Assessment plan
Bachelor's degree programme Applied Physics
2022-2023

June 2022

Introduction

This assessment plan is a systematic description of the type of assessment used in the various modules of the Bachelor's programme Applied Physics. This assessment plan fits within the assessment policy of the Faculty of Science and Engineering [1], and the protocol used by the Board of Examiners of the degree programme [2].

The assessment plan is based on:
- the learning outcomes of the degree programme (appendix 1);
- the Teaching and Examination regulations of the degree programme;
- the description of the various modules of the degree programme in the digital course catalogue *Ocasys*, including:
  - Objective of the module;
  - Course content;
  - Lecturers and examiners;
  - Assessment method used;
  - Lecture format.

Assessment plan 2022-2023
The assessment plan contains two parts:
1. An overview of examiners and assessment methods used for all modules in the Applied Physics Bachelor's programme. The following assessment methods are distinguished in this scheme:
   - Written examination (WE);
   - Oral examination (OR);
   - Assignment, including homework and written report (AST);
   - Assessment of Practical work, including laboratory and computer work (PR);
   - Presentation (P);
   - Midterm test (IT).

   In case of just one examiner, a deputy examiner [3] is given. The coordinator of the module is underlined, in case more examiners are involved in teaching.

2. A matrix describes the relation between the various modules of the programme and the specified learning outcomes of the degree programme. The specified learning outcomes are defined in the programme's Teaching and Examination Regulation and have been included in appendix 1.

[1] FSE Quality Assurance Manual 2016-2017, chapter 6: Assessment policy
[2] FSE Manual for Board of Examiners (version: 2019); Chapter 4: Duties of the Board of Examiners
[3] FSE Quality Assurance Manual 2016-2017, paragraph 6.3: Practical matters

Examiners and assessment methods of modules in the degree programme

First year (core programme)

Module	First examiner	Assessment method	Second examiner and other teachers
Calculus 1 (for Physics) (WBPH057-05)	P.M.J. Tibboel	AST, WE, IT	R.W.C.P. Verstappen
Calculus 2 (for Physics) (WBPH058-05)	T.F. Görbe	AST, WE, IT	H. Waalkens
Electricity and Magnetism (WBPH033-10)	M.S. Pchenitchnikov,	PR, WE, IT	S. Hoekstra
Linear Algebra (for Physics) (WBPH054-05)	M. Mendez	AST, WE, IT	D. Boer
Mathematical Physics (WBPH049-05)	G. Palasantzas	AST, WE, IT	H. Waalkens
Mechanics and Relativity (WBPH001-10)	P.D. Meerburg,	AST, WE, IT	M.H. Lee
Physics Laboratory 1 (WBPH013-05)	J.S. Blijleven	PR, WE	R.J.H. Klein-Douwel
Physics Laboratory 2 (WBPH050-05)	A.K. Biegun	AST, PR, P	J.S. Blijleven
Physics of Modern Technology (WBPH027-05)	C.H. van der Wal	WE, P	M.H. Diniz Guimaraes, A. Giuntoli
Python for Physicists (WBPH044-05)	J.W. Brijan	AST, WE	C.J.G. Onderwater

Second year (core programme)

Module	First examiner	Assessment method	Second examiner and other teachers
Computational Methods in Science and Technology (WBHP005-05)	M. Kavatsyuk	AST, WE	*TBD*
Electronics and Signal Processing (WBPH038-05)	E. Chicca	PR, WE	J.S. Blijleven
Materials Science (WBPH020-05)	V. Ocelik	AST, WE, PR	B.J. Kooi
Numerical Mathematics 1 (WBMA045-05)	C.A. Bertoglio	PR, WE	F.W. Wubs
Physics Laboratory 3 (WBPH051-05)	A.K. Biegun	AST, PR, P	J.S. Blijleven
Physics, Astronomy & Society: Ethical & Professional Aspects (WBPH053-05)	B. Piersma	AST, WE, P	J. Zevenberg, H.J. van der Windt, dr. H.A.J. Mulder
Quantum Physics 1 (WBPH014-05)	D. Roest	WE	A. Mazumdar
Structure of Matter (WBPH034-10)	R.A. Hoekstra	IT	L.J.A.Koster
Thermal Physics (WBPH002-10)	T.A. Schlathölter	WE, IT	A. Borschevsky
Waves and Optics (WBPH032-05)	S. Hoekstra	WE, IT	A.K. Biegun

Third year (core programme)

Module	First examiner	Assessment method	Second examiner and other teachers
Atoms and Molecules (WBPH003-05)	A. Borschevsky	WE	S. Hoekstra
Control Engineering for BME (WMBE024-05)	C. De Persis	AST, WE	B. Jayawardhana, P. Tesi, J.M.A. Scherpen
Device Physics (WBPH037-05)	B.J. van Wees	AST, WE, P	T. Banerjee, M.A. Loi
Introduction to Science Communication (WBEC001-05)	L.T.J. Kraan	R	H.A.J. Mulder, F.H.C.E. van der Graaf
Ionizing Radiation in Medicine (WBPH007-05)	P.G. Dendooven	WE, P	P. van Luijk
Nanophysics and Nanotechnology (WBPH025-05)	M.A. Loi	WE	J. Slawinska
Nuclear Energy (WBPH010-05)	C. Rigollet	AST, WE	E.R. van der Graaf
Oriëntatie op Onderwijs in de Bètawetenschappen (WBEC002-05)	J.E. van der Laan	OR, R	G. Roorda, S. Tuenter
Physics Laboratory 4 (WBPH026-05)	A.K. Biegun	AST, PR, P	J.S. Blijleven
Physics of Fluids (WBPH042-05)	P.R. Onck	WE	E. van der Giessen
Principles of Measurement Systems (WBPH029-05)	A.K. Biegun	WE	J.S. Blijleven
Product Design by the Finite Element Method (for AP) (WBIE043-05)	A.A. Geertsema	AST	F.W. Wubs
Solar Cells (WBCH018-05)	L.J.A. Koster	AST, WE, P	S.C. Veenstra
Solid Mechanics (WBPH015-05)	E. van der Giessen	AST, WE	P.R. Onck
Solid State Physics 1 (WBPH030-05)	J. Ye	AST, WE	M.A. Loi
Bachelor Research Project	*See list examiners research projects below*	AST, PR, P	

Examiners for Bachelor Research projects

Banerjee, prof. dr. T.
Bari, prof.dr. S.
Chicca, prof.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.
Maresco, 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.
Stamhuis, prof.dr. E.J.
Wal, prof.dr.ir. C.H. van der
Wees, prof.dr.ir. B.J. van
Ye, prof.dr. J.

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

Relation between the learning outcomes and the curriculum

The following tables show for each of the specializations how the individual course units contribute to the final qualifications of the programme.

'+' indicates that a course unit has some contribution to the qualification under consideration.
'++' idem - significant contribution to the qualification under consideration.

The numbers in the table correspond to the qualifications that are listed in appendix I.

Year 1

Learning outcomes	Mechanics and Relativity	Electricity and Magnetism	Physics Laboratory 1	Physics Laboratory 2	Python for Physicists	Physics of the Quantum Universe	Physics of Modern Technology	Nanophysics	Energy and Environment	Medical Physics & Biophysics	Introduction to Astronomy	Calculus 1 (for Physics)	Linear Algebra (for Physics)	Calculus 2 (for Physics)	Mathematical Physics
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			++	++	+										

Year 2										
Learning outcomes	Computational Methods in Science and Technology	Quantum Physics 1	Thermal Physics	Waves and Optics	Materials Science and Engineering	Electronics and Signal Processing	Physics, Astronomy & Society: Ethical & Professional Aspects	Structure of Matter	Numerical Mathematics 1	Physics Laboratory 3
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					+				+	+

Year 3

Learning outcomes	*compulsory*								*elective*							
	Control Engineering	Device Physics	Physics Laboratory 4	Physics of Fluids	Product Design by the Finite Element Method	Solid Mechanics	Solid State Physics 1	Bachelor Research Project	Atoms and Molecules	Introduction to Science Communication	Ionizing Radiation in Medicine	Nanophysics and Nanotechnology	Nuclear Energy	Oriënt. op Onderw. In de Bètawetenschappen	Principles of Measurement Systems	Solar Cells
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	+		+		++	+		+	+		+		+			+

Appendix I Learning outcomes of the degree programme

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 1.2.

Appendix 1.1 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 1.2 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.