

In courses of the bachelor program "Mathematics", which are considered difficult by students, additional tutorials are offered. This includes, for example, modules such as Introduction to Logic, Calculus, Linear Algebra, or Introduction to Analysis.

The use of e-learning elements in the learning process allows for class activity without physical attendance. To facilitate the use of blended learning, UGM has developed a Moodle-based e-learning system (eLOK or e-Learning for Knowledge Sharing) and has subscribed for using the webinar platform Cisco Webex.

The experts discuss with the teaching staff the different support they receive for their lectures and grading. In the bachelor program "Mathematics", they mainly employ tutors and grading assistance. The tutors are only approved for specific courses, which usually are the basic courses such as "Logic and sets", "Algebra" or "Analysis" as these are often difficult for students. Graders are only used in courses with a large number of students; they support the lecturer in giving grades on homework, quizzes, projects and assignments. The lecturers are still responsible for grading the mid-term and final exams.

The students confirm to the experts that various teaching methods are implemented into the study programs under review. They confirm that the classes often include assignments and presentations. These include group assignments with real-life data, which the students consider as very positive. This is comparable to the study program "Statistics." Especially the elective courses have a high number of practical lessons. In the bachelor program "Computer Science", they include assistants and graders. There, assistants help the lecturer concerning laboratory classes whereas the graders support the lecturer with assignments or homework. They confirm that the requirement to employ a grader is 30 students in one module. The teaching staff mention to the experts that these assistants, tutors and graders receive money for their tasks, which makes this beneficial for everyone.

In conclusion, the experts confirm that a variety of teaching methods and didactic means are used to promote achieving the learning outcomes and support student-centered learning and teaching. The study programs contain an adequate balance of contact hours and self-study time. The experts see evidence that the teaching methods are regularly reviewed whether the utilized learning and teaching methods support the achievement of the program objectives.

2. Exams: System, Concept and Organization

Criterion 2 Exams: System, concept and organization

Evidence:

- Self-assessment report

- Module handbook of each study programs

- Examples of exams seen during the on-site visit

- Examples of final thesis seen during the on-site visit

- Discussions during the audit

Preliminary assessment and analysis of the experts:

In the SAR, UGM describes that the examinations are designed to assess to which extent the learning outcome were fulfilled. Exams are applied to evaluate the students' achievement in each module by providing assessment scores. Between the bachelor programs and the doctoral programs, there are differences in the concept and organization of examinations.

In the examination in the three bachelor programs under review, every module applies several assessment methods and types depending on the content, the delivery methods and emphases. The final grade for the course is determined by the means of all assessments. Exam methods applied in these programs under review include individual assignments, group assignments, quizzes, laboratory exams, pre-test, post-test as well as midterm exam and final exams. Specific courses also include a final presentation, which is prepared as a group and given in front of a panel. The applied types of examination in one module are determined at the beginning of the semester by the lecturers or a team of lecturers considering the intended learning outcomes. The information is included in the module handbooks and explained to the students at the beginning of the course. The mid-term and final examinations are scheduled by the FMNS and are conducted in written form. Midterm examinations usually take place in the eighths or ninths week of the semester. A period of two weeks is determined to avoid overlap of examination days between courses. Students have one week off to prepare for their final exam; all final examinations take place in a two-week period. Before each mid-term and final examinations, a team reviews the exam questions to ensure they are suitable for the content and learning outcomes of the module. Graders are additionally employed to support the lecturers in large classes.

Grading for the MBKM program are following governmental guidelines. The MBKM activities include internships, student exchange, short courses, or also double degrees (Ba "Computer Science"). In student exchange, short courses or double degrees, the grades from other institutions are accepted and included in the students' transcript of records. Internships are graded based on a report the students have to submit afterwards. This report

explains the activities conducted during the internship as well as their achieved competences. In some cases, students have to additionally present their tasks and achievements of their internship or/and receive grade from their supervisors in the cost company/institutions.

The final grade is expressed as a letter based on a numerical value:

Grade	A	A-	A/B	B+	B	B-	B/C	C+	C	C-	C/D	D+	D	E
Numerical value	4.00	3.75	3.5	3.25	3.00	2.75	2.50	2.25	2.00	1.75	1.50	1.25	1.00	0.00

For transparency, lecturers are encouraged to return students' work. Students, who fail in certain exams may retake the course in the next semester or the next year. Students, who cannot attend the exam due to illness or other severe reasons, can postpone the examination to another day by presenting valid relate documents. Students with disabilities receive necessary assistance based on a case-to-case evaluation.

At the end of their bachelor studies, students have to write a mandatory final thesis. The students work independently on their final project under the supervision of their advisor(s). The final project shall allow the students to show their capabilities to perform an individual assignment at the level of a bachelor's degree. The final project will assess the student's initiative and their skills to plan, report and present their research. The research component of the final projects might include literature studies and/or research/laboratory experiments. The defense of the bachelor's thesis is organized after the final thesis was submitted. The defense will take place in front of a board of examiners and will impact the final grade of the thesis next to the written work of the thesis and the students' handling of data and capabilities to analyze their work. While in the bachelor programs "Mathematics" and "Statistics", four to five examiners are required as well as a grade of C+ to pass, within the bachelor program "Computer Science" three to four examiners are necessary and a grade of C to pass the examination.

Examinations in the doctor program "Computer Science" are integrated in order to assess the achievement of the students regarding the determined learning outcomes. The learning consists of theoretical and research activities, which apply different assessment methods.

Students participate in theoretical courses during the first and second semester. Usually, students visit four to five courses; each course includes special types of examinations,

which are described in the module handbook. In most courses, the assessment is based on an individual assignment, such as reviewing research articles or textbooks or implementing an algorithm and testing them on a certain set of data. Results are usually summarized in a written report. In the cases of theoretical courses, some also use mid-term and final examinations. The minimum grade for passing a theoretical course is B; students who fail or want to improve their grade can retake this course.

Assessment of the students' research work is based on (1) monitoring and evaluation, (2) comprehensive examinations, (3) dissertation manuscript evaluations and (4) closed examination / dissertation defense. The student's supervisor monitors the research activities; every four months, an evaluation of the research progress takes place based on a team of reviewers, who consider the past months and outlines the research activities for the next period. This includes discussion on the publication strategy. A comprehensive examination takes place to review the student's research proposal based on the initial proposal and the preliminary research results. The committee consists of a promoter team and three to four examiners. This comprehensive evaluation takes place once the student has completed their theoretical courses in the first and second semester. This marks the point in their studies, from which the students exclusively focus on their research (usually in the third semester). The next step in the process involves the dissertation manuscript evaluation. This takes place after the main research work was already completed and summarized in the dissertation manuscript. The reviewer team will study the content of the manuscript and decide if it meets the requirements for a PhD thesis. The student might revise the dissertation manuscript based on the comments of the review team. The review team needs to approve the revision, before the student is allowed to prepare for the dissertation defense. In addition, the student has to meet the publication requirements in order to finish their studies. The dissertation defense is a closed examination lasting for 2.5 hours. It includes a 30-minute presentation as well as two hours of questions.

The program coordinators mention in the discussion, that during the last five years they have changed the examination types in the programs. Instead of predominant written exams, the assessment methods were diversified including more projects and assignments. The state to the experts that the students are well-aware of the types of exams used, which is explained in the module handbook and discussed in the class.

The experts are further interested in the tasks and qualifications of graders. The program coordinators describe that graders can be included to all exams if necessary. Usually, there are many applications to grader jobs. The grading itself is performed in close consultation with the lecturer and follows clear grading rules. The grader and the lecturer discuss alternative solution for questions to ensure fair grading of the assessment. An additional quality check for grading is performed in which the grader has to solve exam questions themselves

in order to prove their competences. After proofing their competences, the graders are hired by the department. Graders are limited to courses with more than 30 students. Once the department receives a list of registered students in each course for the semester, they review in which courses graders are necessary. Students in bachelor and master programs can then apply for these jobs. Although their main job is grading, in some courses graders are also integrated in giving tutorials, e.g. on machines or techniques. Graders are not included in the grading of the final project or thesis.

The experts confirm that the exams in the study programs under review are organized to assess the extent to which the defined learning objectives have been achieved. All exams relate to specific modules and provide students with feedback on the competencies that they have acquired.

The study program includes a final thesis or final project. It demonstrates that the students can work independently on a task at the intended level of the study programs. The exams are specified for each module, which is clearly stated in the module handbook. The assessment rules are transparent and rules for make-up exams, non-attendance, cases of illness as well as compensation of disadvantages in the case of students with disabilities or special needs (e.g. pregnancy, childcare, caring for relatives) etc. are established. The experts consider the number and distribution of exams ensure an adequate workload as well as sufficient time for preparation. Examinations are marked according to transparent criteria. Students have the opportunity to consult their lecturers about the results of their exams. They state that the types of exams are regularly reviewed whether the exams can adequately determine the achievement of the learning objectives, whether the requirements are appropriate to the level of the degree programs and whether students have sufficient time for preparing and conducting the exams.

3. Resources

Criterion 3.1 Staff and Development

Evidence:

- Self-assessment report

- Staff handbook

- Webpage Department of Computer Science and Electronics https://dcse.fmipa.ugm.ac.id/site/en/welcome/

- Webpage Department of Mathematics https://matematika.fmipa.ugm.ac.id/id/
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The staff at UGM receives recognition and support by the university rectorate. Recruitment of new staff members is transparently advertised online and open for everyone meeting the requirements. The recruitment is based on criteria including among others the academic record of the applicant, their teaching skills, soft skills, management skills, ethics and English proficiency.

Next to the governmental regulations, UGM has its own internal guidelines for its scientific and supporting staff members. The staff is required to work at least 12 credit units (equal to 36 working hours per week) of teaching, research, and community service each semester. The academic staff needs to provide a work plan and write a report on their activity each semester. The head of the department considers the academic staff members' performance in teaching, research, and community service each semester. Within FMNS, incentives are issued to encourage the staff members to perform their research. This includes research grants offer by UGM and well as financial support to publish manuscripts and attend conferences.

Currently, FMNS employs 201 full time academic staff members within its four departments. The Department of Computer Science and Electronics has a staff of 57 members whereas the Department of Mathematics employs 48. The qualification of the staff members is as following:

Position	Department of Computer Science and Electronics	Department of Mathematics
Professor	2	7
Associate professor	11	11
Assistant professor	19	13
Instructor	13	10
Teaching assistant	12	7
Academic assistant	0	0
total	**57**	**48**

Position	Department of Computer Sciences and Electronics	Department of Mathematics
Doctor	32	33
Master	25	15
Bachelor	0	0
total	57	48

The staff student ratio in the year 2021/20022 is 1 to 11.38 for all programs in the Department of Computer Science and Electronics (649 students) and 1 to 13.45 in the Department of Mathematics (646 students). Basic courses are provided by lecturers from the Faculty of Language, Faculty of Philosophy, and the Faculty of Economics. The average working load in the Department of Mathematics is 37.04 hours per week or 12.96 credits per semester. This includes education, research, community services and supporting activities. Next to the academic staff, the Department of Mathematics employs twelve non-academic staff members, which includes a librarian, a technician and ten people responsible for administration. In the Department of Computer Science employs 17 non-academic staff members, which includes seven lab assistants, seven administrative staff, one technician and two academic IT experts and operators. Visiting experts are welcome to give short classes, such as academics from other institutions or experts from companies.

Within each department, the staff is divided into research groups or labs. Each research lab organizes activities such as scientific discussions, monitoring and carrying out courses, assigning lectures and supervisors and other member's activities. Students are often involved in the research activities resulting in joint projects and publications. In community service, the academic staff members shall share their experiences and knowledge to improve the living quality and the community. This includes giving training to high school teachers or students, organizing competitions and collaborating with enterprises. Next to teaching, the staff also acts as academic mentors to students to give advice in academic issues such as choosing electives or explaining academic rules.

Among the 57 staff members from the Department of Computer Science and Electronics, 32 hold a doctorate and are therefore allowed to teach in the doctoral program "Computer Science."

UGM encourages their staff to continue their education of both academic and non-academic staff members. This includes the promotion of the academic staff to full professors

and the support for non-academic staff members to develop their management and leadership skills. Once a semester during a meeting, various opportunities of further education are discussed and discuss the challenges in the current career development. UGM offers grants for research and community service to strengthen their involvement in research and outreach. Annual grants are also provided for international trips and collaborations. Furthermore, UGM provides support to apply for external funding.

To ensure the continued training, each department needs to submit a budget explaining their strategy including training and certifications. Other training includes professional training in teaching or skills such as leadership. Members from the academic staff also have the opportunity to join industrial internships as experts.

In the discussion with the representatives of the rector's office, the experts ask how the recommendation from the last accreditation on hiring more employees who graduated from outside UGM was realized. The representative of the rector's office confirm that this recommendation was taken into action; during the last new hiring processes, several individuals were hired, who have graduates from other national and international universities. Nevertheless, they state that the application process is open and everyone who fulfills these requirements can apply.

The discussion continues with the workload of the lecturers at the Department of Mathematics and the Department of Computer Science and Electronics. The program coordinators explain that according to the governmental regulation, the workload for each lecturer ranges between 12-16 credits, where one credit includes three hours of preparation, grading and student support. The program coordinators describe that several lecturers spend most of their time with teaching with little time for research and community service. Therefore, they would like to increase the human resources in the department to increase the research output. However, the program coordinators state that it is increasingly difficult to find suitable personnel for teaching. Currently, all teaching staff works between 12-16 credits of teaching while research and community service range only around five credits. The program coordinators confirm that the lecturers have good collaborations with the industry to share facilities. The program coordinators from the Department of Mathematics add that they have to additionally teach supportive classes in other study programs. They try to develop strategies to allow each staff member time for research. The teaching staff reports to the experts that their teaching load might be equal to 16 credits; however, they all find time to conduct research. The teaching staff therefore does not see any problems with high teaching load and mention to the experts that they have several scientific projects to prove their activities. These include grants from UGM and from the government. Lecturers from the doctoral program of "Computer Science" add that their projects also fund several PhD students. Considering the staff mobility, the teaching staff confirm their possibilities to

spend time outside UGM. They do not have specific grants in Indonesia, but staff exchange can be achieved with exchange projects and funding such as DAAD or ÖAD.

In the discussion with the teaching staff, the experts raise the topic of student counselling beside their academic supervisors. The teaching staff confirms that there are raising problems with students feeling stressed. UGM offers counselling for those students. This includes a service on campus as well as a hotline, where students receive counselling on the phone. UGM further operates a crisis center. In addition, they offer counselling at faculty level, who collaborate with the faculty of psychology and the medical center. The teaching staff remarks that these services are also available for all employees of UGM.

The experts summarize that the composition, professional orientation, and qualification of the teaching staff are suitable for successfully delivering the study programs under review. The research and development of the teaching staff contributes to the desired level of education. In the opinion of the experts, the lecturers have the opportunity to further develop their professional and didactic skills and are supported in using corresponding offers. However, the experts recommend the teaching staff to increase their outgoing activities and participate in international staff exchange.

Criterion 3.2 Funds and equipment

Evidence:
- Self-assessment report
- Staff handbook
- Webpage Department of Computer Science and Electronics https://dcse.fmipa.ugm.ac.id/site/en/welcome/
- Webpage Department of Mathematics https://matematika.fmipa.ugm.ac.id/id/
- List of Memorandums of Understanding
- Example of Intellectual property Rights letter
- Visitation of the campus at the Department of Mathematics and the Department of Computer Science and Electronics
- Discussion during the audit

Preliminary assessment and analysis of the experts:
UGM is mainly funded by the government of Indonesia and by tuition fees. As a public state university, UGM receives financial support by the government. These funds are mainly allocated to pay salaries and incentives of their staff, cover operational costs, and offer

competitive research grants. The structure of the student tuition fees is based on individual circumstances and parental backgrounds, considering factors such as residency status, program of study, and financial need. The UGM website outlines the specific tuition fee rates applicable to different categories. The financial management processes in the study programs are executed through a performance-based management system and financial management information system. The tuition fees need to be paid each semester. The tuition fees will be divided and 20% will be distributed to the UGM, 40% to the FMNS and 40% to the responsible departments.

Additional funds from grants can be applied through government and non-government organizations/institutions. In the Department of Mathematics and the Department of Computer Science and Electronics, external research funds were collected each year. These include community service's grant, research grants and other governmental funding. The financial support in the departments is mainly distributed on academic activities and community service, administration and program development.

In addition, UGM offers their staff and students access to a language training center, a health center, an Information and Technology resource Center, sports facilities, and a mosque. Students have the possibility to apply for student lodges in four residence halls inside and outside the campus. The Campus is large and offers the students recreation in two small forests and a valley with a small lake.

The UGM offers a university library, a faculty library and department reference rooms. The university strategy includes constantly expanding their books and journal access. The libraries offer internet access as well as rooms for reading, discussions, a cafeteria, and room for prayer. In addition, students have access to the digital libraries of other institutions including the Institut Teknologi Bandung, Universitas Indonesia, and the national library. The faculty libraries also offer similar facilities including rooms for reading and discussion. In the discussion, representatives of the rector's office remark that the library was significantly improved during the last five years.

The Department of Mathematics also has equipment to complete the laboratory work, which mainly represents a computer room for practical exercises. Computers are renewed on a five-year basis and equipment is all software integrated in their courses. These rooms can be used by up to 30 students and are currently used in 22 courses.

The Department of Computer Science and Electronics offers several facilities. There are four computer teaching laboratories use in the bachelor program "Computer Science" containing each 25 computers. Next to these teaching laboratories, the department has further five research laboratories, which offer more advanced equipment. Students can access these labs during office hours, which will be used mainly by students working on

their thesis. Doctoral students in "Computer Science" receive full access to the research laboratories. UGM offers specifically eight computers to the PhD students to perform their experiments. Additionally, they receive a working space at the department.

The representatives of the rector's office confirm to the experts that UGMs total funds compose of one third of governmental funds, one third of tuition fees and one third from research projects and university enterprises. They explain that there were certain budget cuts during the COVID-19 pandemic, but there were also COVID-19 related new funding opportunities. During this period, UGM has cut their tuition fees by 25% as it was suggested by the government to continue to support their students.

During the discussion, the partners from the industry confirm that they collaborate with UGM; these includes also shared equipment. This is also remarked by the teaching staff. They explain to the experts that they require specific funding for buying new equipment, which can either be from the government or the industry. Both funding schemes are based on projects. Industrial collaboration also might include joint lectures or guest lectures from their partners. In their collaborations, several industrial partners also provide the university with software licenses needed on the job market.

The experts also ask the students if they consider the equipment as adequate and if they receive enough technical support and resources. The students from the bachelor program "Computer Science" consider the facilities as well-equipped; they have enough laboratory access to work on their final research project as well as literature access. Students from the program "Statistics" support this and they are also satisfied with their faculty, library and its computer laboratories. The students are also aware that they can borrow laptops from the university to conduct their analysis if their personal devices are not good enough. The students further appreciate the internet connection on campus, as well as their co-working spaces. Similarly, the students of the doctoral program "Computer Science" consider they have sufficient access to laboratories and literature to do their scientific work. This includes remote access to run their algorithms from home. However, they raise a point of criticism as they wish the facilities would be open longer in the evening for them to study and perform their research. The teaching staff confirms the improve situation of their facilities since the opening of a new building. This gives them more space in their offices and for teaching.

The experts also raise the topic of intellectual property. The teaching staff confirms that they have already registered patents and that UGM has a specific policy on this issue.

The experts conclude that the financial resources and the available equipment constitute a sustainable basis for delivering the degree program. This includes secure funding and reliable financial planning, sufficient infrastructure in terms of both quantity and quality and binding regulation of internal and external cooperation.

4. Transparency and documentation

Criterion 4.1 Module descriptions

Evidence:
- Module handbook of each study program
- UGM Webpage https://ugm.ac.id/en/
- Webpage of the Ba „Mathematics" https://s1math.fmipa.ugm.ac.id/en/
- Webpage of the Ba "Statistics" https://s1stat.fmipa.ugm.ac.id/en/
- Webpage of the Ba "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/undergraduate-computer-science/
- Webpage of the PhD "Computer Science" https://dcse.fmipa.ugm.ac.id/site/en/computer-science-doctoral-program/

Preliminary assessment and analysis of the experts:
UGM offers module descriptions to each module of all study programs under review on their webpage. These can be downloaded for each module or the entire study program by students and stakeholders. The module handbook compiles the information of one study program; each module description is prepared by the responsible lecturer(s). It contains the module name, the semester, contact person, lecturer(s), language(s), relation to the curriculum, type of teaching, contact hours, workload, credit points, and requirements according to the examination regulation. Furthermore, each description lists the recommended pre-requisites, learning outcomes and their corresponding PLOs, content study and examination requirements, forms of examination, employed media, assessment, and evaluation, reading list, and the date of the last amendments. In addition to the module handbook, the students receive a weekly plan, which are distributed internally on the program's platform.

After studying the module descriptions, the experts confirm that they include all necessary information is included in the module handbooks. Further, the module descriptions are accessible to all students and teaching staff.

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Self-assessment report

- Example of diploma certificates

- Examples of diploma supplement

- Examples of Transcript of records

Preliminary assessment and analysis of the experts:

UGM describes in their self-assessment report, that it issues a diploma certificate shortly after graduation.

The experts confirm that the graduates of all four study programs 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 Diploma Supplement contains all necessary information about the degree program including acquired soft skills and awards (extracurricular and co-curricular activities). The Transcript of Records lists all the courses that the graduate has completed, the achieved credits, grades, cumulative GPA, and mentions the seminar and thesis title.

Criterion 4.3 Relevant rules

Evidence:

- Self-assessment report

- UGM Webpage https://ugm.ac.id/en/

- UGM Academic regulation

- Governmental regulations

- Discussion during the audit

Preliminary assessment and analysis of the experts:

As a state university, UGM follows governmental rules and regulations; in addition UGM has issues several internal guidelines in the university and each faculty.

The experts reviewed the access to the rights and duties of both UGM and the students; they consider them as clearly defined and binding. All rules and regulations are published on the university's website and hence available to all relevant stakeholders. In addition, the

students receive all relevant course material in the language of the degree program at the beginning of each semester.

5. Quality management: quality assessment and development

Criterion 5 Quality management: quality assessment and development

Evidence:

- Self-assessment report

- UGM Webpage https://ugm.ac.id/en/

- Discussion during the audit

Preliminary assessment and analysis of the experts:

UGM describes in their self-assessment report their internal and external quality assurance processes. UGM issues their own quality standards and apply several levels of quality assurance. UGM outlines how they achieve continuous improvement of their institution and study programs while complying with academic policies, academic regulations, quality manuals, and quality procedures. Furthermore, they ensure that all graduates have reached the determined competences within their study program and that these competences are relevant to the demands of the stakeholders and society. The quality assurance at UGM is conducted by the Office of Quality Assurance, which is supported by the Quality Assurance Unit at faculty level and the Semester Coordination Team at department level.

External evaluation takes place by accreditation agencies including the National Accreditation Board of Higher Education (BAN-PT) and international agencies.

In addition to the surveys, there is an annual Internal Quality Audit to evaluate whether the general learning objectives have been achieved. This is held annually, assessing all aspects of the educational process conducted by the degree program. The assessment is carried out by two auditors. During the internal audit, lecturers, students, administrative staff, and degree program management are interviewed.

Internal evaluation of the quality of the study programs is mainly provided through student and alumni surveys (annual tracer study conducted by the university). The students give their feedback on the courses by filling out the questionnaire online (EDOM). Giving feedback on the classes is compulsory for the students; otherwise, they cannot access their

account on the digital platform SIMASTER. There are various categories in the questionnaire (e.g. schedule, course materials, workload, and motivation). A compilation of the students' feedback is sent to the respective lecturers. As the students point out during the discussion with the peers, there is also the possibility to give a direct and informal feedback to the teacher. Since 2022, all study programs are monitored online for their learning process. Every semester, a group holds meetings (usually two per semester) to discuss the teaching and learning process of the ongoing semester. This also involves students' representatives. In addition, one alumni meeting is organized once each year. Stakeholders are also integrated in the quality assurance through meetings and email surveys. UGM further conducts tracer studies to track the employability of the graduates.

The results of internal quality assessments are evaluated on faculty level during the Management Review Meetings, attended by the dean, vice deans, heads of departments, heads of laboratories, degree program managements and the Quality Assurance Unit. The RTM takes the final decision on all audit findings and initiates corrective actions if necessary.

In the discussion with the expert panel, the representatives of the rector's office explain that one improvement supported by the quality management was the shorting of the study period on the three bachelor programs under review.

The experts raise the topic of students' involvement in the quality management with the representatives of the rector's office. They confirm to the experts that students are part of the decision-making process as they are part of the board of trustees. The students also receive questionnaires on the courses. The student questionnaires are given to the students after their final examination. To see the results of the exam, the students are invited to take part in this survey. They usually assess the lecture as well as the lecturer. Based on the new university regulations, the information on the results of these courses be given back to the students. The representatives of the rector's office add that it is unique at UGM that students are also involved in the decision on the amount of their tuition fees if they consider the current values does not match their financial status.

They explain to the experts that students and stakeholders are also brought together in their decision-making university bodies. In addition to offline events, there exists also on online platform as a service from UGM to the industrial partners and students. This mainly focuses on seminars, internships, and job opportunities.

The program coordinators confirm the structured monitoring of the study programs at UGM. They confirm that usually, there are around four reports on the monitoring of each study program. Students are also involved in the monitoring process and the compilation of these reports. This follows the learning process and evaluates the learning outcomes of individual students. Every four month, they test if the students have met the requirements

during an evaluation. The program coordinators add that they use the monitoring to verify if the PLOs were achieved in the study programs. The students consider the monitoring of their study progress as positive.

The standard duration for studying is also discussed in several discussion rounds. The representatives of the rector's office state that the average time to graduation was reduced during the last years. The long time to finish the studies was a major point of criticism in the past, therefore the universities has applied several methods to improve the situation. The current average study time in the bachelor programs is round 4.5 years instead of 4 years. They explain that the students had difficulties in finishing their thesis during the COVID-19 pandemic. One main factor were difficulties in scheduling meetings, internships, and exams, which took place up to four weeks later than planned. As a result, in many cases, the students finished their studies within four years, but needed more time to defend their thesis. Other students needed more than one semester for their bachelor project since the schedules for laboratories were limited during the pandemic. The students and alumni state that writing the bachelor thesis in one semester is not a problem in their opinion outside the pandemic. In contrast, for the PhD the biggest threat to prolong the studies is the mandatory publication in a ranked journal. Others report that the data acquisition can cause problems, which prolong their studies. Students with scholarships add that they need to finish their studies in a defined amount of time without exceptions. The doctoral students confirm that the biggest challenge to finish their studies in the recent years was the laboratory access for their research during the COVID-19 pandemic. However, since 2022, the situation has gradually improved. The experts are aware of such problems and consider the presented average study time as acceptable.

The students confirm to the experts that they take part in the evaluation at the end of the semester. Afterwards, at the beginning of the following semester, they have a hearing session and open discussion with the quality management, where the results of the evaluations are discussed. The students add that EDOM is a software from the quality management from UGM they use for general feedback while they prefer to use the TKS made by the Semester Coordination Team. Within this system, the students can create their own questions; therefore they can be more specific for their study program and class. The students additionally report that their batch chairman holds two meetings during the semester with them to receive direct feedback. In the bachelor program "Statistics" this person also creates their survey questions for their batch, which integrates question suitable for their course. The students of the various programs under review agree that they can see changes in these courses in the following semester; therefore, their opinion is recognized by UGM to improve the program.

In conclusion, the study programs under review are subject to periodical internal quality assurance which includes all stakeholders. The results of these processes are incorporated into the continuous development of the programs. Processes and responsibilities are defined for the further development of the programs. The results and any measures derived from the various quality assurance instruments used (various survey formats, student statistics, etc.) are communicated to the students.

D Additional Criteria for Structured Doctoral Programs

Criterion D 1 Research

Evidence:
- Self-assessment report
- Examples of doctoral thesis
- Webpage UGM
- Webpage doctoral program "Computer Science"
- Curriculum document
- Discussion during the audit

Preliminary assessment and analysis of the experts:
According to the self-assessment report, students of the doctoral program "Computer Sciences" should develop the abilities to design and carry out original research at the forefront of their discipline. Therefore, students focus on doing independent research under supervision, which covers 74% of their six-semester study plan. To be accepted, students need to submit a research proposal together with their applications to proof their skills in scientific thinking. The potential of their research initiatives will be decided by an examiner board together with the qualifications of the applicants. Already before the beginning of the semester, the department organizes a meeting to discuss the most suitable supervisors or team of promoters for each nearly accepted student. The determination depends on the workload of each person as well as the area of expertise. This team of promoters will serve as a first contact, who supports the students in developing a study plan and selecting the most suitable elective courses. After attending theoretical courses in the first and second semester, students have to present their research proposal again with preliminary results

in front of a committee to define their research topic. During these examinations, the student receives additional ideas to define their scientific work. The Department of Computer Science and Electronics offers the students equipment and access to computer laboratories to conduct their experiments. Following this comprehensive examination, the student focuses predominately on research in their doctoral studies. During their doctoral studies, the students publish at least one scientific article in an international journal with an impact factor and reputation. The progress in their scientific work is monitored by two lecturers and two students, who meet three teams a year. During this meeting, the scientific progress of the past and future next four months will be discussed to ensure a successful graduation in time. Besides the mandatory courses, UGM offers additional courses and workshops in academic writing and presenting as well as research tools and methods to support the students in their studies.

Students can address a wide scope within their doctoral studies. This includes fundamental theoretical studies as well as cutting-edge developments in the fields of robotics, computer vision, intelligent system, bioinformatics and more. UGM offers the following laboratories to the students to conduct their research:

1. Algorithms and Computation (algorithms, formal methods, cryptology, statistics, and computation that support other fields)
2. Intelligent Systems (methods/algorithms, uncertainties, decision support systems, natural language processing, and hardware/software to enable a system to perform intelligent tasks)
3. Data and Software Engineering (data mining, mobile and cloud computing, database, information management, software engineering for specific purposes)
4. Electronics and Instrumentation (systems that being used to measure/detect, manipulate/process signal, as well as the processing and displaying of physical quantities, systems that being used to measure/acquisition of physical quantities data)
5. Computer Systems and Networks (software systems, operating systems, hardware and networks, system security)

The experts consider that the graduates acquire advanced, cutting-edge knowledge in the study program and are able to demonstrate, on the level of internationally recognized scientific research, a deep and comprehensive understanding of their research field. In the opinion of the experts, the students demonstrate the ability to design and carry out an original research project at the forefront of the discipline, contribute to the advancement of science, and are able to adequately present the results to different audiences.

Criterion D 2 Duration and Credits

Evidence:

- Self-assessment report
- Academic guidebook
- Curriculum document
- Discussion during the audit

Preliminary assessment and analysis of the experts:

The doctoral program "Computer Science" has a standard duration of six semesters or three academic years. During the first and second semester, students have to participate and compulsory (six credits) and electives modules (six credits). The compulsory modules include the module "Research methodology" and "Research trends in computer science." In addition, all students have to take the module "Dissertation", which has 34 credits. All elective courses have a workload of three credits. This dissertation considers the research work, the writing of one mandatory publication, the dissertation thesis as well as the dissertation defense. These modules takes place in four semesters.

The following curriculum structure is presented for the study program:

No.	Semester	Study process and research	Total of Credits	Code of Course	Courses	Credits	Description
1	I	Lecture (course work) 1008 hours (4.2 hours per day) 36 ECTS	12 (minimum)		Elective 1	3 (9 ECTS)	The courses that support students' research topic. The elective courses taken by student may be different among others.
					Elective 2	3 (9 ECTS)	
2	II			MII7000	Research Methodology (Compulsory)	3 (9 ECTS)	Lecture with the promotor team while preparing a research proposal for comprehensive examination. Outside the class, the students must refine their proposals under the promotor team's supervision to prepare the comprehensive examination scheduled in semester III. Therefore total hours spent by student is around 7.5 (4.2 hours in the class + 3.3 hours outside the class) per day.
				MII7020	Research Trend in Computer Science (Compulsory)	3 (9 ECTS)	
3	III 3808 hours (7.9 hours per day) 136 ECTS	Research Proposal Supervision and examination	10	MII7060	Research Activities	6 (24 ECTS)	By promotor team
				MII7090	Comprehensive Examination	4 (16 ECTS)	By examination board
4	IV	Research and publication	12	MII7070	Scientific Publication	12 (48 ECTS)	Acceptance proof
5	V	Writing and Evaluating Dissertation	6	MII7071	Dissertation manuscript	6 (24 ECTS)	By promotor team
6	VI	Writing and Evaluating Dissertation	6	MII7099	Defence examination	6 (24 ECTS)	By examination board
		Total of Credit (minimum)	46			46 (172 ECTS)	

The experts confirm that the study time of the structured doctoral program is appropriate. UGM applies a credit point system (Indonesian credits and ECTS credit points), which is developed for cohorts of students.

Criterion D 3 Soft Skills and Mobility

Evidence:

- Self-assessment report

- Curriculum document

- Discussion during the audit

Preliminary assessment and analysis of the experts:

UGM aims to educate qualified experts in the field of computer science, who have scientific integrity and who are capable of providing solution to problems of the community. During their studies, students receive training in scientific methodologies, scientific writing and have to attend joint seminars, symposia, and workshops on a national and international scale. Furthermore, UGM offers the opportunities to join panel discussions and guest lectures from national and international agencies, institutes, and companies. The research projects often involve research collaborations, where student receive support to organize exchange programs.

UGM encourages their students to get experience abroad. This includes programs such as summer courses, international conference, the so-called "sandwich program" and others. The students receive financial support to realize these opportunities. The Ministry of Research and Technology and Higher Education regularly offers scholarships for doctoral students including the sandwich program. Students are informed on these calls and supported in preparing their application by their promoter team. Student mobility programs are usually in the form of summer courses (two to three weeks), laboratory short visits (one to three months), international conferences (three to five days), and sandwich programs (two to four months).

The doctoral students explained to the experts that they consider attending conferences as a part of their studies. For some, their student grant also covers international conferences while other receive support from the supervisors. They confirm to know about the sandwich program, where colleagues spend three to four months with an international supervisor with whom they had to write a publication during their exchange.

In the discussion with the program coordinators, the experts also discuss the study period to finish the PhD. The program coordinators confirm that the indented study duration is three years, but on average, the students take 4.6 years to graduate. They are aware of this problem, although the number has decreased during the last years. The main problem is that many students to no come to campus regularly during their PhD studies; therefore, their progress is not closely monitored. Many doctoral students already are employed, which reduces their time for research and prolongs their studies. UGM has created a form to connect the students and provide good media to increase the connection between the lecturers and the off-campus students. In addition, they offer a "boot-camp" for students

who took a break from their research. This takes one to three days, in which they conduct meetings, present the results, and discuss the future proposal in the light of the most recent changes in the field of science.

The experts consider that the doctoral candidates are offered a wide range of opportunities for their personal and professional development and take advantage of institutional support for career development and mobility. This includes support structures for professional development, training in transferable skills, and preparation for career choices. The doctoral candidates receive opportunities for academic mobility and international collaboration within an integrated framework of cooperation between universities and other partners.

Criterion D 4 Supervision and Assessment

Evidence:
- Self-assessment report
- Curricular document
- Regulation student behavior
- Discussion during the audit

Preliminary assessment and analysis of the experts:
The students are guided by a transparent framework of shared responsibility between the doctoral candidates (students), promoters (supervisors) and the institution. The students receive close support by their team of promoters, who act as mentors, companions, and speakers for the students. Usually, the students have one promoter as well as one or two co-promotors. The supervision of the students starts in the first semester to prepare the students for the comprehensive examination at the beginning of the third semester. The supervision mainly focuses on the modules (elective courses), the research work of the students and the publication strategy. Consultations are scheduled semi-regularly between the students and the team of promoters. The research work is in close supervision by the team of promoters and stretches across the following four semesters. This takes place in individual supervising sessions, which usually take place every week. Students present their research progress and obstacles in person to their promoter(s). The dissertation is considered as the final scientific report with an in-depth analysis of their research work conducted during the study period.

Evaluation of the thesis consider the content, the research methodology, writing aspects, cohesiveness, and the skills in logical thinking. A team of elevators reviews the dissertation thesis, which can take up until one month. The results will then be discussed with the team

of promotors by providing recommendations on how to revise the dissertation manuscript. All members of this committee need to agree on the draft version for the students to arrange the dissertation defense.

The dissertation defense is a closed examination, which is chaired by the dean or a representative. The session lasts for 150 minutes and beginning with a 30-minutes presentation and 120 minutes Q&A. The grading of the work follows a 4-point scale and considers the content, discussion, and conclusion as well as the writing structure, logical thinking and cohesiveness. Students can pass, but nonetheless can be required to work on a revised dissertation thesis, which needs to be submitted within three months. If the students fail to submit their revision in time, they are required to re-take the dissertation defense.

The experts have received evidence that a transparent contractual framework of shared responsibilities between doctoral candidates, supervisors, and the institution is in place and continuous support by their supervisors is provided. All assessments rules are clearly formulated and binding.

Criterion D 5 Infrastructure

Evidence:
- Self-assessment report
- Visitation of the Department of Computer Science and Electronics
- Discussion during the audit

Preliminary assessment and analysis of the experts:
According to the SAR, UGM provides their doctoral students in the program "Computer Science" a laboratory infrastructure they can access. These include the following research laboratories (1) Intelligent Systems, (2) Algorithm and Computation", (3) Software and Data Engineering, (4) Computer Systems and networks and (5) Electronics and Instrumentation. All laboratories provide courses to introduce their equipment and safety standards allowing the students to work independently. An appointed staff manages the access to the laboratories to keep track of the use of each device in the different laboratories. Recently purchased new equipment includes a universal system for all artificial workloads for analytics, training, and inference.

The student union gives additional trainings to students using e.g. on software like text editor, LaTeX or Mendeley. They also organize events such as general lectures, sharing sessions and guests. Additional activities provide opportunities to train the students' soft skills and share their experience and struggles.

Each doctoral students also receives personal space to with a chair, table and locker within an area reserved for students. The students also have access to the library and the digital library to access journals and eBooks. All this shall contribute to a successful learning and scientific activity of the students.

The experts confirm that UGM provides a suitable infrastructure for the doctoral candidates with an adequate research environment that allows them to appropriately carry out their research projects.

Criterion D 6 Funding

Evidence:
- Self-assessment reports
- Discussion during the audit

Preliminary assessment and analysis of the experts:
In Indonesia, doctoral students have to pay tuition fee in order to study. Students can apply for various types of scholarships; these include either a cover of their tuition fees or additional funding for their living cost and/or research funding. The DIKTI offers special scholarships to gifted graduates of the bachelor programs, who have the qualifications to directly enroll in the PhD program. Also, UGM offers financial support called RTA; in this program promotors will support the students. Based on a special application including an activity plan. The outcome from this scholarship needs to be two international publications of the student and the promotor. Additionally, UGM offers financial incentives for students who publish their scientific work during their studies. Moreover, FMNS offers financial assistance to students by discounting their tuition fees.

In the discussion, the experts raise the issue of funding for the PhD studies. The program coordinators confirm that doctoral programs are usually not funded by the government, but the students have to pay tuition fees. The students report no problems in finding suitable funding as for doctoral studies from the various foundations.

The experts confirm that students have the opportunities to receive funding to support their studies and research. The basic financial assistance for the doctoral program is comp able to the basic funding of UGM described in criterion 3.2.

Criterion D 7 Quality Assurance

Evidence:
- Self-assessment report
- Regulations and guidelines for graduate programs
- Satisfaction survey results from graduate students
- Discussion during the audit

Preliminary assessment and analysis of the experts:

According to the evidences, UGM operates a well-established quality assurance system, including the doctoral programs. On different levels, the program "Computer Science" is evaluated to improve the teaching and learning processes. UGM also considers the student achievements of the program learning outcomes. To measure the success of the program, UGM has set key indicators and goals that determine the achievements of the PLOs. Major revisions are conducted every five years and include students, alumni, users, and stakeholders. UGM collects data based on different surveys, which include stakeholder and alumni tracer studies on evaluation of the compulsory and electives modules. Internal and external stakeholders provide inputs and suggestions in the process of the evaluations, which are transferred into improvements of quality of the study program. The results of the surveys are discussed with the academic and non-academic staff and students in an annual meeting held by the program coordinators.

UGM provides evidence during the accreditation to verify that their last targets for improvements in the study program "Computer Science" were reached showing a greater variety of research topics, a shorter time of study and an increase of international students.

In addition, the experts consider the quality management of the structured doctoral program has passed regulations documenting the rights and duties of the doctoral candidates as well as relevant organizational arrangements. These rules of good scientific practice are followed. They confirm that the university and the faculty collect data related to individual progression, net research time, completion rate, dissemination of research results, and career tracking and uses this data to continuously assess the quality of the structured doctoral program. The quality management involved internal and external stakeholders, and effectively leads to changes in the study program in order of achieving improvement.

E Additional Documents

No additional documents needed.

F Comment of the Higher Education Institution (xx.xx.20xx)

The institution provided a short statement on the 23rd of August providing corrections to the report and further explanations.

"**The comments below are specific to the Computer Science undergraduate program's response to the ASIIN report.**
3. Responses to the Criterion 1.3 Curriculum

Page 23
Updated version: In the bachelor program "Computer Science", since 2012 offers the international class student admissions that can be applied for by local or foreign of the senior high schools. All learning processes, compulsory and elective courses are taught in English. While the regular classes mostly offer in Indonesia. The students of regular class can participate to various English activities, such as writing thesis in English, international training and examination of any computer/IT certification, overseas visiting lecturer classes, international competition/contest, International Student Mobility, Student Exchange, Join class with partner university, etc.

Page 24
Updated version:
The experts continue to discuss the internships in the bachelor programs. Based on the MBKM program, in the bachelor programs "Mathematics" four different internships are offered which differ in duration and structure. The internships A and B are internships of one to two months, which is the most often used typeof internships. Internships C and D are longer with a larger workload and more responsibility. While, the MBKM of bachelor program of "Computer Science" has eight types, with duration in one or two semester (see more at this link). These MBKM activities are: (1) Student Exchange; (2) internship or field practice work activities; (3) school assistance activities; (4) research activities; (5) independent project activities; (6) village projects activities; (7) entrepreneurship activities; (8) humanitarian project activities. The list of courses and the number credits of each MBKM types can be found at this link.

Page 27
Updated version:
Moreover, they recommend that all bachelor students should add one specific course in scientific writing, which should provide them with the knowledge of writing their bachelor thesis based on a thorough literature research and data analysis by consideringthe modern ethics in science and publishing. Especially for the bachelor program of "Computer Science", has a specific course "Scientific Writing and Ethics" (see more at this link).

Page 28

Updated version:

For the MBKM student exchange, UGM had a lot of agreements with their university partners (see this list UGM and partner university at this link). UGM is continuously expanding their networks across Indonesia and abroad. They are currently working on improved agreements with universities across Europe.The bachelor program of "Computer Science" had double degrees with the University of Birminghamand University of South Australia. In coming semester 2023, in following link of table show the list of "Computer Science" students who have arrived at their host university, or/and will leave to their host university for double degree program, exchange program, IISMA, and international Company internship(Link).

Page 28

Updated version:

From the bachelor programs "Computer Science", twelve students are participating in an IISMA exchange in 2021, eleven students in 2021, and nine students in2023."

G Summary: Expert recommendations (28.08.2023)

Taking into account the additional information and the comments given by four the experts summarize their analysis and **final assessment** for the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum du-ration of ac-creditation	Subject-spe-cific label	Maximum dura-tion of accredi-tation
Ba Mathematics	Without re-quirements	30.09.2030	–	-
Ba Statistics	Without re-quirements	30.09.2030	–	-
Ba Computer Science	Without re-quirements	30.09.2030	–	-
PhD Computer Sci-ence	Without re-quirements	30.09.2029	–	-

Recommendations
For all study programs

E 1.   It is recommended to quickly implement changes in technology to the curriculum to match the demand of the students job market, especially in Ba Statistics (like AI and machine learning), Ba Mathematics (software packages).

E 2.   (ASIIN 1.3) It is recommended to review the mechanism and bureaucracy to allow double supervision of thesis.

E 3.   (ASIIN 3.1) It is recommended to increase the international staff mobility.

For the bachelor programs "Mathematics"; "Statistics" and "Computer Science"

E 4.   (ASIIN 1.3) It is recommended to include English as a compulsory module to the cur-riculum.

E 5.   (ASIIN 1.3) It is recommended to include one module on scientific writing.

E 6.   (ASIIN 1.3) It is recommended to ensure a good supervision of bachelor theses.

E 7.   (ASIIN 3.2) It is recommended to make the infrastructure for students accessible for students in the evening.

For the bachelor programs "Mathematics"

E 8.   (ASIIN 1.3) It is recommended to increase the international student mobility in the bachelor program "Mathematics".

For the bachelor programs "Statistics" and "Computer Science"

E 9.   (ASIIN 1.5) Review the balance of the workload of the curriculum in Ba Stats and CS within and among the semesters.

For the doctoral program "Computer Science"

E 10. (ASIIN 1.3) It is recommended to create a flexibility to allow well-prepared students to advance faster in their studies.

H Comment of the Technical Committees

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 proposes editorial changes to recommendations E 2 and E 6. It also points out that the program names in recommendation E 9 should be written out. Otherwise, the TC agrees with the experts' assessment without any changes.

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

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Computer Science	Without requirements	30.09.2030	–	-
PhD Computer Science	Without requirements	30.09.2029	–	-

Recommendations
For all study programs

E 1.   It is recommended to quickly implement changes in technology to the curriculum to match the demand of the students job market, especially in Ba Statistics (like AI and machine learning), Ba Mathematics (software packages).

E 2.   (ASIIN 1.3) It is recommended to review the mechanism and bureaucracy to simplify double supervision of thesis.

E 3.   (ASIIN 3.1) It is recommended to increase the international staff mobility.

For the bachelor programs "Mathematics"; "Statistics" and "Computer Science"

E 4.   (ASIIN 1.3) It is recommended to include English as a compulsory module to the curriculum.

E 5.   (ASIIN 1.3) It is recommended to include one module on scientific writing.

E 6.   (ASIIN 1.3) It is recommended to ensure a adequate supervision of bachelor theses.

E 7.   (ASIIN 3.2) It is recommended to make the infrastructure for students accessible for students in the evening.

For the bachelor programs "Mathematics"

E 8.   (ASIIN 1.3) It is recommended to increase the international student mobility in the bachelor program "Mathematics".

For the bachelor programs "Statistics" and "Computer Science"

E 9.   (ASIIN 1.5) Review the balance of the workload of the curriculum in Ba Statistics and Computer Science within and among the semesters.

For the doctoral program "Computer Science"

E 10. (ASIIN 1.3) It is recommended to create a flexibility to allow well-prepared students to advance faster in their studies.

Technical Committee 12 – Mathematics (04.09.2023)

Assessment and analysis for the award of the ASIIN seal:

The TC 12 discusses the procedure and follows the assessment of the experts without any changes.

The Technical Committee 12 – Mathematics recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	Without requirements	30.09.2030	–	-
Ba Statistics	Without requirements	30.09.2030	–	-

Recommendations
For all study programs

E 1. It is recommended to quickly implement changes in technology to the curriculum to match the demand of the students job market, especially in Ba Statistics (like AI and machine learning), Ba Mathematics (software packages).

E 2. (ASIIN 1.3) It is recommended to review the mechanism and bureaucracy to allow double supervision of thesis.

E 3. (ASIIN 3.1) It is recommended to increase the international staff mobility.

For the bachelor programs "Mathematics"; "Statistics" and "Computer Science"

E 4. (ASIIN 1.3) It is recommended to include English as a compulsory module to the curriculum.

E 5. (ASIIN 1.3) It is recommended to include one module on scientific writing.

E 6. (ASIIN 1.3) It is recommended to ensure a good supervision of bachelor theses.

E 7. (ASIIN 3.2) It is recommended to make the infrastructure for students accessible for students in the evening.

For the bachelor programs "Mathematics"

E 8.   (ASIIN 1.3) It is recommended to increase the international student mobility in the bachelor program "Mathematics".

For the bachelor programs "Statistics" and "Computer Science"

E 9.   (ASIIN 1.5) Review the balance of the workload of the curriculum in Ba Stats and CS within and among the semesters.

For the doctoral program "Computer Science"

E 10. (ASIIN 1.3) It is recommended to create a flexibility to allow well-prepared students to advance faster in their studies.

I Decision of the Accreditation Commission (22.09.2023)

Assessment and analysis for the award of the subject-specific ASIIN seal:

The accreditation commission discussion the recommendations of the experts and the Technical Committees and follows the changes of Technical Committee 04. In addition, the accreditation commission adapts two typos in the recommendation E2 and E9 and deletes the reference to the study programs in the recommendation E9.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN Seal	Maximum duration of accreditation	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	Without requirements	30.09.2030	–	-
Ba Statistics	Without requirements	30.09.2030	–	-
Ba Computer Science	Without requirements	30.09.2030	–	-
PhD Computer Science	Without requirements	30.09.2029	–	-

Recommendations
For all study programs

E 1. (ASIIN 1.3) It is recommended to quickly implement changes in technology to the curriculum to match the demand of the students job market, especially in Ba Statistics (like AI and machine learning), Ba Mathematics (software packages).

E 2. (ASIIN 1.3) It is recommended to simplify the mechanism and bureaucracy to allow double supervision of thesis.

E 3.   (ASIIN 3.1) It is recommended to increase the international staff mobility.

For the bachelor programs "Mathematics"; "Statistics" and "Computer Science"

E 4.   (ASIIN 1.3) It is recommended to include English as a compulsory module to the curriculum.

E 5.   (ASIIN 1.3) It is recommended to include one module on scientific writing.

E 6.   (ASIIN 1.3) It is recommended to ensure an adequate supervision of bachelor theses.

E 7.   (ASIIN 3.2) It is recommended to make the infrastructure for students accessible for students in the evening.

For the bachelor programs "Mathematics"

E 8.   (ASIIN 1.3) It is recommended to increase the international student mobility in the bachelor program "Mathematics".

For the bachelor programs "Statistics" and "Computer Science"

E 9.   (ASIIN 1.5) Review the balance of the workload of the curriculum within and among the semesters.

For the doctoral program "Computer Science"

E 10. (ASIIN 1.3) It is recommended to create a flexibility to allow well-prepared students to advance faster in their studies.

Appendix: Programme Learning Outcomes and Curricula

According to webpage the following **objectives** (program education objectives, PEOs) and program **learning outcomes (PLOs, intended qualifications profile)** shall be achieved by the bachelor program "Mathematics"

PEO 1	have profound knowledge of mathematical theory and are able to apply it to some problems related to differential equations and optimization
PEO 2	are adaptive and able to pursue a higher degree in mathematics or in other fields related to mathematics;
PEO 3	have the ability to keep up with the development of sciences and technology, are literate in information technology and excellent in computational mathematics;
PEO 4	have a responsibility, confidence, emotional maturity, ethics, and lifelong learner principle.

PLO 1	devote to the God Almighty, Pancasila minded, and are aware of the concerns of the nation;
PLO 2	are able to identify and solve mathematics-related problems;
PLO 3	are able to develop their mathematical and logical thinking and are able to make conjectures;
PLO 4	have sufficient knowledge in information technology and are skilled in using it to support mathematics learning and research;
PLO 5	have comprehensive knowledge in mathematical modeling and are able to formulate mathematical models of various problems, both in mathematics and in other fields such as science or daily life problems, and are able to determine its solving strategies;
PLO 6	are able to identify archetypes and forms of analogy and are able to perform generalizations and abstractions;

PLO 7	are able to communicate the mathematical language both orally and in writing appropriately, clearly, and in an organized manner;
PLO 8	have the responsibility, confidence, emotional maturity, ethics, and awareness of being a lifelong learner;
PO 9	are able to apply mathematical knowledge in a career related to the field of mathematics or to continue studies in post-graduate programs.

The following **curriculum** is presented:

Sem	No	Code	Course	Credit	ECTS	Prerequisite	Remark	PIC
I:	1	MMM-1101	Calculus I	3	4.5			Department of Mathematics
	2	MFF-1011	Physics I	3	4.5			Department of Physics
	3	MKK-1101	Fundamental Chemistry I	3	4.5			Department of Chemistry
	4	MII-211201	Programming	3	4.5			Department of Computer Science and Electronics
	5	MII-211202	Lab Work in Programming	1	1.5			Department of Computer

Sem	No	Code	Course	Credit	ECTS	Prerequisite	Remark	PIC
								Science and Electronics
	6	MMM-1209	Introduction to Mathematical Logic and Set	3	4.5			Lab. of Algebra
	7	UNU-100x	Religion	2	3		UNU-1000 Islam UNU-1001 Katolik UNU-1002 Kristen UNU-1003 Hindu UNU-1004 Buddha UNU-1005 Konghucu	University
	8	MMM-1401	Statistics	3 (1)	4.5 (1.5)		Mata kuliah disertai praktikum	Lab. of Statistics
			Total Credits	21	31.5			31.5
II	1	MMM-1102	Calculus II	3	4.5	MMM-1101*		Lab. of Analysis
	2	MMM-1106	Analytical Geometry	3	4.5	MMM-1101*		Lab. of Analysis
	3	MMM-1202	Elementary Linear Algebra	3	4.5			Lab. of Algebra
	4	MMM-1207	Discrete Mathematics	4	6	MMM-1208*		Lab. of Algebra
	5	MMM-1203	Introduction to Algebraic Structure I	3	4.5	MMM-1208*		Lab. of Algebra
	6	UNU-1010	Pancasila	2	3			University
			Total Credits	18	27			
III	1	MMM-2109	Multivariable Calculus I	2	3	MMM-1102* MMM-1106*		Lab. of Analysis
	2	MMM-2201	Introduction to Algebraic Structure II	3	4.5	MMS-1203*		Lab. of Algebra
	3	MMM-2301	Elementary Differential Equations	3	4.5	MMM-1102*		Applied Mathematics Laboratory
	4	MMS-2420	Introduction to Mathematical Statistics	3	4.5	MMM-1102*		Lab. of Statistics
	5	MMM-2401	Introduction to Numerical Analysis	3 (1)	4.5 (1.5)	MMM-2301**	With laboratory work	Lab. of Mathematical Computation
	6	MMM-2111	Advanced Calculus	2	3	MMM-1102*		Analysis Laboratory
	7	MMM-2312	Linear Programming	3 (1)	4.5 (1.5)	MMM-1202*	With laboratory work	Lab. of Applied Mathematics and Lab. of Mathematical Computation
			Total Credits	19	28.5			
IV	1	MMM-2110	Multivariable Calculus II	2	3	MMM-2109* (UP-Math Students) or MMS-2428* (UP-Stat Students)		Lab. of Analysis

Sem	No	Code	Course	Credit	ECTS	Prerequisite	Remark	PIC
	2	MMM-2112	Function of Complex Variables I	2	3	MMM-2109*		Lab. of Analysis
	3	MMM-2116	Introduction to Analysis I	3	4.5	MMM-2111*		Lab. of Analysis
	4	MMM-2202	Linear Algebra	3	4.5	MMM-1202* MMM-2201*		Lab. of Algebra
	5	MMM-2402	Computational Mathematics	3 (1)	4.5 (1.5)	MMM-2310** MMM-2401*	With laboratory work	Lab. of Mathematical Computation
	6	MMM-2310	Introduction to Partial Differential Equations	3	4.5	MMM-2109* MMM-2301*		Lab. of Applied Mathematics
		Total Credits		16	24			
V	1	MMM-3106	Function of Complex Variables II	2	3	MMM-2112*		Lab. of Analysis
	2	MMM-3102	Introduction to Analysis II	3	4.5	MMM-2116*		Lab. of Analysis
	3	MMM-3303	Introduction to Mathematical Models	3	4.5	MMM-2310* MMS-2420*		Lab. of Applied Mathematics
	4	MMM-3002	Introduction to Stochastic Processes	3	4.5	MMS-2420*		Department of Mathematics
	5	UNU-3000	Civic	2	3	≥ 60 credits		University
	6	MMM-3004	Career in Mathematics	1	1.5	≥ 80 credits		UP-Math and Practitioners
		Jumlah SKS		14	21			
VI/ VII	1	UNU-4500	Community Development Participation	3	4.5	≥ 100 credits without grade E		University
		Jumlah SKS		3	4.5			
VII/ VIII	1	MMM-4091	Final Assignment I	3	4.5	≥ 120 credits, IPK ≥ 2,0, total credits with grade D less than or equal to 25%		UP-Math
	2	MMM-4092	Final Assignment II	6	9	Final Assignment I**		UP-Math
		Total Credits		9	13.5			
		Total Credits of Compulsory Courses		100	150			

Table 5.11   Table of Elective Courses

No.	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
			General Elective Courses in UP-Math					
1	VI/ VII/ VIII	MMM-3005	Internship Type A	3	4.5	≥ 100 credits, CGPA ≥ 2.5, total credits with grade D less than or equal to 25%	MBKM Policy implementation	UP-Math
2	VII/ VIII	MMM-4006	Internship Type B	6	9	≥ 100 Credits, CGPA ≥ 2.5, total credits with grade D less than or equal to 25%	MBKM Policy implementation	UP-Math
3	VII/ VIII	MMM-4007	Internship Type C	10	15	≥ 100 units, CGPA ≥ 3.25 (or ≥ 3,00 for those holding national level achievement), total credits with grade D less than or equal to 25%	MBKM Policy implementation	UP-Math
4	VI/ VII/ VIII	MMM-3008	Internship Type D	20	30	≥ 100 units, CGPA ≥ 3.25 (or ≥ 3,00 for those holding national level achievement), total credits with grade D less than or equal to 25%	MBKM Policy implementation	UP-Math
5	VI/ VII/ VIII	MMM-3009	Information Technology Utilization Assistance for Teachers	2	3	≥ 90 units, CGPA ≥ 2,75, total credits with grade D less than or equal to 25%	MBKM Policy implementation	UP-Math
			Elective Courses "Analysis and Geometry"					
No.	Sem	Code	Course	Credits	ECTS	Prerequisite	Keterangan	PIC
1	II	MMM-1105	Introduction to Number Theory	3	4.5	MMM-1209*		Lab. of Analysis
2	III	MMM-2114	Transformation Geometry	2	3	MMM-1106*		Lab. of Analysis
3	III	MMM-2113	Geometry	3	4.5	MMM-1106*, MMM-1209*		Lab. of Analysis
4	IV	MMM-2115	Geometry in n-dimensional Euclidean Space	3	4.5	MMM-1106*		Lab. of Analysis
5	V	MMM-3109	Variational Calculus	3	4.5	MMM-2110*		Lab. of Analysis
6	V	MMM-3108	Introduction to Topology	3	4.5	MMM-3102**		Lab. of Analysis
7	V	MMM-3105	Intrduction to Theory of Measure and Lebesgue Integral	3	4.5	MMM-3102**		Lab. of Analysis
8	VI	MMM-3110	Sthocastic Calculus	3	4.5	MMM-2110*, MMS-2420*		Lab. of Analysis
9	VI	MMM-3103	Introduction to Theory of Differential Equations	3	4.5	MMM-3102**		Lab. of Analysis
10	VI	MMM-3111	Introduction to Riesz Spaces	3	4.5	MMM-1209 and MMM-2109*		Lab. of Analysis

11	VI	MMM-3107	Introduction to Differential Geometry	3	4.5	MMM-2109*		Lab. of Analysis
12	VII	MMM-4102	Introduction to Functional Analysis	3	4.5	MMM-3102*		Lab. of Analysis
13	VII/ VIII	MMM-4149	Capita Selecta in Analysis	3	4.5	MMM-2116		Lab. of Analysis

			Elective Courses "Algebra and Discrete Mathematics"					
No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
1	II	MMM-1204	Set Theory	2	3	MMM-1209*		Lab. of Algebra
2	III	MMM-2210	Applied Linear Algebra	2	3	MMM-1202*		Lab. of Algebra
3	III	MMM-2206	Introduction to Graph Theory	3	4.5	MMM-1207*		Lab. of Algebra
4	III	MMM-2211	Introduction to Integer Partition	2	3	MMM-1207*		Lab. of Algebra
5	IV	MMM-2208	Finite Group Theory	2	3	MMM-1203*		Lab. of Algebra
6	IV	MMM-2209	Introduction to Combinatorics	3	4.5	MMM-1207*		Lab. of Algebra
7	V	MMM-3206	Introduction to Coding Theory	3	4.5	MMM-2202*		Lab. of Algebra
8	V	MMM-3210	Introduction to Semigroup Theory	3	4.5	MMM-1203*		Lab. of Algebra
9	VI	MMM-3209	Applied Linear Algebra II	2	3	MMM-2202*		Lab. of Algebra
10	VI	MMM-3211	Introduction to Cryptography	3	4.5	MMM-2202*		Lab. of Algebra
11	VII	MMM-4207	Introduction to Module Theory	3	4.5	MMM-2202*		Lab. of Algebra
12	VII/ VIII	MMM-4249	Capita Selecta in Algebra	3	4.5	MMM-2202*		Lab. of Algebra

			Elective Courses "Algebra and Mathematical Computation"					
No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
1	V	MMM-3208	Numerical Linear Algebra	3 (1)	4.5 (1.5)	MMM-2202*	With laboratory work	Lab. of Algebra and Lab. of Mathematical Computation

			Elective Course "Applied mathematics and Mathematical Computation"					
No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
1	IV	MMM-2313	Operation Research A	3 (1)	4.5 (1.5)	MMM-2312*	With laboratory work	Lab of Applied Mathematics and Lab. of

No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
								Mathematical Computation
2	VI	MMM-3309	Introduction to Optimization Theory ♥	3 (1)	4.5 (1.5)	MMM-2312*, MMM-2109*	With laboratory work	Lab of Applied Mathematics and Lab. of Mathematical Computation
			Elective Courses "Applied Mathematics "					
No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
1	II	MMM-1302	Introduction to Game Theory	3	4.5	-		Lab of Applied Mathematics
2	IV	MMM-2309	Dynamical System ♥	3	4.5	MMM-1202*, MMM-2301*		Lab of Applied Mathematics
3	IV	MMM-2314	Operation Research B	3	4.5	MMS-2420*		Lab of Applied Mathematics
4	V	MMM-3310	Introduction to System Theory ♥	3	4.5	MMM-2202*, MMM-2301*		Lab of Applied Mathematics
5	V	MMM-3315	Introduction to Sthocastic Differential Equations	3	4.5	MMM-3002. MMM-2310,		Lab of Applied Mathematics
6	VI	MMM-3311	Introduction to Boundary Value Problems	3	4.5	MMM-2310*		Lab of Applied Mathematics
7	VI	MMM-3312	Introduction to Control Theory	3	4.5	MMM-3310*		Lab of Applied Mathematics
8	VI	MMM-3313	Mathematical Biology	3	4.5	MMM-2301*, MMS-2420*		Lab of Applied Mathematics
9	VI	MMM-3314	Introduction to Mathematics for Machine Learning	3	4.5	MMS-2420*, MMM-2116*		Lab of Applied Mathematics

10	VII	MMM-4303	Introduction to Ergodic Theory	3	4.5	MMM-2309*		Lab of Applied Mathematics
11	VII /VIII	MMM-4349A	Capita Selecta in Applied Mathematics A	3	4.5	MMM-3303*		Lab of Applied Mathematics
12	VII/ VIII	MMM-4349B	Capita Selecta in Applied Mathematics B	3	4.5	MMM-3303*		Lab of Applied Mathematics

			Elective Courses "Mathematical Computation"					
No	Sem	Code	Course	Credits	ECTS	Prerequisite	Remark	PIC
1	V	MMM-3404	Computational Inverse Problems	3	4.5	MMM-2202		Lab. of Mathematical Computation
2	V	MMM-3406	Introduction to Finite Element Methods	3	4.5	MMM-3002, MMM-2310		Lab. of Mathematical Computation
3	VI	MMM-3402	Capita Selecta in Computational Mathematics	3	4.5	MMM-2402*		Lab. of Mathematical Computation
4	VI	MMM-3403	Introduction to Boundary Element Methods	3	4.5	MMM-2110*, MMM-2310*		Lab. of Mathematical Computation
5	VI	MMM-3405	Computational Machine Learning	3	4.5	MMM-2402*		Lab. of Mathematical Computation
6	VII	MMM-4401	Introduction to Fractal Geometry	3	4.5	MMM-2112*		Lab. of Mathematical Computation

According to SAR, the following **objectives** (program education objectives, PEOs) and program **learning outcomes (PLOs, intended qualifications profile)** shall be achieved by the bachelor program "Statistics":

PEO 1	Master the theoretical concepts, statistical methods, and data science, then formulate them for problem-solving;
PEO 2	Develop statistical and data science knowledge for the application and development of science and technology;

PEO 3	Apply statistics and data science in education, research, and community service in order to have beneficial impact on institution, community, and nation;
PEO 4	Make the right decision based on statistical and data science analysis';
PEO 5	Communicate scientifically, involve in collaboration, and be responsible.

PLO 1	Have a strong foundation of statistics and mathematics;
PLO 2	Have the ability of statistical thinking, mathematical thinking, computational thinking and able to develop it;
PLO 3	Have the ability to use technology and statistical software
PLO 4	Have experience in solving real cases in the field of statistics and data science;
PLO 5	Have the ability to communicate statistics and data science in writing and oral;
PLO 6	Have the ability to further study, and or lifelong learning
PLO 7	Have good professional ethics and soft skills

The following **curriculum** is presented:

Table 6.   List of Compulsory Courses for UP-Stat

No	Course Code	Course Name	Credit	Prerequisite
Semester I				
1	MMS-1411	Statistical Methods	4	
2	MMS-1413	Statistical Methods Laboratory	1	MMS-1411***
3	MMM-1101	Calculus I	3	
4	MFF-1011	Basic Physics I	3	
5	MKK-1101	General Chemistry I	3	
6	MII-1201	Programming	3	
7	MII-1202	Programming Laboratory	1	
8	UNU-100x	Religion	2	
9	UNU-1010	Pancasila	2	
			22	
Semester II				
1	MMM-1102	Calculus II	3	MMM-1101*
2	MMS-1414	Data Exploration and Visualization	3(1)	MMS-1411*, MMS-1413*
3	MMS -1415	Matrix Algebra	2	
4	MMS-1481	Discrete Mathematics and Combinatorics	2	
5	MMS -1419	English	3	
6	MMS-1416	Data Base	3(1)	
7	MMS -1417	Applied Regression Analysis	3(1)	MMS-1411*, MMS-1413*
8	MMS-1418	Probability and Stochastic Processes	3	
			22	
Semester III				
1	MMS-2429	Survey Sampling Methods	3	MMS-1411*, MMS-1413*
2	MMS-2428	Calculus of Multivariables for Statistics	2	MMM-1102*
3	MMM-2301	Elementary Differential Equations	3	MMM-1102*
4	MMS -2430	Introduction to Experimental Design	2	MMS-1411*, MMS-1413*
5	MMS -2420	Introduction to Mathematical Statistics I	3	MMM-1102*
6	MMS-2422	Statistical Computation I	3(1)	
7	MMM-2111	Advanced Calculus	2	MMM-1102*
8	MMS-2432	Applied Multivariate Statistics	3(1)	MMS-2420***
			21	
Semester IV				
1	MMS -2483	Introduction to Mathematical Statistics II	3	MMS-2420*
2	MMS-2431	Official Statistics	2	
3	MMS-2433	Introduction to Data Science	2	MMS-2432*

No	Course Code	Course Name	Credit	Prerequisite
4	MMS-2434	Statistical Computation II	3(1)	MMS-2422*
5	MMS-2435	Introduction to Data Mining	3(1)	
			13	
Semester V				
1	MMS-3436	Practical Work	3	≥ 80 SKS
2	MMS-3446	Introduction to Measurement and Probability Theory	2	MMM-1102*
3	UNU-3000	Civic	2	
4	MMS-3429	Introduction to Time Series	3(1)	MMS-2420*
			10	
Semester VI				
1	UNU-4500	Community Development Participation	3	≥ 80 SKS
Semester VII, VIII				
1	MMS-4437	Final Assignment I	3	≥ 120 SKS
2	MMS-4438	Final Assignment II	6	Final Assignment I"
			12	
			100	

Table 7. List of Elective Courses for the UP-Stat

No	Course Code	Course Name	Credit	Prerequisite
Odd Semester				
1	MMS-3439	Introduction to Queueing and Simulation Theory	3(1)	MMS-1418*
2	MMS-3424	Quantitative Risk Management	3	MMS-2420*
3	MMS-3441	Biostatistics and Epidemiology	4(1)	MMS-1411*, MMS-1413*
4	MMS-4415	Introduction to Response Surface	3	MMS-2430
5	MMS-4449	Capita Selecta in Statistics A	3	MMS-2483*
6	MMS-4416	Introduction to Analysis of Panel Data	3	MMS-2420*
7	MMS-4421	Introduction to Decision Theory	3	MMS-1411*, MMS-1413*
8	MMS-3433	Introduction to Investment Management	3	MMA-1502*

No	Course Code	Course Name	Credit	Prerequisite
Odd Semester				
9	MMA-2505	Generalized Linear Model	3	MMS-1417*
10	MMA-1502	Introduction to Financial Mathematics I	3	
11	MMA-2502	Introduction to Financial Mathematics I	3	
12	MMM - 2312	Linear Programming	3(1)	MMS-1415*
Even Semester				
1	MMS-2424	Applied Analysis of Variance	3(1)	MMS-1411*, MMS-1413*
2	MMS-2415	Demography	3	MMS-1411*, MMS-1413*
3	MMS-2425	Statistical Quality Control	3(1)	MMS-1411*, MMS-1413*
4	MMS-2426	Categorical Data Analysis	3(1)	MMS-1411*, MMS-1413*
5	MMS-2427	Forecasting Methods	3(1)	MMS-1411*, MMS-1413*
6	MMS-3431	Nonparametric Statistical Methods	3	MMS-1411*, MMS-1413*
7	MMS-3443	Survival Data Analysis	3(1)	MMS-1411*, MMS-1413*
8	MMS-3435	Structural Equation Modelling	3	MMS-2432*, MMS-1413*
9	MMS-3445	Introduction to Econometrics	3(1)	MMS-1411*, MMS-1413*
10	MMS-3448	Statistical Machine Learning	3	MMS-2435*
11	MMS-4423	Capita Selecta in Statistics B	3	
12	MMA-1503	Introduction to Financial Mathematics I	3	MMA-1502*
13	MMA-2504	Introduction to Financial Mathematics II	3	MMA-2502*
14	MMM-2313	Operation Research A	3(1)	MMM-2312*

B-CS

According to SAR the following **objectives** (program education objectives, PEOs) and program **learning outcomes (PLOs, intended qualifications profile)** shall be achieved by the bachelor program "Computer Science":

PEO 1	International standard education that contains innovative, soft skills, and knowledge of the latest technology to produce graduates who are competitive, innovative, responsible and have high confidence.
PEO 2	Environmentally sound research that becomes a national and international reference and can provide solutions to the nation's problems based on the wealth of human and natural resources as well as local wisdom by involving stakeholders.
PEO 3	Community service based on science, appropriate technology, and advocacy that is able to encourage self-reliance and community welfare in a sustainable

	manner and make campus a vehicle for developing science and technology innovation for the community.
PEO 4	The development of human resources, organizations and governance that are professional, fair, transparent, and able to work together to support the implementation of a learning process that is adaptive to Industry 4.0.

PLO 1	Attitudes and Values Student possess a set of universal and fundamental values and principles: universal ethics, patriotism and world peace, social and environmental sensitivity, pluralism and fair play, and rule of law.
PLO 2	Foundational and theoretical knowledge Student master the foundational knowledge and theoretical concepts of the field of computer science, which include mathematics, logic, algorithms, computing, languages, data structures, programming, computer systems and networks, data processing, software, intelligent systems, and numerical analysis.
PLO 3	Applied knowledge Student master the applied concepts of computer science, which include modelling and optimization methods, efficient cloud infrastructure provision and management, data extraction and analysis, software deployment for algorithm development and intelligent computing systems.
PLO 4	Problem solving skills Student are able to apply the basic, theoretical, and applied knowledge that has been acquired, as well as adapt state-of-the-art developments through independent and group research to find constructive solutions to problems encountered in the form of systems or products.
PLO 5	Professional attitudes Graduates have good interpersonal, communication and learner skills. Specifically, graduates are able to work together in teams and have a sense of responsibility for their own work and can be assigned tasks to support the achievement of team work results; able to communicate with stakeholders from various backgrounds, use English, and write scientific papers according to the right rules;

have the skills to keep up with state-of-the-art developments in the field of computer science in particular and to deepen previously acquired knowledge in the context of lifelong learning.

The following **curriculum** is presented:

Table 3.33 Semester Courses Composition

Sem	No	Kode	Mata Kuliah	Courses	SKS	Prasyarat
1	1	MII21-1201	Pemrograman	Programming	3	-
	2	MII21-1202	Praktikum Pemrograman	Lab work in Programming	1	-
	3	MII21-1002	Logika Informatika	Logic for Computer Science	2	-
	4	MII21-1001	Aljabar Linier Fundamental	Elementary Linear Algebra	2	-
	5	MMM-1101	Kalkulus 1	Calculus 1	3	-
	6	MKK-1101	Kimia Dasar 1	Basic Chemistry 1	3	-
	7	MFF-1011	Fisika Dasar 1	Basic Physics 1	3	-
	8	MII21-1003	Bahasa Indonesia dan Etika Ilmiah	Scientific Writing and Ethics	2	-
	9	UNU-100x	Agama	Religion	2	-
			Jumlah		21	
2	1	MII21-1203	Algoritma dan Struktur Data	Algorithms and Data Structures	3	Pemrograman (1)
	2	MII21-1004	Bahasa Inggris	English	2	-
	3	MII21-1005	Integral dan Persamaan Diferensial	Integral and Differential Equations	3	Kalkulus 1 (1)
	4	MII21-1006	Matematika Diskrit	Discrete Mathematics	3	-
	5	MII21-1601	Organisasi dan Arsitektur Komputer	Organization and Computer Architecture	2	-
	6	MII21-1007	Pengantar Statistika	Introduction to Statistics	2	Kalkulus 1 (1)
	7	MII21-1204	Praktikum Algoritma dan Struktur Data	Lab work in Algorithms and Data Structures	1	Algoritma dan Struktur Data(2)
	8	MII21-1602	Sistem Digital	Digital Systems	2	-
	9	UNU-1010	Pancasila	Pancasila	2	-
			Jumlah		20	
3	1	MII21-2201	Analisis Algoritma dan Kompleksitas	Analysis of Algorithm and Complexity	3	Matematika Diskrit(2) , Algoritma dan Struktur Data (2)
	2	MII21-2501	Basis Data	Database	3	Matematika Diskrit (2)
	3	MII21-2601	Jaringan Komputer	Computer Network	2	Matematika Diskrit (2)
	4	MII21-2401	Kecerdasan Artifisial	Artificial Intelligence	3	Logika Informatika (1)
	5	MII21-2502	Praktikum Basis Data	Database Lab work	1	Basis Data (3)*
	6	MII21-2603	Praktikum Sistem Komputer dan Jaringan	Computer System and Network Lab work	1	Sistem Operasi (3)*, Jaringan Komputer (3)*
	7	MII21-2001	Probabilitas dan Proses Stokastika	Probability and Stochastic Processes	2	Matematika Diskrit (2)
	8	MII21-2602	Sistem Operasi	Operating Systems	2	Organisasi dan Arsitektur Komputer (2)
	9	UNU-3000	Kewarganegaraan	Citizenship	2	-
			Jumlah		19	
4	1	MII21-2002	Filsafat Ilmu Komputer	Philosophy of Computer Science	1	50 SKS
	2	MII21-2003	Pengembangan Startup Digital	Startup Digital Development	2	-
	3	MII21-2503	Metode Rekayasa Perangkat Lunak	Software Engineering Methods	2	Basis Data (3)
	4	MII21-2504	Workshop Implementasi Rancangan Perangkat Lunak	Workshop on Implementing Software Design	2	Metode Rekayasa Perangkat Lunak (4)*, Algoritma dan Struktur Data (2)
	5	MII21-2402	Pembelajaran Mesin	Machine Learning	3	Kecerdasan Artifisial (3)
	6	MII21-2202	Bahasa dan Otomata	Languages dan Automata	3	Logika Informatika (1) Matematika Diskrit (2)*
	7	MII21-2203	Metode Numerik	Numerical Methods	2	Integral dan PDE (2)*, Aljabar Linier Fundamental (1)
	8	MII21-2209	Kriptografi dan Keamanan Informasi	Cryptography and Network Security	3	Matematika Diskrit (2)

Semester	No	Code	Mata Kuliah	Course	SKS	Prasyarat
	9		Mata Kuliah Pilihan / MBKM	Elective Courses / MBKM	3	
			Jumlah		21	
5	1	MII21-3001	Kelas Seminar	Seminar Class	1	Metodologi Penelitian Ilmu Komputer (5)*
	2	MII21-3002	Metodologi Penelitian Ilmu Komputer	Research Method of Computer Science	2	70 SKS
	3	MII21-3401	Pembelajaran Mesin Mendalam	Deep Learning	3	Pembelajaran Mesin (4)
	4	MII21-3501	Proyek Rekayasa Perangkat Lunak	Software Engineering Project	3	Workshop Implementasi Rancangan Perangkat Lunak (4)
	5		Mata Kuliah Pilihan / MBKM	Elective Courses / MBKM	12	
			Jumlah		21	
6	1	UNU-4500	KKN (Kuliah Kerja Nyata)	Community Service Program	3	100 SKS
	2		Mata Kuliah Pilihan / MBKM	Elective Courses / MBKM	18	
			Jumlah		21	
7	1	MII21-4001	Proposal Skripsi	Undergraduate Thesis Proposal	2	Seminar (5)*
	2		Mata Kuliah Pilihan / MBKM	Elective Courses / MBKM	13	
			Jumlah		15	
8	1	MII21-4002	Skripsi	Undergraduate Thesis	6	Proposal Skripsi (7)*
			Jumlah		6	
			Total		144	

Table 3.34 List of Elective Courses of the Computer Science Study Program

Kelompok	Sem	No	Kode	Mata Kuliah	Course	SKS	Prasyarat
Algorithms and Computations Lab	3	1	MII21-2204	Pengolahan Citra Digital	Digital Image Processing	3	Algoritma dan Struktur Data (2)
	3,5	2	MII21-3208	Computational Thinking	Computational Thinking	2	
	4	3	MII21-2205	Grafika Komputer	Computer Graphics	3	Integral dan Persamaan Diferensial (2)
		4	MII21-2206	Penglihatan Komputer dan Analisis Citra	Computer Vision and Image Analysis	3	Pengolahan Citra Digital (3), Pembelajaran Mesin(4)*
	5	5	MII21-3201	Metode Optimasi	Optimization Methods	3	Metode Numerik (4)
		6	MII21-3202	Sains Manajemen	Management Science	3	Metode Numerik (4)
		7	MII21-3203	Simulasi Sains	Science Simulation	3	Probabilitas dan Proses Stokastik (3)
	5,7	8	MII21-3204	Tren Penelitian Algoritma dan Komputasi	Research Trends in Algorithm and Computation	3	Analisis Algoritma dan Kompleksitas (3)
	6	9	MII21-3206	Algoritma Terdistribusi dan Pemrograman Paralel	Distributed Algorithm and Parallel Programming	3	60 SKS
		10	MII21-3207	Verifikasi Formal	Formal Verification	3	Bahasa dan Otomata (4)*
	Gasal Genap	11	MII21-3205	Kapita Selekta Algoritma dan Komputasi	Special Topic on Algorithm and Computation	3	60 SKS
Intelligent System Lab	3	1	MII21-2410	Tren Penelitian Sistem Cerdas	Research Trends on Artificial Intelligence	2	Kecerdasan Artifisial (3)*
	4	2	MII21-2404	Logika Fuzzy	Fuzzy Logic	3	Logika Informatika (1)
		3	MII21-2405	Pengenalan Pola	Pattern Recognition	3	Kecerdasan Artifisial (3), Pembelajaran Mesin (4)*
	5	4	MII21-3402	Algoritma Genetika	Genetic Algorithm	3	Pengantar Statistika (2), Algoritma dan Struktur Data (2)
		5	MII21-3403	Bioinformatika	Bioinformatics	3	Kecerdasan Artifisial (3)
		6	MII21-3404	Pemrosesan Bahasa Alami	Natural Language Processing	3	Pembelajaran Mesin (4)
	6	7	MII21-3405	Sistem Pakar	Expert Systems	3	Kecerdasan Artifisial (Semester 3)
		8	MII21-3406	Sistem Pendukung Keputusan	Decision Support Systems	3	Pemrograman (1)
		9	MII21-3407	Kapita Selekta Sistem Cerdas	Special Topic on Intelligent Systems	3	Kecerdasan Artifisial (Semester 3)
Data and Software Engineering Lab	3	1	MII21-2505	Pengembangan UI/UX & Front-end	Frontend and UI/UX development	3	Algoritma dan Struktur Data (2)
	4	2	MII21-2506	Pengembangan Perangkat Lunak Scalable	Scalable Software Development	3	Jaringan Komputer (3), Metode Rekayasa Perangkat Lunak (4)*
		3	MII21-3512	Pengembangan Aplikasi Mobile	Mobile Application Development	3	Algoritma dan Struktur Data (2)
	5	4	MII21-3502	Web Semantik	Semantic Web	3	-
		5	MII21-3503	Temu Kembali Informasi	Information Retrieval System	3	Basis Data (3)
		6	MII21-3504	Pengantar Penjaminan Kualitas Perangkat Lunak	Introduction to Software Quality Assurance	3	Metode Rekayasa Perangkat Lunak (4)
		7	MII21-3510	Tren Penelitian Rekayasa Perangkat Lunak dan Data	Research Trends in Software and Data Engineering	3	60 SKS
	6	8	MII21-3505	Audit dan Forensik Digital	Audit and Digital Forensic	3	Metode Rekayasa Perangkat Lunak (4)*
		9	MII21-3506	Manajemen Proyek Teknologi Informasi	Information Technology Project Management	3	Metode Rekayasa Perangkat Lunak (4)*
		9	MII21-3507	Analisis Big Data	Big Data Analytics	3	Basis Data (3)
		10	MII21-3508	Penambangan Data	Data Mining	3	Pembelajaran Mesin (5)
		11	MII21-3511	Pemodelan Jaringan Komunitas Digital	Digital Society Network Modelling	3	Algoritma dan Struktur Data (2)
		12	MII21-3509	Kapita Selekta Lab. RPLD	Special Topic on Software Engineering and Data	3	Metode Rekayasa Perangkat Lunak (4)
Computer and Networks	3,5,7	1	MII21-2605	Perkembangan Terbaru Penelitian Sistem Komputer dan Jaringan	Computer Systems and Network Research Trends	3	-
		2	MII21-2606	Internet of Things dan Aplikasinya	Internet of Things and Applications	3	-

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		Code	Course Name (ID)	Course Name (EN)	Credits	Prerequisite
Systems Lab	3	MII21-2607	Arsitektur dan Teknologi Data Besar	Big Data Architecture and Infrastructure	3	Basis Data (3)
4,6	4	MII21-2608	Kapita Selekta Sistem Komputer dan Jaringan	Special Topic on Computer and Network Systems	3	-
	5	MII21-2609	Pengembangan Pusat Komputasi Data	Development of Computing Data Centre	3	Organisasi dan Arsitektur Komputer (2), Sistem Pengoperasioan (3)
	6	MII21-2610	Komputasi Awan	Cloud Computing	3	Jaringan Komputer (3)
	7	MII21-2611	Telekomunikasi Generasi Lanjut	Next Generation Networks	3	Sistem Digital (2)*
5,7	8	MII21-3601	Arsitektur dan Infrastruktur Berkinerja Tinggi	High Performance Architecture and Infrastructure	3	Organisasi dan Arsitektur Komputer (2), Sistem Pengoperasioan (3)*
	9	MII21-3602	Keamanan Sistem dan Siber	Cyber System Security	3	Kriptografi dan Keamanan Informasi (4)
	10	MII21-3603	Lingkungan Cerdas dan Intelijen	Smart and Intelligent Environment	3	-
	11	MII21-3608	Pengantar Blockchain	Introduction to Blockchain	3	Kriptografi dan Keamanan Informasi (4)
MBKM Activities	1	MII21-3010	Internship: Spesifikasi Masalah dan Deskripsi Prototipe **	Internship: Prolem Specification and Prototype Description **	2	-
	2	MII21-3011	Internship: Pengembangan Fitur dan Modul Proyek **	Internship: Development of Project Features and Modules **	4	-
	3	MII21-3012	Internship: Sampel dan Definisi Dataset Produk	Internship: Sample and Definition of Internship Dataset	2	-
	4	MII21-3013	Internship: Implementasi Prototipe Produk**	Internship: Implementation of Product Prototype**	4	-
	5	MII21-3014	Internship: Pengembangan Back-end	Internship: Development of Back-end	4	-
	6	MII21-3015	Internship: Pengujian Unit dan Modul Proyek	Internship: Testing of Project Units & Modules	3	-
	7	MII21-3016	Internship: Pengujian Integrasi dan Sistem	Internship: System and Integrating Testing	3	-
	8	MII21-3017	Industri Kreatif dan Game Digital	Creative Industry and Digital Game	4	Pemrograman
	9	MII21-3020	Asistensi Mengajar: Proposal Tutorial Tren Pengetahuan Digital **	Teaching Assistant: Proposal of Digital Knowledge Trends **	2	-
	10	MII21-3021	Asistensi Mengajar: Rancangan Tutorial Modul Digital Interatif **	Teaching Assistant: Design Tutorial of Interactive Digital Modules **	5	-
	11	MII21-3022	Asistensi Mengajar: Asistensi Transfer Tren Pengetahuan Digital **	Teaching Assistant: Assistance Transfered of Digital Knowlegde Trend **	5	-
	12	MII21-3023	Asistensi Mengajar: Kelas Seminar Transformasi Pengetahuan Digital **	Teaching Assistant: Seminar Class of Digital Knowledge Transformation **	2	-
	13	MII21-3030	Proyek Independen: Spesifikasi Proyek Independen **	Independent Project: Specification of Independent Project **	2	-
	14	MII21-3031	Proyek Independen: Proposal Proyek Independen **	Independent Project: Proposal of Independent Project **	3	-
	15	MII21-3032	Proyek Independen: Sampel dan Definisi Dataset Proyek	Independent Project: Sample and Definition of Dataset Project	2	-
	16	MII21-3033	Proyek Independen: Implementasi Proyek Independen **	Independent Project: Implementation of Independent Project **	4	-
	17	MII21-3034	Proyek Independen: Kelas Seminar Proyek Independen **	Independent Project: Seminar Class of Independen Project **	3	-
	18	MII21-3040	Riset: Spesifikasi Riset Inovasi Mahasiswa **	Research: Specification of Student Innovation Research **	2	-
	19	MII21-3041	Riset: Proposal Riset Inovasi Mahasiswa **	Research: Proposal of Student Inovation Research **	3	-

No	Code	Name (Indonesian)	Name (English)	Credits	Notes
20	MII21-3042	Riset: Sampel dan Definisi Dataset Penelitian	Research: Sample and Definition Dataset Research	2	-
21	MII21-3043	Riset: Implementasi Riset Inovasi Mahasiswa **	Research: Implementation of Student Inovation Research **	4	-
22	MII21-3044	Riset: Kelas Seminar Riset Internship **	Research: Review of Intership Research **	3	-
23	MII21-3045	Poster Ilmiah Bidang Ilmu Komputer	Scholarly Poster in Computer Science	1	Diambil bersamaan dengan Mata kuliah Tugas Akhir skripsi, atau mata kuliah pilihan MBKM
22	MII21-3046	Publikasi Akademik Bidang Ilmu Komputer	Academic Publication in Computer Science	2	Diambil bersamaan dengan Mata kuliah Tugas Akhir skripsi, atau mata kuliah pilihan MBKM Penelitian
25	MII21-3047	Publikasi Ilmiah Bereputasi International	International Reputed Scientific Publication	3	Diambil bersamaan dengan Mata kuliah Tugas Akhir skripsi, atau mata kuliah pilihan MBKM Penelitian
26	MII21-3050	Desa Binaan: Spesifikasi Proyek Inovasi Urban **	Village Project: Specification of Urban Inovation Project **	2	-
27	MII21-3051	Desa Binaan: Proposal Proyek Inovasi Urban **	Village Project: Proposal of Urban Inovation Project **	3	-
28	MII21-3052	Desa Binaan: Implementasi Proyek Inovasi Urban **	Village Project: Implementation of Urban Inovation Project **	6	-
29	MII21-3053	Desa Binaan: Kelas Seminar Proyek Inovasi Urban **	Village Project: Seminar Class of Urban Inovation Project **	3	-
30	MII21-3060	Kewirausahaan: Proposal Rencana Bisnis & Startup **	Enterpreunership: Proposal of Bussiness Plan & Startup **	3	-
31	MII21-3061	Kewirausahaan: Modul Desain Produk dan Jasa Startup	Enterpreunership: Specification of Product and Service	3	-
32	MII21-3062	Kewirausahaan: Modul Prototipe Produk Inovatif	Enterpreunership: Module of Innovative Product Prototype	3	-
33	MII21-3063	Kewirausahaan: Modul Anggaran dan Keuangan Startup	Enterpreunership: Module of Startup Financial and Budgeting	4	-
34	MII21-3064	Kewirausahaan: Modul Laporan Keuangan Startup	Enterpreunership: Module of Startup Financial Report	4	-
35	MII21-3065	Kewirausahaan: Modul Pemasaran dan Penjualan Usaha	Enterpreunership: Module of Digital Marketing and Payment	4	-
36	MII21-3066	Kewirausahaan: Modul Laporan Pemasaran & Analisis	Enterpreunership: Module of Marketing Analytics and Report	4	-
37	MII21-3067	Kewirausahaan: Modul Peran dan Manajemen Super Tim	Enterpreunership: Module of Oustanding Team Management	4	-
38	MII21-3068	Kewirausahaan: Modul Kepemilikan dan Badan Hukum	Enterpreunership: Module of Ownership and Legal Entity	4	-
39	MII21-3069	Kewirausahaan: Modul Etika dan Aspek Legal dalam Bisnis	Enterpreunership: Module of Ethics and Legal Aspects in Business	4	-
40	MII21-3070	Proyek Kemanusiaan: Tutorial Tanggap Darurat Kebencanaan	Humanity Project: Preparedness and Quick Disaster Response	2	-
41	MII21-3071	Proyek Kemanusiaan: Tutorial Pemulihan Kebencanaan	Humanity Project: Disaster Recovery Management	2	-
42	MII21-3072	Proyek Kemanusiaan: Tutorial Manajemen Posko & Logistik	Humanity Project: Tutorial Command Posts & Logistic Management	2	-

Category	Sem	No	Code	Nama (Indonesia)	Name (English)	SKS	
		43	MII21-3073	Proyek Kemanusiaan: Modul Digital Penanggulangan Bencana	Humanity Project: A Digital Module of Disaster Management	2	-
			MII21-3074	Proyek Kemanusiaan: Proposal Proyek Kemanusiaan **	Humanity Project: Proposal of Volunteer Project **	2	-
			MII21-3075	Proyek Kemanusiaan: Implementasi Proyek Kemanusian **	Humanity Project: Implementatio of Volunteer Project **	5	-
			MII21-3076	Proyek Kemanusiaan: Kelas Seminar Proyek Kemanusian **	Humanity Project: Seminar Class of Volunteer Project **	3	-
MBKM Softskill	Gasal	1	MII21-4010	Softskill: Kemampuan Berkomunikasi	Good Communcation Training	2	-
	Genap	2	MII21-4011	Softskill: Kemampuan Kepemimpinan	Leadership Training	2	-
		3	MII21-4012	Softskill: Kemampuan Bekerjasama dan Kolaborasi	Teamwork Training	2	-
		4	MII21-4013	Softskill: Etos Kerja & Integritas	Strong Work Ethic & Integrity Training	2	-
		5	MII21-4014	Softskill: Emosional dan Empati	Emosional and Empathy Training	2	-
		6	MII21-4015	Softskill: Berpikir Kritis, Inovatif, dan Strategis	Critical Inovative and Strategic Thinking Training	2	-
		7	MII21-4016	Softskill: Adaptasi	Adaptability Training	2	-
		8	MII21-4017	Softskill: Public Speaking	Public Speaking Training	2	-
		9	MII21-4018	Softskill: Membangun Jaringan Kerjasama	Networking and Partnership Training	2	-
		10	MII21-4019	Softskill: Negosiasi dan Resolusi Konflik	Negotiation and Conflict Resolution Training	2	-
		11	MII21-4020	Softskill: Kemampuan Motivasi Diri Sendiri	Self-Motivated Training	2	-
		12	MII21-4021	Softskill: Multitasking dan Pengelolaan Aktivitas	Well Organized and Multitasking Training	2	-
		13	MII21-4022	Softskill: Kemampuan Berkompetisi Secara Sehat	Competitive and Enthusiastic Training	2	-
MBKM Hardskill	Gasal	1	MII21-4030	Hardskill: Manajemen Waktu dan Penjadwalan	Time Management Training	2	-
	Genap	2	MII21-4031	Hardskill: Majemen Perencanaan Produk	Planning Training	2	-
		3	MII21-4032	Hardskill: Pemecahan Masalah	Problem Solver Training	2	-
		4	MII21-4033	Hardskill: Pengelolaan Anggaran Organisasi	Budgeting Training	2	-
		5	MII21-4034	Hardskill: Manajemen Risiko	Risk Management Training	2	-

According to webpage the following **objectives** (program education objectives, PEOs) and program **learning outcomes (PLOs, intended qualifications profile)** shall be achieved by the doctoral program "Computer Science":

PEO 1	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication, and able as well as reliable to adapt, both as development agents, managers of information system and technology, as well as in the development of computer science, as well as possessing high academic abilities.
PEO 2	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication, and can carry out and develop research that produces new theories, concepts, and methods in the field of computer science.
PEO 3	Doctors in computer science who are devoted to God Almighty, have the spirit of Pancasila, understand the values of UGM, have both integrity and dedication, and can serve as a teaching staff in related master and doctoral programmes.

PLO 1	A graduate should be devoted to God Almighty, uphold the humanity values, internalize academic values and ethics, responsible in working around expertise independently.
PLO 2	A graduate should be up to date with the state-of-the-art especially in computer science field, able to take parts in the development of computer science field that is engaged in and relate it to other fields throughout life; work together within the organization, both as a leader and a member; communicate effectively and efficiently with stakeholders from various backgrounds; use English well.
PLO 3	A graduate should be able to formulate research problems through critical, exploratory, and innovative studies both independently and in groups of computer science field; analyse science and technology problems in the computer science field, develop alternative solutions through intra disciplinary, interdisciplinary, and trans disciplinary approaches to produce innovative, original, and tested works that is engaged in, and present research results in a scientific paper at regional or international level.

PLO 4	A graduate should be able to develop knowledge in the field of computer science that is engaged, which includes abstraction, complexity, evolution and philosophy of changes or developments in the field of science; develop theoretical, philosophical, and applied concepts in the field of computer science that is engaged in, and to represent them in a structured and systematic manner.

The following **curriculum** is presented:

Table 3.6 Category of Courses in the Doctoral Program in Computer Science (Regular)

No	Courses Category	Credits
1	Dissertation	34
2	Compulsory	6
3	Elective	a minimum of 6

Table 3.7 Compulsory Courses

No	Code	Course	Credits
1	MII7000	Research Methodology	3
2	MII7020	Research Trends in Computer Science	3
3	MII7099	Dissertation	34

Table 3.8 Elective Courses in the Doctoral Program in Computer Science (Regular)

No	Code	Course Name	Research Lab	Credits
1	MII7050	Capita Selecta (Special Topics)		3
2	MII7225	Formal Methods	AK	3
3	MII7235	Advanced Statistics	AK	3
4	MII7245	Digital Image Processing	AK	3
5	MII7255	Advanced Computing	AK	3
6	MII7265	Cryptology	AK	3
7	MII7270	Numerical Analysis	AK	3

8	MII7271	Parallel Computing	AK	3
9	MII7425	Artificial Intelligence	SC	3
10	MII7435	Uncertainty	SC	3
11	MII7445	Advanced Decision Support Systems	SC	3
12	MII7455	Computational Intelligence	SC	3
13	MII7465	Natural Language Processing	SC	3
14	MII7520	Data Mining	RPLD	3
15	MII7530	Mobile and Cloud Computing	RPLD	3
16	MII7540	Database Systems	RPLD	3
17	MII7550	Information and Knowledge Management	RPLD	3
18	MII7560	Software Engineering	RPLD	3
19	MII7570	Information Retrieval	RPLD	3
20	MII7625	Advanced Computer Networks	SKJ	3
21	MII7635	Advanced Network Security	SKJ	3
22	MII7645	Embedded Systems	SKJ	3
23	MII7655	Distributed Systems	SKJ	3
24	MII7665	Web Technology	SKJ	3
25	MII7825	Sensor Networks	Elins	3
26	MII7835	Feedback Control Computing Systems	Elins	3
27	MII7845	Pattern Recognition	Elins	3
28	MII7855	Real Time Systems	Elins	3
29	MII7865	Computer Vision	Elins	3