ASIIN Seal

Accreditation Report

Bachelor's Degree Programmes
Astronomy
Mathematics
Physics

Provided by
Institut Teknologi Bandung, Indonesia

Version: 18 March 2022

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 Sarjana Astronomi	Undergraduate programme in Astronomy	ASIIN	ASIIN until 30.09.2021	13
Program Studi Sarjana Matematika	Undergraduate programme in Mathematics	ASIIN	ASIIN until 30.09.2021	12
Program Studi Sarjana Fisika	Undergraduate programme in Physics	ASIIN	ASIIN until 30.09.2021	13
Date of the contract: 23.01.2020 **Submission of the final version of the self-assessment report:** 17.06.2020 **Date of the audit (online):** 10.11. – 12.11.2020				
Peer panel: Prof. Dr. Retna Apsari, Universitas Airlangga Prof. Dr. Ralf-Jürgen Dettmar, Ruhr University Bochum Prof. Dr. Norbert Kroll, German Aerospace Center (DLR) Prof. Dr. Ted Masselink, Humboldt University Berlin Prof. Dr. Christof Schelthoff, University of Applied Sciences Aachen Fiorentina Farah Medina, Universitas Airlangga, Surabaya, student				
Representative of the ASIIN headquarter: Rainer Arnold				
Responsible decision-making committee:				

[1] ASIIN Seal for degree programmes;
[2] TC: Technical Committee for the following subject areas: TC 12 – Mathematics; TC 13 – Physics

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 12 – Mathematics as of 09.12.2016 Subject-Specific Criteria of Technical Committee 13 – Physics as of 20.03.2020	

B Characteristics of the Degree Programmes

a) Name	Final degree (original)	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
Bachelor in Astronomy	Sarjana Sains Biologi / Bachelor of Science in Astronomi	-	6	Full time	no	8 Semester	144 CSU / 200 ECTS	1951, Once a year (August)
Bachelor in Mathematics	Sarjana Sains Matematika / Bachelor of Science in Mathematics	-	6	Full time	no	8 Semester	144 CSU / 200 ECTS	1948, Once a year (August)
Bachelor in Physics	Sarjana Farmasi, Sains Fisika / Bachelor of Science in Physics		6	Full time	no	8 Semester	144 CSU / 200 ECTS	1948, Once a year (August)

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

For the Bachelor's degree programme Astronomy, (UPA) Institut Teknologi Bandung (ITB) has presented the following profile in the Self-Assessment Report:

"The establishment of the Undergraduate Programme in Astronomy, Institut Teknologi Bandung (ITB), Indonesia, cannot be separated from the existence of Bosscha Observatory, located in Lembang, about 15 km from the main campus of ITB in Bandung. This observatory was founded in 1923 by almost the same founding fathers who established Technische Hoogeschool Bandung in 1920. Bosscha Observatory belonged to the Dutch Indies Astronomical Society. After World War II and national independence (1945), the observatory was severely damaged. Works on refurbishment of the observatory took place from 1946 to 1951, mostly led by astronomer G. B. van Albada. In 18 October 1951, van Albada was appointed as Professor of Astronomy in ITB and the observatory was transferred as property of the Republic of Indonesia. This date is commonly referred as the beginning of the Undergraduate Programme in Astronomy. Since then, astronomers worked at Bosscha Observatory were graduated from ITB. Until now, it is the only Astronomy Undergraduate Programme in Indonesia."

For the Bachelor's degree programme Mathematics, (UPM) Institut Teknologi Bandung (ITB) has presented the following profile in the Self-Assessment Report:

"Undergraduate Programme in Mathematics FMNS ITB provides learning in mathematics and related fields. The programme is to equip, grow and nurture students' competence, which includes knowledge and skill in mathematics, to enable them to pursue further studies or to enter job market. UPM's curriculum gives students a high degree of flexibility, so students, with guidance from students' advisor, are able to tailor their program according to their interests in mathematics. The flexibility is designed so students may optimize their potential to develop mathematical power, attitudes and personality, to face challenges coming from advanced studies or job market."

For the Bachelor's degree programme Physics, (UPP) Institut Teknologi Bandung (ITB) has presented the following profiles in the Self-Assessment Report:

"The Undergraduate Program in Physics ITB begins by strengthening the fundamental sciences and mathematics, followed by an enhancement of the physics concept through various physics core courses in classical and modern physics. Students are also equipped with advanced mathematics and computational tools. With the strong basic and advanced physical concepts, the students then learn to apply these concepts and mathematical and computational tools to analyse the physics problems. The students are then introduced to the advanced concept of physics and various physics related expertise in biophysics, nuclear physics, material physics, instrumentation physics and earth physics through elective courses in order that students have wide range of expertise and specialized physics stream. Further applicative learning is capstoned in the form of final project. In this project, students are introduced into research atmosphere and learn how to solve problem according to scientific methodology. Report of the final project is written in the form of a thesis and have to be defended at final thesis examination, attended by examiners."

C Peer Report for the ASIIN Seal

1. The Degree Programme: Concept, content & implementation

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

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Webpage Ba Astronomy: https://www.as.itb.ac.id/undergraduate-program3/
- Webpage Ba Mathematics: http://www.math.itb.ac.id/undergraduate-program/
- Webpage Ba Physics: http://www.fi.itb.ac.id/en/program-sarjana-fisika/
- Discussions during the audit

Preliminary assessment and analysis of the peers:
The auditors base their assessment of the learning outcomes as detailed in the Self-Assessment Reports of the three Bachelor's degree programmes under review.

The auditors refer to the Subject-Specific Criteria (SSC) of the Technical Committee Physics as a basis for judging whether the intended learning outcomes of the Bachelor's degree programmes Physics and Astronomy as defined by ITB correspond with the competences as outlined by the SSC. They come to the following conclusions:

Graduates of the Bachelor's degree programme Astronomy (UPA) should acquire an understanding of the fundamental laws of natural sciences and of and be capable of applying the scientific and technological methods of the astronomical sciences. In addition, graduates should acquire relevant scientific knowledge in the different astronomical subjects such as planetary and stellar systems, galaxies, and astrophysics and understand the underlying physical and mathematical principles. Students should learn to work in a team, to identify and solve scientific problems, and to carry out practical work, especially using a telescope for collecting, interpreting, and analysing observational data. In addition, graduates should comprehend of the role of astronomy in science education and be able to communicate

with the public. The programme is designed as a general astronomy programme with some specialization during the student's final research project.

The programme's educational objectives and learning outcomes are expected to equip graduates with skills required for lifelong learning and for pursuing further academic studies. Most UPA graduates acquire a further academic degree (Master or PhD) and follow a career in research and higher education. Possible employers are mainly scientific agencies (e.g. Bosscha Observatory, LAPAN (National Space and Aeronautics Agency), BMKG (Agency for Climate and Geophysics)). Other graduate are employed as science teachers in high schools, in public agencies such as planetariums or science education centres.

The intended learning outcomes of the Bachelor's degree programme Physics (UPP) focus on conveying scientific methods for observing, understanding, analysing, and solving physical phenomena and problems. This includes that graduates should acquire fundamental physics-relevant knowledge of mathematics, computer sciences, and natural sciences. Furthermore, graduates need to understand how to use models in solving problems. Physics, as a natural science depends on experiments. Therefore, the capability in preparing, conducting and reporting on laboratory experiments is an important competence that graduates need to acquire. Finally, UPP graduates should have adequate competencies in oral and written communication skills, be able to work in a team and be prepared to enter a Master's programme.

As pointed out in the Self-Assessment Report "UPP is not designed to produce graduates to be ready-worked for a specific job, but to be adaptive and trainable." However, UPP graduates have numerous job opportunities, because they are not limited to a specific area but well prepared for a science and technology oriented job market. As a result, alumnae of UPP work in various sectors such as universities, research institutes, public and private agencies, information & communication companies, or high schools. Some open their own private business and others work in areas such as banking, insurances, retail, or other service.

The peers refer to the Subject-Specific Criteria (SSC) of the Technical Committee Mathematics as a basis for judging whether the intended learning outcomes of the Bachelor's degree programme Mathematics (UPM), as defined by ITB, correspond with the competences as outlined by the SSC. They come to the following conclusions:

UPM graduates should acquire a profound knowledge of mathematics and gain methodological competences in the mathematical sciences. Students should develop a mathematical, logical, and rigorous reasoning. In addition, they should be familiar with the different areas of mathematics (linear algebra, discrete mathematics, mathematical computation and simulation, multivariable calculus, data analysis, and differential equations). Finally,

graduates should be able to work with and manipulate mathematical properties and should have a thorough understanding of the underlying mathematical concepts. This should enable them to develop critical thinking skills and the ability to use mathematical concepts.

UPM aims at producing graduates who are able to develop their mathematical skills, to expand their mathematical interests, to manifest their leadership and innovativeness in mathematics or related fields, and to acquire good attitude and characteristics needed for advanced studies as well as career advancement.

UPM graduates usually follow two distinct careers: some work in academia or higher education as math researchers or teachers, while others work in private companies. Job opportunities in the industry are manifold: some graduates have an interest in information technology and work as computer programmers, software developers, or data scientists. Others may take jobs in the financial sector and work as auditors or financial analysts. Many UPM graduates pursue further degrees (Master or PhD) in Mathematics or other scientific fields.

In addition to the subject-related qualification objectives, students of all three Bachelor's programmes should be capable of working autonomously as well as in a team-oriented manner, and be able to conduct research activities. Furthermore, they should be able to solve subject-relevant problems, to present their results, have trained their analytical and logical abilities, and have an awareness of possible social and ethical effects of their actions. During the course of their studies, the students should acquire communicative and language skills, and have developed a strategy for lifelong learning. 10 to 15 % of the undergraduates from FMNS continue directly with a Master's programme at ITB. Altogether, approximately 50 % of the students will enter a Master's programme at either ITB or another university and often several years after graduation because they work in the meantime and earn money for financing their further studies.

Students and alumni confirm during the audit that they have good and diverse job opportunities although many of them will work in areas that are not directly related to their major. During their studies, students learn scientific thinking and acquire analytical problem solving skills. This set of skills opens several job opportunities. In general, alumni are satisfied with their job perspectives.

In summary, the auditors are convinced that the intended qualification profiles of the three undergraduate programmes under review allow students to take up an occupation, which corresponds to their qualification. The degree programmes are designed in such a way that they meet the goals set for them. The peers conclude that the objectives and intended learning outcomes of the degree programmes adequately reflect the intended level of academic qualification and correspond sufficiently with the ASIIN Subject-Specific-Criteria

(SSC) of the Technical Committee 12 – Mathematics (UPM) and the SSC of the Technical Committee 13 – Physics (UPA and UPP).

The peers appreciate that ITB 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 in order to complete a Master and maybe even a PhD-programme. The excellent and manifold job opportunities are one of the strong points of the reviewed undergraduate programmes at ITB.

Criterion 1.2 Name of the degree programme

Evidence:

- Self-Assessment Reports

Preliminary assessment and analysis of the peers:
The auditors confirm that the names of all three Bachelor's degree programmes appropriately reflect the focus and content of the respective undergraduate programmes. Moreover, the English translation and the original Indonesian names of UPA, UPP, and UPM correspond with the intended aims and learning outcomes as well as the main course language (Bahasa Indonesia).

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Webpage Ba Astronomy: https://www.as.itb.ac.id/undergraduate-program3/
- Webpage Ba Mathematics: http://www.math.itb.ac.id/undergraduate-program/
- Webpage Ba Physics: http://www.fi.itb.ac.id/en/program-sarjana-fisika/
- Discussions during the audit

Preliminary assessment and analysis of the peers:
The Faculty of Mathematics and Natural Sciences (FMNS) offers all three Bachelor's degree programmes under review. The undergraduate programmes are designed for four years

and at least 144 credit semester units (CSU) need to be achieved by the students (this is equivalent to approximately 200 ECTS credits).

The courses in the first two semesters (common year, 36 CSU) convey basic knowledge of natural sciences and languages (Indonesian and English). The first-year students are students of the Faculty of Mathematics and Natural Sciences. At the end of the common year, students are given the opportunity to choose the undergraduate programme they wish to attend. The final placement in the undergraduate programme is based on the student's preference as well as GPA and class capacity.

Courses on the different subject-specific sciences are offered from the third to the eight semester. During the eight semesters, students must also complete the undergraduate thesis. Some of the obligatory courses, such as religion and ethics, pancasila and civic education, and sports are university requirements and need to be attended by all students at ITB.

Regular students take 18 credits in every semester, while outstanding students may take up to 24 credits. Therefore, outstanding students are enabled to complete the Bachelor's degree in less than 4 years. However, this case is rare (only 5 to 10 % of the students apply for this option) since the workload of the undergraduate programmes is rather high anyway and designed for a four-year study programme. Students can also apply for the fast track option if they have no C-grade (or below) and a GPA above 3.5. Fast track students can directly continue with a Master's programme and special scholarships are available for them in the Master's programme. The maximum period for the completion of the common first year programme is two years while it is six years for the complete undergraduate programme.

For undergraduate students from the routes of SNMPTN or SBMPTN (via national selection exams), the maximum tuition fee is Rp 12.500.000 (719 Euros) per semester. For undergraduate students from the routes of independent selection (Seleksi Mandiri), the tuition fee is Rp 25.000.000 (1.438 Euros) per semester, with an additional of Institution Development fee of Rp 25.000.000 (paid once by new students).

Approximately 15 % of all undergraduate students at ITB are fully funded by the government including their daily expenditures. Full tuition fee is only paid by approximately 47.8 % of the students. A tuition waiver scheme is available upon request and the amount depends on the parents' economic status. The amount of waiver ranges from 20 to 80 % of the total fee. In addition, several grants for students with financial difficulties are available, such as from the government, industries, foundation, alumni association and ITB parents' association.

During the discussion with the peers, students point out that students in need of financial support usually receive a scholarship from ITB and are offered a room in dormitory. However, most students live either at their parents' house or in a student hostel. Some senior students work as laboratory assistants to earn some money for financing their studies.

The academic year at ITB starts in August and ends in June. Each academic year consists of two semesters, which run for 16 weeks each. Two out of the 16 weeks are examination periods. A short summer semester is offered with a maximum workload of 10 credits. The summer semester is designed to assist students to repeat failed classes or to make up for missing credits in order to be able to complete the programme within the allowed period of time.

In contrast to most other Indonesian universities, community service is not a compulsory course for undergraduate students at ITB. However, all students can enrol in a course called "Social Community Service Course", which is an elective and offered by the Faculty of Arts and Design. Although community service is not mandatory, most of the undergraduates at ITB are involved in social activities and choose community service as an additional course.

Since ITB has the goal to become internationally more visible and wants to internationalise its degree programmes further, the peers discuss with the programme coordinators and students if any classes are taught in English. The programme coordinators explain that usually all courses are delivered in Bahasa Indonesia (Indonesian language) but most of the teaching materials (textbooks) are provided in English. Sometimes parts of a lecture are held in English, for example if there is an international guest lecturer. Sometimes, even the whole course is offered in English in order for international student to attend the classes. Information about the curriculum is available for students in the digital academic information system and on the programme's homepage. Furthermore, students are encouraged to attend summer courses that are held in English with international students and guest lecturers. The students confirm that English textbooks are used but the peers are convinced that more active English speaking would be useful. In general, the peers gain the impression that there could be more English elements in the courses of all three Bachelor's programmes under review. Students should be encouraged to actively speaking English. This could be achieved e.g. by discussing international papers or giving oral presentations in English. Of course, it would be too difficult if advanced classes were taught in English, but introductory classes could introduce more English elements like short presentations.

The peers see that most members of the teaching staff in the Faculty of Mathematics and Natural Sciences have international experience (e.g. have graduated from an international university) and, therefore, have a good English proficiency.

The members of the teaching staff explain on demand of the peers that they offer possible topics for the final projects according to their own research projects. All members of the teaching staff supervise theses. Students have to design a research proposal with a time schedule for the project, which is discussed with the academic advisor. If they agree, the students apply formally for being allowed to work on the suggested topic.

The peers gain the impression that the graduates of the all degree programme under review are well prepared for entering the labour market and can find adequate jobs in Indonesia.

Criterion 1.4 Admission requirements

Evidence:

- Self-Assessment Reports
- ITB Regulation for Academic and Student Affairs
- Decree of Minister of Research, Technology and Higher Education No. 2, 2015
- ITB webpage: https://www.itb.ac.id/admission
- Discussions during the audit

Preliminary assessment and analysis of the peers:
According to the Self-Assessment Reports, admission procedures and policies for new students follow the National Regulation No.2, 2015. The requirements, schedule, registration venue, and selection test are announced on ITB's webpage and thus accessible for all stakeholders.

There are three different ways by which students can be admitted to a Bachelor's programme at ITB:

1. National Entrance Selection of State Universities (Seleksi Nasional Masuk Perguruan Tinggi Negeri, SNMPTN), a national admission system, which is based on the academic performance during the high school (40 % of the students at ITB are admitted through this selection system).

2. Joint Entrance Selection of State Universities (Seleksi Bersama Masuk Perguruan Tinggi Negeri, SBMPTN). This national selection test is held every year for university candidates. It is a nationwide written test (subjects: mathematics, Bahasa Indonesia, English, physics, chemistry, biology, economics, history, sociology, and geography). It accounts for 40 % of the admitted students at ITB.

3. Independent Selection (Seleksi Mandiri, SM) students are selected based on a written test (similar to SBMPTN) specifically held by ITB for prospective students that haven not been accepted through SNMPTN or SBMPTN (20 % of the students at ITB are admitted through this test).

The senate of FMNS decides the number of intakes, which is subsequently proposed to the university. Students are placed in either UPA, UPP, or UPM after completing the Common First Year. The placement is based on students' preferences, GPA and class capacity. Maximum intake numbers in 2018/19 were 50 students (UPA), 110 students (UPP), and 110 students (UPM).

It is a highly competitive selection process to be accepted by FMNS because ITB is one of the most prestigious universities in Indonesia and every year much more students apply for entrance than study places are available.

The details of the application process at ITB and further information on admissions criteria and deadlines can be found in the National Regulation No. 2, 2015 and the ITB Regulation for Academic and Student Affairs, which is also published on the university's webpage.

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:

The peers understand that it is useful to deliver the classes in the first semesters in Bahasa Indonesia. Offering a compulsory English language course is also sensible and the peers appreciate that the course "Scientific Communication" in UPP is delivered in English. In addition, the peers are glad that ITB plans to introduce more English elements in advanced classes, e.g. by having oral presentations in English.

The peers consider criterion 1 to be fulfilled.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- Webpage Ba Astronomy: https://www.as.itb.ac.id/undergraduate-program3/
- Webpage Ba Mathematics: http://www.math.itb.ac.id/undergraduate-program/
- Webpage Ba Physics: http://www.fi.itb.ac.id/en/program-sarjana-fisika/
- Discussions during the audit

Preliminary assessment and analysis of the peers:

The curriculum of all three Bachelor's degree programmes under review are designed for eight semesters. Nevertheless, it also possible for excellent students to complete the degree in only seven semesters. Students cannot cover more than 24 CSU per semester. The students' individual study plans are different from each other, but have to be approved by their academic advisors and the Vice Dean of Academic and Student Affairs.

The undergraduate curriculum is structured into two general phases, namely the Common First Year (Tahap Persiapan Bersama, TPB) and the Bachelor phase (Sarjana). The former is delivered in two semesters while the latter encompasses six semesters, consisting of compulsory and elective courses. The Common First Year contains compulsory courses of ITB, aimed to ensure that students have adequate proficiency in basic science and languages. The normal duration of this stage is two semesters, consists of 36 CSU (50 ECTS). However, students can complete this stage within two years. To complete the Common First Year, students are required to have a minimum GPA of 2.0 out of 4.0 and all courses need to have a minimum grade of D.

Several compulsory courses in the Bachelor phase, namely "Pancasila and Civic Education", as well as "Religion and Ethics", are managed at the university level and are mandatory subjects for all Bachelor's students in Indonesia. They are aimed at developing social skills, and character building. The Bachelor (Sarjana) stage is managed by each school. The aim of this stage is to develop the knowledge and skill of chosen discipline. Normal duration of this stage is 6 semesters with minimum of 108 CSU (150 ECTS). To complete the Bachelor stage, students are required to have minimum GPA of 2.0 out of 4.0 and all courses need to have minimum grade of C. All students have to complete the undergraduate programme (Common First Year and Bachelor stage) within six years.

For the elective subjects, the class size depends on the number of the attending students. The elective subjects are designed not only to give additional knowledge complementing the compulsory course, but also to help students deciding on a final project and personal scientific interest.

A systematic university-wide review of the curriculum is conducted every five years but minor changes may be implemented every year after endorsement by the school's senate.

The Bachelor's degree programme Astronomy includes compulsory courses – 117 CSU and elective courses – 27 CSU. The curriculum consists of general studies, major subjects, and elective studies. In the general studies, student acquire mathematical, scientific and general skills (scientific methods and attitude development) that are required in the major subject studies. Fundamental astronomy and astrophysics are introduced in this part, mainly in the second year of the programme. Major Subjects are all compulsory courses, covering advanced physics and astrophysics, provided mainly in the third year. In the course of these studies, students also do practical laboratory work and observational astronomy. In this way, students can get familiar with data collection and analyses.

Students can start their final project in the fourth year along with appropriate elective studies to support their studies. The final project results in the Bachelor's thesis.

Elective courses can be taken from the second year of study. Students can choose to register in elective courses from UPA or other study programmes (minimum of 3 CSU). More specialized courses are usually selected in the fourth year to support the student's personal area of interest and the final project. There are 29 elective courses offered by UPA that cover specialist as well as social competences related to astronomy or inter-disciplinary areas. Students can choose their electives after consulting with their academic advisor.

For providing an overview of the working environment in astronomy or astronomy-related areas, UPA offers an elective course "Astronomical Job Training. In this course, students conduct a job training/working practice for a minimum of 75 hours (or equal to 10 working days) in an institution where astronomy or astronomy-related subjects are treated. Prior to the internship, students have to write a proposal and present it in the class. At the end of the course, they write a report, which is also presented in the class.

The Bachelor's degree programme Physics requires students to complete 118 CSU of compulsory courses and a minimum of 26 CSU of elective courses. Electives can be chosen from UPP or from other study programs (minimum of 3 CSU). After completing the Common First Year, UPP students enter the second stage of studies (strong foundation). Here students attend classes in the core subjects of classical and modern physics, such as mechanics, electricity and magnetism, and quantum physics. In addition, courses in advanced mathemat-

ics, electronics, data processing & analysis, measurement methods and experimental physics are offered. In this stage, students are also introduced to the different areas of physics in the form of elective courses. Electives offered in seven streams of specialization: theoretical physics, electronic material physics, magnetic and photonic materials, nuclear physics, earth physics, instrumentation and computational physics, and biophysics). The third stage of studies (advanced concepts in physics) covers courses in the third and fourth year. In this stage, physics concepts are discussed in more detail more interdisciplinary subjects introduced. The subjects cover courses in quantum physics, quantum mechanics, statistical physics, solid state physics, and nuclear physics. The final stage (capstone) provides the opportunity for students to involve in the research activities through a final project. In the course of the final project, students should pursue scientific research in a well-defined area and get familiar with teamwork, time management, scientific methods and good scientific practise under the supervision of the final project supervisor. At the end of the project, a report has to be written in the form of a thesis and presented in the final project examination attended by the final thesis examiners.

One elective offered in UPP is an internship. This course is designed to gain practical experience outside ITB in a research centre, a consulting company, or a governmental institution. The topic of the internship is discussed between student, coordinator of internship, and the proposed institution where the internship will be done. The activity during the internship is mainly independent study and learning process, which are supervised by both student's advisor assigned from the institution and an advisor from UPP. At the end of the course, students are required to write a report about their internship activities.

UPM students have to complete 64 CSU in compulsory courses and at least 44 CSU in electives in the Bachelor's stage. According to the Self-Assessment Report, the curriculum is divided into four stages:

1. **Common First Year Stage** (Semester 1 and Semester2): This is a transition period from high school to university. During this stage, students must take, among others, Mathematics I A and Mathematics II A which are basic mathematics courses.
2. **Object-oriented Stage** (Semester 3 and semester 4): In this stage, students have the opportunity to develop a solid and strong foundation in mathematics. Computational and manipulative aspects of mathematics are taught, in which students must manipulate various mathematical objects such as numbers, functions, sets, and relations. Students are gradually acquainted with mathematical, logical, and rigorous reasoning. Compulsory courses offered at this stage are elementary linear algebra, discrete mathematics, mathematical computation and simulation, multivariable calculus, data analysis, and introduction to differential equations.

3. **Property-oriented Stage** (Semester 5 and semester 6): In this stage, the focus is on the ability to work with or manipulate mathematical properties. Students use the results to obtain a deeper understanding and new perspectives of topics or problems. Courses in this stage are designed to help students to develop critical thinking skills and the ability to use mathematical argumentation.
4. **Maturation Stage** (Semester 7 and semester 8): In this stage, the focus is on the final project, in which students should apply all the mathematical knowledge and skills they have acquired. Students should also acquire the necessary skills to perform a task independently, and to communicate clearly in oral and written presentations.

UPM students can choose the course "internship" as an elective. The internship is usually conducted fulltime during the three-month break in summer (May-July) and lasts for 4 weeks. As the only course in which all assignments are completed outside ITB, the final grade is given by the student's external supervisor. Students write a report about the internship and is asked to give a short presentation about their experiences.

While analysing the curricula, the peers notice that there is room for improvement in several areas. First of all, they observe that students can only chose electives from the provided list for the respective undergraduate programme. However, some students will be interested in other subjects from related areas (e.g. computer sciences) or even in subjects from other faculties (e.g. economics, history, or philosophy). For this reason, the peers suggest that students should have more flexibility in choosing their electives and may be the introduction of a minor would be a good idea. Secondly, the peers point out that the cooperation between the different departments of the Faculty of Mathematics and Natural Sciences could be improved so that students have more opportunities of attending classes from other departments (e.g. "General Relativity"). Third, the peers are convinced that in UPM it would be useful to offer more than just one course in coding and that at least one course in this area should be compulsory. Finally, the peers observe that in UPM, there is a continuous development of the curriculum and some new and modern areas of mathematics are represented in the electives (e.g. "Machine Learning" and "Deep Learning" were introduced in 2019). The peers emphasize that this should be a role model for UPA and UPP and the encourage FMNS to further pursue this path because it is necessary to keep up with new developments in the respective scientific area and to continuously update the curriculum and to introduce new courses where necessary.

After analysing the module descriptions and the study plans the peers confirm that all degree programmes under review are divided into modules and that each module is a sum of coherent teaching and learning units. All practical lab work is well integrated into the curriculum. However, it would be useful to update the literature references.

In summary, the peers gain the impression that the choice of modules and the structure of the curriculum ensures that the intended learning outcomes of the respective degree programme can be achieved.

International Mobility

ITB wants to promote academic mobility and to internationalise its degree programmes further. To this end, ITB provides opportunities for students to conduct internships abroad and to participate in exchange programmes. ITB's International Relation Office coordinates these programmes.

In addition, ITB has a budget for international activities (around €600.000 per year) for inviting guest lecturers, conducting summer schools, and organizing student and teacher exchange programmes. ITB co-operates with renown universities in the South East Asia e.g. with the National University of Singapore. Moreover, ITB has established a task force for further developing the internationalization of ITB.

The credits acquired abroad are transferable to ITB, although this transfer of credits is only possible if an agreement exists between ITB and the involved international university. This agreement regulates the details of the transfer, such as the list of courses that can be transferred, the minimum grade, equivalency of curriculum between universities, etc.

UPA collaborates with several institutions in organizing conferences, workshops, and summer school. For example, in 2016, UPA cooperated with LAPAN and Indonesian Science Academy (AIPI) to organize International Symposium on Sun, Earth, and Life. The symposium allowed staff members to present their research, to update their knowledge, and to expand their scientific network.

In 2019, UPA collaborated with the University of Manchester, Jodrell Bank Observatory, Korea Astronomy and Space Science Institute (KASI), and Indosat Ooredoo to organize a summer school in Radio Astronomy for students and young staff members.

In addition, UPA students have joined summer/winter schools in different countries: Germany (University of Göttingen), Japan (Sokendai NAOJ), USA (CUREA), South Korea (UST – GUAS), Austria (Russbach School), Thailand (NARIT), South East Asia Astronomy Network Meeting, India (ICOA), Vietnam School, Netherland (Kapteyn Astronomical Institute), and Taiwan (East Asian Meeting). Other mobility opportunity is the student exchange with Kanazawa University, Japan, for about a month. Although the programme is mostly designed for Master's students, several undergraduate students also participate.

Every year since 2010, UPP selects 6 – 8 third-year students for a two months internship programme at the Department of Physics, Korea Advanced Institute of Science and Technology (KAIST), South Korea. Apart from this programme, some teachers have a research

collaboration with partners abroad and some students are given the opportunity to carry out their research at partner universities (e.g. at Univ. Hiroshima, Univ. Cologne, Univ. Tokyo, Univ. Osaka, Univ. Kanazawa), as part of their final project or as a short internship.

Academic mobility in UPM is rather low. According to the provided data, only 27 UPM students have participated in academic mobility programmes since 2016. Almost all of these outbound activities where short term stays (1 to 3 weeks). The numbers are somewhat higher in UPA. Here, since 2015, 53 students have participated in international mobility programmes and in the last two years, there were also 8 incoming students.

In addition, FMNS organises the Campus Asia Programme with Kanazawa University, Japan. In this programme, several undergraduate students from FMNS visit Kanazawa University for a two weeks student exchange programme. Moreover, since 2017, FMNS provides special grants for Undergraduate Student Union Leaders to visit international universities in South East Asian countries.

The auditors observe that most of these stays were short time visits, e.g. for attending summer schools, symposiums or conferences. In general, students' academic mobility is limited. Some international co-operations exist, but the number of Indonesian Bachelor's students spending some time abroad is rather low.

The programme coordinators admit that the number of Bachelor's students who participate in international exchange programmes is still low. The students confirm during the discussion with the peers that some opportunities for international academic mobility exist. However, they also point out that they wish for more places and better endowed scholarships for long and short-term stays abroad. The auditors point out that students should be better informed about the already existing programmes and opportunities for students' exchange. For example, ITB could organise an "International Day" and ask guest lecturers and international students to give presentations.

The peers recommend increasing the efforts to further internationalising FMNS by establishing more international co-operations and exchange programmes and by offering more and better-endowed scholarships. In addition, the peers see that most of the faculty members have international contacts, which can be used for establishing more international co-operations. It is also possible for students and teachers to apply to international organisations like ERASMUS or the German Academic Exchange Council (DAAD) for receiving funds for stays abroad.

Rules for recognising achievements and competences acquired outside ITB exist but only very few students attend classes at international universities. Moreover, students are not well informed about this possibility and how the credits can be transferred into their degree

programme. For this reason, this possibility should be better explained to students and the necessary procedure should be described in the Academic Regulations.

Criterion 2.2 Work load and credits

Evidence:

- Self-Assessment Reports
- Study plans of the degree programmes
- Module descriptions
- ITB Regulation for Academic and Student Affairs
- Discussions during the audit

Preliminary assessment and analysis of the peers:
Based on the National Standards for Higher Education of Indonesia (SNPT), all three undergraduate programmes under review use a credit point system called CSU. The minimum workload of an undergraduate programme in ITB is 144 CSU, which corresponds to 5.760 academic hours or 200 ECTS (1 ECTS is equivalent to 28.8 hours of students' workload). One academic hour is 50 minutes. The normal workload of each regular semester is 720 academic hours, which corresponds to 18 CSU (25.2 ECTS). The maximum workload of the summer semester is 400 academic hours or 10 CSU (13.9 ECTS).

To complete the degree programme in time, Bachelor students need to take on average of 18 CSU per semester excluding co-curricular contents. However, the regular schedule usually covers 20-21 CSU per semester to give more space in the last semesters for resits, or more electives. If a student is not satisfied with his/her GPA, she or he can repeat the classes, but this will lead to a prolongation of the study time.

For regular classes, 1 CSU of academic load for the undergraduate programme is equivalent to 3 academic hours, which equals 150 minutes. This includes:

- one academic hour of scheduled contact with the teaching staff in learning activities,
- one academic hour of structured activities related to lectures, such as doing the assignments, writing papers, or literature study,
- at least one academic hour of independent activity to obtain a better understanding of the subject matters and to prepare academic assignments such as reading references.

For lab work, final project, fieldwork, and other similar activities, 1 CSU is equivalent to 3 to 5 hours a week of student's activities. The details and the students' total workload are described in the respective module description.

In addition, based on the newest national regulation (Permendikbud No. 3/2020), an Indonesian credit unit is defined as activity hour, which is not only limited to attending regular teaching class. The activity may also include internships, student exchange programmes, community service, research, independent study, and teaching. Such activities can be conducted up to two semesters (equivalent to 40 CSU) and must be supervised by an academic advisor.

The peers point out that there can be no fixed conversion rate between CSU and ECTS point, but the ECTS points need to be calculated separately for each course. This can be easily done by dividing the students' total workload, which is described in detail in the respective module description, through 28.8. With respect to UPP, the peers observe that this conversion is not always done correctly. For example, the module "Thermodynamics" (144 hours total workload) is listed with 4.8 ECTS, correct would be 5 ECTS. The module "Elementary Physics 2A" (196 hours total workload) is listed with 6.4 ECTS; correct would be 6.67 ECTS. In addition, the awarded ECTS of the whole degree programme must be calculated correctly by summarizing the ECTS of each module.

According to the Self-Assessment Report, several of the undergraduate students at the Faculty of Mathematics and Natural Sciences do not complete their degree without exceeding the expected period. As shown in the following tables, in UPA only around 25 % of the students graduate in time and the average length of studies is approximately 9 semesters. The performance indicators are somewhat better in UPP and UPM. In UPP, around 50 % and in UPM around 70 % of the students have graduated within four years. The average length of studies in UPP is 9 semesters and in UPM approximately 8.2 semesters.

UPA:

No	Performance Indicators	2015	2016	2017	2018	2019
1.	Intake Student	30	40	40	50	50
2.	Student Body	110	114	121	145	159
3.	GPA (average)	3.11	3.15	3.11	3.12	3.19
4.	Average Length of Study (semester)	9.40	9.15	9.08	8.91	9.17
5.	Number of student who graduated on time	15	13	15	15	13
6.	Number of graduates with Cum-Laude	5	4	4	4	4
7.	Number of drop-out students	5	9	6	4	1

Source: ITB Self-Assessment Report

UPP:

No.	Performance indicators	2015	2016	2017	2018	2019
1	Intake Student	100	99	106	112	113
2	Student Body	529	507	492	481	495
3.	GPA (average)	3.20	3.21	3.16	3.26	3.28
4.	Average Length of Study (semester)	9.29	9.20	9.08	9.03	8.87
5.	Number of student who graduate on time	47	45	51	47	47
6.	Number of graduates with Cum-Laude	20	10	13	17	16
7.	Number of Drop out students	10	10	19	5	3

Source: ITB Self-Assessment Report

UPM:

NO.	PROGRAM PERFORMANCE INDICATORS	2015	2016	2017	2018	2019
1	Intake student	103	111	106	114	110
2	Student body	357	349	368	362	366
3	GPA (average)	3.24	3.22	3.33	3.40	3.40
4	Average length of study (semester)	8.8	8.9	8.16	7.90	8.12
5	Number of students who graduate on time	89	69	76	88	89
6	Number of graduates with cum-laude	25	18	18	27	36
7	Number of drop-out students (per year)*	4	8	1	9	5

Source: ITB Self-Assessment Report

The programme coordinators of UPA and UPP explain that there are two main reasons why the average study length is more than four years. First, the final projects of astronomy and physics students are full-cycle research projects, which often include experiments and sometimes there are sometimes some technical difficulties in the lab, which thus may prolong the time required for the final project. Secondly, the degree programmes are demanding. Especially in the third semester, some students have problems adjusting to the higher requirements in the Bachelor's stage. The peers suggest better monitoring the progress of the final projects and paying close attention to the average length of studies and the time students spent on their final project.

The provided performance indicators show that the drop-out rates in all three undergraduate programmes are rather low. Only a few students (between 5 and 10 %) do not complete the respective programme.

Based on the study plans, the statistical data, and the comments of the students, the auditors conclude that there are no obstacles to the quality of teaching and the level of education due to the workload.

Criterion 2.3 Teaching methodology

Evidence:

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

Preliminary assessment and analysis of the peers:

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

ITB has the goal to support the transition from a teacher-centred to a student-oriented teaching method in order to involve all students in the learning process and to develop their thinking and analytical skills.

During the classes, active and interactive teaching methods (e.g. lectures, discussions, reports, presentations, and group work) are applied. ITB 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-centred to a student-centred learning approach.

The most common method of learning is class session, with several courses having integrated laboratory practices. Lecturers generally prepare presentations to aid the teaching process. With individual or group assignments, such as discussions, presentations, or written tasks, students are expected to improve their academic as well as their soft skills. La-

boratory work covers laboratory preparation, pre or post-tests, laboratory exercises, reports, discussions, and presentations. In addition, practical activities should enable students to be acquainted with academic research methods.

In addition, there are tutorials for several compulsory courses in order to support students' learning activities. Tutors are selected from senior students with excellent academic records and good tutoring skills. The total hours for tutorial varies from one course to another. On average, tutorials are given once per week, 50 – 100 minutes each. The tutorials include problem exercises, discussions, and practical activities. This practice is also beneficial for the senior students who acquire teaching experience in this way.

To help students achieving the intended learning outcomes and to facilitate adequate learning and teaching methods, ITB has developed an e-learning platform, where students and teachers can interact.

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

Criterion 2.4 Support and assistance

Evidence:

- Self-Assessment Reports
- ITB Regulation for Academic and Student Affairs
- Discussions during the audit

Preliminary assessment and analysis of the peers:
ITB offers a comprehensive advisory system for all undergraduate students. At the start of the first semester, every student is assigned to an academic advisor. Each academic advisor is a member of the academic staff and is responsible for approximately 20 students from his classes. He/she is a student's first port of call for advice or support on academic or personal matters.

The role of the academic advisor 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.

In general, students stress that the teachers are open minded, communicate well with them, take their opinions and suggestions into account, and changes are implemented if necessary.

All students at ITB have access to the digital academic information system (SI-X). The students' profiles (student history, study plan, academic transcript and grade point average/GPA, lecturer evaluation, course list) are available via SI-X.

ITB provides several services to support its students. This includes a Career Centre, a Language Centre, Health Services (Bumi Medika Ganesha), a Health Clinic, a Sports Centre, and Student Dormitories.

Finally, there are several student organizations at ITB. For example, there are 5 religious units, 5 scholarly units, 14 educational units, 30 cultural and art units, 26 sport units, and 6 media units. The Mathematics Student Association (HIMATIKA) organizes events or activities for mathematics students, such as Mathematics Competition Festival (MCF), Math Career Day, Math for Community, and company-visit to industries. UPA students have also a student association (Himpunan Mahasiswa Astronomi, or Astronomy Student Organisation) where they can study together or study with the senior students informally. There is also a student organisation in physics, but they currently have some internal problems. UPP should try to re-establish the students' organisation because such an institution is usually a good support for students.

The peers notice the good and trustful relationship between the students and the 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 and without delay. The students are well informed about the services available to them.

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

The peers appreciate that ITB has recognised the need for further internationalising its degree programmes and for better supporting students' academic mobility. It is a good idea to establish an international coordinator in each department who will offer information to students and help them in organising and conducting stays abroad.

The peers thank ITB for explaining that in all three degree programmes students can chose electives from all courses offered at ITB. That also includes social sciences, history, etc. As

a consequence, there are sufficient opportunities for students to take classes outside their major.

The peers confirm that the 2019 curriculum of UPM includes three compulsory courses concerning coding/programming), namely “Introduction to Computation”, “Simulation and Computational Mathematics” and “Numerical Mathematics”. The peers think that these courses are a useful addition to the curriculum.

The peers expect ITB to submit substantial verification in the further course of the procedure that the ECTS points have been recalculated for each courses and that the awarded credits are in-line with the students’ total workload.

The peers consider criterion 2 to be mostly fulfilled.

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self-Assessment Reports
- Module descriptions
- ITB Regulation for Academic and Student Affairs
- ITB Academic Calendar

Preliminary assessment and analysis of the peers:
According to the Self-Assessment Reports, the students’ academic performance is evaluated based on their attendance and participation in class, their laboratory works and reports, assignments, homework, presentations, mid-term exam, and the final exam at the end of each semester. The most common assessment form are written examinations in the middle and at the end of the semester and quizzes; however laboratory work, assignments (reading, small projects, simulations, reports, etc.), presentations, seminars, and discussions can also contribute to the final grade. Written exams, both closed books and open books, usually include short answers, essays, problem solving or case-based questions, and problem calculations. Some lecturers also provide multiple choice or true-false questions or matching questions in an exam or a quiz. The grade from laboratory work usually consists of laboratory skills, discussions, reports, and oral exams. 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).

The form and length of each exam is mentioned in the module descriptions that are available to the students via ITB's homepage and the digital platform SI-X.

In the first lecture at the beginning of each semester, students are informed about the assessments types, schedule, and their contribution to the final grade. In addition, students can access the schedule of mid-term and final exams via the Academic Calendar. All final grades are entered into ITB's academic information system. Students can see their own final grade there after filling out the evaluation questionnaire of the respective course.

If a student fails, she or he usually has to repeat the entire module in the following year; it is usually not possible to retake just parts of the course or to just retake the final exam. Although, lecturers need to arrange examinations for students who have not taken the examinations due to valid reasons. Some courses allow students, whose grades are still below the passing level, to improve their grades through repeating an exam. The course's final grades are: A (score 4.0, excellent), AB (3.5, good to excellent), B (3.0, good), BC (2.5, fair to good), C (2.0, fair), D (1.0, insufficient), E (0.0, failed), or T (incomplete). The further details are described the ITB Regulation for Academic and Student Affairs.

The peers discuss with the students how many and what kind of exams they have to take each semester. They learn that for each course there is one mid-term exam and one final exam in every semester. Usually, there are additional practical assignments or oral tests. The final grade is the sum of the sub-exams. The students appreciate that there are 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.

Every student in the three undergraduate programmes under review is required to do a final project (Bachelor's thesis). This project is conducted independently under the guidance of one or more supervisors and usually consists of literature study, practical research, and data analysis. Both the student and his /her supervisors might decide the topic and content of the project. In many cases, the lecturers offer particular topics connected to their research. The final project is divided into 2 semesters, namely Final Project 1 and Final Project 2. Students can enrol in the Final Project 1 when they have completed 139 ECTS and passed the courses that they have taken in the second year. The Final Project 1 must be completed prior to starting the Final Project 2. Hence, Final Project 1 and 2 cannot be taken in the same semester. The Final Project 1 consists of literature studies about the possible research project and the preparation of a research plan to be carried out in the Final Project 2. The report about the final project is then presented in front of a group of examiners in seminar format. The examiners consist of the respective supervisors and at least two other lecturers from the faculty (or assigned institutions). It is also possible to conduct an external final project e.g. in co-operation with a company. In this case, one co-

supervisor comes from the respective company. The peers point out that delays in conducting the final projects could be reduced, if it was possible to start with Final Project 2 even before Final Project 1 is formally finished.

Moreover, a comprehensive oral examination (final defence) is compulsory for all students for the completion of their undergraduate programme at ITB. For admission to the final oral examination, students must have passed all modules of their study programme.

The peers discuss with teachers, students, and alumni if students have the right to examine, discuss and appeal their final grade results. Students confirm that they are informed in time about their results and that they can discuss them with the respective lecturer. However, there is no formal regulation in place how students can appeal their grades if they are not satisfied with the results and think that their performance is not reflected adequately. For this reason, the peers emphasize that all lecturers should give a feedback on the final grades and that students should have the right to appeal. A formal procedure for students' appeals should be implemented and included in the Academic Regulation.

Otherwise, students are satisfied with the fairness and transparency of the grading system.

The peers also inspect a sample of examination papers and final theses and are overall satisfied with the general quality of the samples. From their point of view this confirms the good academic quality of UPA, UPP, and UPM.

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

The peers thank ITB for clarifying that teachers usually give feedback on the final grades to students and that students have the right to appeal. There is an established procedure for appealing the grades, which will be added to the Academic Regulations and the Study Guides. The peers expect ITB to submit the updated Academic Regulations in the further course of the procedure.

The peers consider criterion 3 to be mostly fulfilled.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self-Assessment Reports

- Staff Handbook
- Study plans
- Module descriptions
- Discussions during the audit

Preliminary assessment and analysis of the peers:
At ITB, the staff members have different academic positions. There are professors, associate professors, assistant professors and instructors. The academic position of each staff member is based on research activities, publications, academic education, supervision of students, and other supporting activities. For example, a full professor needs to hold a PhD degree. In addition, the responsibilities and tasks of a staff member with respect to teaching, research, and supervision depend on the academic position.

According to the Self-Assessment Report, the teaching staff at FMNS is composed as follows:

Category	Astronomy	Physics	Mathematics
Professors	1	13	13
Associate Professors	5	25	10
Assistant Professors	7	23	17
Instructors	2	2	9
Teaching Assistants	3	11	22
Visiting Lecturers	-	-	-
Total Staffs	**18**	**74**	**71**

Source: ITB Self-Assessment Report

Staff members have the responsibility to teach and support the programs in not only undergraduate programmes, but also the related Master's and PhD programmes within FMNS. Most of the faculty members at FMNS hold a PhD from either a reputable Indonesian or international university (e.g. Australia, Germany, France, UK, The Netherlands, and USA).

All fulltime members of the teaching staff are obliged to be involved in (1) teaching/advising, (2) research, and (3) community service. However, the workload can be distributed differently between the three areas from teacher to teacher.

In addition, FMNS recruits temporary (contract based) academic assistants which hold at least a Bachelor's degree to support research and academic activities. Finally, there are several non-academic staff members:

No.	Categorize	Number of Supporting Staffs per year			
		2016	2017	2018	2019
1	Librarian	7	5	5	4
2	Administrator	80	83	87	84
3	Technician & Laboratory Assistant	31	26	29	32
4	Analyst	11	16	16	16
5	Operator	0	0	0	0
6	Programmer	1	1	1	1
	Total	**130**	**131**	**138**	**137**

Source: ITB Self-Assessment Report

The peers discuss with ITB's management how new staff members are recruited. They learn that every year the faculties and departments announce their vacancies to ITB's management, which subsequently announces the vacancies on ITB's webpage. Since ITB is semi-autonomous, they can decide themselves what staff members to hire. One way to recruit new teachers is to send promising Master's students from ITB abroad to complete their PhD and then to hire them as teachers when they are finished. ITB also hires graduates from other universities. Vacancies are announced nationally, so ITB gets applications from other universities but approximately between 80 and 90 % of the faculty are ITB graduates. During the audit, members of the teaching staff emphasise that the selection process for new teachers is now more open than in the past. Therefore, now more young teachers that have not graduated from ITB are hired.

In summary, the peers confirm that the composition, scientific orientation and qualification of the teaching staff are suitable for successfully implementing and sustaining the degree programmes.

The auditors are impressed by the excellent and open-minded atmosphere among the students and the staff members. This atmosphere of understanding and support is one of the strong points of the degree programmes.

Criterion 4.2 Staff development

Evidence:

- Self-Assessment Reports
- Staff handbook
- Discussions during the audit

Preliminary assessment and analysis of the peers:
ITB encourages training of its academic and technical staff for improving the didactic abilities and teaching methods. As described in the Self-Assessment Reports, faculty members and non-academic staff regularly participate in training or workshops organised by the Centre for Human Resource and Organization Development (Pusat Pengembangan Manusia dan Organisasi, PMO) division of ITB. This division offers in-house training related to human resources development, management and organisation. It also offers tailor-made training for special cases. The subjects of training for non-academic staff include emotional intelligence, computer literacy, English, administration, procurement, management, photography, etc.

Several programmes are offered to the faculty members in order to refine and develop their competencies (e.g. Applied Approach programme, Recharge programme from the Ministry of Education's Directorate General of Higher Education). The Applied Approach programme is designed particularly for junior faculty members to introduce various teaching methods, as well as syllabus and course content development. All teachers at ITB are obligated to attend the lecturer certification programme held by the Directorate General of Higher Education (Direktorat Jenderal Pendidikan Tinggi, DIKTI). An official teaching certificate is issued after the faculty member has completed the certification process. Only certified staff members are allowed to give lectures.

In addition, faculty members can further develop their competencies through several activities such as post-doctoral programmes, training, workshops, joint research, etc. Moreover, they are encouraged to present their research papers in national and international conferences, and to collaborate with colleagues from international universities.

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 ITB, their opportunities to further improve their didactic abilities and to spend some time abroad to attend conferences, workshops or seminars. However, most of these stays are conducted during the semester break in summer time and do not cover a whole semester. For this reason, it would be useful to allow for a sabbatical leave so that more extensive research activities can be carried out.

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

Criterion 4.3 Funds and equipment

Evidence:

- Self-Assessment Reports
- Video of the facilities
- Discussions during the audit

Preliminary assessment and analysis of the peers:
ITB and the Faculty of Mathematics and Natural Sciences provide basic funding of the undergraduate programmes and the facilities. Additional funds for research activities can be provided by ITB or the Indonesian government (Bantuan Pendanaan Perguruan Tinggi Nasional, BPPTN), but the teachers have to apply for them. In addition, there are several co-operations with industrial partners.

ITB distributes the budget among the 12 different schools and faculties according to the size of the student body (all undergraduate programmes have the same tuition fee). Nevertheless, some study programmes (e.g. Physics) need more funds than other programmes because of the necessary instruments and technical equipment. This is also taken into account by ITB's management when the yearly budget is allocated.

The provided budget allows the departments to conduct the study programmes as well as some specific activities, including student exchange programmes, student financial assistance for research, and participation in international conferences. However, the budget is limited but has increased in recent years:

FMNS Budget (in 1000 IDR)

Programs	2016	2017	2018	2019
Astronomy	939,332.00	880,562.00	919,896.00	1,055,228.00
Physics	4,759,656.00	4,465,783.00	4,763,636.00	5,540,581.00
Mathematics	5,120,484.00	4,834,756.00	4,934,668.00	5,303,184.00

Source: ITB Self-Assessment Report

The programme coordinators and teachers of all three Bachelor's programmes under review emphasise that from their point of view, the undergraduate programmes received sufficient funding for teaching and learning activities. Hence, UPA, UPM, and UPP do not face any financial shortages. Of course, there is limited funding to modernize or add laboratory equipment. However, in the last five years, ITB has provided additional funds for renewing and adding laboratory equipment. Furthermore, if sophisticated and expensive instruments are needed, the departments co-operate with international universities e.g. in Europe, Japan, or Australia where these instruments are available and the related experiments can be conducted.

Students and alumni confirm that there are sufficient resources for adequately teaching the classes. The only problem are financial restrictions with respect to maintaining some instruments. However, the situation has improved in recent years and ITB as well as the Indonesian government are now providing more funds. Consequently, it is getting better; for example, each research group now has its own budget, but it still could be further improved.

Before the audit, the peer group receives videos showing the teaching and research laboratories in the Faculty of Mathematics and natural Sciences. They notice that there are no bottlenecks due to missing equipment or a lacking infrastructure. The technical equipment for teaching the students on a Bachelor's level as well as some advanced instruments for conducting research activities are available. The students confirm this positive impression during the discussion with the peers. They are satisfied with the available equipment and the technical infrastructure. The peers learn during the audit that students can use and operate the instruments in the laboratories by themselves after being trained and instructed by either senior students or lab technicians.

The central library provides information services to ITB faculty members, staff and students. It is also open to public. Currently, it has about 225,000 book titles, journals, e-books and e-journals. The services include book lending, ordering copies from other libraries in Indonesia and overseas, and access to various scientific databases. In addition, there are the Mathematics Library, Physics Library, and Astronomy Library. They are separate units and house more specialised books and publications of the respective fields.

The students express their satisfaction with the libraries and the available literature there. However, they criticise that due to the COVID-restrictions, students have problems accessing the digital platform and the remote access to the computer labs and the software does not always work properly. The peers expect that these problems will be solved when the classrooms and labs are open and face-to-face teaching is possible gain.

In summary, the peer group judges the available funds, the technical equipment, and the infrastructure (laboratories, library, seminar rooms etc.) to comply – besides the mentioned small restrictions- with the requirements for adequately sustaining the degree programmes.

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

The peers confirm that there is the possibility of a sabbatical at ITB. For example, in 2020 28 teachers from ITB have taken this opportunity.

The peers consider criterion 4 to be fulfilled.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Self-Assessment Reports
- Module descriptions
- Webpage Ba Astronomy: https://www.as.itb.ac.id/undergraduate-program3/
- Webpage Ba Mathematics: http://www.math.itb.ac.id/undergraduate-program/
- Webpage Ba Physics: http://www.fi.itb.ac.id/en/program-sarjana-fisika/

Preliminary assessment and analysis of the peers:

The students, as all other stakeholders, have access to the module descriptions via ITB's homepage.

After studying the module descriptions, the peers confirm that they 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 and details explaining how the final grade is calculated. However, the peers notice that some literature recommendations are outdated and point that it is necessary to keep up with current developments and to update the literature recommendations accordingly.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Self-Assessment Reports
- Sample Diploma for each degree programme
- Sample Diploma Supplement for each degree programme

Preliminary assessment and analysis of the peers:

The peers confirm that the students of all three degree programmes under review are awarded a Diploma and a Diploma Supplement after graduation. The Diploma consists of a Diploma Certificate and a Transcript of Records. The Diploma Supplement contains all necessary information about the degree programme including acquired soft skills and awards (extracurricular and co-curricular activities). The Transcript of Records lists all the courses that the graduate has completed, the achieved credits, grades, and cumulative GPA.

Criterion 5.3 Relevant rules

Evidence:

- Self-Assessment Reports
- All relevant regulations as published on the university's webpage

Preliminary assessment and analysis of the peers:
The auditors confirm that the rights and duties of both ITB and the students are clearly defined and binding. All rules and regulations are published in Indonesian 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.

The only deficit the peers notice is the fact that not all relevant information about the degree programmes (e.g. module descriptions, study guide, academic regulation) is available on the English homepage of the programmes. For example, in UPP, the study guide is not available, in UPA, the module descriptions are not accessible, and the Academic Regulation is only published on the UPP homepage. For this reason, the peers recommend including this information on the programme's English homepage. This way, it is ensured that domestic and foreign students know their rights and duties.

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

The peers appreciate that ITB will update the literature references in the module descriptions. They confirm that the English webpages of all three degree programmes have been updated and now include all relevant information about the degree programmes. The peers are satisfied with the updated webpages and do not see the need for issuing a requirement in this respect

The peers consider criterion 5 to be fulfilled.

6. Quality management: quality assessment and development

Evidence:

- Self-Assessment Reports

- ITB Regulation for Academic and Student Affairs
- Discussions during the audit

Preliminary assessment and analysis of the peers:
The auditors discuss the quality management system at ITB with the programme coordinators and the students. 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 (IQA) and external quality assurance (EQA). IQA encompasses all activities focused on implementing measures for improving the teaching and learning quality at ITB. EQA focuses on both national and international accreditations. National accreditation is conducted by the National Accreditation Agency of Higher Education (NAAHE), under the Ministry of Education and Culture, Republic of Indonesia. National accreditation of the programme within the university is a legal obligation for every study programme. NAAHE assesses every study program in every Higher Education Institution in Indonesia. Although institutional accreditation is not obligatory, every university in Indonesia is recommended to do so. According to the latest evaluation of the institutional accreditation, ITB has been ranked as an excellent university (grade A, the highest rank of institutional accreditation). All three Bachelor's programmes under have obtained the highest accreditation status (A) from NAAHE.

The internal quality assurance system at ITB is conducted by the Quality Assurance Unit (Satuan Penjaminan Mutu/SPM ITB) at university level. This unit determines the criteria, suitable measures, and its indicator as well as the quality assurance processes for all study programmes at ITB. In addition, the quality assurance processes at school/faculty level is organised by the Quality Control Units (Gugus Kendali Mutu, GKM). The GKM is working directly under the respective dean. Its role is to ensure the quality of educational processes and research activities in each study programme. The main role of GKM is to set up and verify academic standards and guidelines at faculty/school level, which are derived from those at university level. Internal evaluation of the quality of the degree programmes is mainly provided through student and alumni surveys. Students give their feedback on the courses through online questionnaires at the end of each semester. Students assess various aspects such as students' understanding, lecturer's responsiveness, course delivery, lecturer's proficiency, explanation of course objective, and references in each enrolled course. Students' opinion are quantified by means of index 1 (unsatisfactory) to 4 (excellent). This method has been implemented since 2008, and it provides important input to assess the quality of the educational processes. Giving feedback on the classes is compulsory for the students; otherwise, they cannot access their account on the digital platform SI-X. Furthermore, students' feedback is collected by distributing a mid-semester questionnaire. The students' feedback from mid-semester questionnaires is normally addressed directly by the

lecturer by discussing it with the students. . This feedback gives the chance to lecturers to improve their teaching practice.

Furthermore, ITB regularly conducts an alumni study. By taking part at this survey, alumni can reflect on their educational experiences at ITB and their professional career. This tracer study is organised by ITB's alumni organization and the results are annually published

In addition, there is Career Development Centre (CDC) at ITB, which organizes a job fair every other year. This fair is open to the public and not limited to students from ITB. CDC also offers help to find suitable internships and courses to develop soft skills. Finally, each year there is an undergraduate exit survey. Students are asked to respond to several questions regarding their study experiences in ITB. The exit survey focuses on three main areas: quality of academic atmosphere, contribution of ITB education on learning and development on certain skills, and students' satisfaction with services and facilities.

There are some possibilities how external stakeholders (alumni and employers) may give feedback to UPM for improving and developing the degree programme. Besides the already mentioned tracer study, UPM offers the compulsory course "Career in Mathematics", where some alumni are invited to give presentations about their experiences and the relevance of studying mathematics in their professional career. The lectures also provide a communication forum to bring together alumni and students. In addition, the Mathematics Student Association (MSA) conducts a Career Talk every semester, where some employers are invited to present their company's profile and prospects for mathematics graduates. MSA, with support from UPM, also annually organises a company visit.

The peers are convinced that it very useful to keep in close contact with employers and alumni. Alumni and employers are regularly invited to give their insights on further developing the degree programmes. However, it would be useful to institutionalise this cooperation. For this reason, the peers suggest establishing an advisory board in order to support the academic accountability and the further development of the programmes by providing guidance and feedback. An advisory board, either for FMNS or for each degree programme, could include professionals and experts of the relevant fields, and stakeholders from within and outside the university.

The curriculum evaluations are held during the final exam week. A compilation of the students' feedback is sent to the respective lecturers. As the students point out during the discussion with the peers, there is also the possibility to give a direct and informal feedback to the teacher.

During the audit, the peers learn that if there is negative feedback, the Dean or the head of the research group talks to the respective teacher, analyses the problem, and offers

guidance. The auditors gain the impression that students' feedback is taken seriously by the faculties and changes are made if there is negative feedback. However, the peers notice that the results of the questionnaires are not discussed with the students directly. As students point out during the audit, they learn about changes in the degree programmes only from other students that attend the classes in following semesters. From the peers' point of view, it is necessary to close the feedback loops and to involve the students actively in the quality assurance processes. For this reason, the peers emphasise that students need to be informed about the results of the curriculum evaluations/questionnaires and possible improvements. In addition, they expect ITB to institutionalise students' participation, e.g. by having a student member in the Quality Assurance Units. Having a student member in ITB's board of trustees is a good first step. Nevertheless, it would also be necessary to involve students in quality assurance processes on faculty and programme level.

As the peers consider the further development of the degree programmes to be very important, they appreciate the existing culture of quality assurance especially in UPM. This should be a role model for the other degree programmes, because it is essential to keep up with current developments and to update the curriculum regularly.

In summary, the peer group confirms that the quality management system is suitable to identify weaknesses and to improve the degree programmes. All stakeholders are involved in the process.

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

The peers appreciate that FMNS will establish an advisory board for each degree programme and is planning to involve student's representatives in the quality assurance processes on programme level. Verification on students' involvement should be submitted in the further course of the procedure.

The peers confirm that mid-semester surveys are conducted in the three degree programmes to ask students about the quality of the teaching processes. FMNS should make sure that students' feedback is taken seriously by the teachers and that possible improvements are discussed with the students. The feedback cycles need to be closed.

The peers consider criterion 6 to be mostly 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:

- none

E Comment of the Higher Education Institution (29.01.2021)

ITB provides a statement in response to the draft report and provides the following supporting documents:

We also attach the following additional documents:

- ECTS Calculation for UP Physics

- Academic Regulation (Peraturan Akademik) (in English)

- Academic Quality Standard of ITB (in Bahasa Indonesia)

F Summary: Peer recommendations (15.02.2021)

Taking into account the additional information and the comments given by ITB, 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 Astronomy	With requirements for one year	-	30.09.2027
Ba Mathematics	With requirements for one year	-	30.09.2027
Ba Physics	With requirements for one year	-	30.09.2027

Requirements

For all degree programmes

A 1. (ASIIN 3) Establish a procedure how students can appeal their grades and include the information in the Academic Regulations.

A 2. (ASIIN 6) Close the feedback cycles by informing students directly about the results of the questionnaires.

A 3. (ASIIN 6) Directly involve students in the quality assurance processes.

For the Bachelor's programme Physics

A 4. (ASIIN 2.2) Make sure that the awarded ECTS points comply with the students' total workload.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to further promote the academic mobility of the students and to better inform them about the existing programmes and opportunities.

E 2. (ASIIN 2.1) It is recommended to offer more English elements in the advanced courses.

G Comment of the Technical Committees (01.03.2021)

Technical Committee 12 - Mathematics (01.03.2021)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee agrees with the assessment of the peers.

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 Astronomy	With requirements for one year	-	30.09.2027
Ba Mathematics	With requirements for one year	-	30.09.2027
Ba Physics	With requirements for one year	-	30.09.2027

Technical Committee 13 – Physics (01.03.2021)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure and follows the peers' vote without any changes.

The Technical Committee 13 – Physics recommends the award of the seals as follows:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Astronomy	With requirements for one year	-	30.09.2027
Ba Mathematics	With requirements for one year	-	30.09.2027
Ba Physics	With requirements for one year	-	30.09.2027

H Decision of the Accreditation Commission (16.03.2021)

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

The Accreditation Commission discusses the procedure and agrees with the proposed requirements and recommendations.

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

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Astronomy	With requirements for one year	-	30.09.2027
Ba Mathematics	With requirements for one year	-	30.09.2027
Ba Physics	With requirements for one year	-	30.09.2027

Requirements

For all degree programmes

A 1. (ASIIN 3) Establish a procedure how students can appeal their grades and include the information in the Academic Regulations.

A 2. (ASIIN 6) Close the feedback cycles by informing students directly about the results of the questionnaires.

A 3. (ASIIN 6) Directly involve students in the quality assurance processes.

For the Bachelor's programme Physics

A 4. (ASIIN 2.2) Make sure that the awarded ECTS points comply with the students' total workload.

Recommendations

For all degree programmes

E 1. (ASIIN 2.1) It is recommended to further promote the academic mobility of the students and to better inform them about the existing programmes and opportunities.

E 2. (ASIIN 2.1) It is recommended to offer more English elements in the advanced courses.

I Fulfillment of Requirements (18.03.2022)

Analysis of the peers and the Technical Committees (09.03.2022)

Requirements

For all programmes

A 1. (ASIIN 3) Establish a procedure how students can appeal their grades and include the information in the Academic Regulations.

Initial Treatment	
Peers	fulfilled Vote: unanimous/per majority Justification: A procedure has been established in the ITB Academic Regulations 2021 and in a released Deans's Decree of FMNS
TC 12	fulfilled Vote: unanimous Justification: The TC follows the assessment of the peer group.
TC 13	fulfilled Vote: unanimous Justification: The TC concurs with the assessment of the peers.

A 2. (ASIIN 6) Close the feedback cycles by informing students directly about the results of the questionnaires.

Initial Treatment	
Peers	fulfilled Vote: unanimous Justification: Feedback cycles are now closed; different procedures have been established for the degree programmes.
TC 12	fulfilled Vote: unanimous Justification: The TC follows the assessment of the peer group.
TC 13	fulfilled Vote: unanimous Justification: The TC concurs with the assessment of the peers.

A 3. (ASIIN 6) Directly involve students in the quality assurance processes.

Initial Treatment	
Peers	fulfilled/ Vote: unanimous Justification: Students are involved in the quality assurance process through regular meetings with the chairs of the study programmes and the quality insurance units.
TC 12	fulfilled Vote: unanimous Justification: The TC follows the assessment of the peer group.
TC 13	fulfilled Vote: unanimous Justification: The TC concurs with the assessment of the peers.

For the Bachelor's degree programme Physics

A 4. (ASIIN 2.2) Make sure that the awarded ECTS points comply with the students' total workload.

Initial Treatment	
Peers	fulfilled Vote: unanimous Justification: The provided SKS to ECTS conversion clarifies that the awarded ECTS points comply with the students' total workload
TC 12	fulfilled Vote: unanimous Justification: The TC follows the assessment of the peer group.
TC 13	fulfilled Vote: unanimous Justification: The TC concurs with the assessment of the peers.

Decision of the Accreditation Commission (18.03.2022)

Degree Programme	**ASIIN seal**	**Subject-specific labels**	**Maximum duration of accreditation**
Ba Astronomy	All requirements fulfilled	-	30.09.2027

Degree Programme	ASIIN seal	Subject-specific labels	Maximum duration of accreditation
Ba Mathematics	All requirements fulfilled	-	30.09.2027
Ba Physics	All requirements fulfilled		30.09.2027

Appendix: Programme Learning Outcomes and Curricula

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Astronomy:

Programme Learning Outcomes of UPA

PLO1	Comprehend the basic knowledge of natural science in terms of its fundamental laws and the logic of mathematical relations
PLO2	Identify and solve scientific problems using scientific method within its professional ethics
PLO3	Reason the working of the universe and its contents (planetary system, stellar system, realms of galaxies) through astronomy and astrophysics
PLO4	Perform basic astronomical tasks: to collect observational data using telescope, to analyze and interpret data
PLO5	Apply established scientific method using advanced physics, mathematics, and computations in solving astronomical and astrophysical problems.
PLO6	Explore interdisciplinary subjects and technology in fields related to astronomy.
PLO7	Communicate their scientific knowledge and skills in oral presentation and written report
PLO8	Recognize the past/present/future scientific mission and exploration, the availability of scientific data, and the relevant community.
PLO9	Work ethically as an individual as well as a team and develop a good attitude towards cooperation.
PLO10	Follow the development of scientific knowledge and apply scientific thinking in a wide range of work places and various contemporary challenges
PLO11	Recognize the place and role of astronomy in human civilization and maintain strong enthusiasm in science

The following **curriculum** is presented:

Year 1 (Common First Year stage)							
Semester I				Semester II			
No	Code	Course Name	cu[1)]	No	Code	Course Name	cu[1)]
1	MA1101	Mathematics IA	4	1	MA1201	Mathematics IIA	4
2	FI1101	Elementary Physics IA	4(1)	2	FI1201	Elementary Physics IIA	4(1)
3	KI1101	General Chemistry IA	3(1)	3	KI1201	General Chemistry IIA	3(1)
4	KU1102	Introduction to Computation	3	4	KU1202	Introduction to Engineering and Design	3
5	KU1160	Introduction to Mathematics and Natural Sciences	2	5	KU102X	English	2
6	KU1011	Indonesian Language: Scientific Writing	2	6	KU1001	Sports	2
Total			18(2)	Total			18(2)
Year 2 (*Sarjana* Programme)							
Semester III				Semester IV			
No	Code	Course Name	CU[1)]	No	Code	Course Name	CU[1)]
1	FI2102	Mechanics	4	1	FI2202	Electromagnetic Fields	4
2	AS2101	Astrophysics I	3	2	AS2202	Basic Astronomy Laboratory I	3(1)
3	AS2102	Statistics in Astronomy	3(1)	3	AS2204	Mathematical Methods in Astronomy II	3
4	AS2103	Positional Astronomy	3	4	AS2211	Astrophysical Thermodynamics	3
5	AS2104	Mathematical Methods in Astronomy I	3	5	AS2212	Solar System	3
6	AS2112	Computational Astronomy	3(1)	6	AS2213	Astrophysics II	3
Total			19(2)	Total			19(1)
Year 3 (*Sarjana* Programme)							
Semester V				Semester VI			
No	Code	Course Name	CU[1)]	No	Code	Course Name	CU[1)]
1	AS3101	Basic Astronomy Laboratory II	3(1)	1	AS3201	Introduction to Cosmology	3
2	AS3105	Processes in Astrophysics I	3	2	AS3202	Physics of Galaxy	3
3	AS3111	Celestial Mechanics	3	3	AS3204	Processes in Astrophysics II	3
4	AS3112	Physics of Waves	3	4	AS3211	Astrophysical Hydrodynamics	3
5	AS3113	Stellar Physics	3	5	KU2071	Pancasila and Civic Education[2)]	2
6	KU206X	Religion and Ethics[2), 3)]	2	6	XXMANJ	Management Courses[2), 3)]	2
7	XXLING	Environment Courses[2), 3)]	2				
Total			19(1)			Total	16
Year 4 (*Sarjana* Programme)							
Semester VII				Semester VIII			
No	Code	Course Name	CU[1)]	No	Code	Course Name	CU[1)]
1	AS4091	Final Project I	4(4)	1	AS4092	Final Project II	4(4)
Total			4(4)	Total			4(4)

Electives:

No	Code	Course Name	cu[1)]
1	AS2005[4)]	Astronomy and Environment	2
2	AS3002[5)]	Astronomical Institution Management	2
3	AS3006	Calendar System	3
4	AS3121	Advances in Computational Astrophysics	3(1)
5	AS3122	Small Solar System Bodies	3
6	AS3221	Statistics and Data Mining	3(1)
7	AS4021	Capita Selecta in Astrophysics	3
8	AS4093	Astronomical JobTraining	2
9	AS4102	Stellar System	3
10	AS4103	Observational Astrophysics	3
11	AS4104	Interstellar Matter	3
12	AS4105	Stellar Evolution	3
13	AS4022	Space Weather	2
14	AS4202	Dynamics of StellarSystem	3
15	AS4204	Satellite Orbits	3
16	AS4221	Interacting Binary Stars	3
17	AS4222	Observational Cosmology	3(1)
18	AS4223	Exoplanet	2

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Mathematics:

LEARNING OUTCOMES OF UPM

LO1	The students are able to exhibit sufficient knowledge and insight in mathematics and relevant areas, with a relatively deep understanding in some particular subfields of mathematics, and apply them to solve problems
LO2	The students are able to demonstrate adequate basic math skills, such as observing, recognizing, collecting and utilizing data, to make calculation, estimation, and interpretation, with or without the aid of technologies (such as computers and software)
LO3	The students are able to exhibit mathematical powers, that include reasoning, making connections, solving problems, and communicating
LO4	The students are able to show the ability to complete tasks and to develop relatively new ideas, both independently and in team including preparing and presenting reports, orally and in writing as well
LO5	The students have personality characteristics and habits of work necessary for successful career, and understand professional and ethical responsibility
LO6	The students are aware of contemporary issues and able to respond appropriately
LO7	The students are well-prepared for self-development, in mathematics and relevant areas, or career in work

The following **curriculum** is presented

Semester 1				Semester 2			
Code	**Course Name**	**CU**	**ECTS**	**Code**	**Course Name**	**CU**	**ECTS**
MA1101	Mathematics IA	4	6.67	MA1201	Mathematics IIA	4	6.67
FI1101	Elementary Physics IA	4	6.67	FI1201	Elementary Physics IIA	4	6.67
KI1101	General Chemistry IA	3	5	KI1201	General Chemistry IIA	3	5
KU1011	Indonesian Language: Scientific Writing	2	3.33	KU1001	Sports	2	3.33
KU1160	Introduction to Mathematics and Natural Sciences	2	3.33	KU1202	Introduction to Engineering and Design	3	5
KU1102	Introduction to Computation	3	5	KU1024	English	2	3.33
		18	30			18	30

Semester 3				Semester 4			
Code	**Course Name**	**CU**	**ECTS**	**Code**	**Course Name**	**CU**	**ECTS**
MA2111	**Fundamental Mathematics***	**2**	3.33	KU2071	Pancasila and Civic Education	2	3.33
KU206X	Religion and Ethics	2	3.33	MA2231	Multivariable Calculus	4	6.67
MA2121	Elementary Linear Algebra	4	6.67	MA2271	Introduction to Differential Equation	4	6.67
MA2151	Simulation and Mathematical Computation	4	6.67	MA2251	Discrete Mathematics	4	6.67
MA2181	Data Analysis	4	6.67				
		16	26.67			14	23.34

Semester 5				Semester 6			
Code	**Course Name**	**CU**	**ECTS**	**Code**	**Course Name**	**CU**	**ECTS**
MA3131	Introduction to Real Analysis	4	6.67	MA3231	Introduction to Complex Analysis	4	6.67
XXLING	Environmental Subject	2	3.33	XXMANJ	Management Subject	2	3.33
MA3171	Numerical Mathematics	4	6.67	MA3011	Career in Mathematics	2	3.33
MA3181	Probability Theory	4	6.67	MA3271	Mathematical Modeling	4	6.67
		14	23.34			12	20

Semester 7				Semester 8			
Code	**Subject**	**CU**	**ECTS**	**Code**	**Subject**	**CU**	**ECTS**
MA4093	Final Project I	3	5	MA4094	Final Project II	3	5
MA4091	Mathematics Seminar I	1	1.67	MA4092	Mathematics Seminar II	1	1.67
		4	6.67			4	6.67

Electives:

Code	Name of Courses	Credits	ECTS
MA2111	Introduction to Mathematics	2	3.34
MA2011	Perspective in Mathematics	2	3.34
MA2022	The Structures of Integers	2	3.34
MA2075	Introduction to Mathematical Modelling	2	3.34
MA2111	Introduction to Mathematics	3	5
MA2252	Introduction to Number Theory	4	6.67
MA2281	Non-parametric Statistics	2	3.34
MA3021	Algebraic Structures	4	6.67
MA3041	Introduction to Differential Geometry	4	6.67
MA3022	Linear Algebra	4	6.67
MA3023	Numerical Linear Algebra	3	5
MA3032	Fourier and Wavelet Method	3	5
MA3042	Geometry	4	6.67
MA3281	Mathematical Statistics	4	6.67
MA3051	Introduction to Graph Theory	4	6.67
MA3052	Algorithmic Graph Theory	3	5

MA3053	Machine Learning	3	5
MA3071	Introduction to Optimization	4	6.67
MA3073	Partial Differential Equations	4	6.67
MA3182	Analysis of Variance and Regression	2	3.34
MA3261	Introduction to Financial Mathematics	4	6.67
MA3272	Optimization Method	4	6.67
MA3161	Introduction to Theory of Interests	3	5
MA4181	Introduction to Stochastic Processes	4	6.67
MA4031	Real Functions	4	6.67
MA4041	Capita Selecta in Geometry	4	6.67
MA4071	Introduction to Dynamical System	4	6.67
MA4072	Deep Learning	4	6.67
MA4121	Capita Selecta in Algebra	4	6.67
MA4171	Theory of Linear Control	4	6.67
MA4172	Capita Selecta in Applied Mathematics I	4	6.67
MA4151	Cryptography	4	6.67
MA4152	Capita Selecta in Discrete Mathematics I	4	6.67
MA4182	Capita Selecta in Statistics I	4	6.67
MA4095	Internship	2	3.34
MA4281	Multivariate Analysis	4	6.67
MA4032	Capita Selecta in Analysis	4	6.67
MA4221	Capita Selecta in Algebra II	4	6.67
MA4272	Capita Selecta in Applied Mathematics II	4	6.67
MA4251	Coding Theory	4	6.67
MA4252	Capita Selecta in Discrete Mathematics II	4	6.67
MA4282	Capita Selecta in Statistics II	4	6.67

According to the Self-Assessment Report, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the Bachelor's degree programme Physics:

UPP sets the programme learning outcomes (PLO) for the graduates as follows:

1. They are able to demonstrate their knowledge of classical and modern physics by identifying physical properties of a physical system.

2. They are able to formulate a standard physical system into a physical model by using mathematics.

3. They are able to solve problems of a standard physical system comprehensively by the use of mathematics and computational tools.

4. They are able to analyse a physical system by applying mathematics and computational tools/ICT.

5. They are able to design and conduct experiments in physics or related physics areas, and to acquire, analyse and interpret the resulting data.

6. They have a basic capability in oral communication and in writing scientific report in an appropriate scientific style.

7. They are able to work effectively, both individually and in groups.

8. They are able to apply knowledge of physics to broader areas/interdisciplinary problems.

9. They have basic characters of a good scientist.

10. They have an ability to improve their knowledge and be able to continue their study in a higher degree program.

The following **curriculum** is presented:

	No	Code	Course Title	CU	ECTS eq. *)
Stage-1 Common First Year Programme (Common Prepatory Level)			1st Semester		
	1.	MA1101	Mathematics IA	4	5.56
	2.	FI1101	Elementary Physics IA	4(1)	5.56
	3.	KI1101	General Chemistry IA	3(1)	4.17
	4.	KU1011	Indonesian Language: Scientific Writing	2	2.78
	5.	KU1160	Introduction to Mathematics and Natural Sciences	2	2.78
	6.	KU1102	Introduction to Computation	3	4.17
			2nd Semester		
	1.	MA1201	Mathematics IIA	4	5.56
	2.	FI1201	Elementary Physics IIA	4(1)	5.56
	3.	KI1201	General Chemistry IIA	3(1)	4.17
	4.	KU1024	English	2	2.78
	5.	KU1202	Introduction to Engineering and Design	3	4.17
	6.	KU1001	Sports	2	2.78
5 Stage-2 Bachelor Programme			3rd Semester		
	1.	FI2101	Mathematical Physics I	4	5.56
	2.	FI2102	Mechanics	4	5.56
	3.	FI2103	Electronics	4(2)	5.56
	4.	FI2104	Data Processing and Analysis	2	2.78
	5.	KU206X	ITB Compulsory Courses (Religion and Ethics)	2	2.78
	6.		Elective Course 1	2	2.78
			4th Semester		
	1.	FI2201	Mathematical Physics II	4	5.56
	2.	FI2202	Electromagnetic Fields	4	5.56
	3.	FI2203	Modern Physics	4	5.56
	4.	FI2204	Measurement Methods	2	2.78
	5.	FI2205	Experimental Physics I	2 (2)	2.78
	6.	KU2071	ITB Compulsory Courses (Pancasila and Civic Education)	2	2.78
			5th Semester		
	1.	FI3101	Waves	4	5.56
	2.	FI3102	Quantum Physics	4	5.56
	3.	FI3103	Thermodynamics	3	4.17
	4.	FI3104	Experimental Physics II	2(2)	2.78
	5.	XXLING	ITB Compulsory Course (Environmental)	2	2.78
	6.		Elective Courses	3	4.17
			6th Semester		
	1.	F3201	Computational Physics	3(1)	4.17
	2.	F3202	Fluid Mechanics	3	4.17
	3.	F3203	Statistical Physics	3	4.17
	4.	F3204	Experimental Physics IIII	2(2)	2.78
	5.	XXMANJ	ITB Compulsory Courses (Management)	2	2.78
	6.		Elective Courses	5	6.94
			7th Semester		
	1.	FI4001	Solid State Physics	3	4.17
	2.	FI4002	Simulation and Modelling of Physical Systems	3	4.17
	3.	FI4003	Problem-solving in Physics	2	2.78
	4.	FI4091	Final Project I	3	4.17
	5.		Elective Courses	5	6.94
			8th Semester		
	1.	FI4004	Nuclear and Particle Physics	3	4.17
	2.	FI4005	Scientific Communication	3	4.17
	3.	FI4092	Final Project II	3	4.17
	4.		Elective Courses	9	12.50

Electives:

Subject/	Course Title	CU	ECTS eq.
Biophysics	Biophysics	2	2.78
	Physics of Radiology	2	2.78
	Dosimetry and Radiation Protection	2	2.78
	Electrophysiology and Bioenergetics	2	2.78
	Selected Topics on Biophysics and Medical Physics	3	4.17
Earth Physics	Capita Selecta Earth Physics and Complex System	3	4.17
	Physics of Volcanoes and Geothermal Systems	2	2.78
	Econophysics	2	2.78
	Electromagnetic Methods	2	2.78
	Physics of Rocks and Porous Media	2	2.78
Electronic Materials Physics	Material Science and Engineering	2	2.78
	Synthesis and Characterizations of Electronic Materials	3	4.17
	Electronic and Optoelectronic Devices	3	4.17
	Selected Topics on Electronic Materials	3	4.17
Instrumentation and Computational Physics	Instrumentation System	3	4.17
	Microcontroller and Digital Instrumentation	2	2.78
	Network-based Instrumentation	2	2.78
	Computation and Smart Instrumentation System	2	2.78
	Special Topics in Instrumentation Physics	2	2.78
Magnetic and Photonic Materials	Science and Technology of Optics and Magnetics	2	2.78
	Photonics Theory and Applications	2	2.78
	Material Characterizations	2	2.78
	Synthesis and Physical Properties of Materials as well as their Functionalizations	3	4.17
	Selective Topics in Physics of Magnetism and Photonics	2	2.78
Nuclear Physics	Nuclear Applications and Instrumentation	2	2.78
	Reactor Physics	3	4.17
	Nuclear Fuel Management	2	2.78
	Special Topics on Nuclear Physics	2	2.78
	Thermal Hydraulics and Nuclear Safety	2	2.78
Theoretical Physics	Special Theory of Relativity	2	2.78
	General Theory of Relativity	2	2.78
	Advanced Quantum Physics	2	2.78
	Group Theory and Symmetry in Physics	2	2.78
	Selected Topics in Theoretical Physics	3	4.17
	Internships	2	2.78
	Independent Study	2	2.78