ASIIN Seal

Accreditation Report

Bachelor Degree Programmes
Mathematics
Statistics
Computer Science

Provided by
Universitas Gadjah Mada, Yogyakarta

Version: March 29, 2019

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Program Studi S1 Ilmu Komputer	Undergraduate Programme Computer Science	ASIIN	-	04
Program Studi S1 Matematika	Undergraduate Programme in Mathematics	ASIIN	-	12
Program Studi S1 Statistika	Undergraduate Programme in Statistics	ASIIN		12
Date of the contract: 24.02.2017 **Submission of the final version of the self-assessment report:** 29.09.2017 **Date of the onsite visit:** 20.11. – 21.11.2017 **at:** Yogyakarta, Indonesia				
Peer panel: Prof. Dr. Martin Buhmann, Justus-Liebig-Universität Gießen Prof. Dr. H. Peter Gumm, Philipps-Universität Marburg Konrad Roßrucker, IT consultant, previously NTT DATA Germany Prof. Dr. Christoph Schelthoff, FH Aachen University of Applied Sciences Prof. Dr. Helena Szczerbicka, Leibniz Universität Hannover Radhy Muhammad Ampera, Student of Information Systems at Brawijaya University				
Representative of the ASIIN headquarter:				

[1] ASIIN Seal for degree programmes;
[2] TC: Technical Committee for the following subject areas: TC 04 – Informatics/Computer Science; TC 12 – Mathematics

Dr. Iring Wasser, ASIIN office
Responsible decision-making committee: Accreditation Commission for Degree Programmes
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria as of 28.03.2014 Subject-Specific Criteria of Technical Committee 04 – Informatics/Computer Science as of 09.11.2011 Subject-Specific Criteria of Technical Committee 12 – Mathematics as of 01.12.2016

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Undergraduate Programme in Computer Science	(S.Kom) / Bachelor in Computer Science	-	6	Full time	no	8 Semester	144 credits (240 ECTS)	1987
Undergraduate Programme Mathematics	Sarjana Sains (S.Si) / Bachelor of Science	Pure and Applied Mathematics	6	Full time	no	8 Semester	144 credits (240 ECTS)	Annual/September 15th, 1955.
Undergraduate Programme in Statistics	Sarjana Sains (S.Si) / Bachelor of Science		6	Full time	no	8 Semester	144 credits (240 ECTS)	August 1987

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

For the Bachelor degree programme Computer Science Universitas Gadjah Mada UGM has presented the following profile in the Self-Assessment Report:

„The vision of the UP-CS is to be a nationally leading and excellent programme in conducting education, research and community services, especially in the field of computer science and information technology." In order to achieve its vision, the UP-CS has a mission "to improve the quality of academic staffs, students and graduates in fundamental research and its applications that support the development of computer science as well as information technology for national and human being prosperity, and to consistently commit to the "Tri Dharma Penguruan Tinggi" (i.e. education, research and community services)."

For the Bachelor degree programme Mathematics the faculty of mathematics and natural sciences has presented the following mission in the Self-Assessment Report: the program aspires "to develop learning activities through new innovations to improve the quality, efficiency and relevance of mathematics learning, to develop a research culture in groups of expertise to support mathematical research and its applications, to develop the role and applications of mathematics in various fields, to make a mutually beneficial cooperation between the UP-Math and mathematics users and finally to provide a study programme that has a credible, transparent, accountable, responsible and fair management system."

For the Bachelor degree programme Statistics, the department of computer science and electronics has formulated the vision "to be an outstanding programme that is well recognized internationally and leading nationally in statistics education, produces competent graduates with high capability in their field, disposing of information technology literacy, entrepreneurial spirit and competitiveness both in national and international level around the year of 2025. Its mission is "to develop an up-to-date learning process in order to increase its quality of the learning process, to develop the quality and quantity of research and publications, to increase the learning process and research cooperation between UP-Stat and its colleagues national as well as internationally and finally to increase education, research, training, and consultation services in statistics and its application".

C Peer Report for the ASIIN Seal

1. Degree Programme: Concept, content & implementation

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

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Webpage Ba Computer Science: http://dcse.fmipa.ugm.ac.id/site/en/program-educational-objectives-2/
- Webpage Ba Mathematics: https://s1math.fmipa.ugm.ac.id/en/programme-educational-objective/
- Webpage Ba Statistics: http://s1stat.fmipa.ugm.ac.id/english-plo/

Preliminary assessment and analysis of the peers:
The peers refer to the Subject-Specific Criteria (SSC) of the Technical Committee Informatics/Computer Science as a basis for judging whether the intended learning outcomes of the Bachelor degree programmes Computer Science, as defined by UGM, correspond with the competences as outlined by the SSC. Similarly, they analyse if the intended learning outcomes of the Bachelor degree programmes in Mathematics as well as Statistics match with the SSC of the Technical Committee Mathematics.

According to the Self-Assessment report, the graduates of the Bachelor degree programme Computer Science upon graduation have acquired the following knowledge, skills and competences:

They have at their disposal fundamental knowledge in computer sciences including relevant topics from mathematics, logics, electronics and natural sciences. They equally master theoretical concepts in the field, which includes those related to algorithms, computation, formal languages, data structures, programming, computer systems, data processing, software, ethics, and are prepared for lifelong learning. In terms of job profiles more than one

fifth of all graduates are creating their own start up, the majority working in private service companies but some also assuming careers in government.

The Programme Learning Outcomes (PLOs) of the Bachelor of Mathematics programme have been formulated as follows: after completing the programme, successful graduates are able to recognize mathematics-related problems, assess their solvability and solve them within a specified time frame. They command logical and mathematical thinking abilities, formulate mathematical hypotheses and have an understanding of how such hypotheses can be verified or falsified using mathematical methods. They have sufficient knowledge in information technology and have comprehensive knowledge in mathematical modelling. They are able to create mathematical models, both in mathematics, in related fields and while facing real life problems. They have generalization and abstraction abilities and are able to recognize analogies and basic patterns. They are able to communicate in mathematical language, orally and in writing. They operate with responsibility, confidence, emotional maturity, ethics, and can engage in lifelong learning. They have the ability to apply their mathematics ability in their carrier and to continue their studies in master and doctoral programmes. They are prepared for occupations in the information and technology sector, in marketing as well as in the banking and finance sector. About one fourth continues studying in a Master programme.

As to the graduates of the Bachelor degree programme Statistics, they are able to master theoretical concepts and methods of statistics. They are able to develop statistics for the utilization and development of science and technology, apply statistics to education, research and community services. They are able to make the right decisions based on analysis of statistics, have experience in working on real cases in the field of statistic and a good ability to communicate statistics in writing and orally. They dispose of the ability for further studies and/or lifelong learning and demonstrate professional ethics and soft skills. They are prepared to work in various fields such as the Banking and Finance Sector, as actuaries or have positions in higher education institutions, research centres, engage in financial and statistical consultancy etc.

Concerning the ***process of developing and updating the Learning Outcomes*** for all three programs, there is on the one hand an annual internal quality audit (AMI), where continuous adaptations are being implemented, and on the other hand an external revision every five years (in addition to the external accreditation procedures conducted by BAN-PT). This review has taken place for all programs in the year 2016.

The peers learn that a team of lecturers of the faculty reviews the objectives and intended learning outcomes of the degree programs. During this process, the feedback of employers and former alumni is collected and the results of tracer studies are analysed. This feedback

has subsequently led to a revision of certain learning outcomes and to a considerable number of changes in the corresponding three curricula that are further analysed in subsequent parts of this report.

Overall, the peers concluded that there is a formal process in place to update and modernise existing curricula. There nevertheless remains room for improvement to further systematize communication channels with major stakeholder groups.

Regarding the preparation of graduates of all three programs for the labour market: in the discussions with business representatives during the audit it was confirmed that graduates are well prepared for qualified employment. The business representatives emphasised that UGM graduates are ready to take on demanding work positions. The peers appreciate that the intended qualification profiles allow the graduates to take up an occupation which corresponds to their qualification in a comparatively short period of time.

In summary, the auditors come to the conclusion that the objectives and intended learning outcomes of all three Bachelor degree programmes under review are reasonable and well founded. Based on the Self-Assessment Report and the discussions during the on-site-visit, the peers observe that the graduates of all three Bachelor degree programmes acquire the necessary subject-related competences. They are convinced that the intended qualification profiles of all three Bachelor degree programmes allow the students to take up an occupation which corresponds to their qualification. The degree programmes are designed in such a way that they meet their objectives. The objectives and learning outcomes of the degree programmes do reflect the intended level of academic qualification and respectively correspond with the ASIIN Subject-Specific-Criteria (SSC) of the Technical Committee 4 – Informatics/Computer Science as well as TC 12 Mathematics.

The peers also appreciate that UGM aims for high standards as to give their graduates good chances in the national job market as well as a good starting point to transfer to other academic programmes to complete a Master and maybe even a PhD-programme.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Report

Preliminary assessment and analysis of the peers:
The peers discuss the names of the degree programmes with the coordinators of the three Bachelor degree programmes. The peers are satisfied with this explanation and confirm that the English translation and the original Indonesian names of all Bachelor degree programmes correspond with the intended aims and learning outcomes as well as the main

course language. The standard title for the programs in mathematics and statistics is a Bachelor in Science (Sarjana Sains), whereas in computer science the Bachelor of Computer Science (Sarjana Komputer) is awarded, each after completing a minimum number of at least 144 credits.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Webpage Ba Computer Science: http://dcse.fmipa.ugm.ac.id/site/en/program-educational-objectives-2/
- Webpage Ba Mathematics: https://s1math.fmipa.ugm.ac.id/en/programme-educational-objective/
- Webpage Ba Statistics: http://s1stat.fmipa.ugm.ac.id/english-plo/

Preliminary assessment and analysis of the peers:
All three Bachelor degree programmes under review are designed for eight semesters; each semester consists of fourteen weeks of lectures and two weeks of exams. In all programmes, students must complete a Community Service during the seventh and eights´ semester. In the absence of a module description, it is explained that Community Service is compulsory for all Indonesian students. It has a minimum length of six weeks and takes place in villages or rural areas where students stay and live together with the local people. The course is designed "to allow students to apply their knowledge ... in order to empower society." Since the Community Service usually takes place in remote areas the students cannot attend any classes during this time. The students work in interdisciplinary teams during the Community Service in order to advance the causes of society and to support further development, a noble purpose in the experts view.

In a number of ways all of the programmes under review have comparable structures and have undergone comprehensive revisions in 2016:

The Bachelor degree programme Computer Science, offered since 2010 under the coordination of the Department of Computer Science and Electronics, is made up of a minimum of 114 compulsory credits (47 courses) and 30 elective credits (ca. 10 courses) which can be chosen from a list of electives offered by the faculty, the university or an (inter)national partner university. In the first two years, students can only take compulsory modules. These sum up to 20 and 22 credits respectively. Some are specified by the university (e.g. courses

such as Pancasilas States´ Ideology, Religion, Citizenship, Community Service and Philosophy of Computer Science), whereas a second group of compulsory subjects are defined by the faculty (basic foundation courses in Physics, Chemistry, Mathematics (Calculus) and Computer Science (Programming). The number of compulsory subjects is continuously reduced over the course of the eight semesters and replaced by electives. Starting with the third semester, after having mastered the foundation courses, the students for the first time can select electives with the guidance of their academic supervisor from one of the four designated graduate profiles, which are System Programmer, Network Service Supervisor, Database Administrator and Software Engineer.

In the final semester, the thesis remains to be prepared after successfully completing the seminar modules introduced only recently to better familiarize students with adequate research methodologies.

The electives are divided into Computer Science electives provided on the one hand by the research laboratories and on the other hand via supporting modules which are provided by other departments outside of UGM. The maximum number of externally acquired credit points is limited to only 9, a stipulation, which makes a longer international exchange experience rather unattractive. One of the electives is the internship module requiring the students to spend 1-2 months in a company.

At present, the UPS-CS has two types of classes, the regular class and the international class. Both classes are based on exactly the same curriculum, with the only difference that in the international class the course language is predominantly English. It is worthwhile noting, that UPS-CS is the only programme offering an international track.

In the process of programme revision, the recommendations of the American Association for Computer Machinery (ACM) and alumni feedback have been taken into account. One of the major changes has been the introduction of a preparatory course (the above mentioned seminar) to better prepare students for the challenge of writing the final thesis, reducing the standard period of study in the process. In addition, the thesis comprising of 6 credits altogether is further subdivided into the thesis proposal (2 credits) and the thesis itself (4 credits). The peers note that this number of credits is not in sync with the corresponding work load which practically consumes all of the last semester. Other changes in the updated programme structure included new course offerings in Probability and Stochastic, as stakeholders noted the logic of prime importance for programming and language processing. In addition, among others modules in the area of Machine Learning, Compiler Development, Forensic Digital, Satellite Development, and Telecommunication Networks were introduced.

The study programme of the Bachelor degree programme in Mathematics has equally been recently revised, resulting in a new study offer as of the academic year 2016/2017. In the UP Math programme out of the 144 credit points required as a minimum for obtaining the degree 104 (or 72%) are compulsory with the remaining 40 credits being reserved for electives. The latter can be chosen from a large variety of offers provided from different disciplines (including Statistics, Economy, Computer Science and chemistry). One of the major changes in the curriculum has been the augmentation in the number of laboratory classes to upgrade student's skills in computing, simulation and modelling.

Basic courses in mathematics are offered in the first and second semester, intermediate from the third to the six semesters. These foundation courses include Algebra, Analysis, Applied Mathematics and Computing. The specialized elective courses can be chosen from a wide variety of course offerings from the mathematics major (103 credits), at least 4 from UP-CS and finally at least 58 credits from the UP-Stat programme. It is important to mention that the latter have been compiled in alignment with the actuarial courses by the Indonesian Actuarial Society.

The Specializations are being organized along the four tracks Algebra, Analysis, Applied Mathematics and Mathematical Computation in line with the four laboratories of the department. Depending on the specialization the students in the final semester will pick a topic for the final thesis, for which 6 credits are reserved. A concern is the extension of the standard period of study which amounts to more than 5 instead of 4 years on average.

In the revision of the current programme, UP Math has used the results of surveys among alumni. One of the findings was the fact that the biggest number of graduates (around 20%) are currently working in the finance sector with has led to additional course offerings (introduction to Probability, Introduction to Stochastic Processes), which at the same time have been upgraded to compulsory courses. In addition, Entrepreneurship and an Internship have been added as elective courses (see above).

The Bachelor degree programme in Statistics has 164 Credits (68 % of the required total credits as compulsory courses with the remaining 76 credits being reserved for electives. Within the programme, students can choose between four study tracks which are Actuarial Sciences, Biostatistics, Business and Industry and finally Finance; these specialization tracks were introduced as a results of the cyclical programme review in 2016. The programme prepares professionals such as actuaries, researchers, investment managers, specialists in quality control, equity analysts or lectures.

The design of the programme has been organized from basic to advanced courses. As in the case of mathematics, the UP Stat Students are required to take fundamental science courses offered by the department such as Basic Physics, General Chemistry, Calculus and

Programming in the first semesters. Changes to the curriculum, again, were made on the basis of a survey among recent graduates. Based on this, the UP Stat 2016 programme added additional elective courses in Actuaries and Finance. An agreement was reached with the Indonesian Actuaries Society regarding the Actuaries' certification programme. Other additions to the programme resulted in adding a number of compulsory courses such as Philosophy of Science and Progressive Ethics Statistics as well as the "seminar" in order to improve soft and communication skills and prepare better for the final thesis. In addition, the organization of the study programme along four different areas of interest, as mentioned above, was one of the major changes in the programme structure.

During the review, the programme coordinators elaborated how the intended learning outcomes of the programme are reflected in its structure. Basic knowledge, accordingly, is provided by modules such as Calculus, Elementary Linear Algebra or Statistical Methods. Critical thinking skills are transmitted in courses such as Introduction to Mathematical Statistics, Applied Regression Analysis, Introduction to Design Analysis as well as Statistical Methods. The capacity of applying statistics software is conveyed in modules such as Exploratory Data Analysis, Categorical Data Analysis, Statistical Computing. Internship and Final Thesis are designed to prepare students better for the job market; life long learning skills are grounded in courses such as Capita Selecta Statistics and the Final Project.

In their analysis, the peers reach a number of conclusions, some of which pertain to all study programs, while others target the individual programs under review.

Concerning findings for all three programs, the peers **first addressed the introduction of the internship as an elective course**. While, generally speaking, this change is laudable as it attempts to prepare students better for the transition from student to work life, the limited duration of only 1-2 months and the fact that this internship can only be taken during the semester breaks puts serious constraints reaching exactly this goal. In the discussions, Employers accordingly expressed the wish for more flexibility in organizing internships. Usually, a minimum period of three months is seen as prerequisite for organizing a meaningful working experience; by the same token, the current university regulation (75% presence required during the semester) prevents spending time in a company during a semester even if there is an excellent internship offer on the table; more flexibility is needed under these circumstances. Also, the introduction of a systematic and permanently updated database for available internships should be envisaged.

Another concern regards the extension of the standard period of study which is particularly an issue for the Bachelor of Mathematics (more than 5 years on average), but also for the Computer Science and the Statistics Programme. According to the Self-Assessment Report the search for a suitable topic for the Bachelor's thesis, the preparation of the research

proposal, and the execution of the Bachelor's thesis are among the main reasons for exceeding the regular studying time (for other reasons check the section for exams in this report). During the discussion with the students the peers learned that until recently the organisation of the last three semesters has not been optimal. In particular, the completion of the Community Service, the preparation of the research proposal and the Bachelor's thesis should be done successively and should follow a strict time table. For this reason, the peers recommend re-organizing the curriculum of the last three semesters. For example, the Community Service could already be completed before the start of the seventh semester. During the seventh semester, the students should look for a suitable topic for the Bachelor's thesis and prepare the research proposal. The eighth and last semester should then be dedicated for executing the Bachelor's thesis. The peers in general support the idea of having a seminar prior to starting the thesis. A core concern must be that the thesis is started and finished in time, and that the topic can be covered in the allocated amount of time. So far only 6 credits are allocated for the thesis. This topic is also discussed under Criterion 2.2.

Regarding the topic of internationalization, UGM in its strategic plan stresses the goal to become internationally more visible and to further internationalize its degree programmes. This is contradicted by the fact that in all three study programs under review the number of credits which can be attained in an higher education institutions other than UGM is limited to a mere 9 credits. This stipulation in the eyes of the peers should be revaluated. In addition, the number of classes taught in English is very limited (with the notable exception of the international class in the computer science programme, which consists of a mere 30 students). In all discussions during the onsite visit it became apparent that the practical English skills of the graduates as well as of the staff could be improved. This is confirmed by the students who express their sincere wish to have more subject-specific elements taught in English. In addition, the peers recommend doing presentations in English, which will also improve the communication skills of the students. The peers acknowledge the fact that several staff members tries to overcome the language barrier by providing course abstracts and materials in English.

The peers understood that in addition to program specific modules for all three programs **some courses are offered on the level of the university (general education courses), and some on the level of the faculty** especially (basic foundation courses in Physics, Chemistry, Mathematics (Calculus) and Computer Science (Programming). While they understood the need for saving on resources and providing in some instances a standardized set of courses they at the same time believe that from a learning outcome perspective more specialized

and better grouped courses are much more suitable for the individual programs under review. A tailor-made composition of courses thus would better support the achievement of the learning outcomes of each individual programme.

A strong point of the programs relates to the **excellent job perspectives for graduates** in all three programs. Generally speaking, graduates are well prepared for entering the labour market and can find adequate jobs in Indonesia. During the discussion with the peers UGM's partners from the industry/public sector confirm that the graduates have a broad scientific education, are very adaptable, and have manifold competences which allows them to find adequate jobs. Relevant survey results on employers´ satisfaction further underline this.

Additional findings with regard to the individual programs can be summarized as follows:

For the computer science programme: mastering a software project in its entire life cycle, working together with a reasonably sized group, subdividing and sharing responsibilities, experiencing group dynamics is an essential component of a computer science programme and is part of the learning outcome expectations of the ASIIN requirements. Thus far, such a project is foreseen as an elective. The peers see a necessity to upgrade it to the level of a compulsory subject.

The peers furthermore suggest assigning the large number of electives more clearly to the different graduate profiles mentioned above.

They also suggest to critically reflect the question whether courses such as the basic fundamental courses of general science offered indiscriminately by the faculty and other modules such as e.g. Chemistry are really needed in a tailor-made modern computer science programme.

For the Bachelor programme in mathematics the above mentioned statement equally applies. Furthermore, in the eyes of the peers, a course in programming appears to be of value in addition to basic science courses e.g. application of the software package "MatLab" to train computational mathematics skills or to practise numerical solution methods.

Generally, for mathematics the peers observed there are some closely related modules for mathematics which have considerable overlaps (e.g. introduction to theory of differential equations vs. module ordinary differential equations). Therefore, it is recommended to reduce overlaps to a minimum, despite the fact they are possibly useful in some cases.

For the Bachelor programme in statistics: By analogy with the Computer Science programme the peers suggest to align the large number of elective courses in statistics (currently 33) more clearly with the so-called streams namely Actuarial Science,

Biostatistics, Business and Industrial and Finance. In addition for specific prospective profiles like “data scientist” a very close cooperation between the computer science program and the statistics program is recommended since a data scientist needs computer science as well as statistical skills.

Taken the above mentioned findings into consideration the auditors overall are convinced that the intended qualification profiles of all three Bachelor degree programmes under review allow the students to take up an occupation that corresponds to their qualification profile.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Report
- Academic Guidance Book
- Decree of Minister of Education No. 126, 2016
- UGM webpage: https://www.ugm.ac.id/en/pendaftaran

Preliminary assessment and analysis of the peers:
According to the Self-Assessment Report the admission procedures and policies for new students follow the National Regulation No.126. The requirements, schedule, registration venue, and selection test are announced on UGM’s webpage and are thus accessible for all stakeholders.

There are three different venues by which students can get admitted to UGM. First of all, there is the national admission system which is based on academic performance at high school. 40 % of the students at UGM get admitted through this selection system. Secondly, a national selection test is held every year for university candidates. It is a nationwide written test and it accounts for 30 % of the admitted students at UGM. Finally, 30 % of the students are selected on the basis of a written test, specifically designed by UGM.

As regards the Bachelor programme in mathematics, it is worth noting, that only high school students, having followed a natural science track, are eligible for applying. For the admittance to the international class in computer science, students have to demonstrate an advanced level of English.

In the course of the last years the number of applicants for all three degree programmes under review has steadily increased and exceeds the number of available places by far.

In the Bachelor degree programme Computer Science, in 2016/17 the number of applicants amounted to 4330 person, of which finally 137 were accepted, albeit a ratio of 31 to 1. This is equivalent to an admission rate of only 1-2 %.

The situation in the Bachelor degree programme Mathematics and Statistics is comparable. In 2016 e.g., there were 2893 applicant for only 60 Statistics study places, albeit an admittance ratio of 1:45.

The details of the application process at UGM and further information on admission criteria and deadlines can be found in the National Regulation No. 126 and the Academic Guidance Book which is also published on the university's webpage.

The peers inquire of the programme coordinators why there are so many students applying for studying at UGM. They learn these are very popular degree programmes because the job perspectives are very good. In addition, UGM is one of the most prestigious universities in the country. As a consequence, UGM is able to only accept the very best candidates.

From their discussion with the students the peers gain the impression that the admission system is effective and mostly very motivated and high-performing candidates get admitted and, the dropout rate is very low. The peers consider the dedicated students to be one of the strong points of all three Bachelor degree programmes.

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

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

Community Services Module

The peers assess the module description for Community Services (Community Development Participation) that are provided by the University for each of the three degree programmes as suitable. Accordingly, the peers do not consider the related requirement as necessary anymore. Moreover, they realise that not all universities in Indonesia require the students to do Community Services. UGM is the one of universities which keep "Community Service" as a compulsory course because UGM identified itself as a "Universitas Kerakyatan" or "University for the People" (University which is devoted to the interest of the common community). In fact, UGM considers themselves as pioneer of the Community Services Program by serving as the reference model for the implementation of the Community Services Program.

Establishment of UP-CS

The peers take note of the fact that that the Bachelor degree programme Computer Science has been under the coordination of the Department of Computer Science and Electronics since 2010, but the programme itself was founded in 1987 under the coordination of the Department of Mathematics.

External acquisition of credit points

Regarding the number of credit points that can be acquired externally the peers learn that for the Bachelor degree programme Computer Science the maximum number of externally acquired credit points is 10% of the total credits, which is about 14 credits. Currently, UP-CS will use the regulation specified by the faculty (i.e. 10%) instead of limiting the maximum number of credits to 9. The peers notice the future aspirations of the university to review the regulation and to amend the curriculum if necessary, in case the number of students participating in student exchange programs will increase significantly. For the Bachelor degree programme Mathematics the university states that the presented curriculum included all modules (courses) that can be taken by the students of the degree programme. The number of 9 credits relates to elective courses that are not listed in the curriculum. Courses from other universities with the same syllabus as the UP-Math curriculum are supposed to be considered by the credit transfer system scheme, it shall not only apply to elective courses. Summarising, the peers see that the university is interested in ensuring at least a certain degree of acknowledgement of external courses. Nevertheless, the peers still see room for improvement to promote academic mobility as one instrument of the internationalisation strategy. Thus, they keep their recommendation regarding the academic mobility and internationalisation strategy. (see also 2.1)

Structure of the programmes

The peers take note of the fact that the Bachelor degree programme in Statistics has **144** Credits (68 % (97credits) of the required total credits are compulsory courses) with the remaining 47 credits being reserved for electives. Students also can take the other elective courses from the other study programs at the university with the maximum of 10% of total credits.

Internship

The peers note that the internship is an elective course for the Bachelor programme Mathematics and Computer Science, whereas for Statistics it is compulsory. The university states that the duration of the internship is between 1 and 3 months for Statistics and 1 and 2 months for Mathematics and Computer Science. Moreover, the internship can be taken either during the regular semester or during the semester break. The peers welcome the university's intention to address the issues that students completing their internship in

companies located far away from the university while taking several courses in the semester must limit the internship duration to 1-2 months due to the 75% presence regulation. In addition, it is foreseen to set up a systematic and permanently updated database for available internships. As both issues are not yet solved, the peers remain their respective recommendation.

Extension of standard period time of studies

The peers welcome the efforts that have been made for the Bachelor degree programme Mathematics to reduce the average period of study (such as tutorials, offering introductory modules every semester, student monitoring, a workshop on teaching-learning processes for lecturers, evaluation of achievement of learning outcomes). Nevertheless, the peers consider rather the Bachelor thesis as one of the main issues why the standard period time of studies will be exceeded which applies for all three degree programmes. According to the university's comments to the report, the structure of the curriculum has been set up by considering the requirement of each course and is designed in such a way that students could finish in 8 semesters. The university states that the community service can be taken in the regular semester or during the semester break. However, the peers miss a reflection of their assessment, which relates to the design of the last three semester of the degree programmes, in which the Community Services have to be completed, the research proposal has to be prepared and the Bachelor thesis has to be written and finalised. Thus, they still consider the respective requirement as necessary to re-design the degree programmes so that students can complete finish the programme (including Bachelor thesis) in time. Nevertheless, one could argue that the university clearly states why students extend their study, e.g. in order to improve their marks to be eligible for government jobs. It might be that the curriculum allows finishing the degree in the time allotted and it is questionable which measures could be taken in a short period time to improve the situation.

Internationalisation

The peers acknowledge the aims of the university to prepare course materials, hand outs, and course presentation in English language as one instrument to support the internationalisation strategy. The peers consider a recommendation regarding the English proficiency of students by introducing more English taught subject-specific elements into the curriculum and to add more oral exams in English as reasonable.

Additional findings

The peers highly welcome the efforts of the university to include the software project (Database practicum) for the Bachelor degree programme Computer Science as a – by the Academic Senate approved - compulsory course as of the academic year 2018/19. Thus, the

peers see the respective intended requirements as already fulfilled and consequently not necessary anymore.

The peers agree that the mapping of courses for the Bachelor degree programme Computer Science including the electives has been allocated to graduates profiles in table 4 of the Curriculum 2016 Guide Book. However, they are much more in favour with the overview prepared together with the statement of the university. This overview lists very clear and transparent the elective courses that are relevant for each of the four graduation profiles. The peers suggest offering this information to prospective or recently enrolled students. As a comparable overview has not been provided for the degree programme Statistics, the peers keep their respective recommendation for this programme.

Regarding the fact that the curricula of all three degree programmes consist of basic fundamental courses in general sciences, the university states that in 2016 in the frame of the revision of the curricula it has been decided to include these modules. However, the university will propose to tailor-made these modules for the near future. On a long term basis, it takes into consideration to reconsider their decision in the review process of the curricula in 2021. The peers can follow this approach but keep their respective recommendation in order to assess the developments of the curricula development in the framework of the re-accreditation.

Regarding the Bachelor degree programme Mathematics, the peers see that the students learn C++ language in the module Programming I. Moreover, in the third semester C++ is a basic of MATLAB for modules such as Introduction to Numerical Analysis.

The peers also notice the statement of the university regarding the overlaps in modules in the Bachelor degree programme Mathematics. The points the university made are comprehensible they in particular intended to raise the awareness to overlaps in general which should be avoided.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions

- Webpages of the three programs

Preliminary assessment and analysis of the peers:
The structures of the Bachelor degree programme Computer Science, Mathematics and Statistics are very similar and have been elaborated in details in the preceding section of this report.

After analyzing the module descriptions and the study plans the peers confirm that all three degree programmes under review are divided into modules and that each module is a sum of coherent teaching and learning units.

In addition, the peers gain the impression that the choice of modules and the structure of the curricula ensure that the intended learning outcomes of the respective degree programme can be achieved.

What already has been mentioned as an area of concern, is the lack of academic mobility provided by the faculty. This is certainly true before the background that an overwhelming majority of students present during the interviews were looking forward to such an international study experience. As regards the **Bachelor in computer science**, UP-CS has inside of Indonesia Memoranda of Understanding in place with the Universitas Budi Luhur, the Universitas Dian Nuswantoro and the department of electrical engineering and information technology at Universitas Gadjah Madah. Apart from individual exceptions, however, practically no international students are enrolled in the programme and there is also practically no outbound academic mobility. On a positive note, the peers see that for 30 students of the international CS class, English is at least the language of teaching on a regular basis. Further details are given in the diploma supplements of this small group of students.

No evidence is provided that international exchange takes place also for the **study programs in mathematics and statistics.**

In conclusion, the peers are convinced that considerable effort needs to be invested to support the internationalisation strategy of UGM and particularly the faculty of natural sciences and mathematics. The ways to make corresponding progress are manifold, including using English on a more regular basis in the subject-specific classes, upgrading the language skills of students and staff members alike, using the instrument of inviting more visiting lecturers, initiating more international exchange programmes, offering more places for summer courses as well as provide more and better endowed scholarships for outgoing students.

The students confirm during the discussion with the peers that few opportunities for international academic mobility exist but insist that more places, more exchange programmes and more scholarships are desperately needed.

In summary the peers find, that the academic mobility for all three study programs under review is low and see a lot of room for improvement.

Criterion 2.2 Work load and credits

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions
- Academic Guidance Book
- Decree of Minister of Education No. 49, 2014

Preliminary assessment and analysis of the peers:
According to Decree of Minister of Education No. 49, 2014 one Indonesian credit is awarded for:

1. Lecture activity of 50 minutes per week per semester;
2. Learning activities by structured assignments of 50 minutes per week per semester;
3. Self-study activities of 60 minutes per week per semester.

In the form of seminar work or other equivalent learning activities, one Indonesian credit includes:

1. Lecture activities of 100 minutes per week per semester;
2. Self-study activities of 60 minutes per week per semester.

One Indonesian credit of practical work, research (thesis), community services, and other equal learning activities is equivalent to:

1. Learning activities of 160 minutes per week per semester.

The standard workload for students is eight hours per day or 48 hours per week, the semester takes 14 weeks. In total, students are required to complete the workload of 6912 hours for eight semesters, or 1728 hours a year. The workload sums up to 144 Indonesian credits, usually divided into 18 credits per semester.

This workload is equivalent to 60 ECTS credits per year, assuming one ECTS credit equal to 28.8 hours.

The peers confirm that the workload in hours is indicated in the module descriptions and the distinction between classroom work and self-studies is made transparent and is in line with the credits awarded, except for the Final thesis.

The Bachelor degree programmes under review are designed for 8 semesters with a minimum of 144 Indonesian credit points, including mandatory and elective courses.

The peers discuss with the programme coordinators and the students the fact that the average standard period of study is regularly exceeded by more than two semesters. The reasons for this are manifold, but at the core it is the organization of the last three semester and the length of the Community Service and the Bachelor's thesis, the related workload, and the awarded credit points. It is obvious that students regularly spend much more time on both than expected. The experts are also concerned that the extremely low number of credits for the final thesis (in the 2+4 model) does not really provide an incentive to invest more effort in reaching excellent results.

Since the workload of the students was only estimated by the programme coordinators and seems to be too low in comparison to the actual time needed by the students, the peers suggested asking the students directly about their experiences. This could e.g. be done by including a respective question in the course evaluations. In any case, UGM must make sure that the actual workload and the awarded credits correspond with each other.

The Faculty of Mathematics and Natural Sciences has recognised the problems causing the exceedance of the regular length of studies and tries to solve them by doing more collaborative research with companies and by intensively monitoring and counselling the students. Whether additional measures including the introduction of a seminar, the splitting into a 2 + 4 structure, the encouragement to join research projects earlier during their studies in order to easier find suitable topics for the undergraduate thesis etc., bear fruit, remains to be seen.

Criterion 2.3 Teaching methodology

Evidence:

- Self-Assessment Report
- Study plans of the degree programmes
- Module descriptions

Preliminary assessment and analysis of the peers:

The Bachelor degree programmes under review make use of several different educational methods for each course such as: practical laboratory work with presentations, lectures, community service, internship, and undergraduate thesis.

During the classes active and interactive teaching methods (e.g. lectures, discussions, reports, presentations, and group work) are applied. UGM wants to encourage the students to gain knowledge from different scientific areas and wants to introduce them to research activities. This should ultimately contribute to the transition from a teacher centered to a student centered learning approach.

To help the students to achieve the intended learning outcome and to facilitate adequate learning and teaching methods, UGM has developed e-Lisa (eLearning System for Academic Community). It is a learning management system designed as a digital platform where students and teachers can interact.

In summary, the peer group judges the teaching methods and instruments to be suitable to support the students in achieving the intended learning outcomes.

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Report
- Academic Guidance Book

Preliminary assessment and analysis of the peers:
UGM has implemented a comprehensive advisory system for all undergraduate students. At the start of the first semester every freshman is assigned academic advisors who will advice students throughout their academic career on academic or personal matters. Each academic advisor is a member of the academic staff and responsible for up to 20 students which on the one hand consumes considerable time resources but on the other hand contributes to an excellent working atmosphere on campus.

The role of the academic advisors is to help the students with the process of orientation during the first semesters, the introduction to academic life and the university's community, and to respond promptly to any questions. They also offer general academic advice, make suggestions regarding relevant careers and skills development and help if there are problems with other teachers. The students confirm during the discussion with the peers that they all have an academic advisor, that they meet regularly, and that they can always contact their advisor personally and ask for help or advice.

In addition, each student is assigned to an undergraduate thesis supervisor; he supervises four to eight students every semester and helps them to find a suitable topic for the Bachelor's thesis, to prepare the research proposal, and ensures successful completion of the thesis. The students confirm that they are supervised in the working/research group during

their work on the Bachelor's thesis. There are regular lab meetings where they present their results and receive feedback from the other lab members.

All students at UGM have access to the digital academic portal (PALAWA) which is integrated with the Registration Information System, the Academic Information System, the Library Information System, and the Scholarship Information System. The students' profiles (student history, study plan, academic transcript and grade point average/GPA, lecturer evaluation, course list) are available via PALAWA.

There is also medical, social, and psychological support for students at UGM (Gadjah Mada Medical Center/GMC and UGM Hospital).

Finally, there are several student organizations at UGM; they include Student's Activity Clubs which are divided into arts, sports, religious and other non-curricular activities.

The peers notice the good and trustful relationship between students and teaching staff; there are enough resources available to provide individual assistance, advice and support for all students. The support system helps the students to achieve the intended learning outcomes and to complete their studies successfully. The students are well informed about the services available to them.

The peers judge the extensive advisory system to be one of the strong points of UGM.

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

Academic mobility

The peers observe efforts done by the university to increase the academic mobility, such as the information provided on the website of the Office of International Affairs, the financial support of the university, faculty and department (which is considered to be increased), the establishment of the faculty-own Office of International Affairs as well as recently made agreements with three international universities (2 in Japan, 1 in Canada). Nevertheless, the university agrees that the mobility of students enrolled in the three degree programs needs to be increased. As already stated above (criterion 1), the peers keep their recommendation regarding the academic mobility.

The peers take note of the corrected figures regarding the calculation of one Indonesian credit. These slight changes do not seriously affect the calculation as such, in particular as the total workload still sums up to 144 Indonesian credits, usually divided into 18 credits per semester. However, the peers highly welcome the action taken by the university by increasing the number of credits for the final thesis from 6 to 9 credits that already has

been approved by the Faculty Senate. The presented overview for the three degree programmes on the allocation of the credits to each semester (divided into compulsory and elective) is according to the peers reasonable. The peers consider the efforts as very valuable. Nevertheless, another issue raised by the peers during the on-site visit refers to the fact that the students' workload was estimated and does not seem to fully reflect the actual workload the students have. The increasing of the credits for the final thesis is one instrument that seems to be useful. Still, the peers recommend evaluating the actual workload to ensure its consistency with the awarded credits.

The peers take note of the university's statement regarding criterion 2.3 and 2.4 and are pleased that their comments are helpful in developing further the degree programmes.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self-Assessment Report
- Module descriptions
- Academic Guidance Book
- Academic Calendar

Preliminary assessment and analysis of the peers:
According to the Self-Assessment Report the students' academic performance is evaluated by a multitude of different types of exams, such as individual and group assignment, quizzes, pre- and post-test, laboratory work as well as midterm and final exams. Lecturers have the right to hold additional midterm exams if they wish. The form and length of each exam is mentioned in the course/module descriptions that are available to the students via UGM's homepage and the digital platform e-Lisa. The exams are designed to measure the different targeted learning outcomes of a specific course or module. The peers note favourably that in the past couple of years, the faculty of mathematics and natural sciences has engaged in a verification process to check whether the exam manuscripts are of a good standard and the content of courses in line with the proposed syllabi. The peers also concluded that there is a good mix of written and oral examination during the course of the studies.

The students are informed about mid-term and final exams via the Academic Calendar. The final grade is the result of the different activities in the course (e.g. laboratory work, mid-term exam, the final exam, quizzes or other given assignments).

If a student fails a final exam he has to repeat the entire course. The details are described in the Academic Guidance Book. A considerable number of students are retaking exams in order to improve their Grade Point Average. The peers learn that the GPA score usually needs to be bigger than 3 upon graduation. The retaking of exams is one of the reasons (next to the preparation of the thesis), which leads to a prolongation of the average study time.

In the discussion with the peers, the students had no complaints concerning the organization of the exam system, they appreciate that there are a several short exams instead of one big exam and confirm that they are well informed about the examination schedule, the examination form and the rules for grading.

At the end of the first two years the students' academic achievements are evaluated to determine whether they can continue their studies or must leave the faculty. Students may continue their studies if they acquire at least 30 credits and have a GPA above or equal 2.00. According to the comments of the students most drop-outs in the three Bachelor degree-programmes under review are due to students failing this evaluation. Only few students leave the degree programmes for other reasons and the total drop-out rate is rather low.

The peers confirm that there is a form of assessment for each course and that all students are well informed about the form of assessment and the details of what is required to pass the module. The rules for re-sits, disability compensation, illness and other circumstances are written down in the Academic Guidance Book and therefore transparent to all stakeholders. An appeal system is also in place.

As stipulated in the Academic Guidance Book, every student is required to do a final thesis, credited with 6 (2 + 4) credit points. Prior to the actual research work, the student will need to sign up for the thesis course to prepare a research proposal/literature review (2 credits) which is submitted to the Thesis Advisory Committee. This committee will verify the students' administrative fulfilment for thesis requirements, then assign the student to an appropriate thesis advisor. This committee also acts as mediator between student and thesis advisors if there is a dispute. The thesis is usually done parallel to the Community Service in the seventh and eighth semester.

After completing the Bachelor thesis, the student has to defend the thesis in front of the Thesis Defence Committee; it consists of a minimum of 3 lecturers (according to the SAR,

the advisor is not part of the committee) and will determine whether or not the thesis qualifies for graduation.

As already discussed under Criterion 2.4, the peers learn during the audit that the search for a suitable topic, the preparation of the research proposal and the execution of the Bachelor's thesis are major reasons for exceeding the regular length of studies, especially in the Bachelor degree programme in Mathematics. The peers therefore expect a closer monitoring of all processes associated with choosing and completing the Bachelor's thesis especially for the mathematics programme. In particular, the thesis advisor must make sure that the scope of the Bachelor's thesis is suitable and does not exceed the expected time frame. The peers equally note that the numbers are better for the Bachelor in Statistics where most students finish in the standard period of time.

The peers also inspect a sample of examination papers and final theses and are overall satisfied with the general quality of the samples. They confirm a satisfactory standard of the Bachelor's thesis, presented for inspection.

The peers come to the conclusion that besides the critical issue of the length of the Bachelor's thesis the criteria regarding the examination system, concept, and organization are fulfilled and that the examinations are suitable to verify whether the intended learning outcomes are achieved or not.

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

The peers note that the advisor is also part of the Thesis Defence Committee for the degree programme Computer Sciences.

The peers consider criterion 3 as fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self-Assessment Report
- Staff Handbook

Preliminary assessment and analysis of the peers:

At UGM the staff members assume different academic positions. There are professors, associate professors, assistant professors and various forms of lecturers. Each staff engages

in research, teaching, administration and community service. For all study programs under review, UGM has provided a comprehensive staff handbook listing their qualifications.

In the Bachelor of Computer Science programme there are altogether 50 lecturers (among them 2 full professors, 9 associate professors, 11 assistant professors, 17 lecturers, and 11 assistant lecturers), a majority holding a Ph.D qualification. Some international lecturers are recruited via an agreement with the Senior Expert Service SES. The student-teacher ratio is approximately 1:13. There are also 9 technical staff members supporting the programme.

Both the mathematics and statistics Bachelor programmes are running under the authority of the Department of Mathematics. It can rely on 63 academic staffs, among them 35 full time staff (from the different research groups in analysis, algebra, applied mathematics and computational mathematics and statistics) as well as 28 part time lecturers. The staff composition is as follows: there are 5 full professors, 8 associated professors, 6 assistant professors, 2 instructors, 1 teaching assistant and 15 part time lecturers. More than half of them hold a Ph.D. level qualification. Currently 7 academic staff members are undertaking doctoral programs in renowned universities abroad (Singapore, Helsinki, Leiden, Amsterdam and Groningen). The FTE staff-student ratio amounts to 1:7. The average workload of the UP-Math staff amounts to approximately 13 credits per semester, equivalent to a weekly workload of around 37 hour devoted to teaching, research, community services and administration. Additionally 9 non-technical staff members also support the programme, the students generally being very satisfied with the services provided.

As regards the figures for the statistics programme, the numbers are practically identical to those of the mathematics programs.

After studying the staff handbooks and conducting discussions rounds with all stakeholders, the peers come to the conclusion that the composition, scientific orientation and qualification of the teaching staff are suitable for successfully implementing and sustaining the three degree programmes under review.

A point of concern remains the fact that most staff members are also graduates from UGM. Apparently, there is no tradition of “horizontal hiring” in Indonesia, in other words, in order to become a full professor, one usually has to climb the career ladder within an institution for a considerable period of time. The peers recommend recruiting more national and international staff from outside the institution to help diversify the teaching and research portfolios. The attempts of the department to upgrade the qualification of its staff (e.g. by supporting staff to obtain a doctoral degree) is positively noted. The possibility of granting more sabbaticals should also be considered in the future.

The auditors overall commend UGM for the excellent climate and working relations between students and staff members. It is facilitated by an extensive advisory system which ensures that every student has an academic advisor. This atmosphere of collaboration is exemplary in the eyes of the experts.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Report
- Staff handbook

Preliminary assessment and analysis of the peers:
UGM as an institution as well as the faculty of mathematics and natural sciences entertains a comprehensive system of staff support.

One important element of this system consists of upgrading the academic qualifications of Master level students to a Ph.D. level. As mentioned above there are currently a considerable number of academic staff in all three programs enrolled in a Ph.D. program in the quest to upgrade the teaching and research qualifications and to decrease the teaching load. In its Strategic Plan, the faculty aspires to have 90% of staff members with a Ph.D. qualification by the year 2022.

UGM and the faculty also focuses on improving the teaching and learning process by providing courses and workshops on student centred learning, e-learning technologies, modern form of student assessment as well as a workshop on curriculum improvement. An incentive system provides grants for publications of research articles, textbooks or lecture notes, encourages membership in professional organizations, supports staff to participate in scientific meetings and conferences, encourages staff to apply for research grants, organizing colloquia and international conferences on a regular basis etc. Also support is provided for staff to be involved in community services. Finally, management courses or English as a foreign language courses are also offered.

The professional and scientific development of staff members is coordinated by the Vice Dean for Finance, Administration and Human Resources and the Vice Dean for Academic and Student Affairs. There are financial resources available for staff members to engage in the above mentioned activities. The UGM leadership intends to further promote the process of internationalisation at UGM by hosting international scientific events, facilitating sabbatical leaves, and inviting international professors.

The peers discuss with the members of the teaching staff the opportunities to develop their personal skills and learn that the teachers are satisfied with the internal qualification programme at UGM, their opportunities to further improve their didactic abilities and to spend some time abroad to attend conferences, workshops or seminars; even a sabbatical leave is possible.

In summary, the auditors confirm that UGM offers sufficient support mechanisms and opportunities for members of the teaching staff who wish to further develop their professional and teaching skills.

Criterion 4.3 Funds and equipment

Evidence:

- Self-Assessment Report
- On-site visit of the laboratories, lecture rooms, and the library

Preliminary assessment and analysis of the peers:
During the audit the peer group also visits the laboratories, the class rooms and the central library in order to assess the quality of infrastructure and technical equipment. They did not notice any severe bottlenecks due to missing equipment or a lacking infrastructure. The basic technical equipment for teaching students of Bachelor level is available in sufficient numbers. However, some computer labs appear to be extremely small. Students were forced to sit extremely tight.

The students confirm during the discussion with the peers that in general they are satisfied with the available equipment only some materials for the laboratory work are missing and some of the technical equipment is outdated.

There is basic funding from the faculties for teaching, additional funds for advanced research can be provided by UGM or the Indonesian government, but the teachers have to apply for them. In addition, there is the possibility of cooperation with industrial partners.

The technical equipment is very simple and needs to be improved so that students and also the teaching staff can conduct their research activities in their own labs. So far, the members of the teaching staff and the advanced students need to use the much better equipped central laboratory for conducting their experiments.

Since the central laboratory is used by staff members from all faculties, the advanced equipment therein is in high demand which leads to bottlenecks and causes delays. Therefore, the peers expect that UGM as well as the Faculty of Mathematics and Natural Sciences invest additional resources in the teaching laboratories. This will make the faculties more independent from the central laboratory and will also increase the possibilities for the staff

members to conduct their research activities and for students to prepare high quality Bachelor's theses. It would also be necessary to establish research laboratories where the teaching staff can follow their research interests and the students can do their Bachelor's theses.

If UGM and both faculties want to be competitive on an international level such investments have to be made and are urgently needed.

The library is tiny and not very comprehensive. Yet, the peers were assured that the relevant electronic subscriptions were available to all students via remote access. In order to come to a final assessment regarding the equipment, the peers ask UGM to provide a list of electronics subscriptions.

Besides the already mentioned restrictions, the auditors judge the available funds, the technical equipment, and the infrastructure (laboratories, library, seminar rooms etc.) to comply with the requirements for sustaining the degree programmes.

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

Staff

The peers see a slight change in the approach to only hire staff members from the own university. Nevertheless, the transformation takes time and, thus, the peers consider a relevant recommendation helpful to promote the process.

Staff development

The peers welcome the efforts regarding the development of the staff done by the university so far and will encourage them to continue its approach.

Funds and equipment

The explanations provided by the university regarding the technical equipment and teaching laboratories. The peers see possible approaches that have been suggested for the degree programme Computer Science. So, it is considered to reduce the number of computers in the laboratories and add more sessions of laboratory work. The university itself sees room for improvement regarding the computer laboratories equipment. Therefore, it prepared an action plan in which is foreseen to upgrade each year computers in one room. Hence, at the end of the fourth year, all computers have been upgraded. At the end of last year, there are supposed to be two computer laboratories which have been upgraded. The first one is equipped with computers of Intel i3 bought in 2016, the second one is equipped with computers of G4400 bought at the end of 2017. At this moment, there are still 2 laboratories with old computers. The university expects that the upgrading will be complete

by the end of next year. Then, this iteration shall be done again after 3 years of the final upgrade. For the degree programme Mathematics and Statistics, the university has also planned to set up more rooms for the laboratory. The software and computers are according to the university updated periodically, where the last update was in August 2017. The peers highly appreciate the action planned. They are considered useful and convincing. Thus, the peers do not see the necessity anymore for the respective requirement to provide a concept on how the technical equipment in the teaching laboratories. However, they recommend to keep the technical equipment including the list of electronic subscriptions continuously up to date.

The requested list of electronic subscriptions is according to the peers sufficient for the students.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Self-Assessment Report
- Module descriptions
- UGM's webpage: www.ugm.ac.id

Preliminary assessment and analysis of the peers:
The module descriptions of all three study programs are available as appendices to the Self-Assessment Report. The students and all other stakeholders have access to the module descriptions via UGM's homepage.

After studying the module descriptions the peers confirm that these include all necessary information about the persons responsible for each module, the teaching methods and work load, the awarded credit points, the intended learning outcomes, the content, the applicability, the admission and examination requirements, and the forms of assessment.

One aspect the peers find lacking are the sometimes outdated literature recommendations. The peers recommend updating the literature hints in the module descriptions, because some of the mentioned papers and textbooks are comparatively old.

Furthermore, the module handbooks of both Bachelor degree programmes do not include module descriptions for the Community Service and the Bachelor's thesis. Since these two modules are integral parts of the degree programmes, the peers ask UGM to provide descriptions for both modules.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

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

Preliminary assessment and analysis of the peers:
The peers confirm that the students of both degree programmes 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 programme including acquired soft skills and awards (extracurricular, co-curricular, and intra-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.

The auditors point out that a Diploma Supplement should also include statistical data about the distribution of final grade according to the ECTS-Users' guide. This allows the reader to categorise the individual result. For this reason, the peers ask UGM to include this additional information in the Diploma Supplement.

Criterion 5.3 Relevant rules

Evidence:

- Self-Assessment Report
- All relevant regulations as published on the university's webpage: www.ugm.ac.id

Preliminary assessment and analysis of the peers:
The auditors confirm that the rights and duties of both UGM and the students are 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 programme at the beginning of each semester.

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

Module descriptions

The peers take note of the provided module descriptions for the Community Services as well as for the Bachelor thesis. The module description for the Bachelor thesis is already updated taking into account the increase of credit points from 6 to 9. Thus, the respective requirement is not necessary anymore.

Diploma Supplements

The university states that starting in May 2018, Diploma Supplements for the graduates will contain statistical data about the distribution of their final grade according to the ECTS--Users' guide. As the university cannot yet provide an exemplary diploma supplement that contains these data, the peers maintain their respective requirement.

6. Quality management: quality assessment and development

Evidence:

- Self-Assessment Report
- QUALITY PROCEDURE, ANALYSIS OF STUDENTS' PERFORMANCE AND EVALUATION OF LECTURING IMPLEMENTATION, May 27th 2014

Preliminary assessment and analysis of the peers:
The auditors discuss the quality management system at UGM with the programme coordinators. They learn that there is a continuous process in order to improve the quality of the degree programmes and it is carried out through internal and external evaluation. The quality assurance system at UGM is conducted by the Office of Quality Assurance (KJM), which is supported by the Quality Assurance Unit (UJM) at the faculty level.

Internal evaluation of the quality of the degree programmes is mainly provided through student and alumni surveys. The students give their feedback on the courses by filling out the questionnaire online. Giving feedback on the classes is compulsory for the students; otherwise they cannot access their account on the digital platform PALAWA. There are 12 categories in the questionnaire (e.g. schedule, course materials, work load, motivation). The course evaluations are held during the final exam week. A compilation of the students' feedback is sent to the respective lecturers.

In addition to the surveys, there is an annual Internal Quality Audit in order to evaluate whether the general learning objectives have been achieved. Students, supporting staff, lecturers, alumni and employers are all taking part in the Quality Audit.

During the audit the peers learned that the results of the surveys are accessible by the students and the members of the teaching staff. If there is negative feedback, the Dean talks to the respective teacher, analyses the problem, and offers guidance. Furthermore, there is a complain box for the students that can be used for suggestions or criticism. The auditors gain the impression that the students' feedback is taken seriously by the faculties and changes are made if there is negative feedback.

External quality assessment of the degree programmes is provided by the Board of National Accreditation (BAN-PT) every five years. In addition, both degree programmes have been accredited by the ASEAN University Network Quality Assurance (AUN-QA).

The peers discuss with the representatives of UGM's partners from public institutions and private companies that there are regular workshops with the partners on faculty level, where they discuss the needs and requirements of the employers and possible changes to the degree programmes. As the peers consider the input of the employers to be very important for the further improvement of the degree programmes they appreciate the existing culture of quality assurance with the involvement of all stakeholders in the quality assurance process.

In summary, the peer group confirms that the quality management system is suitable to identify weaknesses and to improve the degree programmes.

Final assessment of the peers after the comment of the Higher Education Institution regarding criterion 6:

The peers consider the criterion as fulfilled.

D Additional Documents

Before preparing their final assessment, the panel ask that the following missing or unclear information be provided together with the comment of the Higher Education Institution on the previous chapters of this report:

- Module descriptions for the Community Service and the Bachelor's thesis
- List of electronic subscriptions of the library

E Comment of the Higher Education Institution (12.02.2018)

The institution provided a detailed statement as well as the following additional documents:

- Appendix R1a. Module handbooks of Community Service (UP-CS)
- Appendix R1b. Module handbooks of Community Service (UP-Math)
- Appendix R1c. Module handbooks of Community Service (UP-Stat)
- Appendix R2a. Undergraduate Program in Computer Science - Minor Curriculum Revision
- Appendix R2b. Grouping of elective courses to graduate profiles
- Appendix R3a. Module Handbooks of Elementary Differential Equation
- Appendix R3b. Module Handbooks of Introduction to Theory of Differential Equation
- Appendix R3c. Undergraduate Program in Math - Minor Curriculum Revision
- Appendix R3d. Undergraduate Program in Statistics - Minor Curriculum Revision
- Appendix R4. Current list of staff member
- Appendix R5. Photographs of Department Laboratories
- Appendix R6. Photograph of Department Libraries
- Appendix R7a. List of electronics subscriptions of university
- Appendix R7b. Statistics number of accessed E-Journal papers, 2017
- Appendix R8a. Module handbooks of Undergraduate Thesis I (2 credits, UP-Math)
- Appendix R8b. Module handbooks of Undergraduate Thesis II (4 credits, UP-Math)
- Appendix R8c. Module handbooks of Undergraduate Thesis I (3 credits, UP-Math)
- Appendix R8d. Module handbooks of Undergraduate Thesis II (6 credits, UP-Math)
- Appendix R9a. Module handbooks of Seminar (1 credit, UP-CS)
- Appendix R9b. Module handbooks of Thesis Proposal (2 credits, UP-CS)
- Appendix R9c. Module handbooks of Thesis (3 credits, UP-CS)
- Appendix R9d. Module handbooks of Thesis (6 credits, UP-CS)

- Appendix R10a. Module handbooks of Thesis (6 credits, UP-Stat)
- Appendix R10b. Module handbooks of Thesis I (3 credits, UP-Stat)
- Appendix R10c. Module handbooks of Thesis II (6 credits, UP-Stat)

F Summary: Peer recommendations (22.02.2018)

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Computer Science	With requirements for one year	-	30.09.2023
Ba Mathematics	With requirements for one year	-	30.09.2023
Ba Statistics	With requirements for one year	-	30.09.2023

Requirements

For all degree programmes

A 1. (ASIIN 1.3) Re-design the degree programmes so that students can complete the Bachelor's thesis in time and finish the programs without exceeding the standard period of time.

A 2. (ASIIN 5.2) Include statistical data about the distribution of the final according to the ECTS-Users' in the Diploma Supplement.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to prolong the period for internships to 3 months and to allow for more flexibility in executing them also during semester time. The establishment of a database of internships should also be considered.

E 2. (ASIIN 1.3) It is recommended to review the suitability of basic fundamental courses in general sciences in order to achieve the individual programme learning outcomes.

E 3. (ASIIN 1.3, 2.1) It is recommended to implement suitable instruments that support the internationalization strategy of the university. This includes among others the promotion of the academic mobility of students.

E 4. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students by introducing more English taught subject-specific elements into the curriculum and to add more oral exams in English.

E 5. (ASIIN 2.2) It is recommended to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

E 6. (ASIIN 4.1) It is recommended to hire new staff members also from other universities, not only graduates of UGM.

E 7. (ASIIN 4.3) It is recommend to keep the technical equipment including the list of electronic subscriptions continuously up to date.

G Comment of the Technical Committees

Technical Committee 04 - Informatics (06.03.2018)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure and generally agrees with the assessment of the peers. However, recommendation E6 is considered to be of more immediate importance and should be formulated as a requirement. Further, some minor changes are proposed for A2 and E 7.

The Technical Committee 04 - Informatics recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Computer Science	With requirements for one year	-	30.09.2023
Ba Mathematics	With requirements for one year	-	30.09.2023
Ba Statistics	With requirements for one year	-	30.09.2023

Requirements

For all degree programmes

A 1. (ASIIN 1.3) Re-design the degree programmes so that students can complete the Bachelor's thesis in time and finish the programs without exceeding the standard period of time.

A 2. (ASIIN 5.2) Include statistical data about the distribution of the final grade according to the ECTS-Users' in the Diploma Supplement.

A 3. (ASIIN 2.2) Ensure that the actual workload and its consistency with the awarded credits are continuously evaluated.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to prolong the period for internships to 3 months and to allow for more flexibility in executing them also during semester time. The establishment of a database of internships should also be considered.

E 2. (ASIIN 1.3) It is recommended to review the suitability of basic fundamental courses in general sciences in order to achieve the individual programme learning outcomes.

E 3. (ASIIN 1.3, 2.1) It is recommended to implement suitable instruments that support the internationalization strategy of the university. This includes among others the promotion of the academic mobility of students.

E 4. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students by introducing more English taught subject-specific elements into the curriculum and to add more oral exams in English.

E 5. (ASIIN 4.1) It is recommended to hire new staff members also from other universities, not only graduates of UGM.

E 6. (ASIIN 4.3) It is recommended to keep the technical equipment and the list of electronic subscriptions continuously up to date.

Technical Committee 12 - Mathematics (01.03.2018)

Assessment and analysis for the award of the ASIIN seal:

The technical committee discusses the procedure. It follows the peers' decision proposal in all aspects concerning the Undergraduate Programme in Mathematics and the Undergraduate Programme in Statistics.

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Computer Science	With requirements for one year	-	30.09.2023

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Mathematics	With requirements for one year	-	30.09.2023
Ba Statistics	With requirements for one year	-	30.09.2023

H Decision of the Accreditation Commission (23.03.2018)

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

The Accreditation Commission discusses the procedure.

With regard to requirement A1, the Accreditation Commission concludes that the problem of exceeding the standard period of time is in particular relevant for the Bachelor degree Mathematics and less problematic (compared to Mathematics) for the Bachelor Statistics and Computer Science. Thus, the Accreditation Commission decides to apply the requirement only for the Bachelor Mathematics whereas for the Bachelor Statistics and Computer Science a relevant recommendation is formulated.

With regard to requirement 2, the wording has been adapted.

Finally, the Accreditation Commission does not follow the proposition of the Technical Committee 04 to formulate the recommendation on the workload as requirement. Thus, the recommendation as suggested by the peers will be kept.

The Accreditation Commission for Degree Programmes decides to award the following seals:

Degree Programme	**ASIIN-seal**	**Subject-specific label**	**Maximum duration of accreditation**
Ba Computer Science	With requirements for one year	-	30.09.2023
Ba Mathematics	With requirements for one year	-	30.09.2023
Ba Statistics	With requirements for one year	-	30.09.2023

Requirements

For the Bachelor programme Mathematics

A 1. (ASIIN 1.3) Re-design the degree program so that students can complete the Bachelor's thesis in time and finish the program without exceeding the standard period of time.

For all degree programmes

A 2. (ASIIN 5.2) Include statistical data about the distribution of the final grades according to the ECTS-Users' guide in the Diploma Supplement.

Recommendations

For all degree programmes

E 1. (ASIIN 1.3) It is recommended to prolong the period for internships to 3 months and to allow for more flexibility in executing them also during semester time. The establishment of a database of internships should also be considered.

E 2. (ASIIN 1.3) It is recommended to review the suitability of basic fundamental courses in general sciences in order to achieve the individual programme learning outcomes.

E 3. (ASIIN 1.3, 2.1) It is recommended to implement suitable instruments that support the internationalization strategy of the university. This includes among others the promotion of the academic mobility of students.

E 4. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students by introducing more English taught subject-specific elements into the curriculum and to add more oral exams in English.

E 5. (ASIIN 2.2) It is recommended to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

E 6. (ASIIN 4.1) It is recommended to hire new staff members also from other universities, not only graduates of UGM.

E 7. (ASIIN 4.3) It is recommended to keep the technical equipment and the list of electronic subscriptions continuously up to date.

For the Bachelor Statistics, for the Bachelor Computer Science

E 8. (ASIIN 1.3) It is recommended to re-design the degree programmes so that students can complete the Bachelor's thesis in time and finish the programs without exceeding the standard period of time.

I Fulfilment of Requirements (29.03.2019)

Analysis of the peers and the Technical Committees 04-Informatics and 12-Mathematics (14.03.2019)

Requirements

For all degree programmes

A 1. (ASIIN 5.2) Include statistical data about the distribution of the final according to the ECTS-Users' in the Diploma Supplement.

Initial Treatment	
Peers	fulfilled Justification: All requested data has been delivered by the HEI and is available in the diploma supplement.
TC 12	fulfilled Vote: unanimous
TC 04	fulfilled Vote: unanimous

For the Bachelor's programme Mathematics

A 2. (ASIIN 1.3) Re-design the degree program so that students can complete the Bachelor's thesis in time and finish the program without exceeding the standard period of time

Initial Treatment	
Peers	fulfilled Justification: The HEI redesigned the process and the CPs to achieve improvement with regard to the Bachelor's Thesis. The program underlies some nationwide restrictions, yet the HEI showed substantial effort to overcome the problem of exceeding the standard period of time.
TC 12	fulfilled Vote: unanimous

Decision of the Accreditation Commission (29.03.2019)

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Mathematics	All requirements fulfilled	/	30.09.2023
Ba Statistics	All requirements fulfilled	/	30.09.2023
Ba Computer Science	All requirements fulfilled	/	30.09.2023

Appendix: Programme Learning Outcomes and Curricula

According to Students Guide Book the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Computer Science:

“The objectives of the 2016 Curriculum are

1. To produce graduates who are able to follow the development of computer science in particular and science and technology in general, able to work and compete in national and international job market, and able to continue study to higher education level.

2. Increase the contribution of study programme in the quality of human resources, environmental conservation, science and technology development, and education.

3. Improve the quality of education and computer science research.

4. Growing computer science to play more important roles in national development.”

The following **curriculum** is presented:

No.	Semester	Code	Course	Credit
1.	1	UNU-1000	Religion	2
2.		MMM-1101	Calculus I	3
3.		MFF-1011	Basic Physycs I	3
4.		MKK-1101	Basic Chemestry I	3
5.		MII-1201	Programming I	3
6.		MII-1202	Practicum of Programming I	1
7.		MII-1203	Informatical Logics	2
8.		MII-1205	Introduction to Computer Science	3
			Subtotal	**20**
1.	2	UNU-1010	Pancasila	2
2.		MMM-1102	Calculus II	3
3.		MFF-1012	Basic Physics II	3
4.		MII-1003	Elementary Linear Algebra	2
5.		MII-1211	Programming II	3
6.		MII-1212	Practicum of Programming II	1
7.		MII-1213	Discrete Mathenatics	3
8.		MII-1811	Digital Systems	2
9.		MII-1001	English	3
			Subtotal	**22**
1.	3	MII-2601	Microprocessor	2
2.		MII-2603	Computer Organisation and Architecture	3
3.		MII-2501	Database	3
4.		MII-2502	Practicum of Database	1
5.		MII-2201	Analysis of Algorithm and Complexity	3
6.		MII-2203	Probabiliy and Stochastic Process	3
7.		MII-2205	Language and Automata	3
8.		MII-2207	Computer Graphics	3
			Subtotal	**21**
1.	4	MMM-2301	Elementary Differential Equations	3
2.		MII-2602	Computer Networks	3
3.		MII-2652	Practicum of Computer Networks	1
4..		MII-2611	Operating Systems	3
5.		MII-2612	Practicum of Operating Systems	1
6.		MII-2211	Advance Algorithm	3
7.		MII-2213	Numerical Methods	2
8.		MII-2215	Signal and System	2

No.	Semester	Code	Course	Credit
9.		MII-2411	Artificial Intelligence	3
			Subtotal	**21**
1.	5	UNU-3000	Citizenship	2
2.		MII-3501	Software Development	3
3.		MII-3502	Prakcicum of Software Development	1
4.		MII-3601	Cryptography and Network Security	3
5.		MII-3003	Research Methods	2
6.			Elective course 1	3
7.			Elective course 2	3
8.			Elective course 3	3
			Subtotal	**20**
1.	6	MII-3001	Seminar	1
2.		MII-3005	Scientific Writing	2
3.		MII-3007	Phylosophy of Computer Science	2
4.		MII-3411	Machine Learning	3
5.		MII-3009	Entrepreneurship and Success Skills	2
6.			Elective course 4	3
7.			Elective course 5	3
8.			Elective course 6	3
9.			Elective course 7	3
			Subtotal	**22**
1.	7	MII-4001	Undergraduate Thesis Proposal	2
2.		UNU-4500	Community Service	3
3.			Elective course 8	3
4.			Elective course 9	3
5.			Elective course 10	3
			.Subtotal	**14**
1.	8	MII-4002	Undergraduate Thesis	4
			Subtotal	**4**
			TOTAL	**144**

According to Students Guide Book the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Mathematics:

"To produce graduates

- who have profound knowledge in theory of (pure) mathematics as the core and able to apply the theory to solve problems related to differential equations and optimization.
- are adaptive and able to continue to the next programme in mathematics or in other fields related to Mathematics.
- are literate in information technology and excellent in mathematical computational and
- have ability to follow the development of sciences and technology.
- have responsibility, confidence, emotional mature, ethics, and lifelong learner principle.

The Programme Educational Objectives of UP-Math have been formulated by considering the framework of National curriculum as stated in Level 6 of the Indonesian Qualifications Framework (IQF) /KKNI (Kerangka Kualifikasi Nasional Indonesia), i.e.,

1. Capable to apply science, technology and art within her/his expertise and adaptable to various situations faced during solving a problem.
2. Mastering in-depth general and specific theoretical concepts of a certain knowledge and capable to formulate related problem solving procedure
3. Capable to take strategic decision based on information and data analysis and provides direction in choosing several alternative solutions.
4. Responsible for her/his own job and can be assigned to take responsibility of the attainment of organization's performances."

The following **curriculum** is presented:

LIST OF COMPULSORY COURSES

Sem.	Nr.	Code	Course	Credits	Prerequisite	Remark	PIC
I:	1	MMM-1101	Calculus I	3			Department of Mathematics
	2	MFF-1011	Basic Physics I	3			Department of Physics
	3	MKK-1101	Basic Chemistry I	3			Department of Chemistry
	4	MII-1201	Programming I	3			Department of Computer science and Electronics

	5	MII-1202	Programming I Laboratory	1			Department of Computer science and Electronics
	6	MMM-1208	Introduction to Mathematical Logic	3			Lab. of Algebra
	7	UNU-100x	Religion	2		**UNU-1000 Islam UNU-1001 Katolik UNU-1002 Kristen UNU-1003 Hindu UNU-1004 Budha UNU-1005 Konghucu**	University
	8	MMS-1404	Statistical Methods I	3 (1)		with laboratory work	UP-Stat
Total Credits				**21**			
II	1	MMM-1102	Calculus II	3	MMM-1101*		Lab. of Analysis
	2	MMM-1106	Analytical Geometry	3	MMM-1101*		Lab. of Analysis
	3	MMM-1202	Elementary Linear Algebra	3			Lab. of Algebra
	4	MMM-1206	Discrete Mathematics I	2	MMM-1208*		Lab. of Algebra
	5	MMM-1203	Introduction to Algebraic Structure I	3	MMM-1208*		Lab. of Algebra
	6	MMM-1204	Set Theory	2	MMM-1208*		Lab. of Algebra
	7	MMM-1001	English	2			Department of Mathematics
	8	UNU-1010	Pancasila	2			University
Total Credits				**20**			
III	1	MMM-2109	Multivariable Calculus I	2	MMM-1102* MMM-1106*		Lab. of Analysis
	2	MMM-2201	Introduction to Algebraic Structure II	3	MMS-1203*		Lab. of Algebra
	3	MMM-2301	Elementary Differential Equations	3	MMM-1102*		Lab. of Applied Mathematics
	4	MMS-2410	Introduction Probability Models	3	MMM-1102*		Lab. of Statistics
	5	MMM-2207	Discrete Mathematics II	2	MMM-1206*		Lab. of Algebra
	6	MMM-2114	Transformation Geometry	2	MMM-1106*		Lab. of Analysis
	7	MMM-2312	Linear Programming	3 (1)	MMM-1202*	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation
Total Credits				**18**			

List of Elective Courses

No.	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	V	MMM-3003	Entrepreneurship	2	≥80 Credits		UP-Math
2	VI/ VII/V III	MMM-4001	Internship	3	≥100 Credits, IPK ≥3.00, without grade E, percentage of total credit with grade D less than or equal 25%.		UP-Math
Elective Courses "Analysis and Geometry"							
No.	**Sem**	**Code**	**Course**	**Credits**	**Prerequisite**	**Remark**	**PIC**
1	II	MMM-1105	Introduction to Number Theory	3	MMM-1208*		Lab. of Analysis
2	III	MMM-2113	Geometry	3	MMM-1106* MMM-1208*		Lab. of Analysis
3	III	MMM-2115	Geometry in n-dimensional Euclidean Space in n-dimensional Space	3	MMM-1106*		Lab. of Analysis
4	V	MMM-2105	Vector Analysis	2	MMM-2109*		Lab. of Analysis
5	VI	MMM-3108	Introduction to Topology	3	MMM-3102**		Lab. of Analysis
6	VI	MMM-3103	Introduction to Theory of Differential Equation	3	MMM-3102**		Lab. of Analysis
7	VI	MMM-3105	Introduction to Theory of Measure and Lebesgue Integral	3	MMM-3102**		Lab. of Analysis
8	VI	MMM-3107	Introduction to Differential Geometry	3	MMM-2109*		Lab. of Analysis
9	VII	MMM-4102	Introduction to Functional Analysis	3	MMM-3102*		Lab. of Analysis
10	VII/ VIII	MMM-4149	Capita Selecta in Analysis	3	MMM-3101		Lab. of Analysis
Elective Courses "Algebra and Discrete Mathematics"							
No	**Sem**	**Code**	**Course**	**Credits**	**Prerequisite**	**Remark**	**PIC**
1	III	MMM-2210	Applied Linear Algebra I	2	MMM-1202*		Lab. of Algebra
2	III	MMM-2208	Finite Group Theory	2	MMM-1203*		Lab. of Algebra
3	IV	MMM-2209	Introduction to Combinatorics	3	MMM-2207*		Lab. of Algebra
4	IV	MMM-2206	Introduction to Graph Theory	3	MMM-2207*		Lab. of Algebra
5	V	MMM-3206	Introduction to Coding Theory	3	MMM-2202*		Lab. of Algebra
6	VI	MMM-3210	Introduction to Semigroup Theory	3	MMM-1203*		Lab. of Algebra
7	VI	MMM-3209	Applied Linear Algebra II	2	MMM-2202*		Lab. of Algebra
8	VII	MMM-4207	Introduction of Module Theory	3	MMM-2202*		Lab. of Algebra
9	VII	MMM-4206	Introduction to Cryptography	3	MMM-2202*		Lab. of Algebra
10	VII/ VIII	MMM-4249	Capita Selecta in Algebra	3	MMM-2202*		Lab. of Algebra
Elective Courses "Applied Mathematics"							

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	III	MMM-2308	Introduction to Game Theory	3			Lab. of Applied Mathematics
2	IV	MMM-2303	Biological Mathematics	3	MMM-2301*,MMS-2410*		Lab. of Applied Mathematics
3	V	MMM-3310	Introduction to Theory of System♥	3	MMM-2202*, MMM-2301*		Lab. of Applied Mathematics
4	V	MMM-3311	Introduction to Boundary Value Problem	3	MMM-2310*		Lab. of Applied Mathematics
5	VI	MMM-3306	Dynamical System♥	3	MMM-1202*, MMM-2301*		Lab. of Applied Mathematics
6	VI	MMM-3312	Introduction to Control Theory	3	MMM-3310*		Lab. of Applied Mathematics
7	VII	MMM-4303	Introduction to Ergodic Theory	3	MMM-3306*		Lab. of Applied Mathematics
8	VII/VIII	MMM-4349A	Capita Selecta in Applied Mathematics A	3	MMM-3303*		Lab. of Applied Mathematics
9	VII/VIII	MMM-4349B	Capita Selecta in Applied Mathematics B	3	MMM-3303*		Lab. of Applied Mathematics

Elective Courses "Mathematical Computation"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	VI	MMM-4449	Capita Selecta in Computational Mathematics	3	MMM-3401*		Lab of Mathematical Computation
2	VII	MMM-4401	Introduction to Fractal Geometry	3	MMM-2112*		Lab of Mathematical Computation

Elective Courses "Algebra and Mathematical Computation"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	V	MMM-3208	Numerical Linear Algebra	3 (1)	MMM-2202*	with laboratory work	Lab. of Algebra and Lab of Mathematical Computation

Elective Courses "Applied Mathematics and Mathematical Computation"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	IV	MMM-2311	Operation Research	3 (1)	MMM-2312*,	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation
2	VI	MMM-3309	Introduction to Theory of Optimization♥	3 (1)	MMM-2312*	with laboratory work	Lab. of Applied Mathematics and Lab of Mathematical Computation

Elective Courses "Statistics"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	II	MMS-1410	Explorative data analysis	3 (1)	MMS-1404*	with laboratory work	UP-Stat
2	II	MMS-1409	Statistical Method II	3(1)	MMS-1404*	with laboratory work	UP-Stat
3	III	MMS-2481	Survey sample method	2	MMS-1404*		UP-Stat
4	III	MMS-2418	Introduction to financial mathematics I♦	3	MMM-1102*		UP-Stat
5	III	MMS-2492	Introduction to Actuarial Accounting I♦	3		PAI	UP-Stat
6	III	MMS-2421	Applied Regression analysis♦	3 (1)	MMS-1409*	PAI with laboratory work	UP-Stat
7	III	MMS-2420	Introduction to Statistical Mathematics I♦	3	MMM-1102*	PAI	UP-Stat
8	III	MMS-2493	Introduction to Micro Economy♦	3		PAI	UP-Stat
9	IV	MMS-2419	Introduction to financial mathematics II♦	3	MMS-2418*	PAI	UP-Stat
10	IV	MMS-2497	Introduction to Macro Economy♦	3	MMS-2493*	PAI	UP-Stat
11	IV	MMS-2483	Introduction to Statistical Mathematics II♦	3	MMS-2420*	PAI	UP-Stat
12	IV	MMS-2425	Statistical Quality Control	3 (1)	MMS-1404*	with laboratory work	UP-Stat
13	IV	MMS-2496	Introduction to Actuarial Accounting II♦	3	MMS-2492*	PAI	UP-Stat
14	V	MMS-3429	Introduction to time series♦	3 (1)	MMS-2420*	PAI with laboratory work	UP-Stat
15	V	MMS-3438	Introduction to Actuarial Mathematics I♦	3 (1)	MMS-2418*	PAI with laboratory work	UP-Stat
16	V	MMS-3432	Introduction to Theory of Actuarial Risk I♦	3		PAI	UP-Stat
17	VI	MMS-3434	Introduction to Theory of Actuarial Risk II♦	3	MMS-3432*	PAI	UP-Stat
18	VI	MMS-3443	Survival Data Analysis ♦	3 (1)	MMS-1409*	PAI with laboratory work	UP-Stat
19	VI	MMS-3477	Introduction to Actuarial Mathematics II♦	3	MMS-3438*	PAI	UP-Stat
20	VI	MMS-3488	Official Statistics	2			UP-Stat

Elective Courses "Computer science"

No	Sem	Code	Course	Credits	Prerequisite	Remark	PIC
1	II	MII-1211	Programming II	3	MII-1201*		UP-CS
2	II	MII-1212	Programming II Laboratory	1	MII-1202* MII-1211**		UP-CS

According to Students Guide Book the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor degree programme Statistics:

"After finish the study, students are:

1. able to master the theoretical concepts and methods of statistics and formulating them for problem solving;

2. able to develop statistics for the utilization and development of science and technology;

3. able to apply statistics on education, research and community services that benefit for the institution, community, nation and state;

4. able to make the right decisions based on analysis of statistics;

5. able to communicate scientific, cooperation as well as the responsibility of individuals and organizations.

Generic Description of Human Resource Qualification Level 6 of IQF for D-IV or undergraduate programme's graduates are those who are:

1. Capable to apply science, technology and art within her/his expertise and adaptable to various situations faced during solving a problem.

2. Mastering in-depth general and specific theoretical concepts of a certain knowledge and capable to formulate related problem solving procedure.

3. Capable to take strategic decision based on information and data analysis and provides direction in choosing several alternative solutions.

4. Responsible for her/his own job and can be assigned to take responsibility of the attainment of organization's performances."

The following **curriculum** is presented:

List of Compulsory Courses

No	Code	Course	SKS	Prerequisite
Semester I				
1.	MMS-1404	Statistical Methods I	3(1)	
2.	MMM-1101	Calculus I	3	
3.	MFF-1011	Basic Physics I	3	
4.	MKK-1101	Basic Chemistry I	3	
5.	MII-1201	Programming I	3	
6.	MII-1202	Programming I Laboratory	1	
7.	UNU-100x	Religious study	2	
8.	UNU-1010	Pancasila State's Ideology	2	
			20	
Semester II				
1.	MMS-1409	Statistical Methods II	3(1)	MMS-1404*
2.	MMM-1102	Calculus II	3	MMM-1101*
3.	MMS-1410	Exploratory Data Analysis	3(1)	MMS-1404*
4.	MMS-1481	Discrete Mathematics and Combinatorics	2	
5.	MMS -1479	Linear Algebra for Statistics	3	

6.	MMS -1480	Philosophy of Science and Professional Ethics Statistics	2	
7.	MMM -1001	English	2	
			18	
Semester III				
1.	MMS -2481	Survey Sampling Methods	2	MMS-1404*
2.	MMS-2428	Multivariable Calculus for Statistics	2	MMM-1102*
3.	MMM-2301	Elementary Differential Equations	3	MMM-1102*
4.	MMS -2405	Introduction to Experimental Design	3	MMS-1409*
5.	MMS -2421	Applied Regression Analysis	3(1)	MMS-1409*
6.	MMS -2420	Introduction to Mathematical Statistics I	3	MMM-1102*
7.	MMS-2410	Introduction to Probability Models	3	MMM-1102*
			19	
Semester IV				
1.	MMS -2483	Introduction to Mathematical Statistics II	3	MMS-2420*
2.	MMM-2111	Advanced Calculus	2	MMM-1102*
3.	MMS-2485	Introduction to Sampling Theory	2	MMS 2481*
4.	MMS-2422	Statistical Computation I	3(1)	
			10	
Semester V				
1.	MMS-3421	Applied Multivariate Statistics	3(1)	MMS-2420*
2.	MMS-3429	Introduction to Time Series	3(1)	MMS-2420*
3.	MMS-3404	Introduction to Measurement and Probability Theory	3	MMM-1102*
4.	MMM-3002	Introduction to Stochastic Processes	3	MMS-2410*
5.	MMS-3489	Internship	2	100 SKS
			14	
Semester VI				
1.	MMS-3488	Official Statistics	2	
2.	UNU-3000	Citizenship	2	60 SKS, IPK>2
4.	MMS-3437	Seminar	1	100 SKS
3.	MMS-3487	Introduction to Big Data	2	MMS-3421*
			7	
Semester VII				
1.	UNU-4500	Community Development Participation/Community services	3	100 SKS
			3	
Semester VIII				
1.	MMS-4099	Final Project	6	110 SKS
			6	
		Total credit of compulsory courses	**97**	

List of Elective Courses

No	Code	Course	SKS	Prerequisite
Semester III				
1	MMS-2418	Introduction to Financial Mathemathics I	3	MMM-1101*
2	MMS-2492	Introduction to Insurance Accounting I	3	
3	MMS-2493	Introduction to Microeconomics	3	
			9	
Semester IV				
1.	MMS-2424	Applied Analysis of Variance	3(1)	MMS-1409*
2.	MMS-2415	Demography	3	MMS-1404*
3.	MMS-2425	Statistical Quality Control	3(1)	MMS-1404*
4.	MMS-2419	Introduction to Financial Mathemathics II	3	MMS-2418*
5.	MMS-2426	Categorical Data Analysis	3(1)	MMS-1409*
6.	MMS-2496	Introduction to Insurance Accounting II	3	MMS-2492*
7.	MMS-2497	Introduction to Macroeconomics	3	MMS-2493*
8.	MMS-2427	Forecasting Methods	3(1)	MMS-1409*
			24	
Semester V				
1.	MMS-3438	Introduction to Actuarial Mathematics I	3(1)	MMS-2418*
2.	MMS-3439	Introduction to Queueing and Simulation Theory	3(1)	MMS-2410*
3.	MMS-3424	Quantitative Risk Management	3	MMS-2420*
4.	MMS-3441	Biostatistics and Epidemiology	4(1)	MMS-1409*
5.	MMS-3442	Statistical Computation II	3(1)	MMS-2422*
6.	MMS-3432	Introduction to Actuarial Risk Theory I	3	
			19	
Semester VI				
1.	MMS-3431	Nonparametric Statistical Method	3	MMS-1409*
2.	MMS-3477	Introduction to Actuarial Mathematics II	3	MMS-3438*
3.	MMS-3443	Survival Data Analysis	3(1)	MMS-1409*
4.	MMS-3433	Introduction to Investment Management	3	MMS-2418*
5.	MMS-3434	Introduction to Actuarial Risk Theory II	3	MMS-3432*
6.	MMS-3435	Structural Equation Modelling	3	MMS-3421*
7.	MMS-3445	Introduction to Econometrics	3(1)	MMS-1409*
			21	
Semester VII				
1.	MMS-4415	Introduction to Response Surface	3	MMS-1409*
2.	MMS-4449	Capita Selecta in Statistics A	3	MMS-2483*
3.	MMS-4416	Introduction to Panel Data Analysis	3	MMS-2420*
4.	MMS-4421	Introduction to Decision Theory	3	MMS-1404*
5.	MMS-4422	Introduction to Pension Fund Valuation	3	MMS-3438*
			15	
Semester VIII				
1.	MMS-4402	Reliability	3	MMS-2420*
2.	MMS-4494	Spatio-Temporal Modelling	3	MMS-3429*
3.	MMS-4403	Sequential Methods	3	MMS-1409*
4.	MMS-4423	Capita Selecta in Statistics B	3	
			12	

No	Code	Course	SKS	Prerequisite
	Total credit of elective courses		**100**	