ASIIN Seal

Accreditation Report

Bachelor's Degree Programmes
Mathematics
Physics

Provided by
Universitas Airlangga, Surabaya, Indonesia

Version: September 20th, 2019

Table of Content

A About the Accreditation Process

Name of the degree program (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Ba Fisika	Physics	ASIIN	National Accreditation Agency for Higher Education in Indonesia (BAN-PT) 2015-2021	FA 13
Ba Matematika	Mathematics	ASIIN	National Accreditation Agency for Higher Education in Indonesia (BAN-PT) 2011 – 2017	FA 12

Date of the contract: 22.05.2017

Submission of the final version of the self-assessment report: 16.05.2017

Date of the onsite visit: 21-24.11.2017

at: Faculty of Science and Technology, Universitas Airlangga

[1] ASIIN Seal for degree programs

[2] TC: Technical Committee for the following subject areas: TC 12 Mathematics, TC 13 Physics

Peer panel: Prof. Dr. Martin Buhmann, Justus-Liebig-Universität Gießen Dr. Harald Ehrentraut, Freudenberg Technology Innovation SE & Co. KG Prof. Dr. Mathias Getzlaff, Heinrich-Heine-Universität Düsseldorf Prof. Dr. Jürgen Nolting, Hochschule Aalen – Technik und Wirtschaft Dinda Pitaloka, student peer, University of Brawijaya, majoring in Computational Physics
Representative of the ASIIN headquarter: Dr. Iring Wasser
Responsible decision-making committee: Accreditation Commission for Degree Programmes
Criteria used: European Standards and Guidelines as of 15.05.2015 ASIIN General Criteria as of 28.03.2014 Subject-Specific Criteria of Technical Committee 11 – Mathematics as of 9.12.2016 Subject-Specific Criteria of Technical Committee 13 – Physics as of 9.12.2016

In order to facilitate the legibility of this document, only masculine noun forms will be used hereinafter. Any gender-specific terms used in this document apply to both women and men.

B Characteristics of the Degree Programmes

a) Name	Final degree (original/English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Ba Physics	S.Si./ Bachelor of Science		Level 6	Full time	/	8 Semester	144 credit points minimum, equivalent to 227,5 ECTS credit points	Fall Semester 1982
Ba Mathematics	S.Si./ Bachelor of Science		Level 6	Full time	/	8 Semester	144 credit points, equivalent to 227,5 ECTS credit points	Fall Semester 1982

The Bachelor´s Degree in Physics in the Faculty of Science and Technology has been offered continuously since September of 1982. According to its own vision it "aims to support the advancement of technology, industry, and medical science on national and international level through research, education, and community service based on religious values."

On the website of the University (http://fisika.fst.unair.ac.id/about/spesifikasi-prodi) the mission statement of the study program entails the following elements:

"The Bachelor of Physics program aims to encourage and facilitate high academic capacity, professionalism, innovative and competitive skill, to conduct innovative research using an integrative approach in the area of physics based on advanced science and technology, to dedicate skill and knowledge for social empowerment, to develop students' potential and ability in physics and its applications, to increase their competitive skill especially in the industrial and medical field, to provide a good academic atmosphere conducive to learning and conducting research, to uphold academic ethics and moral values and finally to build collaboration and network with stakeholders (hospitals, industries, and other institutions) both on the national and international level for program sustainability related to educational activities, research, and community services."

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

Among its major educational goals figure

1. "To produce independent graduates and religious intellectuals characterized by good leadership and entrepreneurial skills able to expand their knowledge, analyze natural phenomena and to implement physical sciences in industry/the medical field.
2. To produce beneficial research to support the advancement of science and technology in industry and medical field.
3. To generate and implement physical sciences and its application to serve the local community and the nation
4. To maintain sustainable collaboration related to educational activities, research, and community services with stakeholders both on national and international level."

Physics graduates are trained to work in Physics related fields such as industry, educational institutions and research institutions.

As regards the **Bachelor's Degree Program of Mathematics** the mission of the study program is presented on the faculty website as follows:

1. "Organizing education activities and teaching effectively and efficiently to produce professional graduate students able to adapt toward the development of science and technology for competing at national and regional level.
2. Doing innovative, productive, and good quality research both at national and international level to provide the development of mathematics and its application, especially in natural science and industry.
3. Having community service as an actualization of mathematics application."

Mathematics graduates are trained to work in industry and educational institutions (teachers and lecturers), a considerable number are also employed in the banking field/by insurance companies.

C Peer Report for the ASIIN Seal

1. The Degree Program: Concept, content & implementation

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

Evidence:

- Self Assessment Report with Mappings of LO against ASIIN SCC
- Website for the physics program (http://fisika.fst.unair.ac.id/) and the mathematics program (http://matematika.fst.unair.ac.id/)
- Graduate Tracer Study Result
- Discussion with representatives of UNAIR´s management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The Faculty of Science and Technology in its Self Assessment Report has formulated the intended Learning Outcomes (LO) for the two Bachelor programs under review. The peers during the accreditation process refer to the **Subject-Specific Criteria (SSC)** as a basis for judging whether these intended learning outcomes correspond to the exemplary constituted learning outcomes of the Technical Committee of Physics and Mathematics respectively. The peers in this process take note of different appendices in the Self-Assessment Report in the framework of which the correlation between the learning outcomes as defined in the Subject-specific criteria of ASIIN and the learning outcomes as defined by UA are mapped.

Referring to Appendix 1.3 of the SAR the learning outcomes **for the Bachelor of Physics programs** are formulated. Graduates of the study program accordingly

- Have knowledge of classical and modern physics
- Apply mathematical methods to solve problems in physics
- Apply concepts and principles of physics for theoretical analysis, modeling and simulation
- Conduct scientific methods and apply them in physics problem as well as develop them in interdisciplinary problems

- Conduct measurement methods and experiments in physics problems and their application
- Are familiar with information technology and are able to apply them vis-a-vis relevant physics problems
- Are able to apply knowledge and principles of physics in industry and medical fields as well as other interdisciplinary fields.

In addition they are able

- To solve problems continuously , confidently being familiar with suitable learning strategies
- To solve basic problems and present their results
- Communicate orally and in writing as well as to work in teams.

A number of qualification profiles have been identified by the Department of Physics. The study program is supposed to prepare for different career paths, such as the tracks for research/science, for education, for professional practice in the medical and industrial fields, for management and entrepreneurial positions and also for government employment. In their discussions with the students it becomes apparent that many of them aspire to become researchers and scientists and plan to continue their studies on the Master level.

As regards the competence profile of a ***teacher,*** the experts note that the program itself does ***not*** cater for a pedagogical training. This only can be acquired by an additional qualification offered under the authority of the ministry of education. The peers are of the opinion that this should be clarified in the program learning outcome descriptions.

Regarding ***the management and entrepreneurial track,*** thus far there is only one single module in place to support this competence profile, which according to the peers is not sufficient and accordingly must be strengthened. In the discussion it turns out that there are efforts under way to add additional course offers in the area of entrepreneurship.

Overall the peers recommend defining more clearly the competence profiles of the above mentioned different occupational tracks.

With regard to the l**earning outcomes of the Bachelor in Mathematics,** the Self Assessment Report lists the following qualifications:

After successfully completing the study program graduates are capable

- To master the mathematical concept, to make connection between concepts and to present them in accordance with the rules of mathematics.
- Of abstraction and analogy and finding the archetype

- To reason logically, critically and systematically, using mathematical principles to solve mathematical problems
- To use software to support the resolution of problem
- To know how to identify problems, to develop a mathematical model and to determine the completion strategy as well as to interpret the results of the solution
- To communicate with good interpersonal skills and are able to work in teams.

The Bachelor program in mathematics also has identified a number of graduate profiles, distinguishing between those for academics, analysts and consultants, as well as for managerial posts and has mapped different learning outcomes to these profiles.

Regarding transferrable skills, the peers acknowledge that they have been formulated for both degree programs and comprise competences like the ability of students to communicate effectively orally and written, both in Bahasa Indonesia and in English and to contribute effectively either as an individual or in multidisciplinary and multicultural teams. In the discussions (see below) especially with alumni and employers, it became however apparent that there is considerable room for improvement with respect to English speaking capabilities, presentation and other soft skills in a working environment as it would make a better working candidate.

Concerning the ***process of developing and updating the LO*** for both programs, there is on the one hand an internal annual review taking place, where minor adaptations (frequently in the composition of the electives) are made, and on the other hand a major external revision every five years.

The peers learn that a team of lecturers of the department develops the objectives and intended learning outcomes of the degree programs in physics and mathematics. Based on the draft concepts, the Faculty of Science and Technology subsequently invites different stakeholders to present and discuss the degree programs. Their feedback is taken into consideration when revising the educational objectives and the intended learning outcomes, also the results of tracer studies are taken into consideration. In the discussions during the onsite visit, it turns out however, that some stakeholder groups have either not been engaged at all or not in a systematic way. This is certainly true for the group of students which were not involved in the discussion regarding necessary changes to the programs. They therefore are not aware of the process and no formal communication channel has been established; this to a certain degree is also true for the group of alumni. Some of the business representatives who participated in a meeting with the peers confirmed that there had been meetings between the university and business representatives at least once a year; additionally a number of case to case meetings have taken place. After completion of the stakeholder process, the submitted curricula are reviewed by the Faculty Advisory

Board and approved by the Dean, before it is then approved by the Institute for Educational Assessment and Development.

The peers find that while there is a formal process in place to update and modernize existing curricula (on the described 5 year cycle but also on an annual basis), not all relevant stakeholders have been systematically included in the process of formulating and further developing the objectives and learning outcomes.

In view of the positioning of graduates of both programs on the labour market: in the discussions with the business representatives during the audit it was confirmed that graduates are by and large properly prepared for qualified employment. The business representatives highlighted that UNAIR graduates are ready to take on demanding work positions. The peers understand that the intended qualifications profile allows the graduates to take up an occupation which corresponds to their qualification. The waiting time to find a job for graduates of both programmes amounts to a little over two months. For the graduates in mathematics, 90% of them are reported to work in fields closely related to their studies.

In summary, the peers confirm that, except for the indicated limitations, the learning outcomes of the Bachelor programmes under review correspond to the learning outcomes of level 6 of the European Qualification Framework. They also conclude that the subject specific criteria of ASIIN are by and large covered in the learning objectives under review considering the stated deficiencies. At the same time they recommend describing more accurately the subject-specific and professional classifications of the different professional tracks listed above.

Criterion 1.2 Name of the degree program

Evidence:

- Self Assessment Report
- Webpages of the degree programs

Preliminary assessment and analysis of the peers:
The names of the two degree programs are published on the subject specific web-page. The auditors confirm that the names of the degree programmes “Physics” and “Mathematics” properly reflects the intended aims and learning outcomes. The programs are published in English and in Indonesian language. The study programs are primarily carried out in Indonesian language.

Criterion 1.3 Curriculum

Evidence:

- Self Assessment Report
- „Study contract“ /Module Descriptions
- LO-Matrices, FST Academic Prospectus
- Discussions with representatives of UNAIR management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The representatives of the Faculty of Science and Technology have included a description of the overall study structure for both programs under review as well as a comprehensive module handbook (in the terminology of UA this is referred to as a “Study Contract”). It entails all necessary information regarding content, learning outcomes, grading and examination system etc. The peers also welcome that each subject-specific webpage entails the description of the curricula and the module handbooks.

Both curricula comprise eight semesters, students are expected to graduate in this time period (maximum study period allowed is 14 semesters). Students with an excellent Grade Point Average may complete the program in seven semesters with the approval of their academic advisors.

The total number of credits for an undergraduate´s degree at the Faculty in general is 144 credits at minimum and 160 credits maximum. For the physics programme the relevant number of compulsory credits amounts to 129, with the rest being electives; for the mathematics, compulsory credits are fixed at 119 credits.

Bachelor of Physics program

The program in physics is structured in four stages: in the first semesters the students are acquainted with fundamental knowledge about mechanics, vibration, wave, optics, general thermodynamics, electromagnetism and modern physics. The students are also introduced to mathematics as general language to incorporate physics concepts.

In a second phase advanced physics courses providing more in depth mathematical methods to solve more complex physics problems in courses such as modern physics, mechanics, physics of wave and thermodynamics are being taught.

Subsequently advanced physics knowledge about quantum physics, statistical physics, nuclear physics, advanced electromagnetism, solid state concepts and physics implementation in life is on the course plan. In the last phase students are exposed to structure physics

research in the framework of their thesis integrating the concepts learned before. As regards the electives they are grouped along the existing research groups in the department which are: medical physics, material physics, theoretical physics, photonics, computation physics and physics instruments.

Concerning the specific curricular setup, the peers focus on the following findings:

The ***elementary particle physics*** is part of the ASIIN subject specific criteria for physics but the experts cannot find a course/module covering that subject. The representatives of the physics program argue that there used to be a separate course on this topic before, but that it had meanwhile been integrated into the nuclear physics course. When checking the course handbook (the "study contract" in the terminology of UA) nothing can be found there. In the discussions, the students are also not aware of the fact that elementary particle physics is taught as a sub-topic of nuclear physics. They thought it to be part of theoretical physics. The peers consequently request to strengthen elementary particle physics and to teach it as a separate module.

The peers also argue in favor of transforming ***the atomic and molecular physics course*** from an elective to a compulsory one, finding consensus for this proposal too.

Generally speaking, there is a good balance between theoretical and experimental physics. This is however not the case in the area of ***mechanics*** (which is only offered as a theoretical course) and also in ***electrodynamics and mechanics***. This needs to be addressed.

As regards the course ***on computational physics,*** the focus is primarily on programming and algorithms, utilizing mainly the computer language Delphi. The peers regard this language as rather outdated. They recommend applying a more modern approach based e.g. upon Matlab and C++. According to staff members only open source should be utilized. In this case GNU Octave could serve as a replacement, compatible to Matlab to a significant extend. Microsoft Visual Studio implements free versions of C++ and C#. Even Visual Basic could be recommended, if the emphasis lies on a low threshold approach.

The peers learn that the last reviews of the Physics program at the Faculty of Science and Technology have taken place in 2006 and 2011 respectively. Following a standard five year cycle of major review, the program is currently under review. A number of major demands have been raised by stakeholders in the above described review process:

First of all the request has been received to strengthen the **profile of a medical physicist**. Secondly it was recommended to put more emphasis on industry management and entrepreneurial skills to prepare graduates more aptly for the exigencies of the labor market and thirdly, to make adjustments in the teaching methodology for mathematical fundamentals.

Regarding the latter demand, the problem resides in the fact that as physics and mathematics students are taught in the exact same classes. Due to different entrance qualifications both group of students suffer from this indiscriminant form of joint teaching (e.g. in the area of calculus with students of physics frequently struggling); obviously there is a lack of communication between the mathematics and physics departments to cater for the different needs of both student groups. The representatives of both departments confer to this finding. In addition written and spoken English language courses as well as English for Scientists courses for students as well as staff were found to be essential as is the improvement of communication skills among students.

Bachelor of Mathematics

The current mathematics curriculum has been in place since 2014. It has the following structure: in the first stage of the mathematics study program students are exposed to the basic concepts of mathematics necessary to grasp the concept of advanced degree in mathematics. Students are trained in solving mathematical problems by using its symbolic language as a translation of the problem. In the suite, students are familiarized with the method of mathematical proof as the main basic concept used to prove a mathematical statement. Students then learn abstraction and analogy, especially those related to the concepts in analysis, algebra, statistical theory and mathematical modeling. Students are also trained to communicate mathematical concepts in simple logic through understanding, proofing, using, or rewriting a theorem. In the final phase students are asked to develop and complete a final project related to the use and application of mathematical concepts.

The content of curriculum is proposed by the four existing research groups in the department. The research groups are grouped in the areas of Algebra (Fundamentals of Mathematics, Discrete Mathematics, Linear and Abstract Algebra), Analysis (Calculus, Analytical Geometry, Real Analysis, and Complex Functions), System Modeling (Numerical Method, Differential Equation, Mathematical modeling) , and Operations Research and Computation (Algorithm and Programming, Operations Research, Simulation).

The peers discuss the curriculum at hand and identify the following areas for improvement:

One of the issues to be solved is the problem mentioned above that the math fundamental courses are taught not specifically for mathematics, but also caters for the needs of students of physics, which have different levels of knowledge to build on. This results in the undesirable effect that fundamental modules are not taught in the beginning, but only in the second and third semester. Algebra is only an elective course; the peers strongly recommend transforming it to a compulsory one.

The two courses in complex functions and real analysis are compulsory, but only taught very late in the fifth and sixth semester. In the eyes of the experts they ought to be taught at the beginning of a mathematics course to lay early the foundation for advanced studies.

For both programs there is a considerable discrepancy between the wish of practically all students to have an international study experience and the fact that no one has actually experienced it. The peers are told that UNAIR/the faculty of Science and Technology has signed a number of cooperation agreements with different national and international universities. When looking at international exchange programs there is however as of now comparatively very little in place: For the physics program there are some outbound programs (short courses) with a small number of universities in Malaysia (Malaysia university) and Japan (Kumamoto University). For the mathematics program there is a cooperation agreement with Prince of Songkhla University in Thailand in place as well as an inbound program with Universiti Utara in Malaysia.

Other impediments for mobility cited are especially a lack of English knowledge, the absence of exchange programs at Universitas Airlangga (at times also not a sufficient GPA), but not so much funding issues. The peers recommend therefore to increase the exposure of student to English lessons in spite of the fact that certain elements are in place (existence of the ECOMAS community to speak English, use of English speaking literature and handbooks in English, exigency to formulate an English abstract of the thesis, the possibility to attend a limited number of individual courses being taught in English). The peers recommend introducing technical English/English for science courses.

All students present report having done an internship; an internship regulation is in place. It is usually of one or two months duration and completed during the holidays. If an attractive offer is presented to a student during the lecture time, permissions by the Head of the department is possible. Given the interest of students to get more practical working experiences, the peers encourage the faculty to provide more opportunities for students to carry out an internship in a company and to consider the establishment of a database of internships.

As outlined under criterion 1.1, the auditors can see that the intended learning outcomes are reflected with some limitations in the curricula presented. UA has provided module-objective matrices for each degree programme depicting which module contributes to the fulfilment of which learning outcome; the respective contribution was specified in terms of “high”, “medium” or “low” contribution.

Considering the limitations indicated in this section the peers confirm that the curriculum allows the students to achieve the intended learning outcomes in order to obtain the degree.

Criterion 1.4 Admission requirements

Evidence:

- Ministry of Education Regulation No. 034/2010
- Universitas Airlangga Student Admission Center Official Website
- Self Assessment Report

Preliminary assessment and analysis of the peers:

UA uses a nation-wide student admission system which consists of two different routes: student admission based on written and skill test and student admission based on academic performance. These tests are managed under the auspices of the Indonesian Ministry of Research, Technology and Higher Education. In addition, all state universities have to recruit students with a high academic performance but who have financial difficulties with a proportion of at least 20% of the new students to be admitted to the university. The admission process for the two programs under review is highly selective. It is also worth mentioning that Universitas Airlangga has a policy that requires students to have English proficiency such as an ELPT score of at least 450.

The Faculty of Science and Technology cites as proof of an adequate selection process the fact that the Grade Point Averages in both programs under review have risen steadily over the past years, reaching 2,9 on average for the Bachelor of physics and 3.06 for the graduates in the field of mathematics. With a reported completion rate of almost 100%, all students are guided toward a successful graduation of their respective programs.

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

Taken the statement of the university into account, the peers consider the criterion as not yet completely fulfilled.

Objective and learning outcomes of the programmes

The peers appreciate the announced review of the definition of the graduate profiles of both programmes. As no action has been taken yet, the peers maintain their respective recommendation.

Curriculum

The peers welcome the planned re-designing of the curriculum for the degree programme Physics which comprises the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses, the usage of modern programming language

for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics). In order to assess the implementation of the re-design the peers keep their relevant requirement.

Regarding the degree programme Mathematics, the peers see that Basic Physics, General Physics, General Biology and Mathematics Fundamental are courses that shall underline the principle of natural sciences and are, thus, taught in all four degree programmes. However, the university announced to give subject specific courses (such as calculus) exclusively to mathematic students. Moreover, it is planned that subjects of Fundamentals of Mathematics I and Fundamentals of Mathematics II will be converted into Fundamentals of Mathematics which is foreseen in semester 2. The university also states that Algebra is given not only as elective course (Matrix Algebra), but also as compulsory courses including Elementary Linear Algebra, Linear Algebra, and Algebra Structure. The Matrix Algebra is an advanced course that is rather applicable for students who choose Algebra as topic for their final project. In general, all mathematics students obtain elementary matrix materials in Elementary Linear Algebra. Finally, the peers see that Real Analysis and Complex Functions that are given in the fifth and sixth semester due to the fact that students at this stage are exposed to process of abstraction and analytical, which is offered by subjects such as Real Analysis and Complex Function. Taking into account the statement of the university, the peers maintain their requirement to re-design the degree programme by delivering fundamental mathematic courses exclusively and by offering fundamental courses at the beginning of the study.

The peers recognise the effort the university is taken to improve the English proficiency of the students and encourage the organisation to promote these activities further among other by introducing more English taught subject-specific elements into the curriculum. The peers also maintain their recommendations to promote academic mobility of students.

2. The degree programme: structures, methods and implementation

Criterion 2.1 Structure and modules

Evidence:

- Self Assessment Report
- Study Contract/Module descriptions
- Discussions with representatives of UA management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The program structure of the two undergraduate programs under review is clearly outlined on the subject specific website for each study program. All degree programs consist of courses/modules which comprise a sum of teaching and learning units. The module descriptions (describing the module name and level, the semester of its offering, the module coordinator and lecturers, the classification compulsory/elective, workloads, the credits points and requirements, the learning outcomes and content, the exam requirements, teaching methods and literature) are also published on the subject specific website in English and can be downloaded. Hence, the module descriptions are available for all interested stakeholders.

While overall the peers obtain most of the necessary information from these descriptions, there remains however room for upgrading and improving part of them. Evidence to that regard is giving in the following detailed analysis:

A list of modern literature is frequently missing, in some modules the literature list is quite outdated (examples are BIL101, FIB101, FIE209). As regards module requirements, they too are on occasions missing or should be corrected (examples are FIB307, FIC104, FIC107, FIK307, FIO304, FIT301, FIT303). Announced semesters are either not correct or at least questionable (examples to that regard are FIB203, FIB303, FIB305, FIM304, FIM308, FIO301, FIO303). The peers also question the rationale to place the module BAE112 (English II) very late in the 7th semester of the curricula.

The entire description of module FIB301 needs to be reviewed. The peers also like to clarify whether FIT 302 is really compulsory (in APP it is listed as elective) and whether FIT 305 (Atomic and molecular physics) are really elective. KIDS 103 und 104 are not mentioned in the module descriptions at all.

The peers underline that the module descriptions are to be revised based on the aspects mentioned above.

Based on the analysis of the sequence of modules and the respective module descriptions the peers conclude that the structure of the degree programs ensures that the learning outcomes can be reached. The programs also offer a number of elective courses which allows the students to define an individual focus. The elective courses are grouped along the various research focus groups mentioned above.

Based on the analysis of the curriculum and the module descriptions the peers confirm the qualification level and the overall intended learning outcomes can be attained by the graduates.

Criterion 2.2 Work load and credits

Evidence:

- Self Assessment Report
- Module descriptions
- Discussions with representatives of UNAIR´s management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
There is a university wide system of calculating ECTS at Universitas Airlangga in place, one Indonesian credit point equals around 1,3 ECTS.

As a general requirement, the minimum number of credits to successfully graduate from either of these two programs is 144 Indonesian credits, the maximum number of credits allowed amounts to 160 credits. The Thesis is credited with six + two credits.

Total credits in the first semester is set at 18 credits, the subsequent work load is then dependent on students performance. Students with a low GPA are restricted in the number of credits they actually can take per semester. For the high performers on the other hand, there exists a possibility to graduate after 3.5 years with the consent of the academic advisor.

In general, the undergraduate programs at UA are designed to be completed within four academic years. The maximum length of study is limited to seven years. During the onsite visit the peers learn that the standard period of time for students of the physics program amounts to 4.08 study years, whereas the figures for the mathematics Bachelor are 4.34 years on average, in line with expectations. The number of drop outs is exceedingly low in both cases.

The peers conclude that the curriculum/the workload is structured in a way to allow students to complete the degree in the regular timeframe.

The system of credit transfer on an (international basis) is reported to be in place though there are no actual cases reported of students transferring from another Indonesian university to UA and the figures related to international student exchange are very low.

What is however completely absent is a system to systematically evaluate the logic/fairness of credit point distribution in the curricula (example: optical physics is a very difficult course to which too little credits are attached). The peers therefore ask UA to provide a questionnaire of the teaching evaluation or any other document that provides evidence if the workload and credit unit relation is systematically verified.

Criterion 2.3 Teaching methodology

Evidence:

- Self Assessment Report
- Module Description
- Discussions with representatives of Universitas Airlangga management, program co-ordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
The two Bachelor degree programs at Universitas Airlangga are full-time programs with classroom and self-study activities. The university according to its Self Assessment Reports pursues a concept based (CBL), problem based (PBL), project based (PJBL) and skill based learning approach (SBL). During the discussions numerous examples are given by the teaching staff on how the delivery of teaching has changed in recent years to that regard. While some subjects are applying e-learning methods, others are making use of case studies in their respective course (e.g. artificial intelligence) or adapt the way group works in laboratories are effectuated (more focus is now claimed to be laid on data interpretation instead of mere data collection). The student groups doing experiments in the labs are however still too big in the opinion of the experts. They insist that group numbers in excess of two deny students the chance of a personal hands on experience.

The representatives of Universitas Airlangga furthermore point to the strengthened correlation between teaching and research of professors. In the field of physics, there are 6 research groups which are medical physics, optoelectronics, molecular advanced material, instrumentation, computational physics and theoretical physics. In the area of mathematics, there are 4 research groups in the area of algebra, analysis, system modeling and operations research and computation. The peers note positively, that to a certain degree students are engaged in research and even to publish the scientific results obtained, which is a remarkable accomplishment on the level of Bachelor programs. Most students are well aware of the different areas of research. It is also important to note that the options for specialization via elective courses are constructed around the research areas and are used by the students to focus their studies according to their personal profiles of interest.

There is an obvious connection between teaching methodology and the examination system with some shortcomings mentioned below.

While acknowledging the positive developments in the area of modern teaching methodologies, the experts maintain as a central challenge to the faculty to further instill critical thinking skills in students.

Criterion 2.4 Support and assistance

Evidence:

- Self Assessment Report
- Discussions with representatives of UNAIR´s management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

The peers welcome the academic advisor concept at UA. The peers learn that at the start of the studies an academic advisor is appointed for each student. Each academic is responsible for supervising about 15-20 students, which consumes a lot of time. Usually, the academic advisor is available for any consultation a student may need, even for problems beyond academic matters. Students can come individually every week for consultation sessions.

The advisors assist students in arranging their respective study plans, to choose their electives and to determine their semester work load while following the students grade card in the process. Students also receive special assistance in writing their thesis/identifying suitable research topics.

If in need, tutorial sessions are arranged to help students with difficult courses though during the discussions with students the wish was formulated to have more tutorials in certain areas (e.g. in theoretical physics).

Student Study Success is evaluated at two points during their studies. It is remarkable that the dropout rates in the two programs under review are very low.

The peers commend the department on this efficient system and on the excellent working relations between staff and students.

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

Taken the statement of the university into account, the peers consider the criterion as widely fulfilled.

Structure and modules

The peers take note of the revised module descriptions. They appreciate the efforts that have been done in order to revise the module descriptions according to the peers' remarks. Thus, they do not see the necessity for a respective requirement. Only, the fact that literature hints are frequently missing and only a few module descriptions were revised, the peers maintain their recommendation.

Workload and credits

The provided questionnaire of lecturer performance does include neither the evaluation of the actual workload nor whether it is corresponding with the allocated credit points. The peers support the university's proposal to appoint the Center for Innovation Learning and Certification to collect date on this issue in future evaluation. The peers, thus, endorse a recommendation to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

Teaching methodology

See the peers' assessment under criterion 4.

Support and assistance

The peers are surprised by the provided figures regarding drop-out rate and number of students that have withdrawn. According to the these figures, the drop-out rate is actually 0 and the numbers of withdrawal of students do not exceed 6% per year.

The peers wanted to stress again the students' wish to arrange more tutorial sessions to help students with difficult courses (e.g. in theoretical physics).

3. Exams: System, concept and organisation

Criterion 3 Exams: System, concept and organisation

Evidence:

- Self Assessment Report
- Module descriptions
- Quality Manual for diploma and undergraduate examinations (PP-UNAIR-PBM-03)
- Quality Manual for thesis/final project (PP-UNAIR-PBM-04)
- Discussions with representatives of Universitas Airlangga management, program co-ordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

There is a standardized system/university regulation in place with regard to the conduct of exams at UA. The procedure of examination is managed by the Directorate of Education, the regulations are summarized in two documents, namely the undergraduate examination

manual (PP-UNAIR-PBM-03) as well as the quality manual for thesis/final projects. In addition more information on exam requirements is given in the course manual/study contract and explained to the students at the outset of each semester. There are fixed regulations for the conduct of midterms and final exams (taken place in the 8/9th week and the 16/17th week of the semester respectively), other forms of exams are up to the individual staff member to design. At the end of the semester, the course coordinator submits the grades of quizzes, examinations and other assessments to the UA Cybercampus and the department office for announcing the results to the students. Students can access their grades at any time through the student's information systems (UACC).

There are overall a high number of exams in place; students however did not seem to mind, on the contrary they cherished the possibility of exams to check their progress of understanding.

According to the Self Assessment Report, the examinations at UA are designed to evaluate students´ achievement of intended Learning Outcomes (LO). The peers however identify a number of shortcomings with regards to this claim. On the one hand there is - apart from the defense of the thesis - an almost complete absence of oral exams. Given the fact, that employers report missing communication skills among graduates, it is recommended to increase the number of oral exams during the studies to increase these skills. The peers also observe a high reliance on multiple choice tests in the exam schemes which are not suited to find out learning outcomes. It is therefore recommended to find better suited exam modes.

As regards the number of students engaged in laboratory work, it is strongly recommended to reduce their number to a maximum of two per group to guarantee exposure to the hands on experience.

The students confirm that the examinations are well organised and fully transparent. The peers gained the conviction that the exams are graded using transparent criteria. The auditors understand that the deadline for submission of the Final Score List is two weeks after the end of semester examinations to ascertain that no delays hamper the progression of the students. Students have the right to inquire about their marked examination, quizzes, and assignments and can ask questions should there be a grading mistake. The lecturers have the obligation to arrange examinations for students who have not taken the examination for a valid reason; for students with disabilities or other limitations compensational measures are agreed on individually.

Students have to finish a final project by conducting research in one of the areas of interest. Each student chooses a prospective supervisor through the Final Project Information System and decides on the research subject for their final project. The objective of the final

project is to synthesize the knowledge, apply the scientific method to conduct problem solving and obtain the research objective and to deepen the understanding in the research areas concerned. Each student is under supervision from a faculty staff member in the related laboratory. The final project report is presented orally in front of a committee (open session in physics and closed session in mathematics).

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

Taken the statement of the university into account, the peers consider the criterion as not yet fulfilled.

The remaining issue is the oral capabilities of the students. The peers understood that the defense (presentation) of the thesis is the only oral exam. Consequently, it would not be sufficient to have this presentation as the only obligatory oral exam as suggested by the university. Thus, the peers maintain their requirement to strengthen the oral skills of the students.

4. Resources

Criterion 4.1 Staff

Evidence:

- Self Assessment Report
- Staff handbook for all degree programs under review (http://physics. fst.unair.ac.id/about/sdm/ and http://mathematika.fst.unair.ac.id/staf-pendidik)
- Discussions with representatives of Universitas Airlangga management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:

UNAIR, due its semi autonomous status, has more leeway than other universities in Indonesia in organizing its recruitment policies in spite of the fact that the procedure for selecting lecturers is based on ministerial degrees. The minimum requirements for obtaining a teaching assignment at Universitas Airlangga are to hold at least a Master degree and to pass a written as well as a leadership test. Pedagogical training for newly hired staff is provided on a regular basis (the joined pedagogical training is called Pekerti or applied approach). It is also important to note that there is a difference in the status of government

versus non-government employees. In addition there is a scheme for visiting professorships; separate funds are available for this.

UA has provided staff handbooks for the two degree programs under review:

For the **Bachelor of physics program**, there are 28 active lecturers, with 3 full professors, 7 associate professors, 11 senior and 6 junior lectures. 5 staff members are currently pursuing doctoral studies. The calculated staff-student ratio amounts to around 1:23. Staff members are conducting research along six main areas of interest: medical physics, photonics, material physics, electronics and instrumentation, computational physics and theoretical physics.

In the **mathematics program** there are 20 active lecturers, 6 of them with a doctoral degree and 5 pursuing a doctoral degree.

The peers understand that staff members have four major set of tasks to fulfil which are education, research, administration and community services. Each lecturer serves as an academic advisor as well as final project supervisor.

The average workload of staff is currently quite high at around 16 credits which, according to the Dean, requires additional efforts in hiring new staff. As mentioned above, there is a guest lecture program in place which allows inviting guest speakers from outside the university on a regular basis.

The research activities at the Faculty of Science and Technology are carried out by research groups. The lecturers mention that research proposals, presentations at international conferences or publications in international journals are awarded with monetary incentives in order to motivate lecturers to get actively involved in research activities. Based on the individual curricula vitae of the staff members the peers can see that most staff members have more or less recent publications in different journals which shows the active research environment of the faculty. Additionally, the staff members of the faculty made it plausible for the auditors that students are actively involved in research activities primarily in terms of final theses.

The peers can see that research and development activities are implemented by the teaching staff. However, there is also to a certain degree concern that outdated laboratory equipment in a certain number of laboratories might hamper the implementation of advanced research projects (see criterion 4.3 below).

When it comes to the issue of technical staff, more qualified staff is required in some instances (the photonics laboratory is cited as an example in case – the students reported,

that the optical spectrum analyzer could repeatedly not be utilized as required, due to the absence of technical supporting staff).

In summary, the peers confirm that the compositions, scientific orientation and qualification of the teaching staff are suitable for successfully implementing and sustaining the two degree programs under review. The only weak point they identify with respect to the teaching staff is the fact that most of the staff members are also graduates from Universias Airlangga. For this reasons they recommend also hiring new staff members that graduated from other universities.

Criterion 4.2 Staff development

Evidence:

- Self Assessment Report
- Discussions with representatives of Universitas Airlangga management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
UNAIR explains that there are several concepts in place to foster the didactical competences of staff members (courses provided by its Institute for Educational Assessment and Development). Newly hired staff members who hold a master's degree are encouraged to continue their study to doctorate level. Faculty members are encouraged to present their research papers in both national and international conferences, and receive travel funding to that purpose. Especially new staff members are required to take short courses in teaching methodology. As regards the offer of UNAIR in the area of training English language skills however, especially older and more experienced staff members indicate that sometimes no open places were available.

There are also certain performance reviews in place (staff performance index), with the monitoring and evaluation being done according to written regulation. The peers however did not find any evidence to which degree a good or bad performance impacts on the professional lives of the concerned staff.

In summary, the peers conclude that UNAIR offers certain (limited) opportunities to staff members to further develop their professional and teaching skills. They at the same time recommend that there should be a transparent system of rules and possibilities in place for obtaining a sabbatical on regular intervals.

Criterion 4.3 Funds and equipment

Evidence:

- Self Assessment Report

- Discussions with representatives of Universitas Airlangga management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
Financial sources for UNAIR stem from government funding, society funding, and tuition fees. In the SAR, further data was provided. The peers take note of this information and are convinced that the financial means are sufficient and secure for the timeframe of the accreditation period.

Equipment and Laboratories

The situation concerning the equipment and laboratories presents itself as follows to the experts:

As regards the laboratories for basic physics education they are mostly equipped with rather old equipment, which to the opinion of the peers is nevertheless suited for the purpose of acquiring basic experimental knowledge. Lab courses are organized as group works, about 3-4 students running a specific experiment as a group effort. In total, on average 3-4 groups work in parallel during the lab courses. The staff-to-student relation during the lab courses appears to be adequate. Typically two staff members are responsible for each lab and are available throughout the course.

The **labs for Basic Physics 1** (mechanics, optics and calorimetry) and **Basic Physics 2** (viscosity, electromagnetism, expansion coefficients of metallic rods) are equipped with aged but functional setups. The **lab of Analog Electronics** (LRC combinations, diodes, analog filters) has modern setups with oscilloscopes and frequency generators, students are experimenting with bread-board setups. This is regarded as a well-suited approach for basic education in electronics by the peers.

The **Modern Physics lab** (cathode rays, X rays, Rutherford scattering, radioactivity, e/m measurement) is found to have comparatively old equipment. The students are experimenting with radioactive materials. The peers criticize that radiation safety is not regarded as important and in consequence is also not taught during the lab course. Lab personnel states that only weak emitters are applied (due to the age of the emitters the half-life time has long passed) and therefore radiation safety measures are not required. The peers emphasize nevertheless the necessity to include the aspects of radiation safety into this context in order to sensitize the students for possible dangers in any exposure situation. Exemplary preventive measures (e.g. lead barriers) could easily be implemented.
The lab personnel indicates consensus with the proposed improvement of safety related setups in lab courses.

The equipment of the **Materials lab** (production of nanoparticles, radiative heat transfer, elasticity measurements) is in comparison to the other labs newer. Apparently in this lab a significant amount of research can be done.

In the **Biophysics Lab** (audiometer, measurement of glucose concentration, electrical stimulating during acupuncture) the most modern and expensive equipment can be found. Research and development are performed successfully. Two gadgets were demonstrated that have been developed in this lab (electrostimulator for acupuncture, dentolaser for antimicrobiotic applications in dentistry); 5 patents have been registered.

As regards the **Photonics lab** (optical displacement sensors, determination of Rhodamin concentration with frequency-doubled Nd:YAG lasers), sophisticated equipment could be found (optical spectrum analyzer, microscope). Students performed laser experiments with optical displacement sensors – research posters in English were on display, written and compiled in the course of bachelor's theses in the area of applied photonics.

The **Computer lab** of the Mathematics program is well equipped with approximately 30 modern PCs.

Overall, the peers come to the conclusion that in spite of the fact that some laboratories are in need of modernization especially of the experimental setup in the basic lab course, they are overall suited to achieve the learning outcomes of the two programs under review. Students request to upgrade some of the other facilities, especially more space for group works and more learning rooms.

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

Taken the statement of the university into account, the peers consider the criterion as not yet completely fulfilled.

Staff

The peers welcome the fact that not all of the teaching staff graduated from UNAIR and if so, they have to obtain their doctoral degree from another university. The peers see a slight change in the approach to only hire staff members from the own university. Nevertheless, the transformation takes time and, thus, the peers consider a relevant recommendation for helpful to promote the process.

It seems that the university misunderstood the peers' statements regarding the technical staff at laboratories. The peers did not want to criticise the qualification of the staff but the availability of relevant technical staff for students during their practical work, in particular

in the photonics and optical spectrum analysis laboratory. As technical staff that can operate the equipment is necessary for the practical work, the peers see still the need for the respective requirement.

Staff development

The peers understand that the university started a program in 2017, to increase the number of staff members that spent time outside the university to improve their professional and teaching skills. The university decided to increase the financial resources for the program. The peers see opportunities for teaching staff to go abroad in the course of a dispensation up to three months as alternative to a classical sabbatical. On a long term basis, the peers maintain their recommendation to introduce a system of sabbaticals for staff members on a regular basis.

Teaching methodology / Technical equipment

The peers welcome that the university allocated extra budget for purchasing new teaching equipment. However, the peers miss a clear concept how the technical equipment in the teaching laboratories will be increased so that the students will be able to do practical work in groups of two. The peers agree that it is one approach to reduce the number of students per experimental setup by additional funding of new technical equipment as proposed and allocated by the university. An alternative way could be to limit the number of students per lab session in total, being aware of the fact that it results in a need for additional lab course groups. Consequently, the focus is not only on funding for additional technical equipment but also on the need for additional staff and a higher organisational effort. Therefore, the peers amend their original requirement accordingly. They consider it necessary to provide a concept how the university will ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students.

As the university resigned any further comments, the panel confirmed its preliminary assessments regarding the space for working groups and learning rooms.

5. Transparency and documentation

Criterion 5.1 Module descriptions

Evidence:

- Self-Assessment Report
- Module descriptions
- UNAIR website

Preliminary assessment and analysis of the peers:

A module handbook (in terms of semantics, in the SAR this module handbooks are referred to as semester learning plans) for the two programs under review are in place, describing course learning outcomes, grading and examination system, literature use etc.). While overall the peers obtain most of the necessary information from these descriptions, there remains however considerable room for upgrading and improving part of them. Evidence to that regard has been giving in prior parts of this report.

The peers come nevertheless to the conclusion that the students receive all relevant course material in the language of the degree programme including the syllabi at the beginning of each semester. In addition, most information was also available on the intranet accessible to all students.

Criterion 5.2 Diploma and Diploma Supplement

Evidence:

- Certificate of study program
- Transcript of Records of study program
- Diploma Supplement

Preliminary assessment and analysis of the peers:

The peers acknowledged that after graduation a degree certificate, a transcript of records and a Diploma Supplement are being issued. Regarding the latter, a sample was provided with the Self Assessment Report. Crucial components such as the description of the program and course learning outcomes are however missing and the interviewed students and staff are not really aware of its existence.

Statistical data as set forth in the ECTS User's Guide are also not included to allow readers to categorise the individual result/degree.

Criterion 5.3 Relevant rules

Evidence:

- Regulations on Universitas Airlangga learning and student affairs.

Preliminary assessment and analysis of the peers:

The peers acknowledged that in the “regulations on UA learning and student affairs”, the rights and duties of students are described in detail.

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

Taken the statement of the university into account, the peers consider the criterion as not yet completely fulfilled.

Unfortunately, due to a low resolution and quality, the peers could not assess the Diploma Supplement that has been provided with the statement of the university. However, the peers take note of the fact this it shall be improved. Again, the peers raised again awareness to the description of the program and overall learning outcomes that are missing as well as statistical data about the distribution of the final according to the ECTS-Users' Guide. Finally, for each degree programme an individual Diploma Supplement is required.

6. Quality management: quality assessment and development

Criterion 6 Quality management: quality assessment and development

Evidence:

- Self Assessment Report of the Faculty chapter 6
- Regulations for Academic and Student Affairs
- Tracer Studies
- Discussions with representatives of UNAIR management, program coordinators, lecturers, business representatives, students

Preliminary assessment and analysis of the peers:
Universitas Airlangga applies two types of quality assurance systems, one geared towards Internal Quality Assurance, the other one towards External Quality Assurance. The Internal Quality Assurance encompasses all activities focused on the improvement of teaching and learning quality within the university. The External Quality Assurance focuses on both national and international accreditation. National accreditation is conducted by the Indonesian National Accreditation Agency of Higher Education (NAAHE), the international accreditations by ASIIN and other bodies are part of a systematic strategic improvement drive and a quest to advance in international rankings.

As regards the QA system related to the quality of teaching and learning, the following observations can be made:

Online surveys distributed at the end of each semester (before taking the final exam) are used by UA as an instrument to collect student feedback. Individual teachers have access

to their results and can draw appropriate lessons. The overall mark with regard to the different dimensions of the questionnaire related to the planning of the course, various aspects of the teaching process and well as course evaluations (exam and assignments) plus written comments in concluding sections are given to the dean and the student coordinator.

The QA process for teaching and learning in the two programs under review overall seems to work. A number of examples for "closing the feedback loop" are given during the course of the on site visit. In the ***physics department*** e.g., the problem of students systematically having difficulties with mathematical courses has been addressed by staff. As a consequence additional tutorial classes were introduced, which resulted in an improvement of the grade levels. As regards the continuous problem with English proficiency among students (challenged with the fact that many textbooks used are in English) teaching staff responded by translating core topics into Indonesian. When complaints with regard to lecture attendance were voiced in the ***mathematics department*** substitute sessions were organized by the department leadership.

These examples demonstrate that the instrument of collecting student feedback via online surveys is producing positive results. There is however room for improvement in providing a more structured feedback to students on the results of the surveys at the beginning of the new semester and on the other hand also considering whether alternative QA instruments such as discussing the development of the program with a student focus group would not result in even better results. During the discussions it also has become clear that students are not formally involved in the discussion process about major revisions of the programs/curricula under review (the committee BEM as a vehicle of student voice is not being heard in this process).

Another issue related to organizing student feedback which caught the attention of the peers: there could be an issue of confidentiality due to the fact that the feedback of students is not anonymous, can be personalized and is given before delivering the final grade. Another limiting factor is the fact that there is no real possibility to deal with continuous bad evaluations, as lectures are usually hired for life time.

It was mentioned that there is a university wide system of calculating ECTS in place as well as a standard equation, according to which one Indonesian credit point equals around 1.3 ECTS. What is however absent as part of a comprehensive internal QA system are efforts to evaluate systematically the logic/fairness of credit point distribution as a measure of typical student workload for the different courses within the curricula. To further illustrate this by one example: the course in optical physics was reported by all students to be a very challenging course to which too little credits are attached. Instead of applying an abstract

formula to all courses, the student work load should be evaluated and discussed internally. Where necessary, adjustments of the relative weight of credit points associated with student workload should be made.

Graduate survey/tracer studies are administered just prior to graduation to collect the opinions of the outgoing students during the graduation ceremony. Usually two months later a sample of this group (a number of 15-20 alumni is cited) is contacted to get a feedback with regard to the adequacy of their career positions as well as their salary level. In addition, to a certain degree, social networks (WhatsApp Alumni network, groups by years) are used as lines of communications. The peers however recommend engaging in a more sustained interaction pattern with alumni organizations, more in depth inquiries about success on the labor market as well as transition time from university to the job plus remuneration on a systematic level.

As regards the **involvement of industry**, during the discussions a number of successful cooperation university-industry projects were presented. At the same time it also turned out that the full potential of university-industry interaction has not yet been tapped into. The idea of an industry advisory board to organize a more substantiated feedback of employers on a regular basis should be considered.

The experts also criticize the absence of a Strategic Development Plan for the programs/departments under review. The paper presented to the peers does not fulfill the exigencies of a real strategic plan with measurable key performance indicators, timelines, persons in charge in place, against which the development/success of the programs could be measured.

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

Taken the statement of the university into account, the peers consider the criterion as widely fulfilled.

The peers take note of the provided Quality Assurance Policy. Even though the document is in Indonesian language, one part of the content is translated into English out of which the peers get the impression that the documents encompasses all necessary processes of a complete quality cycle. The university states that in every redesign of curriculum, the programs always involve internal stakeholder (including staffs, students, dean and vice dean) and external stakeholders (alumni and users). The peers thus do not see the necessity for a recommendation.

Regarding the issue with Students' confidentiality, the university states that it is guaranteed. However, many students seems not be aware of it and, thus, the university starts from this semester on to inform about it at the beginning of the lecturer. The follow up of students' feedback is discussed under criterion 4.2.

Finally, the peers welcome the Strategic Plan 2016-2020 provided by the university that is prepared every 5 years. The document includes measurable and dynamic key performance indicators, timelines, as well as the persons in charge. The plan can be changed and revised in accordance to the progress of the programs. Moreover, the university has a monitoring and evaluation systems called Strategic Performance Management System for all degree programs, and subjected to evaluation every 4 months (quarterly).

D Additional Documents

Before preparing their final assessment, the panel asks 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:

1. Questionnaire for lecturer evaluation
2. Drop Out Rates for both programs
3. Quality assurance policy
4. Budget overview for the past three years

E Comment of the Higher Education Institution (12.02.2018)

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

- Questionnaire for lecturer evaluation
- Drop Out Rates for both programs
- Quality assurance policy
- Budget overview for the past three years
- Example of Diploma Supplement
- Quality Assurance Policy
- Strategic Development Plan at Program Level

F Summary: Peer recommendations (23.02.2018)

Taking into account the additional information and the comments given by Airlangga University 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 Physics	With requirements for one year	-	30.09.2023
Ba Mathematics	With requirements for one year	-	30.09.2023

Requirements

For both degree programmes

A 1. (ASIIN 4.3) Provide a concept how the university will ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students.

A 2. (ASIIN 3) Strengthen the oral skills of the students.

A 3. (ASIIN 4.1) Increase the supportive technical staff in the photonics and optical spectrum analysis laboratories.

A 4. (ASIIN 5.2) Redesign the Diploma Supplement so that it includes the description of the program and overall learning outcomes as well as statistical data about the distribution of the final according to the ECTS-Users' Guide.

For the Bachelor degree programme Physics

A 5. (ASIIN 1.3) Re-design the degree programmes regarding the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses,

the usage of modern programming language for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics).

For the Bachelor degree programme Mathematics

A 6. (ASIIN 1.3) Re-design the degree programme by delivering fundamental mathematic courses exclusively and by offering fundamental courses at the beginning of the study

Recommendations

For both programmes

E 1. (ASIIN 1.1.) It is recommended to define and adapt more clearly the competence profiles of the different occupational tracks as outlined in the report

E 2. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students and staff by introducing more English taught subject-specific elements into the curriculum.

E 3. (ASIIN 2.1) It is recommended to further promote the academic mobility of the students.

E 4. (ASIIN 2.2) It is recommended to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

E 5. (ASIIN 2.4) It is recommended to offer additional tutorial sessions to help students in difficult subjects (e.g. theoretical physics).

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

E 7. (ASIIN 4.2) It is recommended to introduce a system of sabbaticals for staff members on regular intervals.

E 8. (ASIIN 4.3) It is recommended to provide more study rooms for students.

E 9. (ASIIN 5.1) It is recommended to update the literature hints in the module descriptions.

G Comment of the Technical Committees

Technical Committee 12 - Mathematics (01.03.2018)

Assessment and analysis for the award of the ASIIN seal:

The technical committee discusses the procedure.

The members recommend changing the formulation of requirement A2 as indicated below in order to make the matter better understandable.

They change the position of former requirement A3: As it concerns only the Physics degree programme, it should be put in the respective section – thus becoming requirement A4. (Former requirement A4 thereby becomes A3.)

They finally suggest inserting the phrase “to improve research skills” into recommendation E7 in order to make the matter clearer.

The Technical Committee follows the peers’ decision proposal regarding all remaining aspects concerning the Bachelor degree programme in Mathematics.

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

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

Requirements

For both degree programmes

A 1. (ASIIN 4.3) Provide a concept how the university will ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students.

A 2. (ASIIN 3) Strengthen the verbal communication and presentation skills of the students.

A 3. (ASIIN 5.2) Redesign the Diploma Supplement so that it includes the description of the program and overall learning outcomes as well as statistical data about the distribution of the final according to the ECTS-Users' Guide.

For the Bachelor degree programme Physics

A 4. (ASIIN 4.1) Increase the supportive technical staff in the photonics and optical spectrum analysis laboratories.

A 5. (ASIIN 1.3) Re-design the degree programmes regarding the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses, the usage of modern programming language for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics).

For the Bachelor degree programme Mathematics

A 6. (ASIIN 1.3) Re-design the degree programme by delivering fundamental mathematic courses exclusively and by offering fundamental courses at the beginning of the study.

Recommendations

For both programmes

E 1. (ASIIN 1.1.) It is recommended to define and adapt more clearly the competence profiles of the different occupational tracks as outlined in the report.

E 2. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students and staff by introducing more English taught subject-specific elements into the curriculum.

E 3. (ASIIN 2.1) It is recommended to further promote the academic mobility of the students.

E 4. (ASIIN 2.2) It is recommended to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

E 5. (ASIIN 2.4) It is recommended to offer additional tutorial sessions to help students in difficult subjects (e.g. theoretical physics).

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

E 7. (ASIIN 4.2) It is recommended to introduce a system of sabbaticals to improve research skills for staff members on regular intervals.

E 8. (ASIIN 4.3) It is recommended to provide more study rooms for students.

E 9. (ASIIN 5.1) It is recommended to update the literature hints in the module descriptions.

Technical Committee 13 - Physics (06.03.2018)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure. It follows basically the assessment of the peers. Only, requirement 4 relates according to the Committee to the Bachelor Physics.

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

Degree Programme	**ASIIN seal**	**Subject-specific Label**	**Maximum duration of accreditation**
Ba Physics	With requirements for one year	-	30.09.2023
Ba Mathematics	With requirements for one year	-	30.09.2023

H Decision of the Accreditation Commission (23.03.2018)

Assessment and analysis for the award of the ASIIN seal:

The ASIIN Accreditation Commission for Degree Programmes follows the suggestions of Technical Committee 12 and adapts requirement 2 accordingly. It also follows the suggestion that the requirement regarding the technical staff in the photonics and optical spectrum analysis laboratories only relates to the Bachelor Degree Programme Physics. Moreover, the idea of requirement 6 is made clearer by including "to Mathematics students". Finally, the Accreditation Commission follows the suggestions of Technical Committee 12 regarding recommendation 7.

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

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

Requirements

For both degree programmes

A 1. (ASIIN 4.3) Provide a concept how the university will ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students.

A 2. (ASIIN 3) Strengthen the verbal communication and presentation skills of the students.

A 3. (ASIIN 5.2) Redesign the Diploma Supplement so that it includes the description of the program and overall learning outcomes as well as statistical data about the distribution of the final according to the ECTS-Users' Guide.

For the Bachelor degree programme Physics

A 4. (ASIIN 4.1) Increase the supportive technical staff in the photonics and optical spectrum analysis laboratories.

A 5. (ASIIN 1.3) Re-design the degree programmes regarding the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses, the usage of modern programming language for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics).

For the Bachelor degree programme Mathematics

A 6. (ASIIN 1.3) Re-design the degree programme by delivering fundamental mathematics courses exclusively to Mathematic students and by offering fundamental courses at the beginning of the study.

Recommendations

For both programmes

E 1. (ASIIN 1.1.) It is recommended to define and adapt more clearly the competence profiles of the different occupational tracks as outlined in the report.

E 2. (ASIIN 1.3) It is recommended to further improve the English proficiency of the students and staff by introducing more English taught subject-specific elements into the curriculum.

E 3. (ASIIN 2.1) It is recommended to further promote the academic mobility of the students.

E 4. (ASIIN 2.2) It is recommended to continuously evaluate the actual workload to ensure its consistency with the awarded credits.

E 5. (ASIIN 2.4) It is recommended to offer additional tutorial sessions to help students in difficult subjects (e.g. theoretical physics).

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

E 7. (ASIIN 4.2) It is recommended to introduce a system of sabbaticals to improve research skills for staff members on regular intervals.

E 8. (ASIIN 4.3) It is recommended to provide more study rooms for students.

E 9. (ASIIN 5.1) It is recommended to update the literature hints in the module descriptions.

I Fulfilment of Requirements (29.03.2019)

Analysis of the peers and the Technical Committees (11.03.2019)

Requirements

For both degree programmes

A 1. (ASIIN 4.3) Provide a concept how the university will ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students.

Initial Treatment	
Peers	Fulfilled Justification: The university provides a concept and an overview over steps already taken to ensure that the technical and organisational infrastructure in the teaching laboratories will be appropriate to work in groups of two students. The peers agree that these measures are adequate.
TC 12	fulfilled Vote: unanimous Justification: The TC agrees with the peers' assessment.
TC 13	fulfilled Vote: unanimous Justification: The TC agrees with the peers' assessment.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' assessment.

A 2. (ASIIN 3) Strengthen the verbal communication and presentation skills of the students.

Initial Treatment	
Peers	fulfilled Justification: The university details that verbal communication and presentation skills of the students are strengthened by oral presentations and oral examinations used in both programmes. The university also gives examples for oral examinations or presentations in both programmes. Furthermore, by encouraging

	students to be involved in student organization activities, student social activities, seminars, scientific activities, and others, these skills are strenghtened in extracurricular activities as well. The peers agree that these measures are sufficient to fulfil the requirement.
TC 12	fulfilled Vote: unanimous Justification: The TC agrees with the peers' assessment.
TC 13	fulfilled Vote: unanimous /per majority Justification: The TC agrees with the peers' assessment.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' assessment.

A 3. (ASIIN 5.2) Redesign the Diploma Supplement so that it includes the description of the program and overall learning outcomes as well as statistical data about the distribution of the final according to the ECTS-Users' Guide.

Initial Treatment	
Peers	Fulfilled (4) / not (completely) fulfilled (1) Justification: The university provides an amended Diploma Supplement for each programme. The peers agree that the Diploma Supplement now include the description of the program and overall learning outcomes. However, as one peer remarks, the Learning Outcome mentioned for both programmes refers to a veterinary course instead of a physics or mathematics course. As for the statistical data about the distribution of the final according to the ECTS-Users' Guide, the Diploma Supplements do not include a "grade distribution table" or any information on how to interpret the statistical data given ("5 % Best", "10 % Best").
TC 12	not fulfilled Vote: unanimous Justification: The TC follows the peer's judgement that this requirement is not yet formally fulfilled.
TC 13	not fulfilled Vote: unanimous Justification: The TC recognizes that the HEI worked on fulfilling this requirement. However, they follow the peer's judgement that this requirement is not yet formally fulfilled.
AC	Not fulfilled

	Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

For the Bachelor degree programme Physics

A 4. (ASIIN 4.1) Increase the supportive technical staff in the photonics and optical spectrum analysis laboratories.

Initial Treatment	
Peers	not fulfilled Justification: The university provides detail on a training workshop in the field of Optical Spectrum Analysis (OSA) given to all the lecturers, laborants, and students who are doing their final projects on photonics field. However, the peers feel that inviting guest lecturers from other universities, though it increases staff knowledge, is insufficient to increase the number of technical staff needed in the optical labs.
TC 13	not fulfilled Vote: unanimous Justification: The TC agrees with the peers' reasoning. They would like to stress that the requirement refers to an increase in the NUMBER of staff and not an increase in knowledge. The requirement is thus not yet fulfilled.
AC	Not fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

A 5. (ASIIN 1.3) Re-design the degree programmes regarding the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses, the usage of modern programming language for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics).

Initial Treatment	
Peers	not fulfilled Justification: The university presents an amended curriculum. The peers agree that according to the changes made to the curriculum, the requirement is fulfilled. However, these changes are not yet reflected in the module handbook, leading to several inconsistencies between the curriculum and the module handbook. The peers feel that this requirement is not yet fulfilled.

TC 13	not fulfilled Vote: unanimous Justification: The TC recognizes that the HEI worked on fulfilling this requirement. However, they follow the peer's judgement that this requirement is not yet formally fulfilled.
AC	Not fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

For the Bachelor degree programme Mathematics

A 6. (ASIIN 1.3) Re-design the degree programme by delivering fundamental mathematics courses exclusively to Mathematic students and by offering fundamental courses at the beginning of the study.

Initial Treatment	
Peers	Fulfilled Justification: Justification: The university presents an amended curriculum and module handbook that include the requested redesign.
TC 12	fulfilled Vote: unanimous Justification: The TC agrees with the peers' assessment.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' assessment.

Decision of the Accreditation Commission (29.03.2019)

The ASIIN Accreditation Commission for Degree Programmes follows the suggestions of the peers and Technical Committee 12 and 13 and considers requirements 1, 2 and 6 as fulfilled. The Accreditation Commission also agrees with the peers' and the Technical Committees' assessment of requirements 3, 4, and 5 as being unfulfilled. The ASIIN Accreditation Commission for Degree Programmes therefore decides to grant a six months prolongation for the fulfillment of the remaining requirements.

Degree programme	**ASIIN-label**	**Subject-specific label**	**Accreditation until max.**
Ba Mathematics	Requirement 3 not fulfilled	--	6 months prolongation

Degree programme	ASIIN-label	Subject-specific label	Accreditation until max.
Ba Physics	Requirement 3, 4, 5 not fulfilled	--	6 months prolongation

J Fulfilment of Requirements (20.09.2019)

Analysis of the peers and the Technical Committees (12.09.2019)

Requirements

For all degree programmes

A 3. (ASIIN 5.2) Redesign the Diploma Supplement so that it includes the description of the program and overall learning outcomes as well as statistical data about the distribution of the final according to the ECTS-Users' Guide.

Initial Treatment	
Peers	Fulfilled (4) / not (completely) fulfilled (1) Justification: The university provides an amended Diploma Supplement for each programme. The peers agree that the Diploma Supplement now include the description of the program and overall learning outcomes. However, as one peer remarks, the Learning Outcome mentioned for both programmes refers to a veterinary course instead of a physics or mathematics course. As for the statistical data about the distribution of the final according to the ECTS-Users' Guide, the Diploma Supplements do not include a "grade distribution table" or any information on how to interpret the statistical data given ("5 % Best", "10 % Best").
TC 12	not fulfilled Vote: unanimous Justification: The TC follows the peer's judgement that this requirement is not yet formally fulfilled.
TC 13	not fulfilled Vote: unanimous Justification: The TC recognizes that the HEI worked on fulfilling this requirement. However, they follow the peer's judgement that this requirement is not yet formally fulfilled.
AC	Not fulfilled Vote: unanimous

	Justification: The AC agrees with the peers' and the TC's assessment.
Secondary Treatment	
Peers	fulfilled Justification: The HEI provides an amended Diploma Supplement for each programme, which now include a "grade distribution table" and information on how to interpret the statistical data given.
TC 12	fulfilled Vote: unanimous Justification: The TC recognizes that the Diploma Supplement is now adequate and agrees with the peers' opinion that the requirement has now been fulfilled.
TC 13	fulfilled Vote: unanimous Justification: The TC follows the assessment of the auditors.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

For the Bachelor degree programme Physics

A 4. (ASIIN 4.1) Increase the supportive technical staff in the photonics and optical spectrum analysis laboratories.

Initial Treatment	
Peers	not fulfilled Justification: The university provides detail on a training workshop in the field of Optical Spectrum Analysis (OSA) given to all the lecturers, laborants, and students who are doing their final projects on photonics field. However, the peers feel that inviting guest lecturers from other universities, though it increases staff knowledge, is insufficient to increase the number of technical staff needed in the optical labs.
TC 13	not fulfilled Vote: unanimous Justification: The TC agrees with the peers' reasoning. They would like to stress that the requirement refers to an increase in the NUMBER of staff and not an increase in knowledge. The requirement is thus not yet fulfilled.
AC	Not fulfilled Vote: unanimous

	Justification: The AC agrees with the peers' and the TC's assessment.
Secondary Treatment	
Peers	fulfilled Justification: The HEI hired additional staff for the Optics Laboratory.
TC 13	fulfilled Vote: unanimous Justification: The TC follows the assessment of the auditors.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

A 5. (ASIIN 1.3) Re-design the degree programmes regarding the inclusion of Elementary Particle Physics as well as Atomic & Molecular Physics, the delivery of theoretical and experimental approaches of Electrodynamics and Mechanics as compulsory courses, the usage of modern programming language for scientific computing, and the integration of courses related to the profile of a Medical Scientist (such as Biophysics).

Initial Treatment	
Peers	not fulfilled Justification: The university presents an amended curriculum. The peers agree that according to the changes made to the curriculum, the requirement is fulfilled. However, these changes are not yet reflected in the module handbook, leading to several inconsistencies between the curriculum and the module handbook. The peers feel that this requirement is not yet fulfilled.
TC 13	not fulfilled Vote: unanimous Justification: The TC recognizes that the HEI worked on fulfilling this requirement. However, they follow the peer's judgement that this requirement is not yet formally fulfilled.
AC	Not fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.
Secondary Treatment	
Peers	fulfilled Justification: The HEI provides a re-designed curriculum, which now among others includes Electrodynamics and Mechanics as compulsory courses, the usage of modern programming lan-

	guage for scientific computing, and the integration of courses related to the profile of a Medical Scientist, specifically Biophysics. Students can also specialize during the internship and the field work according to this profile.
TC 13	fulfilled Vote: unanimous Justification: The TC follows the assessment of the auditors.
AC	fulfilled Vote: unanimous Justification: The AC agrees with the peers' and the TC's assessment.

Decision of the Accreditation Commission (20.09.2019)

The Accreditation Commission decides to extend the award of the seals as follows:

Degree programme	**ASIIN-label**	**Subject-specific label**	**Accreditation until max.**
Ba Mathematics	All requirements fulfilled	-	30.09.2023
Ba Physics	All requirements fulfilled	-	30.09.2023

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 Mathematics:

Learning Outcomes (LO)	
LO-1	Mastering the mathematical concept, able to make connections between concepts and present them in accordance with the rules of mathematics.
LO-2	Abstraction and analogy and find the archetype
LO-3	Mastering the power of mathematics is the ability to reason logically, critically and systematically carried out in a creative and innovative manner
LO-4	Using mathematical principles to solve mathematical problems broadly
LO-7	Using software to support the resolution of problems
LO-8	Develop themselves independently and sustainably
LO-3	Mastering the power of mathematics is the ability to reason logically, critically and systematically carried out in a creative and innovative manner
LO-5	Identify problems, develop a mathematical model, determining the completion strategy, completing and interpreting the results of the solution.
LO-6	Grouping, identify, formulate and solve real problems using mathematical methods.
LO-8	Develop themselves independently and sustainably
LO-9	Communicating with good interpersonal and able to work in teams
LO-3	Mastering the power of mathematics is the ability to reason logically, critically and systematically carried out in a creative and innovative manner
LO-5	Identify problems, develop a mathematical model, determining the completion strategy, completing and interpreting the results of the solution.
LO-8	Develop themselves independently and sustainably
LO-9	Communicating with good interpersonal and able to work in teams

The following **curriculum** is presented:

The curriculum 2012 has a number of the whole course load 187 credits that consist of:

Compulsory courses : 119 cp

Elective courses : 68 cp

Those 187 cp of total load is classified according to science field (mathematics and non-mathematics) as follows :

Mathematics courses : 148 cp that consist of

- compulsory courses : 84 cp
- Elective courses : 64 cp

Nonmathematics courses : 39 cp that consist of

- compulsory courses : 35 cp
- Elective courses : 4 cp

The mathematics' compulsory courses is classified according to science field in Bachelor Degree Programme of Mathematic are presented as follows :

Research Group	Courses	CP
Algebra (17 cp)	Fundamentals of Mathematic I Fundamentals of Mathematic II Elementary Linear Algebra Discrete Mathematics Abstract Algebra Linear Algebra Algebra (Practical)	2 2 3 3 3 3 1
Analysis (23 cp)	Calculus I Calculus II Calculus (Practical) Multivariable Calculus Analytical Geometry Real Analysis I Real Analysis II Complex Function	3 3 1 4 3 3 3 3
System Modelling (10 cp)	Numerical Method Ordinary Differential Equation Partial Differential Equation Mathematical Modelling I	3 3 2 2
Operations Research and Computation (13 cp)	Algorithm and Programming Algorithm and Programming (Practical)	3 1

	Linear Programming Operations Research Operations Research (Practical) Simulation	3 2 1 3

The elective courses that offered by science field in Bachelor Degree Programme of Mathematic are presented as follows :

Research Group	Courses	CP
Algebra(19 cp)	Number Theory	2
	Matrix Algebra	2
	Fuzzy Logic	2
	Discrete Geometrics	2
	Graph Theory	2
	Linear Control Theory	3
	Discrete Control Theory	2
	Cryptography	2
	Special Topics in Algebra	2
Analysis (16 cp)	Problem Solving Method	2
	Differential Geometrics	3
	Metric Space Theory	3
	Hilbert Space Theory	3
	Advanced Real Analysis	3
	Special Topics in Analysis	2
System Modelling (16 cp)	Business Mathematics	2
	Insurance	2
	Population Dynamic	3
	Boundary Value Problem	2
	Linear Control Theory	3
	Discrete Control Theory	2
	Special Topics in System Modelling	2
Operations Research and Computation (22 cp)	Business Mathematics	2
	Insurance	2
	Data Base	2
	Fuzzy Logic	2
	Data Structure & Algorithm	3
	Artificial Intelligence	3
	Advanced Operations Research	2
	Advanced Operations Research (Practical)	1
	Optimization	3
	Special Topics in Operations Research and Computation	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 Physics:

Specialist Competences	
LO1	They have knowledge of classical and modern physics with their relevant problems
LO2	They have ability to apply mathematical methods to solve problems in physics
LO3	They have ability to apply concepts and principles of physics for theoretical analysis, modeling and simulation
LO4	They have ability to conduct scientific methods and apply them in physics problems and develop them in interdisciplinary problems
LO5	They have ability to conduct measurement methods and experiments in physics problems and their applications
LO6	They are familiar with information technology and able to apply them on relevant physics problems
LO7	They are able to apply knowledge and principles of physics in industry and medical field as well as other interdisciplinary fields
Social Competences	
LO8	They are able to solve problems continuously and self-reliantly and familiar with suitable learning strategies
LO9	They are able to solve basic problems and present their results
LO10	They are able to communicate orally and in writing as well as to work in team.

Specialist Competences	
LO1	They have knowledge of classical and modern physics with their relevant problems
LO2	They have ability to apply mathematical methods to solve problems in physics
LO3	They have ability to apply concepts and principles of physics for theoretical analysis, modeling and simulation
LO4	They have ability to conduct scientific methods and apply them in physics problems and develop them in interdisciplinary problems
LO5	They have ability to conduct measurement methods and experiments in physics problems and their applications
LO6	They are familiar with information technology and able to apply them on relevant physics problems
LO7	They are able to apply knowledge and principles of physics in industry and medical field as well as other interdisciplinary fields
Social Competences	
LO8	They are able to solve problems continuously and self-reliantly and familiar with suitable learning strategies
LO9	They are able to solve basic problems and present their results
LO10	They are able to communicate orally and in writing as well as to work in team.

The following **curriculum** is presented:

1st Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	MAA102	Calculus I	3	3,9	-
2.	FID101	Basic Physics I	2	2,6	-
3.	FID102	Basic Physics I (Practical)	1	2,6	-
4.	KID101	General Chemistry I	2	2,6	-
5.	KID102	General Chemistry I (Practical)	1	2,6	-
6.	BID103	General Biology I	2	2,6	-
7.	BID104	General Biology I (Practical)	1	2,6	-
8.	SOB101	Basic Cultural and Social Science	2	2,6	-
9.	BAE111	English I	2	2,6	-
10.	AGI101	Religion I (Islam)	2	2,6	-
	AGP101	Religion I (Protestant)			
	AGK101	Religion I (Catholic)			
	AGB101	Religion I (Budha)			
	AGH101	Religion I (Hindu)			
	AGC101	Religion I (Confucius)			
11	BAI101	Indonesian Languange	2	2,6	-
Total Credit Points			20	29,9	

2nd Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	NOP101	Civics	2	2,6	-
2.	NOP103	Pancasila	2	2,6	-
3.	SOK203	Communications	2	2,6	-
4.	FID104	Basic Physics II	2	2,6	-
5.	FID105	Basic Physics II (Practical)	1	2,6	-
6.	KID101	General Chemistry I	2	2,6	-
7.	KID102	General Chemistry I (Practical)	1	2,6	-
8.	FII101	Mechanical Work	2	5,2	-
9.	MAA103	Calculus II	3	3,9	-
10.	BID105	General Biology II	2	2,6	-
11.	BID106	General Biology II	1	2,6	-

		(Practical)			
12.	FID107	Basic Physics III	2	2,6	FID101, FID103
13.	BIL101	Environmental Science	1	2,6	-
Total Credit Points			22	37,7	

3rd Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FID201	Modern Physics	4	5,2	-
2.	FIT201	Mathematical Physics I	4	5,2	MAD100, MAD106, FID103
3.	FIT204	Thermodynamics	3	3,9	FID101, FID103
4.	FIE201	Analog Electronics	3	3,9	FID101, FID103
5.	FIE202	Analog Electronics (Practical)	1	2,6	FID102, FID104
6.	FIB101	Biophysics	3	3,9	FID101
7.	FIT206	Physics of Wave	3	3,9	FID101, FID103, FIT201
8.	PHT101	Philosophy of Science	2	2,6	-
Total Credit Points			23	31,2	

4th Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	PNT497	Research Methodology	2	2,6	FII308
2.	FIT202	Mathematical Physics II	4	5,2	FIT201
3.	FIT203	Mechanics	4	5,2	FID101, FID103, FIT201
4.	FII201	Experimental Physics I	2	5,2	FID103, FIT206, FID201
5.	FIE204	Digital Electronics	2	2,6	FID104
6.	FIE205	Digital Electronics (Practical)	1	2,6	FID104
Total Credit Points			15	23,4	

Elective Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIM201	Introduction to Material Physics	3	3,9	FID101, FID103, FID201
2.	FIO202	Introduction to Biophotonic	2	2,6	BID103, FID201
3.	FIO301	Modern Optics	3	3,9	FID103, FIT201

4.	FIT207	Special Relativity	2	2,6	FID101
5.	FIB203	Introduction to Radiological Physics and Dosimetry	2	2,6	FID201
Total Credit Points			12	15,6	

5th Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIT303	Electricity and Magnetism	4	5,2	FID101, FIT201
2.	FIT301	Quantum Physics	4	5,2	FID201, FIT201, FIT202
3.	FIT302	Statistical Physics	3	3,9	FID201, FIT206
4.	FII202	Experimental Physics II	2	5,2	FID201, FIT206
5.	FIK303	Computational Physics Programming	3	3,9	FIT201, FIT202
6.	FIK304	Computational Physics Programming (Practical)	1	2,6	FIT201, FIT202
Total Credit Points			17	26,0	

Elective Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIE303	Instrumentation System	2	2,6	FIE204
2.	FIM302	Biomaterials	3	3,9	FIM201
3.	FIE304	Microprocessor and Microcontroller	2	2,6	FIE204, FIE206
4.	FIO302	Fiber Optics	2	2,6	FIO301
5.	FIO303	Optical Laser	2	2,6	FIO301
6.	FIE307	Introduction to Radiotherapy Physics	2	2,6	FIB203
7.	FIB302	Radiobiology	2	2,6	BIO103
8.	FIK308	Finite Element Method	2	2,6	FIT202
9.	FIB303	Health Physics and Radiation Protection	2	2,6	FIB203
Total Credit Points			19	24,7	

6th Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIM301	Solid State Physics	3	3,9	FIT301
2.	FIK305	Computational Physics	3	3,9	FII306
3.	FIK306	Computational Physics	1	2,6	FII306

		(Practical)			
4.	FIK307	Research Methods in Physics	2	2,6	FII301
5.	KLT301	Field Study	2	2,6	≥110 credit points
6.	FIN401	Nuclear Physics	3	3,9	FIT301
Total Credit Points			14	19,5	

Elective Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIM306	Biomaterial Analysis	3	3,9	FIM302
2.	FIB305	Radiotherapy Planning	2	2,6	FIB307
3.	FIB307	Practical Work on Radiology Diagnostic and Radiotherapy	1	2,6	FIB307
4.	FIO302	Fiber Optics	2	2,6	FIE204, FIO232
5.	FIE308	Controlling System	2	2,6	FIE300, FIT202
6.	FIT402	Quantum Mechanics	2	2,6	FIT301
7.	FIM304	Spectroscopy	3	3,9	FIT301
8.	FIK309	Modeling Physics	2	2,6	FIK305
9.	FIK310	Artificial Intelligence	2	2,6	FII309
	FIT305	Atomic and Molecular Physics	2	2,6	FID104, FID107
Total Credit Points			21	26,0	

7th Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	AGI401	Religion II (Islam)	2	2,6	AG101
	AGP401	Religion II (Protestant)			
	AGK401	Religion II (Catholic)			
	AGB401	Religion II (Budha)			
	AGH401	Religion II (Hindu)			
	AGC401	Religion II (Confucius)			
2.	PNT498	Final Project Proposal	2	2,6	≥110 credit points
3.	KNT401	Community Study	3	15,6	≥110 credit points
4.	BAE112	English II	2	2,6	BAE111
5.	MNW402	Management and Enterpreneurship	2	2,6	-
Total Credit Points			11	26,0	

Elective Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	FIT306	Many Body Quantum Mechanics	3	3,9	FIT301
2.	FIB309	Practical Work on Health Physics and Enumeration System	1	2,6	FIB203
3.	FIM308	Biomaterial Design	2	2,6	FIM302
4.	FIT403	Quantum Optics	2	2,6	FIT303, FIT206, FIT301
5.	FIO304	Optical Image Processing	2	2,6	FIK305
6.	FIK311	Digital Image Processing	3	3,9	FIK305
7.	FIT307	Electromagnetic Field	2	2,6	FIT301
8.	FIE309	Interfacing	2	2,6	FIE206, FIE301
Total Credit Points			17	23,4	

8th Semester

Compulsory Course					
No.	**Code**	**Course**	**Credit Points**	**ECTS cr-eq**	**Requirements**
1.	PNT499	Final Project	6	7,8	PNT496, PNT497
Total Credit Points			6	7,8	