ASIIN Seal

Accreditation Report

Bachelor's Degree Programmes
Geophysics
Physics

Master's Degree Programme
Physics

PhD Degree Programme
Physics

Provided by
Universitas Gadjah Mada

Version: June 28th 2024

Table of Content

A About the Accreditation Process

Name of the degree programme (in original language)	(Official) English translation of the name	Labels applied for [1]	Previous accreditation (issuing agency, validity)	Involved Technical Committees (TC)[2]
Program Studi Sarjana Geofisika	Undergraduate Programme in Geophysics	ASIIN	National Accreditation (BAN PT) – A(2019-2024) AUN (ASEAN University Network) Certification (2016-2020)	13, 11
Program Studi Sarjana Fisika	Undergraduate Programme in Physics	ASIIN	National Accreditation (BAN PT) – A(2019-2024)	13
Program Studi Magister Fisika	Master Programme in Physics	ASIIN	National Accreditation (BAN PT) – Unggul (2021-2026)	13
Program Studi Doktor Fisika	Doctoral Programme in Physics	ASIIN	National Accreditation (BAN PT) – Unggul (2021-2026)	13

[1] ASIIN Seal for degree programmes.

[2] TC: Technical Committee for the following subject areas: TC 01 - Mechanical Engineering/Process Engineering; TC 02 - Electrical Engineering/Information Technology; TC 03 - Civil Engineering, Geodesy and Architecture; TC 04 - Informatics/Computer Science; TC 05 - Materials Science, Physical Technologies; TC 06 - Engineering and Management, Economics; TC 07 - Business Informatics/Information Systems; TC 08 - Agriculture, Forestry, Food Sciences, and Landscape Architecture; TC 09 - Chemistry; TC 10 - Life Sciences; TC 11 - Geosciences; TC 12 - Mathematics; TC 13 - Physics; TC 14 - Medicine.

Date of the contract: 07.07.2023 **Submission of the final version of the self-assessment report:** 31.10.2023 **Date of the onsite visit:** 05.-06.03.2024 **at:** Faculty of Mathematics and Natural Sciences, Yogyakarta	
Expert panel: Prof. Dr. Gert-Ludwig Ingold, University Augsburg Prof. Dr. Bülent Tezkan, University of Cologne Dr. Herri Trilaksana, Universitas Airlangga Langgam Bagaspratomo, PF Fortasindo Muhammad Taufiqi, PhD Student in Physics, Institut Teknologi Sepuluh Nopember (ITS)	
Representative of the ASIIN headquarter: Dr. Natalia Vega	
Responsible decision-making committee: Accreditation Commission for Degree Programmes	
Criteria used: European Standards and Guidelines as of May 15, 2015 ASIIN General Criteria, as of December 10, 2015 Subject-Specific Criteria of Technical Committee 13 – Physics as of March 20, 2020 Subject-Specific Criteria of Technical Committee 11 – Geosciences as of December 9, 2011 ASIIN Additional Criteria for Structured Doctoral Programmes as of March 15, 2021	

B Characteristics of the Degree Programmes

a) Name	Final degree (original/ English translation)	b) Areas of Specialization	c) Corresponding level of the EQF[3]	d) Mode of Study	e) Double/Joint Degree	f) Duration	g) Credit points/unit	h) Intake rhythm & First time of offer
Undergraduate Programme in Geophysics	S.Si (Sarjana Sains/Bachelor of Sciences)	Geoscience	6	Full time	No	8 Semester	144 credit unit (239 ECTS)	Annually / 1 May 1985
Undergraduate Programme in Physics	S.Si (Sarjana Sains/Bachelor of Sciences).	Physics	6	Full time	No	8 Semester	144 credit unit (239 ECTS)	Annually / 1 May 1985
Master Programme in Physics	M.Sc (Magister of Science	Physics	7	Full time	Yes (with Kanazawa University)	4 Semester	40 credit unit (66.4 ECTS)	Each semester / 29 September 1993
Doctoral Programme in Physics	Dr. (Doctor)	Physics	8	Full time	No	6 Semester	46 credit unit (166 ECTS)	Each semester / 29 September 1993

Universitas Gadjah Mada (UGM) is a state university located in Yogyakarta, a city in the centre of the Indonesian island of Java and the educational hub of the archipelago. Founded on 19 December 1949, it is one of the oldest and largest higher education institutions in Indonesia. UGM has 18 faculties and 2 schools, as well as 20 research centres. It currently offers 287 programmes, of which 125 are double degree programmes. The university has about 61,440 enrolled students and a total of 4,336 faculty members. UGM has been ranked as one of the best universities in Indonesia. The university was ranked 231st in the world by the QS World University Rankings for 2022.

The Faculty of Mathematics and Natural Sciences of the UGM is divided into the following four departments: i) Department of Physics; ii) Department of Computer Science and

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

Electronics; iii) Department of Chemistry; and iv) Department of Mathematics. The Faculty offers 16 Study Programmes consisting of 8 Undergraduate Study Programmes, 4 Masters Study Programmes, and 4 Doctoral Study Programmes. The Department of Physics offers of four study programs, namely Bachelor Programme in Physics, Bachelor Programme in Geophysics, Master Programme in Physics and Doctoral Programme in Physics.

For the **Bachelor's degree programme in Geophysics (BPG)** the institution has presented the following profile in the self-assessment report:

"The vision: Geophysics Study Program (BP-Geoph) UGM as a global partner for Indonesian better life and mankind in education, research, and service in the geophysical field with an environmental perspective.

The mission:

1. Develop an integrated undergraduate, postgraduate, and doctoral learning process.
2. Develop research and learning laboratories.
3. Improving the quality and quantity of education, research, community service, service, and cooperation.
4. Improve the ability to compete in the international job market".

For the **Bachelor's degree programme in Physics (BPP)** the institution has presented the following profile in the self-assessment report:

"The vision: The vision of the Bachelor Program in Physics (BP-Phys) is that by 2037 it will become an undergraduate Physics study program that excels nationally and is well known internationally in the fields of education and teaching for the glory and welfare of Indonesian people and humanity in general.

The mission:

1. Organizing education and teaching programs in Physics based on a quality management system that meets national and international standards which produce graduates with a bachelor's degree in physics who are competent, active in community development efforts, creating prosperity and improving community civilization, and able to continue to education level higher.
2. Organizing education and teaching of Physics that is oriented to the development of superior science and technology that is beneficial to human civilization.
3. Organizing integrated physics education and teaching in various community service activities to help achieve the nation's welfare."

For the **Master's degree programme in Physics (MPP)** the institution has presented the following profile in the self-assessment report:

"The vision: In 2037, becoming a Master Program in Physics (MP-Phys) that excels in various academic aspects, and produces graduates who are competent and qualified and can be proud of at the national level and recognized at the international level.

The mission: The mission of the MP-Phys, Faculty of Mathematics and Natural Sciences UGM are:

1. Organizing a quality learning process in various fields of Physics that can provide a deep understanding of Physics for the study of the branches of Advanced Physics.
2. Organizing quality learning processes in various fields of Advanced Physics, which can prepare students to conduct Physics research independently.
3. Organizing a process of guidance and assistance in research to prepare students to be able to conduct quality Physics research activities."

For the **Doctoral programme in Physics (PhD)** the institution has presented the following profile in the self-assessment report:

"The vision: The vision of the Doctoral Program in Physics (DP-Phys) at the Faculty of Mathematics and Natural Sciences UGM is to evolve into a globally renowned Physics Doctoral program by the year 2037. It aspires to excel and innovate in various facets of academic endeavours while producing highly competent and qualified Doctoral Physics graduates who can attain international recognition and take pride in their achievements.

The mission: The missions of the Doctoral Program in Physics at the Faculty of Mathematics and Natural Sciences UGM are as follows:

1. Providing high-quality doctoral education to cultivate graduates capable of leading in educational and research endeavours.
2. Facilitating a comprehensive mentoring and guidance process to assist students in conducting outstanding physics-related activities.
3. Enhancing collaborations and partnerships with educational institutions and industries on both national and international levels".

C Expert Report for the ASIIN Seal

1. The Degree Programme: Concept, Content & Implementation

Criterion 1.1 Objectives and Learning Outcomes of a Degree Programme (Intended Qualifications Profile)

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Programme-specific Objectives and Learning Outcomes
- Matrix of Expected Learning Outcomes for each degree programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The experts refer to the respective ASIIN Subject Specific Criteria (SSC) of Technical Committee 13 (Physics) and 11 (Geosciences), the learning module matrices for each programme and the modules as a basis for assessing whether the intended learning outcomes of the programmes under review correspond to the competences as outlined in the SSC.

The objectives and learning outcomes for each programme are described in the SAR (see **Appendix** below). The Programme Educational Objectives (PEO) are based on the vision, mission and stakeholder needs. The Programme Learning Outcomes (PLOs) have been evaluated by all lecturers and academic senators and accredited by the National Accreditation Agency for higher education (BAN-PT).

In addition, the Module Handbook contains the learning outcomes for each module of the programmes under review. The processes for achieving module learning outcomes involve all lecturers as teachers and supervisors who guide students or participants to take some subjects at the beginning of the semester. Each lecturer should identify a module and describe the learning outcomes to be achieved by students for each subject.

In addition, the following work areas are described for the **Bachelor's Programme in Geophysics (BPG)**:

1. "Energy, oil, gas and mineral industries and exploration services.
2. Mapping industry.
3. Research and development institutions.
4. Mitigation of natural disaster risk institutions.
5. Environmental preservation institutions.
6. Defence and security institutions.
7. Educational institutions.
8. Consulting and independence institutions.
9. Software and database development industry.
10. Entrepreneur".

The profile of **BPG** graduates is as follows:

1. "Design the geophysical survey and mapping.
2. Manager/Implementer/Quality Assurance of Geophysical measurement and data collection.
3. Analyze and process the geophysical data.
4. Interpret and create geophysical data models.
5. Researcher, developer, educator in geophysical field.
6. Exploration of natural resources based on geophysical methods.
7. Implementing geophysical science-based disaster risk reduction.
8. Implementing geophysics-based environmental conservation.
9. Geophysics consultant.
10. Earth science software developer.
11. Geophysics entrepreneur.
12. Lifelong learner in geophysics".

The skills and abilities of graduates from the **Bachelor's degree in Physics (BPP)** are, according to the Academic manual book as follows:

- "In general skills, physics graduates master problem solving skills, have strong analytical skills, are able to communicate well, and master managerial skills.
- In field-specific abilities and skills, physics graduates not only have an understanding of the basics of physics, but also develop investigative, experimental, mathematical, computational, and modelling skills of physical systems.

- In specific interest abilities, physics graduates master the skills of both theoretical and computational physics, materials development and functionalization, and implementation in the applied field".

Additionally, regarding the fields and professional opportunities for the graduates of the programmes under review, UGM classified the areas, in general, in three profiles:

1. Educators (lecturers and teachers)
2. Researchers
3. Consultants, Bureaucrats, and Entrepreneurs

In addition, for the BPG the profile "community leader" is also included.

According to UGM, each study programme has formulated a measurement method for each of their programme learning outcomes. The PLO's implementation and development methods used in the four programs generally have similarities. Such as (a) determining the number of program learning outcomes and schedule, (b) determining the sample of courses for assessment, (c) formulation of criteria or rubric of connection between each course outcome and program learning outcome; (d) determining the variety of measurement methods or benchmarks used such as midterms, semester final exams, individual/group assignments, exercises, quizzes, and presentations. The PLO assessment by the lecturer consist of several evaluations such as performance evaluation, detail evaluation and enhancement plan, and course Portfolio.

There are some indicators to measure the graduate profiles of the study program:

1) Internal Indicators: Using direct assessment via the average Cumulative GPA (CGPA), average length of study, and average of finishing the final project.

2) External Indicators: using indirect assessment via graduate questionnaire, alumni tracer study, and user survey which measure how quickly the graduate obtains a job, how well the job profile fits the graduates, and how satisfied the employers are with the graduates.

Based on alumni surveys, the programmes under review present the following statistics for the graduate job field after graduation:

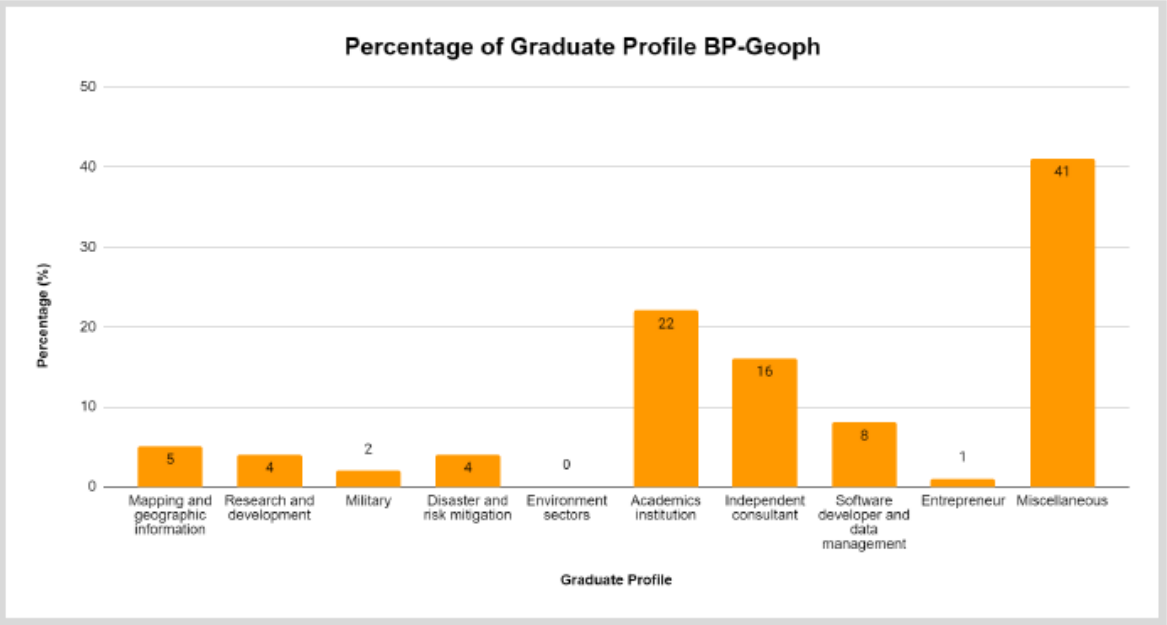


Figure 5.20. Graduate Profile of BP-Geoph

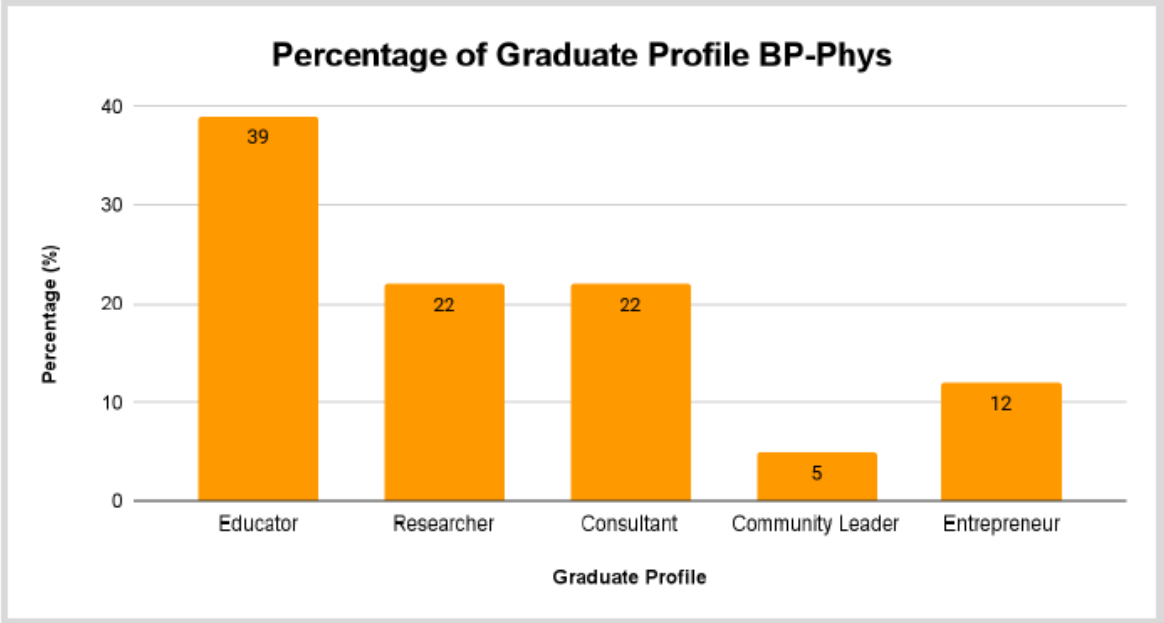


Figure 5.21. Graduate Profile of BP-Phys

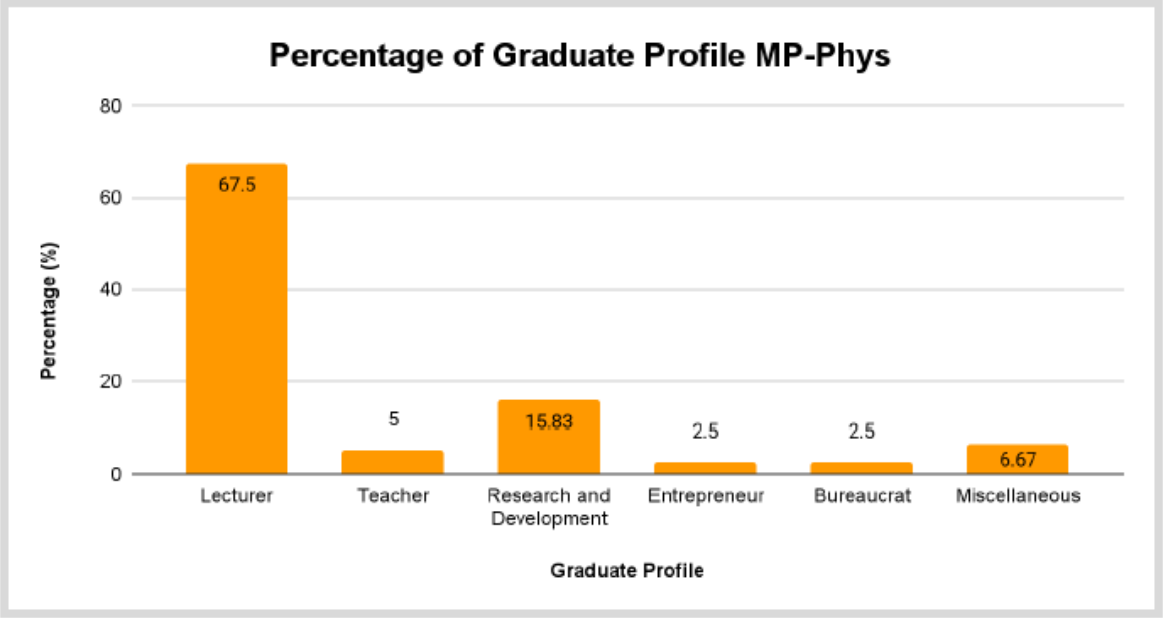


Figure 5.22. Graduate Profile of MP-Phys

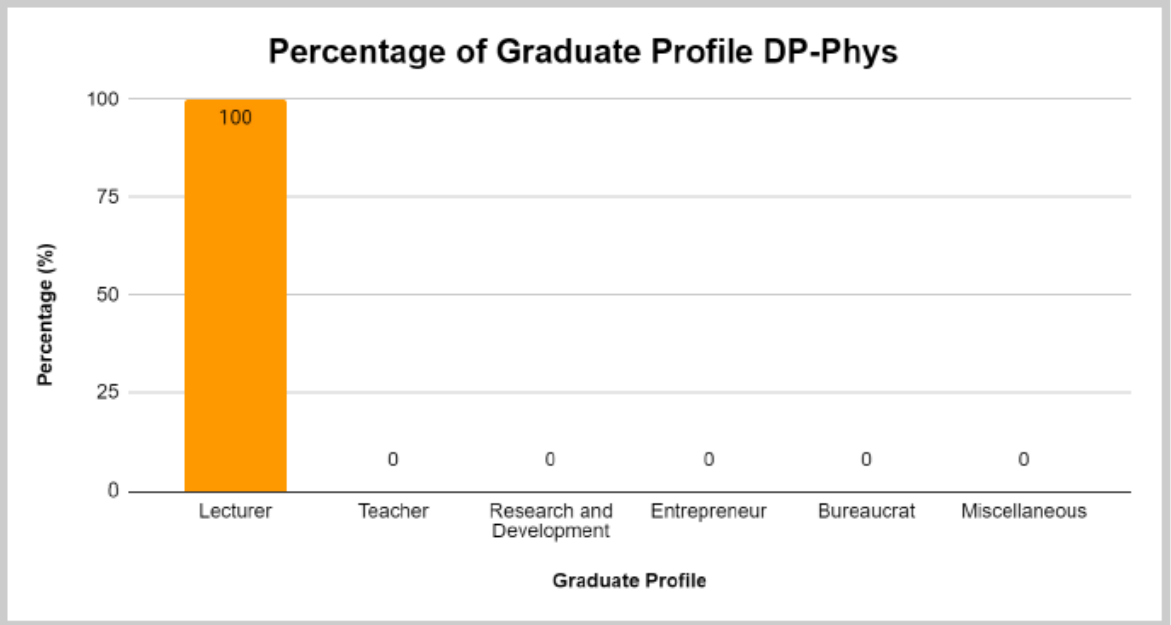


Figure 5.23. Graduate Profile of DP-Phys

During the audit, the experts discuss the profile of the graduates of the **PhD programme** in physics and whether the doctoral studies are mainly aimed at positions in academia. The programme coordinator explains that there is no recruitment of PhD graduates by industry, which is common in Indonesia, because industry is looking for bachelor graduates.

Therefore, most of the graduates of the doctoral programme want to work as lecturers and researchers.

Regarding the job opportunities and possibilities for **BPG** graduates to continue their studies, it is pointed out that the Master in Physics is already available. However, it is planned to open a Master in Geophysics as soon as possible and a PhD programme in the future. However, the programme representatives note that so far graduates have no problem getting jobs and have several opportunities in industry, such as the oil and gas industry or data processing. Usually, BPG students do a project and get an internship to prepare for their future careers in different areas. They programme representatives believe that about 10% would go on to do a Master's degree, in some cases at the same time as getting a job in industry. Industry representatives confirm this and consider BPG graduates to be very important for Indonesian companies.

To increase interest in the **BPP**, the programme coordinators are planning to strengthen research cooperation with other universities and with industry. They also want to focus more on new technologies. There have also been collaborations with industry in other countries, such as Japan and Taiwan. Regarding the MPP, the auditors ask why the double degree programme with Kanazawa University (Japan) is chosen only by a few students. The programme coordinators explain that the agreement with the institution in Japan is good, but they hope that the situation will improve by trying to organize two or three scholarships because the cost of living in Japan is very high. Perhaps cooperation with Taiwan, which offers funding, could be a solution and a good opportunity for students and graduates of the programmes under review to go abroad.

After reviewing the learning outcomes and discussing them with the various stakeholders, the experts conclude that the descriptions of the qualification objectives are comprehensive and include the competences achieved and the possible career opportunities for graduates. The objectives and learning outcomes are made available to all stakeholders as they can be found on the UGM website. In addition, they are anchored and published in a transparent manner, making them available to students, lecturers and interested third parties. On the basis of a learning objectives-module matrix describing the modules in which students learn the skills envisaged in the PLOs, the expert group considers that the intended learning outcomes of the programmes are suitable for producing qualified graduates. The experts appreciate that, according to the industry representatives, there are good job opportunities, especially for geophysicists, but they consider it desirable to open a Master's programme in Geophysics, taking into account the ratio of lecturers to students.

Criterion 1.2 Name of the Degree Programme

Evidence:

- Self-Assessment Report (SAR)
- Evidence regulation of the directorate general of higher education, research and technology, ministry of education, culture, research and technology
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:

As stated in the SAR, the title of the degree programmes in Indonesia is adjudged by the ministry of education and culture, research and technology, Indonesia Government (the Decree of The Minister of Research, Technology, and Higher Education Republic of Indonesia Number 257/M/Kpt/2017 about the name of study program in universities).

The experts confirm that the English translation and the original Indonesian name of the bachelor's degree programmes under review correspond with the intended aims and learning outcomes. They agree that the teaching and learning content and the competence profile are consistent with the proposed titles of all programmes.

Criterion 1.3 Curriculum

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Matrix of Expected Learning Outcomes for each degree programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of BP-Geoph and BP-Phys
- Curriculum Structure and Contents of each programme
- General guidelines for implementation of Independent Learning-Campus Merdeka
- Evidence external cooperation
- Statistical Data about the progress of Studies
- Discussions during the audit

Preliminary assessment and analysis of the experts:

Curriculum Content and structure

The **Bachelor's Degree in Geophysics** is a four-year programme of 144 credits (239.04 ECTS). It includes 100 credits of compulsory subjects covering basic mathematics, physics, geology and geophysical methods such as seismic, electromagnetic, gravitational, magnetic and resistive. The first five semesters consist of basic courses and fundamentals in the area of Geophysics together with the mandatory Ministry and Faculty courses (e.g. Religion, Pancasila, Indonesian Language, Basic Chemistry). In addition, from the third semester, students can choose elective courses in geography, geomatics, geology and entrepreneurship for a total of 84 credits. The internship is compulsory and is included in the fifth semester. One supervisor from the university and one from the company supervise the students during the internship. In semesters 6-8, the courses focus on applied geophysics and personal development. In the sixth semester, students are required to conduct a geophysical field camp where all geophysical methods are implemented and applied to real cases such as mineral exploration, geological hazard mitigation, geothermal and volcanic physics. In the eighth semester, students complete their bachelor's thesis. The thesis is compulsory and should be a research project that reflects that they apply their basic knowledge of geophysics to solve a real-world problem.

Additionally, in the sixth semester, community service (KKN) is included. The sixth and seventh semester consists of the Independent Learning Campus Merdeka (Internship), where students gain knowledge based on their experience from the internship in a company or government institution.

The distribution of the credits in the BPG is as follows:

Table 1.21. Modules Composition

No	Name of The Program	University	Faculty	Study Program	Total Compulsory Courses	Minimal Elective Courses
1	Bachelor Program in Geophysics (BP-Geoph)	5 (5.26%)	12 (12.63%)	78 (82.11%)	47 (49.47%)	48 (50.53%)

The auditors discuss the curriculum structure of the BPG with the programme coordinators. They wonder why courses such as Basic Chemistry are compulsory and the course "Inverse Methods" is only offered as an elective. Knowledge of the latter is essential for the interpretation of geophysical data and therefore for the successful completion of the bachelor's thesis. The programme coordinators explain that general chemistry is a compulsory course regulated by the faculty. They believe that knowledge of chemistry is

also important for geophysicists. In addition, they point out that it could be difficult to add more compulsory courses because the curriculum already includes the credits required for compulsory courses (100 credits) by the Ministry's regulations. Nevertheless, the experts believe that this course is much more important than chemistry for the geophysics students. Therefore, the module “Inverse Methods” should be added as a compulsory course, and if it is not possible due to the Ministry's regulations, at least should be ensured that the majority of **BPG** students choose this important course.

In addition, the experts take note that based on the results of the survey of satisfaction the majority of respondents (60.4%) stated that **BPG** graduates have very good skills, especially in mastering information technology and in self-development. However, a small number of respondents stated that the English language skills and communication skills of BPG graduates still need to be improved. This survey has been conducted centrally by the Faculty of Mathematics and Natural Sciences and was targeted towards graduate users and stakeholders.

The BPG students interviewed during the audit are very motivated and satisfied with the study programme and support they receive from the lecturers. However, they would like to improve their English skills, have more English practice in the courses, and learn more academic English. In addition, some students think that the explanation of software and applications used in geophysics needs to be improved. Taking into account the students' feedback, the experts think that more English practice should be introduced in the courses of **BPG**, for example by giving more presentations in English. They see this as important for the student’s future careers. They also believe that BPG students should be better introduced to industry-standard software. This could be done, for example, by inviting guest lecturers, alumni and representatives from industry.

The **Bachelor’s Programme in Physics** also encompasses 8 semesters and 144 credits (239.04 ECTS). After having taken mandatory basic courses including also religion, pancasila, and basic chemistry in the first and part of the second semester, students receive a broad education in theoretical and experimental physics as well as the mathematical tools. The final 44 credits (73.04 ECTS) which represent 30% of the curriculum may be taken from elective credits covering areas like sensors, medical physics, astrophysics, environmental physics, biophysics and computational physics. Additionally, community service (KKN) is included in the fifth semester and the independent learning-campus Merdeka is in the sixth semester.

The experts ask during the discussions why ordinary differential equations are taught relatively late in mathematical physics, although they are needed early in physics courses. The programme coordinators point out that in the first year, students are taught basic

subjects, such as calculus and basic physics, together with compulsory modules from the Ministry and the Faculty. With the introduction of the Independence Learning Campus in 2021, the curriculum is more compressed than before and some subjects had to be moved to an early part of the programme. In the BPP, the right to Independent Study on an Independent Campus is offered in semesters 6 and 7. The programme coordinators explain that this is in line with the university's policy, based on government regulations, to facilitate independent study and learning outside the study programme at UGM. Students have the freedom of learning and may choose to study outside the Physics programme, for example by participating in student exchanges, internships in industry, research assistantships in research institutes.

The BPP students interviewed are very motivated and satisfied with the study programme and the support provided by the lecturers. However, some **BPP** students feel that the content in the first three semesters is very demanding and too much considering the complexity and difficulty of the subjects. For example, in the third semester they have to take modules such as Statistical Physics and Quantum Physics. Some of the modules also contain basic knowledge for students to learn other modules better, but they have to take the mentioned module(s) in the same semester. This curriculum compression is mainly due to the Merdeka Belajar (Freedom to Learn) programme in later semesters. They also miss some important basic subjects that should prepare them for the mechanics modules in the second and third semesters.

The **Master's Programme in Physics** consists of two tracks: the "regular track" and the "by research track". Students in both tracks must obtain a minimum of 40 credits to complete the programme, normally in two years, although it can be completed in one year. The 40 credits consist of 19 credits of compulsory courses including the thesis and at least 21 credits of elective courses. All students on both tracks are required to take the compulsory courses. The electives for the regular track are divided into four fields of interest according to the four expert groups of the Physics Department (Material Physics, Theoretical and Computational Physics, Applied Physics and Geoscience). The elective courses of the By Research track are designed to help students conduct and complete their research (e.g. Research I-III, National Seminar, International Seminar, Scientific Publications).

The compulsory courses for MPP students are as follows:

NO	CODE	COURSES	Credits	ECTS	Semester
1	MFF 5001	Research Methodology	2	3.32	Odd/Even
2	MFF 6001	Thesis	8	13.28	Odd/Even
3	MFF 5009	Mathematical Physics	3	4.98	Odd/Even
4	MFF 5033	Quantum Mechanics	3	4.98	Odd/Even
5	MFF 5051	Statistical Mechanics	3	4.98	Odd/Even
6	MFF 5401	Classical Mechanics	3	4.98	Odd/Even
7	MFF 5411	Electrodynamics	3	4.98	Odd/Even

Students are required to take research methodology and thesis courses and need only to pass three of the following five compulsory courses: Physics Mathematics, Classical Mechanics, Quantum Mechanics, Statistical Mechanics, and Electrodynamics.

In addition, students of the Regular Track have the possibility to join the **Double Degree Programme** with the Master in Computational Science of the Graduate School of Natural Science and Technology of Kanazawa University in Japan. This double degree programme lasts for two years (including the thesis), with one year at FMIPA UGM and the next year at Kanazawa University Japan. At the end of the programme, students will receive two diplomas: a Master's degree from UGM and a Master of Computational Science from Kanazawa University Japan. Students applying for this programme have to go through the selection process carried out by the MPP and the partner institution. Before starting the programme at Kanazawa University, all compulsory courses and at least nine credits of elective courses of the MPP must be completed in the first two semesters of the double degree programme. A limited number of scholarships are available for qualified students. Students must submit their UGM thesis before or during their programme at Kanazawa University and can transfer a maximum of 12 credits. They must complete 30 credits of Kanazawa University courses in two semesters and submit a separate thesis to Kanazawa University.

MPP students and alumni are very satisfied with the Master's programme. They always feel very well supported by the lecturers. They find the curriculum easy to follow and a good balance between compulsory and elective subjects. The content is also very helpful for writing the Master's thesis. Alumni of the double degree programme emphasise the excellent support before and during their stay in Japan and for the graduation.

In general, the industry representatives are very satisfied with the students and graduates' skills of all programmes under review. The graduates show strong analytical skills and are hard workers and fast learners.

The **Doctoral Programme in Physics** also includes a "Regular track" and a "By research track". Both tracks require students to successfully complete a minimum of 46 credits (166.56 ECTS) of compulsory and elective courses within three years. For the regular track,

the 46 credits include 37 credits of compulsory courses and a minimum of 9 credits of elective courses. The compulsory courses include 3 credits of lectures and 34 credits of dissertation. Meanwhile, for the By Research track, the 46-credit course load consists of 40 credits dedicated to the dissertation, 3 credits of compulsory lectures and an additional 3 credits of elective lectures (see below **D1**).

PhD students are very satisfied with the programme, lecturers and supervisors. They find the curriculum flexible and helpful in carrying out their research projects. They feel that it is possible to finish in the 3rd year, depending on the topic of the research project. In addition, they feel very well supported in writing papers and publishing them in recognised journals.

Periodic Review of the Curriculum

The curricula of all the programmes under review are periodically reviewed using various instruments and involving various stakeholders. The Quality Assurance Unit (UJM), which is responsible for implementing the internal quality assurance system (SPMI) at faculty level, carries out annual internal quality audits (AMI) on all programmes in collaboration with the Quality Assurance Office of the UGM (KJM) in order to assess, correct and improve the quality standards of the educational process.

Within the faculty, the Curriculum Committee/Quality Assurance Team (GJM) is responsible for curriculum review and revision, coordination and evaluation. It coordinates the preparation of the curriculum structure within the framework of the implementation of the established quality standards and ensures that the curriculum content complies with national and university regulations. The curricula have been adapted each year based on input from faculty members, students, alumni and external stakeholders (industry, research institutions, etc.). The adjustment is also based on the regular meeting of the lecturers, which maps the learning outcomes and course outcomes. The proposed topics are then included in the updated curriculum document, which is approved by the Faculty Senate.

The curricula are also regularly evaluated by the National Accreditation for Higher Education (BAN-PT), which takes place every 5 years. Currently, the programmes organised by the Department of Physics have been accredited with the highest grade (Excellent/A). The programmes also carry out an evaluation of alumni and stakeholders. The information and suggestions from alumni and stakeholders contribute to the improvement and development of the curriculum. In addition, the evaluation by students, organised by the Faculty in the form of an online questionnaire (EdoM), is also taken into account to review the curriculum.

Student mobility

UGM collaborates with more than 300 universities around the world. There are collaborations and agreements not only with Asian universities, but also with Australian and European institutions for exchange and research cooperation. The university offers several double degree opportunities for Master's students, especially with universities in Asia such as Taiwan and Japan.

According to the representatives of the Rectorate and the Office of International Affairs, there is a high number of incoming students, especially from Malaysia. The Gadjah Mada International Fellowship (GMIF) Degree Program offers 15 fellowships for a full-time master degree program.

In addition to the Double Degree Programme, UGM Master's students have the opportunity to take part in a short-term exchange programme of several days to several weeks at other graduate institutions abroad. In addition, there are exchange programmes offered by the UGM Office of International Affairs. In addition, some research groups of the UGM Physics Department also offer students the opportunity to participate in a short-term exchange programme as part of the groups' collaboration with research/academic institutions abroad. The Faculty presents a list of 45 national and international partner institutions with which BPG, BPP and MPP have collaborated, including the activities of the collaboration carried out such as internship, bachelor thesis and joint research and exchange.

As stated in the SAR, the student mobility regulation for undergraduate programmes covers eight activities such as independent projects, community service, humanity project, teaching, research, internship, entrepreneurship and student exchange. These activities are to be carried out within the framework of the Merdeka independent learning campus.

During the on-site interview, some students and graduates tell the auditors about their experiences abroad and emphasise that they feel supported by the university and the department in informing, preparing and carrying out their stays abroad (e.g. letters of recommendation, administrative issues, help with applications, permits). Moreover, lecturers continue to support them when they go abroad.

Overall, the experts conclude that the curricula of all the programmes under review enable students to achieve the learning outcomes set for the programmes as a whole. The electives offered provide opportunities for individual focus and study. In addition, they highlight that students and graduates appear to be very satisfied with their respective programmes and feel well prepared for their future careers. They also appreciate that the

curriculum is regularly reviewed and that suggestions and input from stakeholders are used as important considerations in the curriculum review process. The experts are of the opinion that UGM promotes international student mobility and provide an adequate framework to enable students to go abroad.

Nevertheless, for **BPP**, the experts find the content of the first four semesters very compressed, especially in the second year. Despite the constraints imposed by government decisions, the experts believe that the curriculum should be adjusted. Especially, the number of compulsory modules in the second year should be reduced to make sure that the core competence can be achieved by the student with proper sequence and time.

With regard to the **BPG**, the experts consider it desirable to offer the elective module 'Inverse Methods' as a compulsory module. If this is not possible due to ministry regulations, the programme should at least ensure that the majority of students choose this important course. In addition, based on student feedback, the experts believe that the **BPG** should provide more English language training in the courses, for example through presentations in English. In addition, students should be better introduced to the use of industry-standard software (e.g. Petrel, which is a software platform used in the exploration and production sector of the petroleum industry). It is recommended to increase sessions for the students using this software. The experts suggest also inviting guest lecturers, alumni and people from industry to contribute to these topics.

Criterion 1.4 Admission Requirements

Evidence:

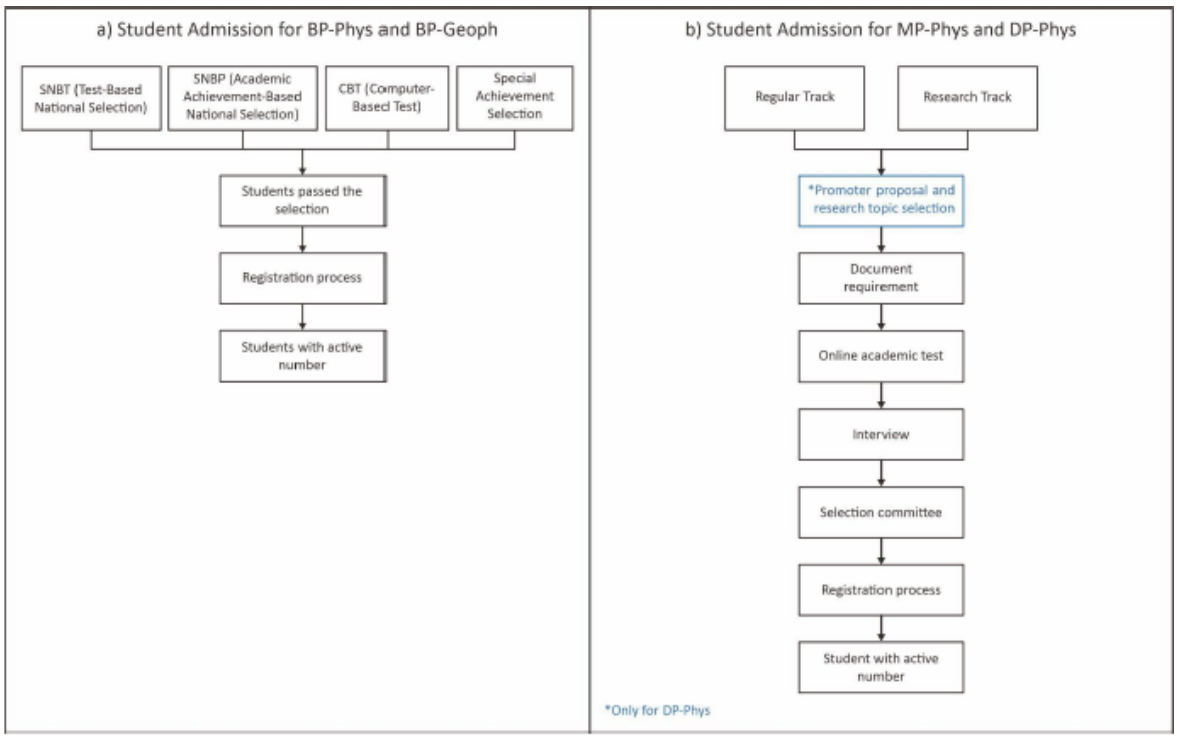
- Self-Assessment Report (SAR)
- Universitas Gadjah Mada Entrance Procedure Guidelines
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
As stated in the SAR, the admission procedure for the BPP and BPG follow the national procedure and the university procedure, while the MPP and the PhD in Physics follow the university procedure.

The **BPP and BPG** only open admissions in odd semesters, while the **MPP and PhD** open admissions in odd and even semesters. The number of students expected to be admitted each year is about 70 for the BPP, about 60 for the BPG, about 50 for the MPP and about 30 for the PhD in Physics. The number is decided by taking into account several factors such

as: the ratio of lecturers to students, the load of each lecturer in each semester, and the percentage of enrolled students to accepted students.

The following diagram shows the admission procedure for the study programmes under review:



The regular admission for the **Bachelor's degrees** consists of four mechanisms: SNBT (Test-Based National Selection), SNBP (Academic Achievement-Based National Selection), Computer-Based Test (CBT), and Special Achievement Selection. The SNBT and SNBP selections are organized nationally by The Minister of Education of Indonesia, while the CBT and the Special achievement selection are organized by the admission committee of the UGM.

Admission to the **MPP and PhD Programmes in Physics** (both the Regular and By Research tracks) is based on the following documentation requirements and the results of an academic test (online computer-based test) and an interview. The final decision is taken at the meeting of the Selection Committee of the Faculty of Mathematics and Natural Sciences.

1. "Prospective student that apply for MP-Phys regular track should have a Bachelor degree in Physics or Physics Education or from Science or Engineering fields, from accredited study program and accredited university with the following minimum GPA (scale 4 or equivalent):

a) GPA 2.5 from an accredited undergraduate program with “Unggul” (Excellent) or “A” accreditation.
b) b. GPA 2.75 from an accredited undergraduate program with “Baik Sekali” (Very Good) or “B” accreditation.
c) c. GPA 3.0 from an accredited undergraduate program with “baik” (Good) accreditation of “C.”

Candidates for the MPP in the by research track require a minimum GPA of 3.0 from an undergraduate programs with minimum accreditation of “baik sekali” (Very Good) or B.

2. “An academic potential test (TPA or PAPs - the Indonesian version of the Graduate Record Examination) with a minimum score of 450 or its equivalent.
3. A TOEFL score of at least 450 or from another test that is equivalent.
4. Recommendation from two people who know the applicant.
5. Research proposal (proof of publication if any).”

The requirements for admission to the **PhD Programme in Physics** are as follows:

1. “A minimum Grade Point Average (GPA) of 3.25 or higher on a 4.0 scale from an accredited Master's Program at the time of graduation.
2. A score of at least 500 on an academic potential test, which can be one of the following:
   a) UGM Postgraduate Academic Potential Test (PAPs)
   b) Academic Basic Ability Test of Indonesian Test Service Center (TKDA PLTI)
   c) Academic Potential of the National Development Planning Agency (TPA Bappenas)
3. Proficiency in English, demonstrated by achieving the following scores on specific tests:
   a) AcEPT UGM: at least 209
   b) TOEP PLTI: at least 40
   c) IELTS: at least 5.0
   d) TOEFL: at least 450
   e) Internet Based Test (IBT): at least 45
   f) Institutional Testing Program (ITP): at least 450
4. Two letters of recommendation from individuals who know the applicant:
   a) For working applicants: one from the head of their workplace institution and another from a lecturer from their Master's Program.
   b) For applicants without work experience or institutional affiliations: both recommendations should come from lecturers from their Master's Program.

5. If already employed, a study permit or study assignment letter from the applicant's workplace agency.
6. A pre-proposal research document".

In addition, candidates are advised to have contacted a potential supervisor during the registration process. The choice of supervisor will be made during the discussion of the research design.

Admission decisions to the Doctoral Programme in Physics are based on the fulfilment of the requirements for prospective doctoral students in physics, the results of the interview, and the recommendations of the prospective supervisors. It is determined by a feasibility meeting conducted by the Doctoral Programme in Physics or the Faculty.

The Admission Rules are published on the University's website and provide potential students with detailed information on the requirements and steps necessary to apply for admission to the programmes. As they are based on official regulations, the assessors consider them to be binding and transparent. They confirm that the admission requirements support students in achieving the intended learning outcomes.

Criterion 1.5 Workload and Credits

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of BP-Geoph and BP-Phys
- Curriculum Structure and Contents of each programme
- Regulation: "Conversion and calculation of semester credit system (credits) student learning load to european credit transfer and accumulation system"
- Discussions during the audit

Preliminary assessment and analysis of the experts:

According to the UGM Rector's Regulation No. 4732/UN1.P.I/Dir-PP/KR.01.02/2023, 1 credit corresponds to approximately 1.5-1.8 ECTS. Considering that a semester lasts 16 weeks, the following calculation for the conversion into ECTS points is regulated by the UGM:

Conversion Basis	Conversion Calculation
1 ECTS = 25-30 hours	1 CREDITS = 170 minutes/week/semester = 170 minutes x 16 weeks = 2,720 minutes = 45.33 hours
	= 45.33/30 hours – 45.33/25 hours = 1.5 – 1.8
	1 CREDITS = 1.5 – 1.8 ECTS

As stated in the SAR, 1 credit in the form of lectures, responses or tutorials consists of: class activities of 50 minutes per week for one semester; structured assignment activities of 60 minutes per week for one semester; and 60 minutes of independent activities per week for one semester. 1 credit in the form of seminars or other similar forms, consisting of: 100 minutes of classroom activities per week for one semester and 70 minutes of independent activities per week for one semester. 1 credit in the form of internship, studio practice, workshop practice, field practice, research, community service and/or other similar learning processes, equivalent to 170 minutes per week for one semester.

In the Bachelor's and Master's programmes under review, the student workload depends on the GPA achieved in the previous semester. For the first semester, each programme determines the student workload. In the **BPG** and **MPP** the workload for the first semester is 20 credits (33.2 ECTS) and in the **BPP** it is 21 credits (34.86 ECTS). The maximum student workload is determined as follows:

BACHELOR PROGRAM	
GPA IN PREVIOUS SEMESTER	**MAXIMUM CREDIT**
≥ 3.00	24
≥ 2.50	21
≥ 2.00	18
< 2.00	15

MASTER PROGRAM	
GPA IN PREVIOUS SEMESTER	**MAXIMUM CREDIT**
≥ 3.50	20
≥ 3.00	17
< 3.00	12

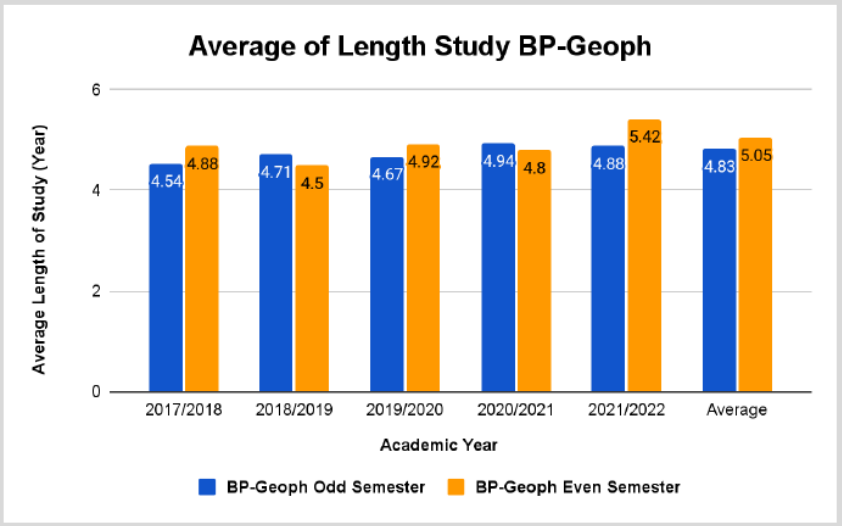
In the Bachelor's programmes, the number of compulsory subjects and credits for each semester varies and gradually decreases from 20 to 4 credits in the final semester. Since

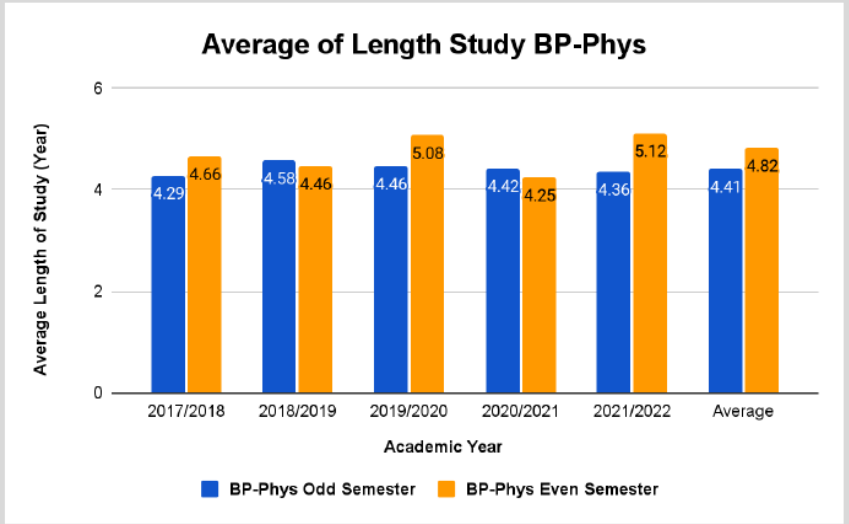
students are required to complete 144 credits (239.04 ECTS), they can take optional credits between the second and final semesters to complete their total credits for graduation.

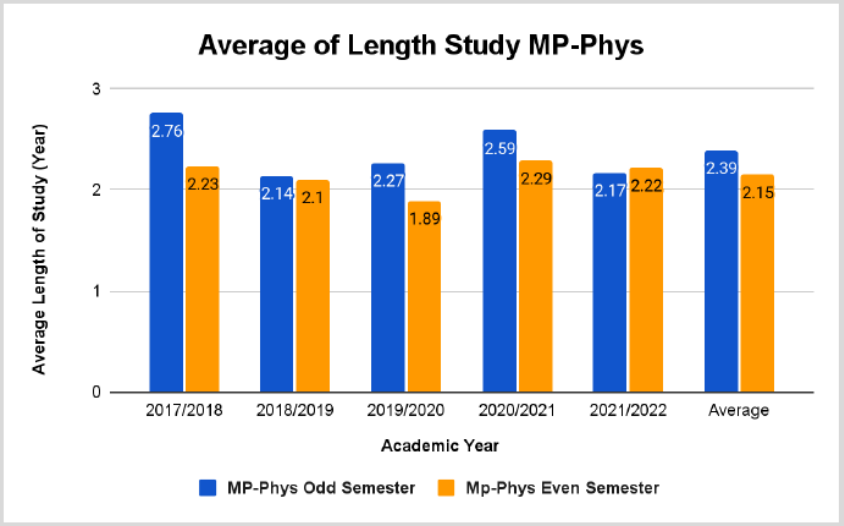
The **PhD programme in Physics** consists of a total of 46 credits (166.56 ECTS), including 12 credits for theory and 34 credits for research (dissertation).

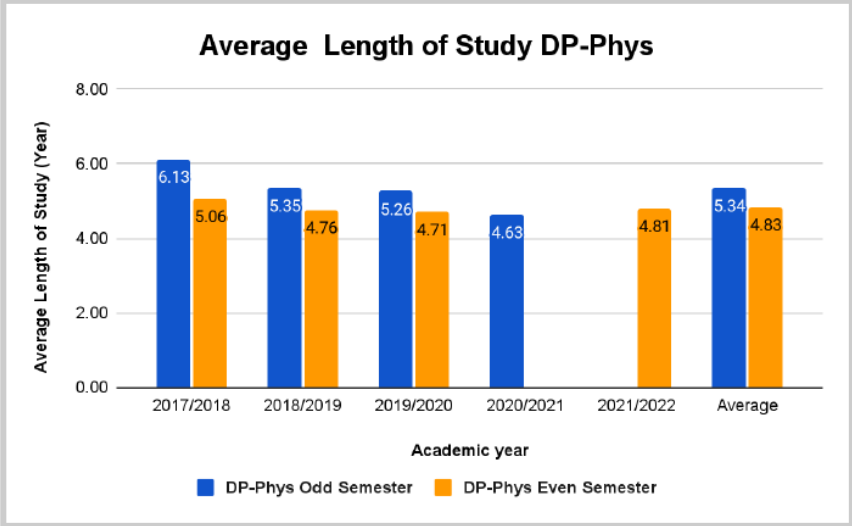
Students in all the programmes assessed consider the workload to be realistic and appreciate that it is based on their achievement in the previous semester.

Regarding the average length of study, UGM presents following statistics:









The Bachelor's programmes comply with the regulation allowing up to seven years to graduate. The average length of study at BPG is 9 semesters or 4.5 years and at BPP it is 4.41 for odd semesters and 4.82 for even semesters. According to the SAR, the main reason for the long duration of study in BPG is the waiting time for a place in off-campus training and thesis programmes (government or industrial agencies), which are chosen by a large number of students. The solution offered by the programme is, among other things, to provide practical work and thesis topics that can be done on the campus.

The average length of study for the MPP is 2.39 years for odd semesters and 2.15 years for even semesters, while the maximum length of study is four years. The length of study for PhD is 4.07 years, 4.27 years for odd semesters and 3.87 years for even semesters, but has decreased over the last five years.

The experts confirm that the credit system used by UGM is based on student workload and that all compulsory components are included. They are satisfied that the amount and

composition of the workload is described in detail for each module in the module handbook. As the workload for each semester is reflected in the GPA, they believe that the estimated workload is realistic, as confirmed by students, and that the workload is regularly monitored.

Criterion 1.6 Didactic and Teaching Methodology

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- General guidelines for implementation of Independent Learning-Campus Merdeka
- Discussions during the audit

Preliminary assessment and analysis of the experts:
As stated in the SAR, the teaching methods implemented in all the study programmes in the Physics Department of the UGM are based on the student-centred learning concept.

The study programmes under review employ a range of teaching and learning methods, including class lecturing, field lecturing, discussion, practice, seminars, guest lecturing, problem-based learning, case-based learning and blended learning. The university provides support for the department to bring guest lecturers from abroad, covering visa and accommodation costs. Alumni are also invited to deliver courses to students, sharing their industry experience. Students can suggest topics for discussion with guest lecturers.

The Bachelor's degrees include courses such as Scientific Writing and Presentation in BPG and Research Methodology and Scientific Communication in BPP. Students are introduced to independent scientific work and are encouraged to write papers and publish these in recognised journals.

The experts appreciate the diversity of teaching methods and believe that they ensure that the course objectives and the overall intended learning outcomes are achieved.

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

In its response, the UGM states that the process of proposing the establishment of the Master's programme in Geophysics has begun. The necessary documents are being prepared and will be submitted to the Faculty and University Senate for approval. With

regard to the ratio of lecturers to students, the University states that there are three new lecturers since 2023 and in May 2024 there will be a new recruitment of lecturers dedicated to geophysics in order to strengthen the opening of the new Master in Geophysics. The experts appreciate that steps towards the installation of a master's programme in geophysics have been undertaken. However, as this process is just beginning and in support of the department's request, they decided to keep their recommendation.

With regard to the expert team's suggestions on the curriculum (criterion 1.3), the UGM explains that the introduction of the new regulations on the university curriculum No. 53/2023 (Permendikbudristek No. 53 Year 2023) will soon allow for the adjustment of the number of compulsory modules in the first two years of the BPG. A process of reviewing and evaluating the existing curriculum structure will be initiated, and essential courses, such as the "Inverse Method" course, will be reconsidered in terms of their placement and changed from elective to compulsory or compulsory elective. The experts appreciate that the opportunities offered by the new regulations will be used to adjust the first two years of the BPG, and that "Inverse Methods" may play a more prominent role in a future curriculum, with the intention of making it compulsory. However, as the BPG curriculum review process is not yet complete, the experts maintain their recommendations regarding the BPG curriculum.

In addition, the UGM comments that the BPG has already incorporated a strategy into its teaching and learning activities to improve the English language and communication skills of BPG graduates. The experts appreciate the department's efforts and consider this strategy to be appropriate. Nevertheless, the experts maintain their recommendation, as the students interviewed during the visit felt that they did not receive enough English language training.

Regarding licensed software, BPG explains that the department already has Petrel and Reveal, which are robust and sophisticated seismic exploration software of industry standard. The experts believe that it is good and important that the Institute has licensed industrial software for seismic data interpretation (e.g. Pertel) in the Institute. However, much more practice with this software in the modules is recommended. Guest lecturers from industry can be invited to work with students using this software.

In addition, the UGM points out that the BPP has a double degree programme with Lung Hwa University in Taiwan, in order to meet the resources of the semiconductor industry and increase interest in the BPP. The experts welcome these developments.

2. Exams: System, Concept and Organisation

Criterion 2 Exams: System, Concept and Organisation

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Matrix of Expected Learning Outcomes for each degree programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Samples of exams, reports, final project and thesis
- Document Assessment of Internship Report
- Final Project Writing Guidelines
- Discussions during the audit

Preliminary assessment and analysis of the experts:

Examinations in the programmes under review are conducted in accordance with the examination rules set out in the Faculty's examination regulations. Accordingly, the quality of the examination questions prepared by the lecturers is checked by the head and/or secretary of the respective programme in terms of their alignment with the learning outcomes. Each examination question correlates with the achievement of the previously established Course Outcomes (CO), which represent the skills to be acquired by graduates or the Programme Learning Outcomes (PLO) of each programme. Each question has its own weight, which influences the final score, and the scores obtained by the students later become indicators of the programme's success in achieving the Course Outcomes (CO) of each course and the Programme Learning Outcomes (PLO) of the programme. In this way, regular checks are made to ensure that the examinations determine the achievement of the learning outcomes.

The module handbooks provided by UGM for all programmes under review specify the course assessments for each module, together with the expected competencies, the type of assessment and the weight of each assessment. The module handbook is also available on the website and can be accessed by lecturers and students.

Examinations for the Bachelor's and Master's degrees are held twice, in the middle and at the end of each semester (mid-term and final examinations). Examinations are scheduled and various forms of assessment are used, namely written exams, quizzes, practical exams, presentations, structured assignments, either individually or in groups, consisting of, for

example, case reports or scientific writing. As stated in the SAR, UGM provides for a “preparation week” (“minggu tenang”) to allow students time to prepare for the examination. The examination schedule is also designed to avoid overloading each day during the examination period. In the case of assessments carried out outside the university in companies or research institutions, such as the internship or final project, quality control is carried out by internal and external supervisors who are responsible for assessing the progress of the final report.

The value of the learning outcomes is expressed in letters by converting the numerical form. The grading system at UGM is as follows:

No	Letter Grade	Grade Range	Final Grade	Student's Ability Against the Subsections of the Courses Taken			
				Theory/Concept	General Question	Applicable Questions	Concept Development
1	A	3.76 – 4.00	4.00	Yes	Yes	Yes	Yes
2	A-	3.51 – 3.75	3.75	Yes	Yes	Yes	Enough
3	A/B	3.26 – 3.50	3.50	Yes	Yes	Yes	Average
4	B+	3.01 – 3.25	3.25	Yes	Yes	Enough	Low
5	B	2.76 – 3.00	3.00	Yes	Enough	Average	No
6	B-	2.51 – 2.75	2.75	Enough	Average	Low	No
7	C	1.76 – 2.00	2.00	Average	Low	No	No
8	D	0.51 – 1.00	1.00	Low	No	No	No
9	E	0.00 – 0.50	0.00	No	No	No	No

In principle, re-examinations are only held in the following cases: participation as an ambassador for the nation/university, illness requiring hospitalisation, death of parents/siblings or natural disaster. If the required minimum GPA has not been achieved, students may repeat a course taken with the aim of improving grades and GPA. A course must be repeated if it is a required course with a grade of E. The GPA of a student which does not meet the minimum requirements may be corrected by taking additional courses above the minimum requirements, for example by taking electives, or by dropping electives with poor grades. Cancellations are only allowed for electives and the number of credits for dropped courses cannot exceed 10% of the total credits for all courses taken.

Students are required to complete a thesis or final project in order to obtain a Bachelor's or Master's degree. As stated in the Faculty's guidelines, the final project is an academic activity that aims to train students' independence and scientific responsibility as future scientists, starting from the selection of topics and the preparation of research plans, through the conduct of research, the evaluation of research results, to the writing of the final project reports/thesis/dissertation. For undergraduate programmes, it consists of research of 6 credits. The BPG includes the "Undergraduate Thesis" in the eighth semester, in which students are expected to be able to carry out scientific geophysical research,

reported in the form of a thesis. The seventh and eighth semesters of the BPP consist of the modules Final Project A (2 credits = 3.32 ECTS) and Final Project B (4 credits = 6.64 ECTS). The regulation of the Bachelor's/Master's thesis begins with the registration of the student at the Administration Office. Then, within one month, the director or secretary of the programme should select the examiners who will examine the thesis. The final project examination is conducted by presenting the project results in a dissertation defence. Afterwards, the examiners and supervisors determine the grade.

For the **MPP**, the topic of the thesis is defined according to the student's area of interest, i.e. theoretical and computational physics, physical materials and geosciences. Students discuss the topic with their supervisors and prepare a research proposal. Preliminary work should be carried out by the student and the result will be examined in the proposal seminar. It will be examined by three referees and the mark will count for 40% of the final thesis mark. The remaining 60% of the thesis work will be continued after the examination of the proposal. Students of the Master by Research programme are also required to have at least one publication accepted in a reputable international scientific journal or two publications accepted in the proceedings of a reputable international seminar/conference in order to graduate.

During the on-site visit, the programme coordinators are asked about the rules for making up exams (related to disability, illness, etc.). They explain that, in such cases, students must formally request a new examination from the faculty, explaining the reasons and providing evidence. Students in all the programmes surveyed report that they are satisfied with the examination forms and their organisation, and with the support and feedback they receive from lecturers. Lecturers ask questions in the examinations about what has been learnt and the learning outcomes are always taken into account. They also explain the guidelines for the bachelor's thesis. The maximal duration of the final project in the BPP is two semesters according to the curriculum. For the **BPG** there seems to be no time limit for the final projects. Experts believe that this may lead to a longer duration of study. The duration of the final project should be less than 6 months and the school needs to manage the mechanism how to control this.

In the **PhD in Physics**, in addition to the doctoral research project and the dissertation, there is an assessment of the courses that will support the research topic proposed during the admission process at the beginning of the programme. Student research is assessed through a variety of activities, including monitoring and evaluation, comprehensive examination, evaluation of the dissertation report and the final examination/defence of the dissertation, as shown in the table below:

No.	Assessment Component	Assessment Criteria	Assessor
1.	Comprehensive Exam (4 credits or 17.04 ECTS)	1. Mastery of theories and concepts in their field is shown in problem formulation and literature review. 2. Originality and potential contribution to the discipline of science. 3. Mastery of research methods. 4. Quality of writing.	Comprehensive testing team (study program/department administrators, promoter team, and proposal assessment team).
2.	Research Performance (6 credits or 25.56 ECTS)	1. Discipline and hard work 2. Mastery of data processing 3. Communication and cooperation 4. Independence in problem-solving.	Promoter team (assessment has been given at the time of submitting the Dissertation Eligibility draft)
3.	Disertasi manuscript (6 credits or 25.56 ECTS)	1. Explanation, contextualization, and articulation of the problem and objectives of the study. 2. Review of relevant literature. 3. Formulation, development, and explanation of relevant background theories. 4. Methodology, design, and implementation. 5. Testing, results, analysis, and evaluation of results. 6. The structure of writing and organization of the dissertation.	Dissertation manuscript assessment team. (Outside the Promoters Team) (Maximum 1 month).
4.	Scientific Publications: Regular (12 credits or 51.12 ECTS)/ by Research (18 credits or 61.98 ECTS)	1. Journal reputation, 2. Conference reputation, 3. The quality of the manuscript includes: • Originality/novelty of the topic, • Research methods, • Presentation of data and discussion, • Grammar.	Dissertation manuscript assessment team and publication.
5.	Closed dissertation exam (6 credits or 25.56 ECTS)	1. Presentation 2. Reasoning and 3. Mastery of the material	Closed examination examiner team (Chairman of the session, promoter team and dissertation assessment team, and additional examiners).

The auditors examine samples of examinations and final projects submitted by the programmes under review. According to them, the documents show that the level of the students' academic performance and the content of the modules are sufficient for the programmes concerned. The final projects or dissertations are of a very high standard and show that students are able to work independently. They also consider that the number and distribution of examinations ensure an appropriate workload and sufficient time for preparation. However, for the **BPG**, the experts consider that the time needed to work on the thesis should be fixed and be consistent with the established 6 credits (9.96 ECTS).

3. Resources

Criterion 3.1 Staff and Development

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Staff Handbook
- Discussions during the audit

Preliminary assessment and analysis of the experts:
As stated in the SAR, the UGM Physics Department consists of 47 full-time academic staff, of which 7 are professors, 16 associate professors, 17 assistant professors and 2 lecturers, and 5 instructors. In terms of academic qualifications, 39 have a doctorate and 8 have a master's degree. In addition, 8 are female (17%) and 39 are male (83%). These data are for the year 2022.

The **BPG** is supported by 15 academic staff (2 female and 13 male), 5 support staff and 10 part-time lecturers from the Faculty of Philosophy and the Faculty of Engineering. Considering that the number of students enrolled in the BPG (until October 2022) is 296, the teacher-student ratio is 1:20.

According to the data for the year 2022, for the **BPP**, the teaching staff is 33 (7 female and 26 male), of which 26 have a doctorate and 7 a master's degree. The distribution of academic qualifications is 6 professors, 14 associate professors, 9 assistant professors, 1 lecturer and 3 instructors. There were 248 students enrolled. This means that the average ratio of academic staff is 0.133. The **MPP** consists of 39 teaching staff and 84 students (ratio = 0.46). The **PhD programme in Physics** has 35 teaching staff and 37 students enrolled in 2022. A promoter or supervisor is required to have at least a PhD and the academic position of Associate Professor, while a co-promoter should have at least a PhD and the academic position of Assistant Professor. This means that 20 members of the teaching staff are qualified to be promoters. The promoter team regularly guides students in preparing and reviewing research proposals, preparing for comprehensive exams, conducting research, writing dissertations, and preparing exams/seminars on research findings.

In addition, the Faculty has 22 support staff (5 female and 17 male) in the areas of administration, finance, library, teaching, IT, laboratory and infrastructure. There are also

32 tutors, i.e. for the core compulsory courses, and 6 freelancers who help with administrative work such as database collection, documentation and social media.

The UGM and the Faculty offer pedagogical training and development through programmes such as talent scouting, the "Improved Basic Skills of Instructional Techniques" programme, specifically for junior lecturers, and the Applied Approach (AA), which is available to both junior and senior lecturers. The Directorate of Human Resources is responsible for the academic and didactic development of teaching staff. The academic and didactic qualifications of the teaching staff are regularly reviewed to ensure that they contribute adequately to the delivery of the programme.

Lecturers may exchange staff abroad for research, publications, guest lectures or to act as reviewers. They also have the opportunity to develop their professional and didactic skills through several offers (e.g. PEKERTI programme).

In addition, each member of staff may apply annually for faculty-level teaching research grants and compete for national or international research grants. The University increases the allocation of the annual budget for laboratory and research activities to support the development of lecturing capacity. The University offers rewards to academic staff who publish articles in prestigious international journals. The research conducted by the academic staff will generally involve students and the research will become part of the student's thesis, and the academic staff will financially support their students to present their research at national and international conferences.

During the interviews, the lecturers reported that the university and the faculty provide didactic training for new lecturers. They find these very useful. They also confirm that they are supported to attend international conferences. The university also provides support for inviting international guest lecturers. Teaching staff is very satisfied with the conditions and the teaching workload. They like the flexibility offered by the Faculty and the time they have to carry out research projects. In addition, the UGM provides support for childcare (e.g. crèche and kindergarten).

In conclusion, the experts confirm that the composition and academic orientation of the teaching staff are appropriate for the successful implementation and sustainability of the two programmes under review. The university and the faculty support their staff and provide adequate opportunities for professional and pedagogical development.

Student Support

According to the SAR, UGM aims to provide students with comprehensive support, guidance and resources to ensure their academic success, personal development and well-being. For example, it provides counselling services to support students' emotional and

psychological needs in the Health Promoting University unit. Students also have access to the “Gadjah Mada Medical Centre”.

UGM encourages student involvement in co-curricular activities such as sports and arts-cultural-spiritual activities in the sports arena, student centre, music and mosque facilitated by the university, and they also have a Physics Graduate Students Association to organise scientific and social events.

Students are very satisfied with the support they receive from teachers and administrative staff. Masters and PhD students and graduates emphasise that they feel very well supported by their supervisors. They receive useful and sufficient advice. They also help them to prepare documents for international conferences and presentations. Supervisors help students to find funding and encourage them to publish in recognised journals. In addition, there are supervisors who work with industry.

The experts note that students generally have a very good relationship with their teachers and that alumni still maintain contact with the institution and staff and are very proud of the institution. Both students and staff confirm that there is always an academic advisor available to work with students on any questions or problems. The auditors believe that the support system helps students to achieve the intended learning outcomes and to complete their studies successfully and without delay. They appreciate that students are encouraged to publish and attend international conferences. Students are well informed about the services available to them. The experts consider that the guidance and mentoring system in place is very good.

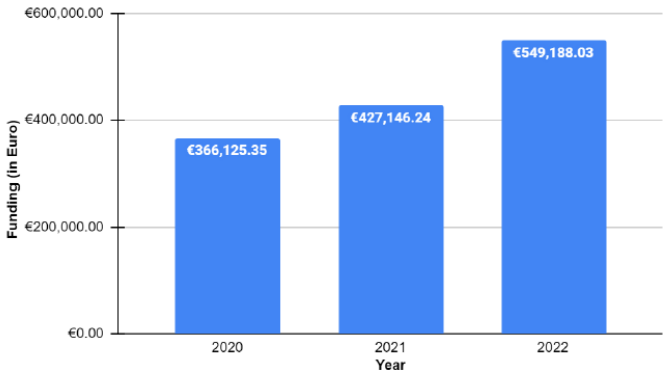
Criterion 3.2 Funds and equipment

Evidence:

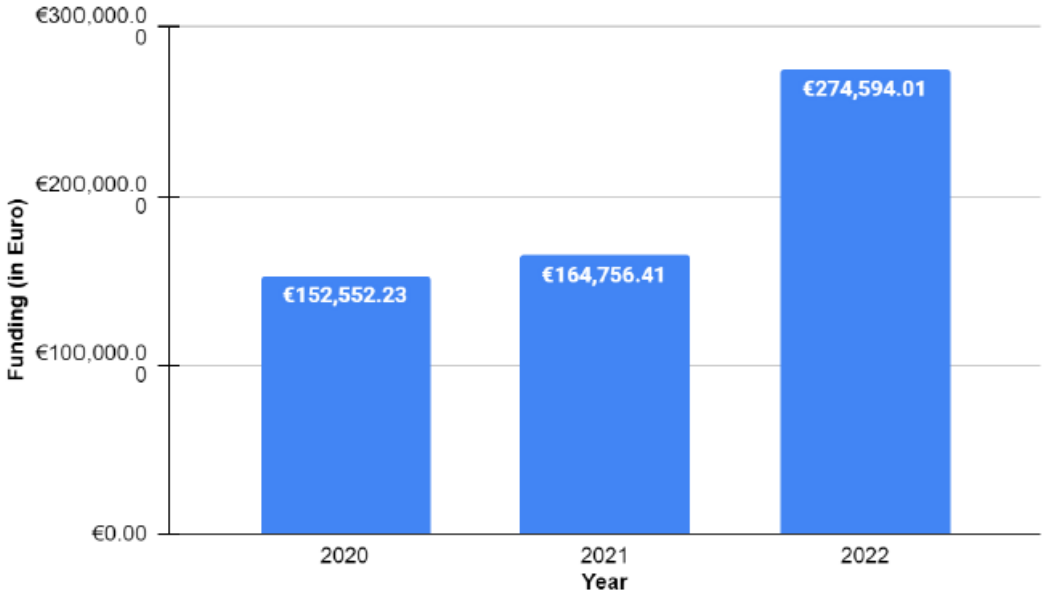
- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Evidence Annual Budget
- Evidence Financial Planning
- Facilities of Physics Department UGM
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
According to the SAR, the Department of Physics has a sustainable basis for delivering three degree programmes. Each year, there is a secured annual budget for each programme and

an additional annual budget based on the total number of students enrolled in that year. As the following data shows, the total budget of the Department of Physics is increasing, reaching more than 29 billion rupiah (1.8 million USD):



This budget is allocated to staff salaries and honoraria, research funding, staff development and facilities. The annual budget for laboratory and research activities is distributed as follows:



There is also funding from state enterprises such as Pertamina, and research collaboration with foreign institutions such as JICA (Japan International Cooperation Agency).

Based on a questionnaire (i.e. satisfaction with equipment and facilities) in the Department of Physics, most respondents said they were satisfied. All lecture rooms are equipped with LCD projectors, Wi-Fi facilities and air conditioning. All facilities are located in three buildings. Student facilities, such as student lounges on each floor, are available in each building. Internet access is also available through the UGM hotspot and eduroam. The canteen is located on the ground floor of the Undergraduate Building. The Department of Physics has four laboratories:

1) Atomic and Nuclear Physics Laboratory

2) Basic Physics laboratory

3) Geophysical Laboratory

4) Material Physics and Instrumentation Laboratory.

During the on-site visit, the experts inspect the university's facilities, faculties and laboratories. Overall, the experts conclude that the university has secure funding and reliable financial planning. In general, the experts appreciate that the programmes receive funding from a variety of sources, including industry, such as the SEG (Society for Exploration in Geophysics). The UGM campus and infrastructure are adequate and sufficient. They consider that there is sufficient space, rooms and facilities.

However, the experts encourage both **BPG and BPP** to continue modernising the laboratories and equipment. They recognise that this is an ongoing process, but it is important for the motivation of the students. In particular, the experts recommend the acquisition of the following equipment for the Geophysics labs: Multi channel DC resistivity device.

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

UGM notes in its statement that due to limited budget, each research laboratory can upgrade its "expensive instrument" every 3 years. The university has also integrated modern equipment in the Integrated Laboratory for Research and Testing. The experts appreciate these explanations, especially regarding expensive equipment, and understand that this is a long-term process. However, they encourage BPG and BPP to continue with the modernisation of laboratories and equipment.

4. Transparency and Documentation

Criterion 4.1 Module Descriptions

Evidence:

- Self-Assessment Report (SAR)
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The module handbook for all degree programmes under review is published on the university's website for each degree programme and is thus accessible to the students as well as to all stakeholders websites in both Indonesian and English. Information about the curriculum and courses offered can be found at the faculty's website. The experts observe that they contain the necessary information about the persons responsible for each module, the teaching methods, the credit points awarded, the intended learning outcomes, the applicability, the forms of assessment, the admission and examination requirements, the workload (incl. contact hours and self-study time), the literature as well as the details explaining how the final grade is calculated.

The experts are of the opinion that the module descriptions are accessible and contain the required information for each module.

Criterion 4.2 Diploma and Diploma Supplement

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Module Handbook for each programme
- Samples of Diploma Supplement and Transcript of records
- University Website: https://ugm.ac.id/en/
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The graduates for each study program receive a diploma certificate, academic transcript, as well as the diploma supplement (SKPI). The academic transcript and diploma supplement are written in both Indonesian and English in a single document. The diploma certificate is written in Indonesian, however the English version can be provided upon request. The Transcript of Records contains the marks for each module. At the end of the study, the final mark is calculated as cumulative grade point average (CGPA) by taking the average of the grades weighted by the credits attributed to each course. The graduation predicate is based on the CGPA and the time taken to complete the study.

On the basis of samples of these documents, the experts confirm that students on the programmes assessed receive a Diploma Supplement in English and a Transcript of Records, and that these documents contain the required information. However, the experts take note that the diploma supplements of all programmes under review do not contain information of the student's GPA relative to the cohort. The experts are of the opinion that

the GPA distribution of graduates should be added in the diploma supplement to ensure fair transfer and recognition of grades of mobile students.

Criterion 4.3 Relevant Rules

Evidence:

- Self-Assessment Report (SAR)
- University Website: https://ugm.ac.id/en/
- List of Regulations
- Discussions during the audit

Preliminary assessment and analysis of the experts:
In the SAR, all rules and regulations regarding the code of conduct and responsibility of students, lecturer, academic staff are established on many regulation levels, from national regulation, university statutes and guidelines, faculty's rules and guidelines, and other additional guidelines are listed. These regulations are published on the university's website and are therefore available to all stakeholders.

The experts confirm that the rights and obligations of both UGM and the students are clearly defined and binding. The students interviewed seem to be satisfied with the website and the academic intranet. They say that they can find all the information they need.

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

With regard to the lack of information on the student's GPA in relation to the cohort in the Diploma Supplement, the UGM points out that this information is currently available and that the Programme Studies carries out an automatic system mapping/analysis at the end of each academic semester. The University confirms that information on the student's GPA relative to the cohort will be added in the future as part of the SKPI. The programme/department will discuss the placement of this information with the relevant unit. The experts appreciate these explanations and the fact that the UGM is taking immediate action in this respect. However, the experts decide to maintain the requirement until evidence of the integration of the student's cohort GPA in the Diploma Supplement has been provided.

5. Quality management: quality assessment and development

Criterion 5 Quality management: quality assessment and development

Evidence:

- Self-Assessment Report (SAR)
- University Website: https://ugm.ac.id/en/
- Sample student survey questionnaire
- Results of student surveys
- Statistical data about the progress of studies
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The UGM has a number of monitoring and quality assurance procedures in place to review and develop its programmes. On the one hand, the national accreditation audits are carried out by external accreditation agencies, such as the National Accreditation Board for Higher Education (BAN-PT) as a national independent external institution. Currently, the programme organised by the Physics Department is accredited with the highest grade (Excellent). In addition, a unit called the "Centre of Academic Study and Innovation" (PIKA) has been created to continuously improve the learning process through the development of innovative learning. The purpose of PIKA is to facilitate, empower and enable lecturers in the task of improving the quality of graduate competence and accelerating the completion of the “study period” (participatory approach and co-creation to build new material and new learning culture in the implementation of learning).

The assessment and measurement of programme outcomes can be achieved through a number of steps, such as the collection, processing and analysis of data relating to the achievement of student objectives and learning outcomes, which involves the development and consistent administration of a variety of measures of learning, both direct and indirect. Examples of direct assessment measures include student portfolios, student projects, assignments and examinations, while indirect assessment measures include some employer surveys and alumni surveys.

In summary, measuring programme learning outcomes offers many benefits, including assessment of student achievement, curriculum improvement, quality assurance, evidence-based decision making, student and programme evaluation, and fostering a culture of continuous improvement. In addition, average PLO achievement is measured by

several parameters, including average GPA, length of study and doctoral publications. The institution presents the average PLO performance and GPA for each programme in the SAR.

Similarly, each programme invites industry experts to give courses or public workshops, and sends out several questionnaires to the labour market and to alumni to obtain information on alumni skills and performance.

The Faculty has the following quality assurance units for quality assurance at different levels, such as:

1. The Semester Coordination Team (TKS) at faculty level, which is responsible for monitoring and evaluating the educational process. The team oversees the implementation of academic management and ensures compliance with established quality assurance standards, including module content, delivery methods, lecturer performance, student assessment and student learning outcomes (LO) assessment mechanisms. The team involves stakeholders such as students, lecturers and education staff.

2. The Curriculum Committee/Quality Assurance Group (GJM) at the department level coordinates the preparation of the curriculum structure in the context of the implementation of the quality standards set and the control of the implementation of the educational process, including the improvement of the quality of human resources, learning processes, research and community service.

3. The Quality Assurance Unit (UJM, Quality Assurance Unit), which is responsible for the implementation of the internal quality assurance system (SPMI) at the faculty level. In practice, the UJM, together with the Quality Assurance Office of the UGM (KJM, Quality Assurance Office), carries out annual internal quality audits (AMI, Internal Quality Audits) on all programmes in order to evaluate, correct and at the same time improve the quality standards of the educational process.

Every semester, the Semester Coordination Team (TKS) holds a meeting to discuss the teaching and learning process for that semester. At the meeting, TKS invites all its members and all level/year student representatives to gather information about teaching. The findings of the TKS team are passed on to the department where solutions are discussed in a management meeting. If necessary, the findings can also be brought to the faculty level management meeting.

The Department of Physics also uses the Faculty of Mathematical Sciences' internal quality assurance system (SPMI) to ensure that its vision and mission are consistently achieved. The SPMI is a systematic faculty quality assurance tool for the sustainable monitoring of the faculty's own higher education implementation.

In order to monitor the teaching and learning process, the Faculty organises student evaluation in the form of an online questionnaire (EDoM). Students are asked to fill in the online questionnaire before accessing their study results. The purpose of the evaluation is to assess the teaching efficiency and the overall impression of the lecturer's performance. In addition to the students' evaluation by means of the online questionnaire with the above-mentioned results, the department also organises the evaluation by means of course notes via an online system. The result of the questionnaire for each course is given as feedback to each associated lecturer.

The study programmes under review also carry out surveys of alumni and stakeholders for improving the curriculum and developing teaching-learning methods.

During the audit, the students explain that a survey is held at the end of each semester and that they are informed of the results. They explain that there are different ways to communicate their feedback. For example, they can report any problems during the mid-term monitoring.

In conclusion, the expert group confirms that the overall quality management system is effective in identifying weaknesses and improving programmes. All stakeholders are involved in the process. The results and any actions derived from the evaluations are communicated to the students.

D Additional Criteria for Structured Doctoral Programmes

Criterion D 1 Research

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for the PhD programme
- Matrix of Expected Learning Outcomes for the PhD programme
- Programme-specific Objectives and Learning Outcomes for the PhD programme
- Module Handbook for the PhD programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of PhD-Phys
- Curriculum Structure and Contents of PhD-Phys
- Discussions during the audit

Preliminary assessment and analysis of the experts:

As described above in section 1.3., the **Doctoral Programme in Physics** includes a "Regular track" and a "By research track". The programme puts a focus on coursework related to the Dissertation Research each PhD student is carrying out.

The compulsory courses are as follows:

KBK	Code	Credits	ECTS	Course Name
Compulsory Courses	MFF 7001	3	5.43	Research Methodology and Writing Scientific Papers
	MFF 8001	34	144.84	Dissertation
	MFF 8002	40	170.4	Dissertation by Research

The curriculum of the Regular Track is as follows:

No	Semester	Study and Research Process	Total Credits	ECTS	Code	Courses	Credits	ECTS	Note
1.	I	Course	12	21.72	MFF7001	Research Methodology and	3	5.43	Courses of Option 1, 2, and 3 are chosen based on the student's
						Writing Scientific Papers			research topic and taken on the recommendation of the supervisor
						Option 1	3	5.43	
						Option 2	3	5.43	
						Option 3	3	5.43	
2.	II	Preparation of Proposals and Research Activities	7	29.82	MFF8001-Dissertation	Comprehensive Exam	4	17.04	
						Research Performance Seminar I	3	12.78	
3.	III	Research and Publications	3	12.78		Research Performance Seminar II	3	12.78	
4.	IV	Research and Publications	12	51.12		Regular Scientific Publications	12	51.12	Attaching Journal Indexation
5.	In	Preparation and Assessment of Dissertations	6	25.56		Dissertation Manuscript	6	25.56	Assessment of the dissertation manuscript
6.	WE	Dissertation Assessment and Examination	6	25.56		Dissertation Exam	6	25.56	Closed Exam
	Total credits (minimum)		46	166.56			46	166.56	

The curriculum of the By research track is as follows:

No	Semester	Study and Research Process	Total Credits	ECTS	Code	Courses	Credits	ECTS	Note
1	I	Lecture	6	10.86	MFF7001	Research Methodology and Writing Scientific Papers	3	5.43	Course of Option 1 is chosen based on the student's research topic and taken on the recommendation of the supervisor
						Option 1	3	5.43	
2	II	Preparation of Proposals and Research Activities	7	29.82	MFF8002-Dissertation	Comprehensive Exam	4	17.04	
						Research Performance Seminar I	3	12.78	
3	III	Research and Publications	3	12.78		Research Performance Seminar II	3	12.78	
4	IV	Research and Publications	18	61.98		Scientific Publications *by Research*	18	61.98	Attaching Journal Indexation
5	In	Preparation and Assessment of Dissertations	6	25.56		Dissertation Manuscript	6	25.56	Assessment of the dissertation manuscript
6	WE	Dissertation Assessment and Examination	6	25.56		Dissertation Exam	6	25.56	Closed Exam
	Total credits (minimum)		46	166.56			46	166.56	

The feasibility of the preliminary research proposals is verified before admission to the programme. These proposals are submitted for evaluation to an examination panel consisting of three lecturers (professors) serving as a selection committee taking into account various criteria, including originality, innovativeness, potential contributions, practicality, and ideally, alignment with the Physics Department's Research profile.

During the first year, students should improve their research proposal under the guidance of the supervisor's team in preparation for a comprehensive examination, which is conducted at the beginning of the second year. After successfully passing this examination, they will benefit from a more rigorous and frequent schedule of consultations provided by their supervisor's team. Additionally, students have the flexibility to engage in research discussions with their peers or utilize the resources available in the relevant research laboratory outside of their scheduled meetings with their mentors. From the third semester, there is a mandatory monitoring session each two months where students are required to present their achievements and outline their goals for the upcoming session. In addition, the program provides various initiatives such as workshops on scientific paper writing for publication, training on research tools, and related activities.

Throughout the research process, students are expected to produce at least one paper for Regular students or two papers for Research students, intended for publication in an internationally recognized journal with a strong reputation and impact factor. These publications serve as prerequisites for the final examination (defence) of their dissertations, and they must have been published after the students have passed the comprehensive examination. During the audit discussion, the lecturer stated that the journal article does not become an obstacle for the student in finishing the program, which the student also confirmed during the student discussion session.

The programme encourages also their participation in various international opportunities and mobility programs, including summer courses, international conferences, sandwich programs, and similar initiatives.

PhD students are very satisfied with the programme, lecturers and supervisors. They find the curriculum flexible and helpful in carrying out their research projects. The examination and monitoring sessions are in their opinion very useful to improve their research projects. In addition, they feel very well supported in writing papers and publishing them in recognised journals. During the on-site visit, the experts can review some samples of dissertations defended in the faculty. Based on that, the experts believe that the focus of the programme enables doctoral candidates to broaden their skills and network for their research activities. In addition, they observe that lecturers encourage PhD students to

publish in international journals and that the university provides good conditions and support for PhD's research projects.

Criterion D 2 Duration and Credits

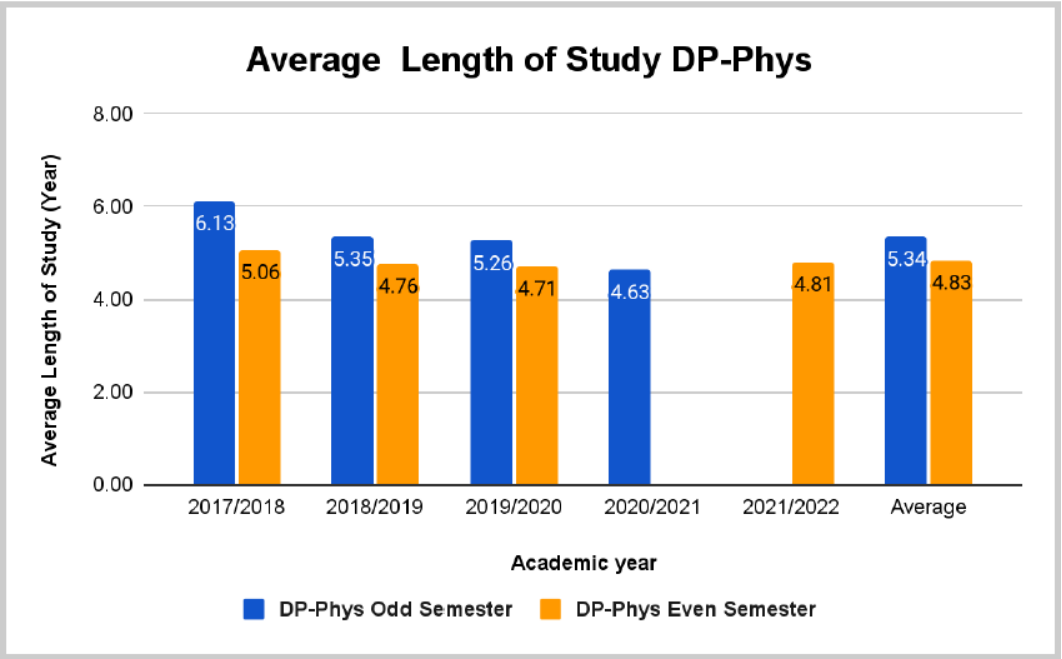
Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for the PhD programme
- Study and examination regulations
- Module Handbook for the PhD programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of PhD-Phys
- Curriculum Structure and Contents of PhD-Phys
- Statistical data about the progress of studies
- Discussions during the audit

Preliminary assessment and analysis of the experts:

The length of the PhD programme is designed to be completed within 3 years. However, the maximum allowed study duration is seven years. Both tracks require students to successfully complete a minimum of 46 credits (166.56 ECTS) of compulsory and elective courses within three years. For the regular track, the 46 credits include 37 credits of compulsory courses and a minimum of 9 credits of elective courses. The compulsory courses include 3 credits of lectures and 34 credits of dissertation. Meanwhile, for the By Research track, the 46-credit course load consists of 40 credits dedicated to the dissertation, 3 credits of compulsory lectures and an additional 3 credits of elective lectures.

As shown in the statistics presented below, the average duration of study in the programme is 4.07 years, (4.27 years for odd semesters and 3.87 years for even semesters) and has decreased over the last five years.



The doctorate candidates feel that the workload is acceptable and, depending on the topic of the research project, three years are enough time for the PhD programme. The experts are of the opinion that the doctoral programme operates within an appropriate time duration.

Criterion D 3 Soft Skills and Mobility

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for the PhD programme
- Study and examination regulations
- Module Handbook for the PhD programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of PhD-Phys
- Curriculum Structure and Contents of PhD-Phys
- Evidence external cooperation
- Discussions during the audit

Preliminary assessment and analysis of the experts:

The PhD programme offers doctoral students various programmes and activities for their personal and professional development, such as training in scientific writing, collaborative seminars, symposia and workshops at national and international levels, panel discussions,

guest lectures from relevant agencies or institutions, collaborative research initiatives, student exchange programmes, sandwich programmes, etc. In addition, many PhD students engage in joint research projects with their supervisors, which are recognised as part of their final project.

In addition, doctoral students are strongly encouraged to participate in a range of international opportunities such as summer courses, international conferences, short laboratory visits, collaborative research initiatives, sandwich programmes etc. The programme actively supports students in obtaining academic research funding, laboratory research grants and access to research facilities to support their research endeavours.

International publications are a mandatory requirement for the final thesis examination, and the quality of these publications reflects the research activities of the doctoral students.

Doctoral students express their satisfaction with the opportunities and support offered by the university for academic mobility and international collaboration. The experts conclude that UGM offers a wide range of opportunities for the personal and professional development of doctoral students and sufficient support and cooperation for mobility.

Criterion D 4 Supervision and Assessment

Evidence:

- Self-Assessment Report (SAR)
- Decree of the Dean regarding regulation about supervision in PhD in Physics
- Assessment methods for the PhD in Physics
- Dissertation writing guidelines
- University Website: https://ugm.ac.id/en/
- Sample student survey questionnaire
- Results of student surveys
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The decree issued by the Dean of the Faculty sets out the shared responsibilities between the doctoral candidate, the supervisor and the institution.

Supervisors normally consist of one supervisor and a maximum of two co-supervisors. Each supervisor must hold a doctoral degree and have published an article in an internationally

renowned journal. The supervisor must be an active associate professor at the UGM, while the co-supervisor may come from another institution.

There is an examination at the beginning of the third semester or at the latest at the end of the third semester, once all courses have been successfully completed. The comprehensive examination assesses various aspects of research, including theoretical understanding, originality of research, mastery of research methods and the quality of written work. The examination is administered by the doctoral programme and evaluated by an examination team consisting of programme administrators, supervisors (supervisor and co-supervisor) and a proposal examiner.

Regular meetings are arranged between doctoral students and supervisors. Additionally, every two months, there is a kind of colloquium to monitor the progress of the research projects (Mon-Ev). During these sessions, students present their research progress to fellow students and lecturers. Both lecturers and fellow students can ask questions and provide suggestions.

Students may write the dissertation in either Bahasa or English, following the format and rules set out in the Dissertation Guidelines. A minimum GPA of 3.25 is required to register for the dissertation defence. The dean (or the vice-dean) leads the examination, and the examining panel consists of the lead examiner (the Dean), the supervisors (supervisor and co-supervisor), a dissertation examiner, and two additional examiners (one of whom is not affiliated with the UGM, provided that his or her expertise is relevant to the topic of the dissertation).

The assessment for the dissertation defence is based on the quality of presentation, argumentation and mastery of the subject. The results of the dissertation defence are categorised as 'passed without revision', 'passed with revision' or 'failed', with scores ranging from 0 to 4. To pass, students must achieve an average score of 3.25, either 'passed without revision' or 'passed with revision'. Students who pass with revision are required to submit the final corrected manuscript within three months of the defence and to obtain the approval of each member of the examination panel. Failure to obtain these approvals within the specified timeframe will result in the nullification of the examination and the student will be required to retake the dissertation examination. In the case of a 'fail', the student has one year in which to apply for a re-examination.

The following overview about the assessment method in the PhD in Physics is presented by UGM:

<table>
<tr><th>N0</th><th>Components (weights)</th><th>Minimum assessment criteria</th><th>Assessment</th></tr>
<tr><td>1</td><td>Comprehensive Exam
(4 credits)</td><td>1. Mastery of theories and concepts in their field is shown in problem formulation and literature review.
2. Originality and potential contribution to the discipline of science.
3. Mastery of research methods.
4. Quality of writing.</td><td>Comprehensive testing team (study program/department administrators, promoter team, and proposal assessment team).</td></tr>
<tr><td colspan="4">Comprehensive exam assessment form:
<table>
<tr><th>No.</th><th>Rubric</th><th>Value</th></tr>
<tr><td>1</td><td>Mastery of theories and concepts in their field indicated in problem formulation and literature review</td><td>0,00 – 4,00</td></tr>
<tr><td>2</td><td>Originality and potential contribution to the discipline of science</td><td>0,00 – 4,00</td></tr>
<tr><td>3</td><td>Mastery of research methods</td><td>0,00 – 4,00</td></tr>
<tr><td>4</td><td>Writing quality</td><td>0,00 – 4,00</td></tr>
</table></td></tr>
<tr><td>2</td><td>Research Performance
(6 credits)</td><td>1. Discipline and hard work
2. Mastery of data processing
3. Communication and cooperation
4. Independence in problem-solving.</td><td>Promoter team (assessment has been given at the time of submitting the Dissertation Eligibility draft)</td></tr>
<tr><td colspan="4">Research Performance consists of 2 courses, namely: Research Performance Seminar I (3 credits) and Research Performance Seminar II (3 credits), and is assessed by the promoter team (Table 3.10).
<table>
<tr><th>No.</th><th>Rubric</th><th>Value</th></tr>
<tr><td>1</td><td>Discipline and hard work</td><td>0,00 – 4,00</td></tr>
<tr><td>2</td><td>Mastery of data processing</td><td>0,00 – 4,00</td></tr>
<tr><td>3</td><td>Communication and cooperation</td><td>0,00 – 4,00</td></tr>
<tr><td>4</td><td>Independence in problem-solving</td><td>0,00 – 4,00</td></tr>
</table></td></tr>
</table>

D Additional Criteria for Structured Doctoral Programmes

<table>
<tr><th>N0</th><th>Components (weights)</th><th>Minimum assessment criteria</th><th>Assessment</th></tr>
<tr><td>3</td><td>Disertasi manuscript
(6 credits)</td><td>1. Explanation, contextualization, and articulation of the problem and objectives of the study.
2. Review of relevant literature.
3. Formulation, development, and explanation of relevant background theories.
4. Methodology, design, and implementation.
5. Testing, results, analysis, and evaluation of results.
6. The structure of writing and organization of the dissertation.</td><td>Dissertation manuscript assessment team.
(Outside the Promoters Team)
(Maximum 1 month).</td></tr>
<tr><td colspan="4">Dissertation Manuscript Assessment Form:
<table><tr><th>No.</th><th>Rubric</th><th>Value</th></tr><tr><td>1</td><td>Explanation, contextualization, and articulation of the problem and the objectives of the study</td><td>0,00 – 4,00</td></tr><tr><td>2</td><td>Review of relevant literature</td><td>0,00 – 4,00</td></tr><tr><td>3</td><td>Formulation, development, and explanation of relevant background theories</td><td>0,00 – 4,00</td></tr><tr><td>4</td><td>Methodology, design, and implementation</td><td>0,00 – 4,00</td></tr><tr><td>5</td><td>Testing, results, analysis, and evaluation of results</td><td>0,00 – 4,00</td></tr><tr><td>6</td><td>The structure of writing and organization of the dissertation</td><td>0,00 – 4,00</td></tr></table></td></tr>
<tr><td>4</td><td>Scientific Publications:
Regular
(12 credits)/
by Research (18 SKS)</td><td>1. Journal reputation,
2. Conference reputation,
3. The quality of the manuscript includes:
• originality/novelty of the topic,
• research methods,
• presentation of data and discussion,
• Grammar.</td><td>Dissertation manuscript assessment team and publication.</td></tr>
<tr><td colspan="4">Scientific Publication Manuscript Assessment Form:
<table><tr><th>Rubric</th><th>Value</th></tr><tr><td>Journal reputation:
International journal: 3.25 ≤ < score of 3.50
Reputable international journals Q3, Q4, or equivalent:
3.50 ≤ a < value of 3.75
Reputable international journals Q1, Q2 or equivalent:</td><td>3,25 – 4,00</td></tr></table></td></tr>
<tr><td>5</td><td>Closed dissertation exam
(6 credits)</td><td>1. Presentation
2. reasoning and
3. mastery of the material</td><td>Closed examination examiner team (Chairman of the session, promoter team and dissertation assessment team, and additional examiners).</td></tr>
<tr><td colspan="4">Closed Dissertation Examination Assessment organized by the faculty</td></tr>
</table>

In conclusion, the experts note that the lecturers and supervisors are in close contact and work together with the doctoral candidates in their research projects and students feel well supervised and supported. Assessment rules seem to be clearly formulated and binding.

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

The UGM comments that a strong relationship between doctoral students and their supervisors depends not only on bimonthly meetings organised by the doctoral programme, inviting both students and supervisors, but also on regular weekly meetings. The experts appreciate these explanations and consider that the supervision and assessment of doctoral candidates is very good.

Criterion D 5 Infrastructure

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for each programme
- Module Handbook for each programme
- University Website: https://ugm.ac.id/en/
- Staff Handbook
- Discussions during the audit

Preliminary assessment and analysis of the experts:

As described above (see section **3.2**), the UGM Physics Department has four research laboratories where the doctoral candidates can carry out their research projects depending on the topic:

1. Atomic and Nuclear Physics Laboratory
2. Basic Physics Laboratory
3. Geophysical Laboratory
4. Material Physics and Instrumentation Laboratory

According to the SAR, for testing or characterizing research samples, students can use the integrated laboratories at LPPT UGM through internal cooperation. The laboratory is equipped with supporting equipment, including SEM, XRF, XRD, GC-GMS, AAS, NMR spectrometer, RT-PCR, DNA sequencer etc. This facility allows students to perform a wide range of research activities, such as materials and metabolomics research, molecular

biology, histology analysis, and studies related to herbal plants. Additionally, students have the opportunity to conduct research and testing at partner institutions.

Students have access to e-books, scientific journals, and digital learning materials through digital libraries at the university, accessible at http://lib.ugm.ac.id. The Physics Department also provides special workspaces for doctoral students with each room accommodating 3-4 students in a 12.5 m^2 space intended for various activities such as studying literature, writing papers, and working on dissertations.

Based on the tour of the institution and laboratories (see above section **3.2** Funds and Equipment), the experts observe that PhD students are provided with an adequate research environment that allows them to appropriately carry out their research projects.

Criterion D 6 Funding

Evidence:

- Self-Assessment Report (SAR)
- Academic Manual Book for the PhD programme
- Study and examination regulations
- Module Handbook for the PhD programme
- University Website: https://ugm.ac.id/en/
- Curriculum Map of PhD-Phys
- Curriculum Structure and Contents of PhD-Phys
- Evidence external cooperation
- Discussions during the audit

Preliminary assessment and analysis of the experts:

There are scholarships for PhD students provided by the Directorate General of Higher Education, Research, and Technology of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, known as PMDSU funding, and scholarships from the Indonesian Endowment Fund for Education supported by the Ministry of Finance, referred to as LPDP funding. These scholarships cover tuition fees, living expenses, and research funds. For the year 2022, for example, seven scholarships from PMDSU were awarded and two scholarships from LPDP funding.

There are also scholarship programmes for research and publication costs, such as PDD (Pembiayaan Disertasi Doktoral) and RTA (Rekognisi Tugas Akhir). The faculty also provides financial assistance to students, including doctoral students, through the reduction of tuition fees, especially for those who have significant economic challenges. UGM provides

funding by reimbursing publication fees for each student once during their academic career, through the BPP (Academic Administration Bureau). The funding scheme for students from partner institutions is established in accordance with agreements.

The majority of doctoral students confirm that they have a scholarship. The expert group concludes that the university and state grants provide sufficient financial support for doctoral candidates and that the doctoral programme under review has adequate and sustainable funding.

Criterion D 7 Quality Assurance

Evidence:

- Self-Assessment Report (SAR)
- University Website: https://ugm.ac.id/en/
- Sample student survey questionnaire
- Results of student surveys
- Statistical data about the progress of studies
- Discussions during the audit

Preliminary assessment and analysis of the experts:
The academic book for the doctoral programme in Physics contains all regulations defining rights and responsibilities of doctoral candidates across various stages of their PhD time, including admission, supervision, evaluation, and completion requirements.

The PhD programme in Physics regularly gathers and analyses relevant data related to the progress of doctoral candidates. These data serve as critical performance indicators for evaluating and identifying areas for enhancement. The program uses educational quality improvement tools and surveys to evaluate the programme including all relevant stakeholders, as shown in the following table:

No	Quality Assurance tool	Frequency	Carried out through/person in charge	Aspects to be evaluated
1	EDoM (Evaluasi Dosen Mengajar/Teaching Lecturer Evaluation)	Every semester (by the end of each semester)	SIMASTER academic system	Focusing on one semester lecture performance from the student perspective, including: the efficient use of the class time, adherence to the syllabus, availability of teaching materials, lecturer expertise, discussion opportunities, alignment of assignments with the study workload, relevance of exam questions, and student understanding. The inputs and feedback are obtained through a closed-ended survey (quantitative) provided by the SIMASTER academic system and filled out by the students (see Appendix B.3.1).
2	Semester evaluation	Every semester (by the end of each semester)	TKS (Tim Koordinasi Semester/Semester Coordination Team)	Focusing on evaluating the one-semester teaching and learning process (lecture module content, delivery methods, and lecturer performance), adherence to quality standards and assess the general aspects of services provided by the study program from the student perspective, which have not been covered by the EDoM. Qualitative feedback is obtained through interviews with some students who serve as representatives (see **Section 5.1** and **Figure 5.4** of **Section 5.1.4**).
3	Monitoring and Evaluation (Mon-Ev) (see Section 6.1)	Bi-monthly, each student presents his/her research progress once per semester	DP-Phys	Focusing on monitoring the progress of student research to track their development, understand the milestones and potential challenges they may face, identify the kind of support required for students' research, and take proactive measures to prevent any delays in the research progress. This helps in identifying opportunities for improvement and ensures that the research stays on track. (see Appendix A.5.8)
4	Online Monitoring System (Si-Moni)	Twice per semester (before the semester and during the semester)	The head of DP-Phys via SIMASTER academic system	The program head reports to the faculty on teaching matters. **Before the semester**: ensure teaching materials (such as PLO and CO availability, lesson plans, clear schedules), teaching facility readiness (room cleanliness, equipment like whiteboards, erasers, markers, projectors, and access to Zoom, Google, and Learning Management System/LMS), and student communication platform (websites, SIMASTER academy system, and LMS). **During the semester**: monitor teaching progress and address any issues promptly to ensure classes run as planned until the semester ends (see Appendix A.5.5).
5	Internal Quality Audit (AMI)	Annually	Quality Assurance Unit (UJM) of the Faculty	Focusing on aligning quality assurance with Faculty Academic and Quality Documents, mapping the Study Program's readiness for (national and international) accreditation, ensuring the effective organization of program management, identifying quality improvement opportunities, and verifying any revisions that have been made in line with previous year's data for continuous quality improvement (see **Table 5.5** of **Section 5.1.4**).
6	External Quality Audit: BAN-PT	Every 5 year	National Accreditation Board for Higher Education (BAN-PT, *Badan Akreditasi Nasional Perguruan Tinggi https://www.banpt.or.id/*)	BAN-PT is the accrediting body authorized by the Ministry of Research, Technology, and Higher Education of the Republic of Indonesia. Its roles include conducting institutional accreditation, providing recommendations, and ensuring the adherence to quality assurance and national education standards. Accreditation is renewed every five years, and the current status is "Unggul BAN-PT" (Outstanding). Please see: https://fisika.fmipa.ugm.ac.id/sertifikat-akreditasi/

E Additional Documents

No additional documents needed.

F Comment of the Higher Education Institution (29.05.2024)

The following quotes the comment of the institution:

„ **Response 1.1**: As an effort to meet the expectations of stakeholders who require further studies at the master's and/or PhD levels in Geophysics, the process of proposing the establishment of the program has already begun, especially for master program. This involves preparing the academic manuscript and regulations, which outline the rationale, objectives, curriculum, and other important details needed for the approval of a new academic program. These documents will subsequently be submitted to the faculty and university senate for approval.

Response 1.1: To increase the BPP interest, BPP has a double degree program with Lung Hwa University, Taiwan to meet with the resources in the semiconductor industry.

Response 1.1: To balance the ratio of lecturers and student especially in BPG and incoming master in Geophysics, there are three new lecturers belong to PhD in Physics (one) and BPG (two) in 2023. And also, in May 2024 there is new lecturer recruitment dedicated for Geophysics to strengthen the opening of new master in Geophysics.

Response 1.3: We appreciate the assessment and suggestions provided by the assessor regarding criterion 1.3: curriculum. For your information, we would like to convey the following:

1. To enhance the English language and communication skills of BPG graduates, the study programs have already incorporated the following strategies into teaching and learning activities
    a) Integration of English Across the Curriculum by providing course materials and learning resources in English, conducting certain class sessions in English, and requiring presentations to be delivered in English.
    b) Inviting English-speaking alumni, professionals, and academics to give lectures and webinars, enabling students to practice listening and comprehension in real-world contexts.
    c) Assigning readings from scientific journals, articles, and books in English.
    d) Encouraging students to participate in internships, research projects, or

industry collaborations where English is the primary mode of communication. Our program collaborates with geophysics alumni to conduct guest lectures, and some of the guest lecture materials are strongly related to the industry and sometimes discuss technical aspects.

2. Regarding licensed software, we already have Petrel and Reveal, which are robust and sophisticated software for seismic exploration in industry standards.

With the introduction of new regulations for higher education curriculum No. 53/2023 (Permendikbudristek No 53 Year 2023), it provides an opportunity for the number of compulsory modules in the first two years to be adjusted soon. The changes begin with reviewing and assessing the existing curriculum structure so that essential courses, such as the "Inverse Method" course for geophysics students, are reconsidered in terms of their placement. They may transition from elective to compulsory or mandatory elective courses.

Response 3.2:-Our department has three research laboratories and one basic physics laboratory. Each research laboratory can upgrade their ‘expensive instrument’ every 3 years, i.e. in 2021 – Material Physics Lab, 2022 – Atomic Physics Lab and 2023 – Geophysics Lab, due to limited budget. University also has integrated modern facilities in Integrated Laboratory for Researching and Testing.

Response 4.2: The information regarding the student's GPA relative to the cohort is currently available, and the program studies conducts mapping/analysis at the end of each academic semester automatically by system. However, it is not yet included in the Diploma Supplement. This information is typically issued based on request because it requires specific details about the request, such as the purpose of the request and the scope of the information needed. In the future, the information regarding the student's GPA relative to the cohort will be added as part of the SKPI. The study program/department will discuss the placement of this information in with the related unit.“

G Summary: Expert recommendations (06.06.2024)

Taking into account the additional information and the comments given by UGM, the experts 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 Geophysics	With requirements for one year	-	30.09.2029
Ba Physics	With requirements for one year	-	30.09.2029
Ma Physics	With requirements for one year	-	30.09.2029
Doctoral Programme in Physics	With requirements for one year	-	30.09.2029

Requirements

For all degree programmes

A 1. (ASIIN 4.2) Ensure that the Diploma Supplement contains detailed information about the student's GPA relative to the cohort.

Recommendations

For the Bachelor's degree programme in Geophysics

E 1. (ASIIN 1.1) It is recommended to open a Master's programme in Geophysics.

E 2. (ASIIN 1.3) It is recommended that the Inverse Methods module be offered as a compulsory module.

E 3. (ASIIN 1.3) It is recommended that more English language training be provided in the courses, for example through presentations in English.

E 4. (ASIIN 1.3) It is recommended that students are better introduced to the use of industry-standard software by inviting guest lecturers, alumni and people from industry to contribute to these topics.

E 5. (ASIIN 2) It is recommended to regulate the time needed to work on the final thesis and to and ensure that it complies with the established 6 credits (9.96 ECTS).

For the Bachelor's degree programme in Physics

E 6. (ASIIN 1.3) It is recommended that the compulsory modules with related content in the third semester are properly distributed over the semesters to ensure that the core competence can be achieved by the students in the correct sequence and time.

For the Bachelor's degree programmes in Geophysics and in Physics

E 7. (ASIIN 3.2) It is recommended to continue the modernization of labs and equipment.

H Comment of the Technical Committees 11 Geosciences and 13- Physics

Technical Committee 11 – Geosciences (13.06.2024)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedures and follows the assessment of the auditors without changes.

The Technical Committee 11 – Geosciences recommends the award of the seals as follows:

Degree Programme	ASIIN Seal	Subject-specific label	Maximum duration of accreditation
Ba Geophysics	With requirements for one year	–	30.09.2029

Technical Committee 13 – Physics (13.06.2024)

Assessment and analysis for the award of the ASIIN seal:

The Technical Committee discusses the procedure, particularly E6. The TC wonders to what extent the government's guidelines for a free semester (MBKM, independent learning) stand in the way of restructuring the curriculum. They believe that there are ways to facilitate the MBKM by restructuring the curriculum so that it is not as compressed as it is now. In addition, students complained about this situation. Therefore, they propose to change this recommendation to a requirement (A1).

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

Requirements

For all degree programmes

A 1. (ASIIN 4.2) Ensure that the Diploma Supplement contains detailed information about the student's GPA relative to the cohort.

For the Bachelor's degree programmes in Physics

A 2. (ASIIN 1.3) The compulsory modules in the third semester with related content need to be properly distributed over the semesters, in order to make sure that the core competence can be achieved by the students with proper sequence and time.

Recommendations

For the Bachelor's degree programme in Geophysics

E 1. (ASIIN 1.1) It is recommended to open a Master's programme in Geophysics.
E 2. (ASIIN 1.3) It is recommended that the Inverse Methods module be offered as a compulsory module.
E 3. (ASIIN 1.3) It is recommended that more English language training be provided in the courses, for example through presentations in English.
E 4. (ASIIN 1.3) It is recommended that students are better introduced to the use of industry-standard software by inviting guest lecturers, alumni and people from industry to contribute to these topics.
E 5. (ASIIN 2) It is recommended to regulate the time needed to work on the final thesis and to and ensure that it complies with the established 6 credits (9.96 ECTS).

For the Bachelor's degree programmes in Geophysics and in Physics

E 6. (ASIIN 3.2) It is recommended to continue the modernization of labs and equipment.

I Decision of the Accreditation Commission (28.06.2024)

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

The Accreditation Commission discusses the procedures and follows the assessment of the auditors and the changes proposed by the Technical Committee 13.

The Accreditation Commission decides to award the following seals:

Degree Programme	ASIIN-seal	Subject-specific label	Maximum duration of accreditation
Ba Geophysics	With requirements for one year	-	30.09.2029
Ba Physics	With requirements for one year	-	30.09.2029
Ma Physics	With requirements for one year	-	30.09.2029
Doctoral Programme in Physics	With requirements for one year	-	30.09.2029

Requirements

For all degree programmes

A 1. (ASIIN 4.2) Ensure that the Diploma Supplement contains detailed information about the student's GPA relative to the cohort.

For Bachelor’s degree programme in Physics

A 2. (ASIIN 1.3) The compulsory modules in the third semester with related content need to be properly distributed over the semesters, in order to make sure that the core competences can be achieved by the students with proper sequence and time.

Recommendations

For the Bachelor’s degree programme in Geophysics

E 1. (ASIIN 1.1) It is recommended to open a Master's programme in Geophysics.
E 2. (ASIIN 1.3) It is recommended that the Inverse Methods module be offered as a compulsory module.
E 3. (ASIIN 1.3) It is recommended that more English language training be provided in the courses, for example through presentations in English.
E 4. (ASIIN 1.3) It is recommended that students are better introduced to the use of industry-standard software by inviting guest lecturers, alumni and people from industry to contribute to these topics.
E 5. (ASIIN 2) It is recommended to regulate the time needed to work on the final thesis and to and ensure that it complies with the established 6 credits (9.96 ECTS).

For the Bachelor's degree programmes in Geophysics and in Physics

E 6. (ASIIN 3.2) It is recommended to continue the modernization of labs and equipment.

Appendix: Programme Learning Outcomes and Curricula

According to the curriculum guidebook, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the **Bachelor's degree in Geophysics (BPG)**:

Program Education Objectives (PEO):

"**PEO 1** The realization of human beings who are good in intellect and morality.

PEO 2 The realization of a geophysical knowledge society that actively participates in civil society.

PEO 3 Mastering the leading science and technology in the field of Geophysics.

PEO 4 Have a high commitment to various social roles in applying science and technology.

PEO 5 Take an active role in the global sustainable development movement (memayu hayuning bawono langgeng)."

Program Learning Outcomes (PLO):

"**PLO 1 Good Attitude**: Graduates are honest, discipline, curious, critical, confident, independent, emotionally mature, cooperative, and trustworthy. Upholding norms, values, morals, religion, general and professional ethics, and actively playing a role in the global sustainable development movement and behaving professionally,

PLO 2 Proficiency of knowledge: Graduates able to apply basic science (mathematics, physics, chemistry, biology, geology), and geophysics in general and its relation to other sciences such as geology, geodesy, geochemistry, geography, computing and information technology.

PLO 3 Operational and comprehensive skills: Graduates able to apply all geophysical methods (seismic, gravitational, magnetic, electrical, electromagnetic, and thermal methods) for energy exploration (e.g., oil and gas, coal, geothermal), mining materials (e.g.: iron, copper, gold, silver, tin) and groundwater and disaster mitigation.

PLO 4 Application and analytical skills: Graduates are able to carry out and manage a geophysical survey which includes scientific steps in the acquisition, processing and interpretation of data for natural resource exploration both for energy (e.g. oil and gas, coal, for energy exploration (e.g. oil and natural gas, coal, geothermal), mining materials (e.g. iron, copper, gold, silver, tin) as well as groundwater and disaster mitigation.

PLO 5 Synthesis and Evaluation Skills: Graduates are able to interpret geophysical data in the form of integrated forward and inverse problems that have ambiguous characters, carry out interpretations by making models and/or solving simple forward and inverse problems and advanced in using computers for both purposes solving geophysical problems and for communication and internet access.

PLO 6 Managerial skills and self-development: Graduates able to update their competencies, by lifelong learning in line with the latest geophysical conditions to compete nationally and internationally by upholding UGM values (Pancasila: Divinity, Humanity, Unity, Democracy, Justice, and Science: universality, objectivity, freedom, respect for reality and truth)."

According to the curriculum guidebook, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the **Bachelor's degree in Physics (BPP)**:

Program Education Objectives (PEO):

"**PEO-1** Graduates who believe and fear God Almighty, have high integrity and personality, are open and responsive to changes, scientific advances and problems faced by society, especially those related to their fields of expertise, and international quality.

PEO-2 Graduates who have superior abilities to be able to study at an advanced level at national and international levels.

PEO-3 Graduates who are knowledgeable and skilled personnel for centers of excellence in education, research and community service based on physics and its applications which are known and recognized at the national and international levels.

PEO-4 Graduates who are competent, qualified, with national and international insight, and able to work together to encourage the growth of community welfare and the advancement of world civilization."

Program Learning Outcomes (PLO):

Aspects	Code	Program Learning Outcomes (PLO)
Attitude	PLO 1	Have faith and fear of God Almighty, apply good morals, ethics, initiative, and responsibility in completing their duties.
Knowledge	PLO 2	Able to explain theoretical concepts and principles of classical and modern physics, and able to apply basic concepts of physics and related mathematical methods in finding solutions to physical problems.
General Skills	PLO 3	Able to communicate the results of problem studies and physical behavior both in writing and verbally, as well as being able to lead and collaborate at various levels of roles in a team.
Special skill	PLO 4	Able to design and carry out experiments/theoretical reviews, able to identify a physical problem based on the results of observations and experiments, and able to operate related technologies.
Long Life Learning	PLO 5	Able to analyze various alternative solutions to physical problems and conclude them for appropriate decision making, both in familiar and new problems.

According to the curriculum guidebook, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the **Master's degree in Physics (MPP)**:

Program Education Objectives (PEO):

"**PEO-1** Mastering various fields of Physics studies that allow him/her to expand and/or deepen a field of advanced physics studies.

PEO-2 Mastering in depth one of the disciplines of Physics to be able to produce innovative and tested work.

PEO-3 Able to solve complex problems in physics through a multidisciplinary approach.

PEO-4 Able to plan and manage research properly so that it can produce research works that have the potential to be applied and are worthy of publication in reputable scientific journals at the national or international level."

Program Learning Outcomes (PLO):

"**PLO 1. ATTITUDES AND ETHICS**

Have a commendable attitude, and ethics as a scientist. These commendable attitudes and ethics include:

1. Be devoted to The Almighty God and be able to show a religious attitude.
2. Upholding human values in performing duties based on religion, morals, and ethics.
3. Contribute to improving the quality of life in society and the progress of civilization based on Pancasila values.

4. Act as citizens who are proud and love the homeland, have nationalism and a sense of responsibility to the nation.
5. Respect the diversity of cultures, religions, and beliefs, as well as the original opinions or findings of others.
6. Work together and have social sensitivity and concern for the community and the environment.
7. Obey the law and discipline in social and state life.
8. Internalizing academic values, norms, and ethics.
9. Demonstrate an attitude of responsibility for work in their field of expertise independently.
10. Internalizing the spirit of independence, struggle, and entrepreneurship.

PLO 2. PROFESSIONALISM

Have the professional ability of a scientist. These professional abilities include:

1. Able to make decisions in the context of solving problems in the development of science and technology and apply humanities values based on analytical or experimental studies of information and data.
2. Able to manage, develop and maintain networks with colleagues, peers within the institution and the wider research community.
3. Able to increase learning capacity independently.
4. Able to increase the capacity to work together in teamwork or project work.
5. Can adapt to failures, and difficulties that arise unexpectedly in conducting research or development projects.
6. Able to conduct professional activities outside their field of specialization, using knowledge of physical sciences, scientific methods and problem-solving strategies.

PLO 3. CUTTING-EDGE PHYSICS KNOWLEDGE

To further master the knowledge of classical and modern physics theory, and its relation to other disciplines, and its association with other disciplines, and having mastered one area of advanced physics specialization that allows him to keep up with the latest international research developments.

PLO 4. MATHEMATICAL AND COMPUTATIONAL

Mastering various mathematical disciplines related to a field of advanced physics and being able to develop physical models using various mathematical and computational devices with an inter or multidisciplinary approach to solving problems related to an advanced field of physical science.

PLO 5. RESEARCH

Able to plan, manage and conduct experiments and conclude the results, or be able to create and use modeling and simulation based on basic physics rules to study and solve a problem in a scientific field of Physics or Applied Physics that produces tested and innovative models, methods, or theories.

PLO 6. APPLICATION AND PROBLEM SOLVING

Able to analyze, synthesize, formulate problems, and solve problems comprehensively in one of fields of Advanced Physics, through experimental or theoretical research, then can classify and draw conclusions of their findings for the development of science and technology.

PLO 7. COMMUNICATION AND DISSEMINATION

Able to communicate and discuss orally and in writing the results of studies, and their mastery of various problems in the field of physical sciences and other related fields in Indonesian and English, as well as being able to document and store the results of these studies and masteries, as well as publish them in scientific forums or reputable scientific journals. These communication skills include:

1. Able to develop logical, critical, systematic, and creative thinking through scientific research, the creation of designs or works of art in the fields of science and technology that can be applied to humanities values in accordance with their fields of expertise, compile scientific conceptions and study results based on scientific rules, procedures, and ethics in the form of a thesis or other equivalent forms, and uploaded on the college website, as well as papers that have been published in accredited scientific journals or accepted in international journals;
2. Able to compile ideas, thoughts, and scientific arguments responsibly and based on academic ethics, and communicate them through the media to academic community and wider community.
3. Able to document, store, secure, and rediscover research data to ensure validity and prevent plagiarism."

According to the curriculum guidebook, the following **objectives** and **learning outcomes (intended qualifications profile)** shall be achieved by the **Doctoral programme in Physics (PhD in Physics)**:

Program Education Objectives (PEO):

PEO 1	Cultivate doctoral graduates in Physics who are dedicated to God Almighty, characterized by their unwavering integrity and commitment.
PEO 2	Advances the field of physics by incorporating the latest, most advanced, and cutting-edge physics models to address scientific and technological challenges within the relevant domain of physics.
PEO 3	Foster increased collaboration and partnerships in the Tri Dharma of Higher Education, both at the national and international levels.
PEO 4	Generate and validate original scientific contributions that deepen or expand the realm of physics through research that embraces an inter-, multi-, or interdisciplinary approach.

Program Learning Outcomes (PLO):

"**PLO 1. ATTITUDES AND VALUES**

Demonstrating commendable attitudes and ethical conduct as a scientist, including:

1. Devotion to God Almighty and the demonstration of religious values.
2. Upholding human values in the fulfillment of duties rooted in religion, morality, and ethics.
3. Contributing to enhancing the quality of life within society, the nation, the state, and the advancement of civilization in line with Pancasila principles.
4. Embracing a sense of pride and love for the motherland, fostering nationalism, and exhibiting a sense of responsibility towards the state and nation.
5. Respecting cultural diversity, differing viewpoints, religions, and beliefs, as well as the original ideas and discoveries of others.
6. Collaborating and possessing social awareness and concern for the community and the environment.
7. Adhering to the law and maintaining discipline in social and civic life.
8. Internalizing academic values, norms, and ethics.
9. Demonstrating a sense of responsibility for work within their field of expertise, working independently.
10. Embracing the spirit of independence, resilience, and entrepreneurship.

PLO 2. PROFESSIONAL ATTITUDE

1. Proficient in communicating these findings effectively, either through mass media or direct engagement with the public.

2. Able to exhibit academic leadership in the management, growth, and mentoring of resources and organizations within their purview.

3. Skilled at cultivating and sustaining collegial and peer relationships within their immediate environment and through collaborative networks with research communities beyond their institution.

4. Adaptable to addressing setbacks and unforeseen challenges that may arise during the course of research or development projects.

PLO 3. PROFICIENCY IN PHYSICS KNOWLEDGE

Possessing a profound understanding of the scientific philosophy of physics and a comprehensive mastery of the latest and cutting-edge developments, as well as leading issues, in the application of multidisciplinary theories pertinent to the advancement of physics science.

PLO 4. PROFICIENCY IN SPECIFIC SUBFIELDS OF PHYSICS

Acquiring expertise in the scientific progress of a particular subfield of physics to the level of the most recent advancements (state of the art).

PLO 5. RESEARCH AND PROBLEM-SOLVING CAPABILITIES

1. Capable of discovering or formulating innovative scientific theories, concepts, and ideas, while contributing to the progress and practical application of science and technology, while incorporating human values within their areas of expertise. This contribution is achieved through the production of scientifically rigorous research founded on methodologies rooted in logic, critical thinking, systematic analysis, and creativity.

2. Proficient in selecting research topics that are relevant, contemporary, cutting-edge, and hold potential benefits for humanity. This selection is made through an interdisciplinary, multidisciplinary, or transdisciplinary approach, aimed at developing solutions in the realms of science, technology, art, or society, grounded in a comprehensive assessment of available internal and external resources.

3. Skilled in crafting a research roadmap that integrates an interdisciplinary, multidisciplinary, or transdisciplinary approach, based on a comprehensive understanding of the primary research objectives and their connections to broader objectives.

PLO 6. COMMUNICATION SKILLS AND PUBLICATION SKILLS

1. Capable of effectively communicating and articulating the findings of their research, both orally and in written form.

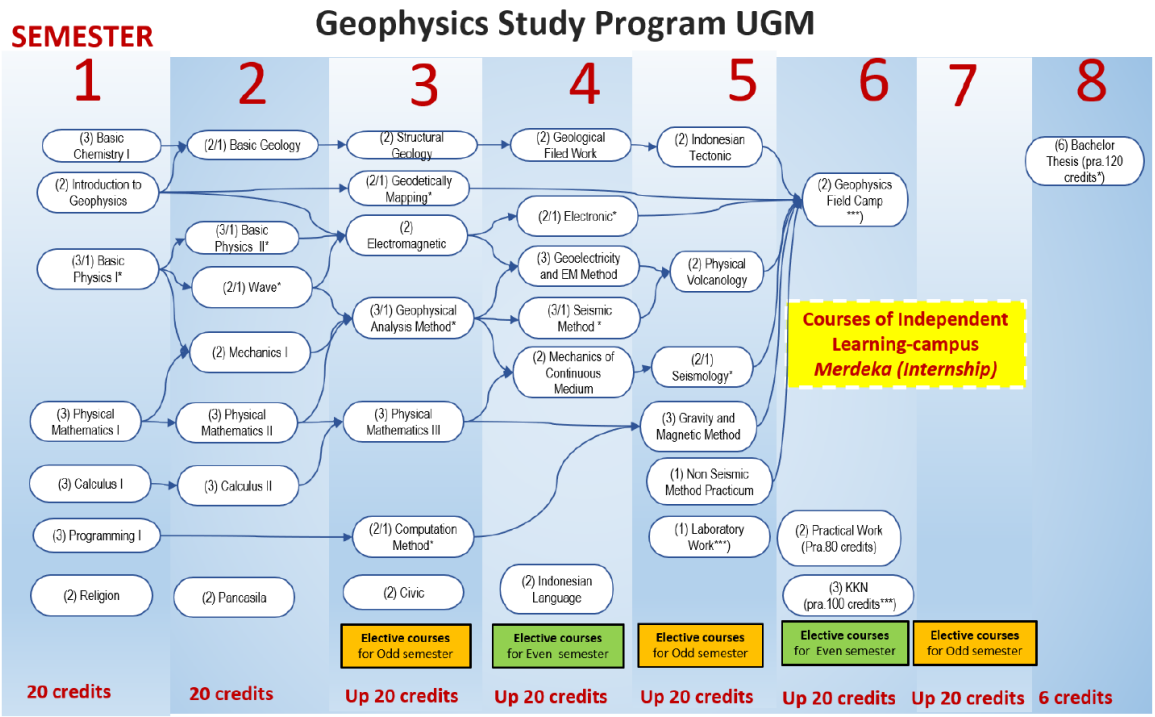
2. Proficient in the development of interdisciplinary, multidisciplinary, or transdisciplinary research, which includes theoretical investigations and/or experimental work across the domains of science, technology, art, and innovation.

This work is presented in the form of a comprehensive dissertation and papers published in reputable international journals.

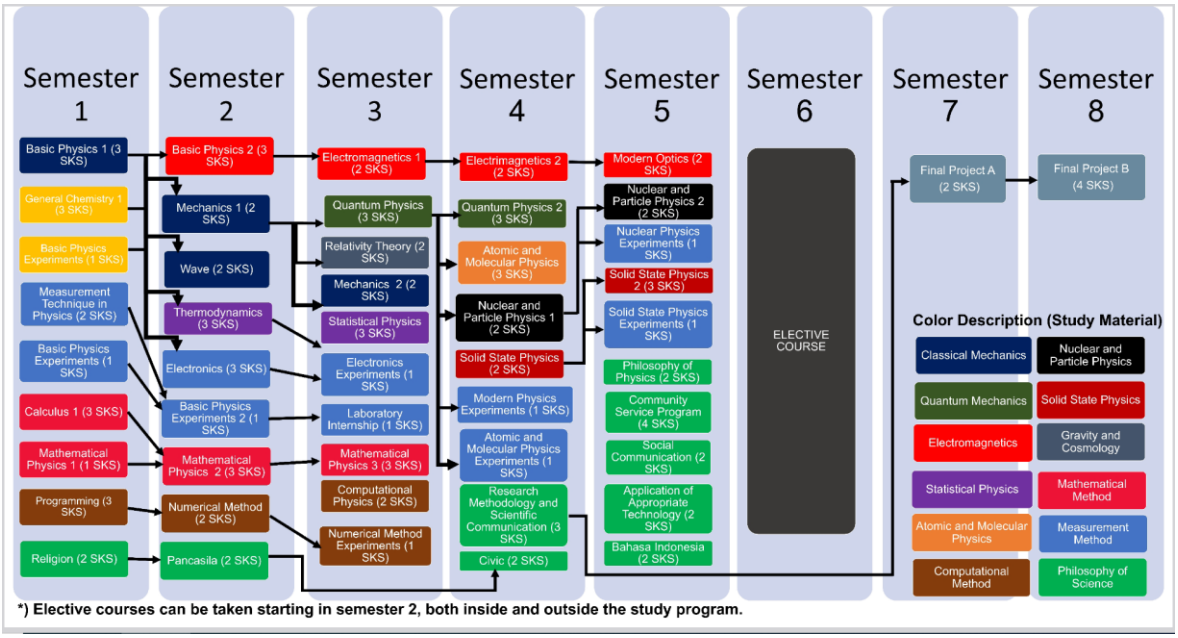
3. Skilled in managing research data and information, encompassing storage, auditing, security, and retrieval processes for research outcomes within their purview."

The following **curriculum** is presented:

Bachelor's programme in Geophysics



Bachelor's programme in Physics



Master's programme in Physics

a. List of Compulsory Courses

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd/Even	MFF 5001	Research Methodology	2	3.32
Odd/Even	MFF 6001	Thesis	8	13.28
Odd/Even	MFF 5009	Mathematical Physics	3	4.98
Odd/Even	MFF 5033	Quantum Mechanics	3	4.98
Odd/Even	MFF 5051	Statistical Mechanics	3	4.98
Odd/Even	MFF 5401	Classical Mechanics	3	4.98
Odd/Even	MFF 5411	Electrodynamics	3	4.98
Total			25	41.5

b. List of Elective Courses by Material Physics Expertise Group

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd	MFF 5071	Physics of Instrumentation	3	4.98
Odd	MFF 5073	Data Acquisition System	3	4.98
Odd	MFF 5601	Soft Condensed Matter Physics	3	4.98
Odd	MFF 5611	Crystal Physics	3	4.98
Odd	MFF 5617	Nanophysics	2	3.32
Odd	MFF 5701	Condensed Matter Physics	3	4.98
Odd	MFF 5713	Material Design Computational	3	4.98
Odd	MFF 5855	Spintronics	3	4.98
Even	MFF 5412	Applied Electromagnetics	3	4.98
Even	MFF 5710	Physics of Electronics Material	3	4.98
Even	MFF 5750	Condensed Matter Magnetism	3	4.98
Even	MFF 5780	Condensed Matter Optics	3	4.98
Even	MFF 5814	Material Characterization Methods	3	4.98
Even	MFF 5870	Biomaterial Physics	2	3.32
Total			40	66.4

c. List of Elective Courses by Theoretical and Computational Physics Expertise Group

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd	MFF 5003	Stochastics Process for Physicist	2	3.32
Odd	MFF 5005	Group Theory for Physicist	2	3.32
Odd	MFF 5007	Topology and Geometry for Physicist	2	3.32

Odd	MFF 5027	Computational Physics	3	4.98
Odd	MFF 5039	Special Topics in Computational Physics	3	4.98
Odd	MFF 5041	General Theory of Relativity	3	4.98
Odd	MFF 5115	Quantum Field Theory	3	4.98
Odd	MFF 5211	Nuclear Physics	3	4.98
Odd	MFF 5951	Astrophysics	3	4.98
Even	MFF 5002	Special Topics in Theoretical and Mathematical Physics	3	4.98
Even	MFF 5010	Logic and Symbolic Computation in Physics	2	3.32
Even	MFF 5022	Functional Analysis for Physicist	2	3.32
Even	MFF 5032	Computation of Celestial Body Mechanics	2	3.32
Even	MFF 5034	Advanced Quantum Mechanics	3	4.98
Even	MFF 5056	Fractal and Chaos in Physics	2	3.32
Even	MFF 5114	Particle Physics	3	4.98
Even	MFF 5404	Fluid Mechanics	3	4.98
Even	MFF 5514	Condensed Matter Electronics Structure Computation	3	4.98
Even	MFF 5982	Cosmology	3	4.98
Total			50	83

. List of Elective Courses by Applied Physics Expertise Group

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd	MFF 5061	Methods of Experimental Physics	3	4.98
Odd	MFF 5281	Radiation Physics	3	4.98
Odd	MFF 5321	Atomic and Molecular Spectroscopy	2	3.32
Odd	MFF 5431	Theoretical Acoustics	2	3.32
Odd	MFF 5841	Microwave Theory and Applications	2	3.32
Odd	MFF 5873	Digital Imaging	3	4.98
Odd	MFF 5811	Non-Destructive Test	2	3.32
Odd	MFF 5875	Three-Dimensional Imaging	2	3.32
Even	MFF 5423	Laser Spectroscopy	2	3.32
Even	MFF 5424	Biomedical Optics	2	3.32
Even	MFF 5426	Laser Physics	2	3.32
Even	MFF 5434	Photoacoustic and Photothermal	2	3.32
Even	MFF 5872	Magnetic Resonance in Medical Physics	2	3.32
Even	MFF 5876	Imaging Methods in Physics	3	4.98

Even	MFF 5878	Image Reconstruction	3	4.98
Total			35	58.1

e. List of Elective Courses by Geoscience Expertise Group

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd	MFF 5073	Data Acquisition System	3	4.98
Odd	MFF 5831	Advanced Continuum Mechanics	3	4.98
Odd	MFF 5881	Advanced Geothermal Exploration	2	3.32
Odd	MFF 5891	Disaster Mitigation	2	3.32
Odd	MFF 5911	Physics of Earth	3	4.98
Odd	MFF 5931	Electromagnetic Survey	3	4.98
Odd	MFF 5933	Geophysics Inversion	2	3.32
Odd	MFF 5935	Quantitative Seismology	3	4.98
Odd	MFF 5937	Petroleum Exploration	2	3.32
Odd	MFF 5939	Geoscience Field Trip	2	3.32
Odd	MFF 5913	Geotechnical Engineering	2	3.32
Odd	MFF 5915	Geoscience Frontiers	2	3.32
Odd	MFF 5925	Analysis and Visualization of Geoscience Data	2	3.32
Even	MFF 5052	Time Series Analysis	3	4.98
Even	MFF 5910	Physical Geology	2	3.32
Even	MFF 5916	Advanced Rock Physics	2	3.32
Even	MFF 5918	Vulcanology	2	3.32
Even	MFF 5924	Advanced Environmental Geophysics	2	3.32
Even	MFF 5930	Advanced Seismology	3	4.98
Even	MFF 5932	Potential Field Theory	3	4.98
Even	MFF 5934	Non-Electromagnetics Survey	2	3.32
Even	MFF 5936	Mineral Exploration	2	3.32
Even	MFF 5070	Data Science for Geosciences	2	3.32
Even	MFF 5880	Advanced Seismic Imaging	2	3.32
Total			56	92.96

f. List of Elective Courses by Research Program

Semester	Code	Courses	Credits	
			SKS	ECTS
Odd/Even	MFF 6011	Research I	3	4.98
Odd/Even	MFF 6012	Research II	3	4.98
Odd/Even	MFF 6013	Research III	3	4.98
Odd/Even	MFF 6021	National Seminar	3	4.98

Odd/Even	MFF 6022	International Seminar	4	6.64
Odd/Even	MFF 6031	Scientific Publications A	4	6.64
Odd/Even	MFF 6032	Scientific Publications B	5	8.3
Total			25	41.5

Doctoral programme in Physics (PhD in Physics)

A. List of Compulsory Courses

KBK	Code	Credits	ECTS	Course Name
Compulsory Courses	MFF 7001	3	5.43	Research Methodology and Writing Scientific Papers
	MFF 8001	34	144.84	Dissertation
	MFF 8002	40	170.4	Dissertation by Research

B. List of Elective Courses

KBK	Code	Credits	ECTS	Course Name
Applied Physics	MFF 7430	3	5,43	Acoustics
	MFF 7301	3	5,43	Laser Spectroscopy
	MFF 7302	3	5,43	Spectroscopic Instrumentation
	MFF 7872	3	5,43	3D Imaging Specific Topics
	MFF 7871	3	5,43	Medical Physics
	MFF 7303	3	5,43	Atomic and Molecular Spectroscopy
	MFF 7873	3	5,43	Physics Imaging Instrumentation
	MFF 7874	3	5,43	Undamaged Test Special Topics
Ethical and Computational Theoritics Physics	MFF 7021	3	5,43	Topics Specialized in Stochastic Processes for Physicists
	MFF 7111	3	5,43	Special Topics in Particle and Field Physics
	MFF 7971	3	5,43	Special topics in Astrophysics
	MFF 7042	3	5,43	Special Topics in the Theory of Relativity
	MFF 7023	3	5,43	Specific topics in Functional Analysis for Physics
	MFF 7025	3	5,43	Specialized Topics in Topology and Differential Geometry for Physicists
	MFF 7027	3	5,43	Special Topics of Stochastic Computational Physics
	MFF 7026	3	5,43	Computational Physics-Specific Topics
Functional Material Physics	MFF 7600	3	5,43	Physics of Compressed Substances
	MFF 7750	3	5,43	Material Electromagnetics
	MFF 7810	3	5,43	Special Topics in Sensor Systems
	MFF 7811	3	5,43	Special Topics in Materials Physics
	MFF 7813	3	5,43	Special Topics in Material Computational Physics

KBK	Code	Credits	ECTS	Course Name
	MFF 7070	3	5,43	Special topics in Instrumentation Physics
	MFF 7814	3	5,43	Functional Materials
Geosciences	MFF 7930	3	5,43	Digital Signal Analysis
	MFF 7931	3	5,43	Deformation and Gravity
	MFF 7932	3	5,43	Geodynamics-Specific Topics
	MFF 7933	3	5,43	Inversion Method Specific Topics
	MFF 7911	3	5,43	Advanced Quantitative Seismology
	MFF 7912	3	5,43	Seismology-Specific Topics
	MFF 7913	3	5,43	Earthquake Hazard Analysis
	MFF 7934	3	5,43	Rock Physics Special Topics
	MFF 7914	3	5,43	Microseismic Analysis
	MFF 7915	3	5,43	Computational Seismology
	MFF 7935	3	5,43	Advanced Volcano Physics
	MFF 7400	3	5,43	Electromagnetics Special Topics
	MFF 7916	3	5,43	Geothermal-Specific Topics
	MFF 7917	3	5,43	Geoelectric Method Special Topics
	MFF 7918	3	5,43	Geology Special Topics
	MFF 7901	3	5,43	Geography-Specific Topics
	MFF 7919	3	5,43	Special Topics of Geophysical Numerical Methods