Assessment plan for the curriculum of the Bachelor's degree programme in Applied Physics 2025-2026

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Date approval Faculty Board:

1. Vision on assessment

Objectives
The vision behind the Applied Physics Bachelor's degree programme is to organize and facilitate the teaching and training of the next generation of innovative applied physicists. Its aim is to provide students with a solid understanding of the workings of nature and to offer them the tools and techniques to apply this knowledge towards new designs. This is done by providing them with profound knowledge of general physics subjects, training them in performing scientific research and product and process design, and providing them with general academic skills. Independent and critical thinking, an open mind, problem solving eagerness, skills in clear writing and exposition, and a dedication to Applied Physics both as an academic discipline and as a field that has strong connections to adjacent scientific disciplines and societal developments – these are important general objectives of the programme.

Assessment vision statement:

- The assessment guides and evaluates student learning in a diverse manner, with a focus on applied physics content knowledge and relevant skills including problem-solving, group work and applied physics practicals.
- The assessment stimulates students to adopt an active learning stance and to learn from their mistakes, by combining formative aspects at various stages and a summative assessment.
- The assessment equips students with an applied physics perspective that models relevant phenomena and studies and designs possible applications, and in this way prepares students for a future career or further study.

2. Assessment guidelines

Guidelines for assessment quality:

- The BSc programme consists of 165 ECTS worth of courses and a 15 ECTS research project. There are four 10-ECTS courses in the first two years of the programme, all other courses are 5 ECTS.
- The programme offers a variety of different assessment methods, assessing different learning outcomes and skills. The course assessment scheme can be found on Brightspace and Ocasys from the start of the course, and cannot be changed during the course (unless given explicit permission by the Board of Examiners).

- The majority of courses are assessed with an individual, written exam at the end of the course. A number of these courses have intermediate assessment moments as well, consisting of e.g. midterm exams or homework assignments, that contribute a fraction to the final grade.
- The 10-ECTS courses in the first year of the programme have a practical assignment as well, that needs to be completed with a pass grade before the full course can be passed.
- To facilitate preparation by the students for the final exam, a mock exam (for example an exam from a previous year) must be available, at least two weeks prior to the exam.
- A clear and explicit answer key for the exam is drawn up by the course coordinator to ensure the transparency and fairness of the grading process.

- Most resits of these courses consist of a single, individual, written exam. The examiner can opt for an oral exam in case there are very few students attending a resit. These are graded using the dedicated oral exam grading form and an independent observer (preferably the preassigned second examiner) must be present during the full exam. At the beginning of the exam, the student should be informed of the topics to be examined.

- Next to the courses with individual assessment, the programme also contains courses that are based on group work, e.g. practical or project-based courses. In these cases, the course grade is determined by presentations of the students as well as the final report that is handed in.

- Clear and explicit rubrics are available that facilitate the grading of the project as well as the feedback to students.

- The 15-ECTS research project at the end of the programme takes place in one of the research groups and supervised by an examiner of the programme.
- Regular progress meetings (at least every week) with the (daily) supervisor will take place, in which the student will be given feedback and instructions on the day-to-day research. Progress meetings (at least every four weeks) with the supervisor should take place, in which the students will be given clear feedback on their progress.
- The examiner should provide feedback on at least one full draft version of the thesis, provided the student meets the agreed deadline for handing in the full draft.
- To ensure standardized and fair grading, the project is assessed by the examiner and a second examiner from another research unit than the first supervisor.
- All written assignments must be checked for plagiarism before grading.
- All assessment and feedback, final and day-to-day, is provided in English to prepare students for further study and a future career with an international job market.

3. Learning outcomes of the degree programme

Learning Outcome: *At the end of the programme, the graduate …*	
A. Generic learning outcomes - Knowledge	
A1	Bachelor's graduates have general knowledge of the foundations and history of mathematics, natural sciences and technology, in particular those of Applied Physics.
A2	Bachelor's graduates have mastered the basic concepts of their own discipline (see Appendix 1.1 for further specification) and are familiar with the interrelationships of these concepts within Applied Physics as well as with other disciplines.
A3	Bachelor's graduates have in-depth knowledge of several contemporary topics within Applied Physics.
A4	Bachelor's graduates are familiar with the quantitative character of the fields of mathematics and natural sciences and have an understanding of the methods used in these fields, and particularly within Applied Physics, including computer-aided methods.
A5	Bachelor's graduates have sufficient knowledge and understanding of mathematics and natural sciences to successfully complete a follow-up Master's degree programme in Applied Physics.
A6	Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences, and act accordingly.
B. Generic learning outcomes - Skills	
B1	(Research) Bachelor's graduates are able to draw up a research question, design, plan and conduct research and report on it independently with an appropriate degree of supervision. Bachelor's graduates are able to evaluate the value and limitations of their research and assess its applicability outside their own field.
B2	(Designing and Modelling) Bachelor's graduates are able to translate a physics problem, in particular a design problem, into a plan of approach and - taking into account the requirements of the client and/or practical boundary conditions - find a solution.
B3	(Gathering information) Bachelor's graduates are able to gather relevant information using modern means of communication and to critically interpret this information.
B4	(Collaborating) Bachelor's graduates are able to collaborate in teams on technical-scientific problems.
B5	(Communicating) Bachelor's graduates are able to communicate in English, both orally and in writing, in academic and professional contexts, with both colleagues and others. They are familiar with the relevant means of communication.
B6	(Reflecting) Bachelor's graduates are able to assess their own actions and those of others in a natural sciences context, bearing in mind the social/societal and ethical aspects.
B7	(Learning skills) Bachelor's graduates are able to apply learning skills that enable them to pursue a follow-up degree and acquire knowledge in new fields with a high level of autonomy.

B8	Additional subject-specific skills are listed in Appendix 2.
Appendix 1: Degree programme-specific learning outcomes - Basic Knowledge The Bachelor's graduate in Applied Physics has:	
1.1	Knowledge of the most important subjects in the field of a) Classical and Relativistic Mechanics b) Electromagnetism c) Quantum Physics d) Thermodynamics e) Statistical Physics f) Wave phenomena, Oscillations and Optics g) Structure and Properties of Materials h) Calculus, Linear Algebra and Numerical Mathematics
1.2	Knowledge of a) Principles of design b) Continuum Mechanics
Appendix 2: Degree programme-specific learning outcomes - Skills The Bachelor's graduate in Applied Physics is able to:	
2.1	estimate the orders of magnitude of various physical processes;
2.2	use specific software, such as a programming language or a (symbolic) software package;
2.3	measure mechanical, electric, magnetic and optical properties of materials, while taking into account safety and environmental issues;
2.4	apply insights in the fundamental workings of nature for science-based design.

4. Overview of assessment methods, test moments for course units, and examiners

The abbreviations for the relevant teaching methods are explained in the legend of the table. Examples of assessment methods include:

- *Written Exam (WE)*
- *Midterm (MT)*
- *Multiple Choice (MC)*
- *Oral Exam (OR)*
- *Report (R)*
- *Presentation (P)*
- *Practical Work (PR)*
- *Assignment (AST)*

Year 1

Year	Period	Course	EC	Assessment methods	Incl. formative assessment?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
1	1	Mechanics and Relativity (WBPH001-10)	10	WE, MT, R	Yes	continuous assessment, exam week	P.D. Meerburg	D. Roest
1	1A	Calculus 1 (for Physics) (WBPH057-05)	5	AST, WE	Yes	continuous assessment, exam week	T.F. Görbe	H. Jardon Kojakhmetov
1	1A	Physics Lab: Skills (WBPH077-05)	5	WE, R	Yes	continuous assessment, exam week	J.S. Blijleven	R.J.H. Klein-Douwel
1	1B	Calculus 2 (for Physics) (WBPH058-05)	5	AST, WE	Yes	continuous assessment, exam week	T.F. Görbe	H. Waalkens
1	1B	Physics of Modern Technology (WBPH027-05)	5	WE, P	Yes	exam week	C.H. van der Wal	A. Giuntoli
1	2	Electricity and Magnetism (WBPH033-10)	10	PR, WE	Yes	continuous assessment, exam week	M.S. Pchenitchnikov	J. Aalbers
1	2A	Computational methods 1 (WBPH064-05)	5	WE, MT	Yes	continuous assessment	J. Slawinska	P.R. Onck
1	2A	Linear Algebra (for Physics) (WBPH054-05)	5	AST, WE, PR	Yes	continuous assessment, exam week	M. Mendez	D. Boer
1	2B	Differential Equations (for Physics) (WBPH089-05)	5	AST, WE	Yes	continuous assessment, exam week	E. Dimastrogiovanni	G. Palasantzas
1	2B	Physics Lab: Design Project	5	AST, P, R,	Yes	continuous assessment,	J.S. Blijleven	R.J.H. Klein-Douwel

Year	Period	Course	EC	Assessment methods	Incl. formative assessment?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
		(WBPH075-05)		PR		midterm, exam week		

Year 2

Year	Period	Course	EC	Assessment methods	Incl. formative assessment?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
2	1	Thermal Physics (WBPH002-10)	10	WE, MT	Yes	mid-term, exam week	G. Palasantzas	L.J.A. Koster
2	1A	Computational methods 2 (WBPH065-05)	5	AST	Yes	continuous assessment	M. Kavatsyuk	J.W. Brijan
2	1A	Quantum Physics 1 (WBPH014-05)	5	AST, WE	Yes	continuous assessment, exam week	M.H. Diniz Guimaraes	D. Roest
2	1B	Materials Science and Engineering (WBPH071-05)	5	WE, P, PR, AST	Yes	continuous assessment	B.J. Kooi	TBA
2	1B	Waves and Optics (WBPH032-05)	5	AST, R	Yes	continuous assessment	S. Hoekstra	A.K. Biegun
2	2	From Atoms to Solids (WBPH085-10)	10	WE, MT	Yes	continuous assessment, exam week	A. Borschevsky	T.A. Schlathölter
2	2A	Applied Physics & Society: Ethical & Professional Aspects (WBPH082-05)	5	MC, AST, WE, P, R	Yes	continuous assessment	M. van Genne	J. Zevenberg
2	2A	Fundamentals of Electronics (WBPH070-05)	5	AST, PR, WE	Yes	continuous assessment, exam week	E. Chicca	J.S. Blijleven
2	2B	Digital Signal Processing (WBPH067-05)	5	WE, PR	Yes	exam week	R. Lo Conte	E. Chicca
2	2B	Physics Lab: Advanced Applications 1 (WBPH072-05)	5	R	Yes	exam week	A.K. Biegun	J.S. Blijleven

Year 3

Year	Period	Course	EC	Assessment methods	Incl. formative assessment?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
3	1A	Atoms and Molecules (WBPH003-05)	5	AST, WE	Yes	continuous assessment, exam week	R. Hoekstra	A. Borschevsky
3	1A	Control Engineering for BME (WMBE024-05)	5	WE	Yes	Exam week	C. De Persis	J. Sjollema
3	1A	Ionizing Radiation in Medicine (WBPH007-05)	5	AST, WE, P	Yes	continuous assessment, exam week	T.A. Schlathölter	P.G. Dendooven
3	1A	Nanophysics and Nanotechnology (WBPH025-05)	5	AST, WE	Yes	continuous assessment, exam week	M.A. Loi	J. Slawinska
3	1A	Nuclear Energy (WBPH010-05)	5	AST, WE, MT	Yes	continuous assessment, exam week	C. Rigollet	J. Even
3	1A	Optical Spectroscopy (WBPH078-05)	5	AST, WE, PR	Yes	continuous assessment, exam week	P.J. van der Zaag	R. Vlijm
3	1A	Solid State Physics (WBPH068-05)	5	AST, WE	Yes	continuous assessment, exam week	J. Ye	M.A. Loi
3	1B	Device Physics (WBPH037-05)	5	WE, P, R	Yes	continuous assessment, exam week	B.J. van Wees	T. Banerjee, M.A. Loi
3	1B	Introduction to Science Communication (WBEC001-05)	5	R	Yes	exam week	L.T.J. Kraan	H.A.J. Mulder, F.H.C.E. van der Graaf
3	1B	Oriëntatie op Onderwijs in de Bètawetenschappen (WBEC002-05)	5	OR, R	Yes	continuous assessment, exam week	J.E. van der Laan	G. Roorda, S. Tuenter
3	1B	Physics Lab: Advanced Applications 2 (WBPH066-05)	5	PR, R	Yes	continuous assessment, exam week	A.K. Biegun	J.S. Blijleven
3	1B	Principles of Measurement Systems (WBPH029-05)	5	AST, WE	Yes	continuous assessment, exam week	A.K. Biegun	J.S. Blijleven
3	1B	Solar Cells (WBCH018-05)	5	WE, P, R	Yes	continuous assessment, exam week	L.J.A. Koster	S.C. Veenstra
3	1B	Solid Mechanics (WBIE055-05)	5	WE	Yes	Exam week	F. Maresca	TBD
3	2A	Nanoprobing and Nanofabrication	5	WE, R	Yes	continuous assessment,	T. Banerjee	A. Grubisic-Cabo

Year	Period	Course	EC	Assessment methods	Incl. formative assessment?	Test moment(s) (e.g. mid-term, continuous assessment, exam week, etc)	First examiner	Second examiner
		(WBPH041-05)				exam week		
3	2A	Physics Instrumentation and Technology (WBPH069-05)	5	AST, WE, P	Yes	continuous assessment, exam week	A. Grubisic-Cabo	R. Hildner
3	2A	Physics of Fluids (WBPH042-05)	5	WE	Yes	Exam week	P.R. Onck	E. van der Giessen
3	2A	Product Design by the Finite Element Method (for AP) (WBIE043-05)	5	AST	Yes	continuous assessment, exam week	A.A. Geertsema	F.W. Wubs
3	2B	Bachelor Research Project	15	AST, PR, P, R	Yes	continuous assessment	*See list examiners research projects below*	*See list examiners*

Examiners for Bachelor Research projects

Zernike Institute
Banerjee, prof. dr. T.
Bari, prof.dr. S.
Chicca, prof.dr. E.
Covi, dr. E.
Diniz Guimaraes, dr. M.H.
Ehrler, dr. B.
Giessen, prof.dr.ir. E. van der
Giuntoli, dr. A.
Hoekstra, prof.dr.ir. R.A.
Kooi, prof.dr.ir. B.J.
Koster, prof.dr. J.A.
Krushynska, dr. A.O.
Loi, prof.dr. M.A.
Maresca, dr. F.
Noheda Pinuaga, prof.dr. B.
Ocelik, ing.dr. V.
Onck, prof.dr.ir. P.R.
Palasantzas, prof.dr. G.
Protescu, dr. L.
Rudolf, prof.dr. P.
Vlijm, dr. R.
Wal, prof.dr.ir. C.H. van der
Wees, prof.dr.ir. B.J. van
Ye, prof.dr. J.
Zaag, dr. P.J. van der

ESRIG
Stamhuis, prof.dr. E.J.
Purushothaman Vellayani, prof.dr. A.

UMCG
Dendooven, dr. P.G.
Gerbershagen, prof.dr. A.
Graaf, dr E.R. van der

An examiner for the Bachelor Research projects in Physics may also act as second supervisor for a Bachelor Research Project in Applied Physics.

5. Relationship between course units and details of the learning outcomes

Year 1																				
Learning outcomes	A1	A2	A3	A4	A5	A6		B1	B2	B3	B4	B5	B6	B7		1.1	1.2		2.1	2.2	2.3	2.4
Calculus 1 (for Physics)	X	X		X	X											X						
Calculus 2 (for Physics)	X	X		X	X											X						
Computational methods 1		X		X				X	X	X		X		X			X		X	X	X	X
Differential Equations (for Physics)	X	X		X	X											X						X
Electricity and Magnetism	X	X		X	X											X						
Linear Algebra (for Physics)	X	X		X	X											X						
Mechanics and Relativity	X	X		X	X											X						
Physics Lab: Design project		X		X	X	X		X	X	X	X	X							X		X	X
Physics Lab: Skills		X		X	X	X					X								X		X	X
Physics of Modern Technology	X		X			X				X	X	X					X		X			

Year 2																					
Learning outcomes	A1	A2	A3	A4	A5	A6		B1	B2	B3	B4	B5	B6	B7		1.1	1.2		2.1	2.2	2.3	2.4
Applied Physics & Society: Ethical & Professional Aspects						X				X	X	X	X									
Computational methods 2				X	X															X		
Digital Signal Processing		X	X	X	X			X	X					X		X	X			X	X	X
From Atoms to Solids	X	X			X											X						
Fundamentals of Electronics		X		X	X						X					X			X		X	
Materials Science and Engineering		X			X											X	X		X			X
Physics Lab: Advanced Applications 1				X	X			X		X	X	X	X	X		X			X		X	X
Quantum Physics 1	X	X			X											X						
Thermal Physics	X	X			X											X						
Waves and Optics	X	X	X		X											X					X	

Year 3																				
Learning outcomes	A1	A2	A3	A4	A5	A6		B1	B2	B3	B4	B5	B6	B7		1.1	1.2		2.1	2.2	2.3	2.4
Atoms and Molecules	X	X	X		X											X			X			X
Control Engineering for BME		X		X	X				X								X		X	X		X
Device Physics		X	X		X							X				X						
Introduction to Science Communication			X			X		X	X	X	X	X	X	X								
Ionizing Radiation in Medicine		X	X			X			X			X				X	X			X		X
Nanophrobing and Nanofabrication		X	X		X	X											X					
Nanophysics and Nanotechnology		X	X		X	X											X					
Nuclear Energy		X	X			X			X								X					X
Optical Spectroscopy		X	X	X	X									X		X	X		X		X	X
Oriënt. op Onderw. In de Bètawetenschappen			X			X		X	X	X	X	X	X	X								
Physics Instrumentation and Technology			X	X		X			X					X		X	X		X		X	X
Physics Lab: Advanced Applications 2				X	X			X		X	X	X	X	X		X			X		X	X
Physics of Fluids		X		X	X												X					
Principles of Measurement Systems		X		X	X				X										X			
Product Design by the Finite Element Method		X		X	X				X			X					X			X		X
Solar Cells		X	X		X	X							X				X		X			X
Solid Mechanics		X		X	X							X				X	X		X	X		X
Solid State Physics	X	X			X											X						
Bachelor Research Project			X	X	X	X		X	X	X	X	X	X	X			X		X	X	X	X