STUDY GUIDE
2016-2017

BACHELOR’S DEGREE PROGRAMMES

MATHEMATICS
APPLIED MATHEMATICS
PHYSICS
APPLIED PHYSICS
ASTRONOMY
CHEMISTRY
CHEMICAL ENGINEERING
# TABLE OF CONTENTS

## A General part ........................................................................................................... 9

### A1 GENERAL INFORMATION .............................................................................. 11
   A1.1 INTRODUCTION .......................................................................................... 11
   A1.2 FACULTY ORGANIZATION ....................................................................... 11
   A1.3 DEGREE PROGRAMMES IN BRIEF ............................................................. 11
      A1.3.1 Research and academic skills in undergraduate education ............. 12
      A1.3.2 Erasmus programmes ........................................................................ 13
      A1.3.3 Science, Business and Policy profile .................................................. 14
      A1.3.4 How to become a high school teacher .................................................. 14
   A1.4 UNIVERSITY OF GRONINGEN HONOURS COLLEGE ................................. 15
      A1.4.1 Honours College during the Bachelor’s phase ................................... 15
      A1.4.2 Honours College during the Master’s phase ........................................ 15
      A1.4.3 HTSM Honours programme .............................................................. 16

## A2 STUDENT MATTERS .......................................................................................... 17
   A2.1 ADMISSION TO THE PROGRAMME ............................................................ 17
      A2.1.1 Admission to bachelor’s programmes ................................................... 17
      A2.1.2 Admission to master’s programmes ...................................................... 17
   A2.2 ACADEMIC YEAR ....................................................................................... 18
   A2.3 FINANCIAL MATTERS ................................................................................ 20
      A2.3.1 Tuition fees ........................................................................................... 20
      A2.3.2 Student finance – DUO grants ............................................................... 20
      A2.3.3 Study costs ............................................................................................ 20
   A2.4 REGISTRATION FOR COURSE UNITS AND EXAMS .............................. 20
   A2.5 CREDIT POINTS AND MARKING SYSTEM .............................................. 22
      A2.5.1 Marking system .................................................................................... 22
      A2.5.2 Fraud ..................................................................................................... 22
   A2.6 BINDING STUDY ADVICE: THE BSA SYSTEM ........................................... 22
   A2.7 STUDY DELAY AND GRADUATION FUND (PROFILERINGSFONDS) ........ 23
   A2.8 GRADUATION AND APPROVAL OF STUDY PROGRAMME ................... 24
   A2.9 OBJECTION AND APPEAL PROCEDURES .............................................. 24
      A2.9.1 Board of Appeal for Examinations (CBE) ............................................. 25
      A2.9.2 Complaints, concerning sexual harassment, aggression, violence and discrimination (SIAGD) ............................................................. 25
      A2.9.3 Central Portal for the Legal Protection of Student Rights (CLRS) ...... 25
   A2.10 COMMITTEES ............................................................................................ 25
      A2.10.1 Board of Examiners .......................................................................... 25
      A2.10.2 Programme Committee ....................................................................... 26
      A2.10.3 Admission Board BSc Programmes ..................................................... 26
      A2.10.4 Admissions Board for the Master’s programme ................................. 27
      A2.10.5 Faculty Board ..................................................................................... 27
      A2.10.6 FMNS Faculty Council ........................................................................ 27

## A3 STUDENT SUPPORT ............................................................................................ 28
B1.3 TRANSITIONAL ARRANGEMENTS ................................................................. 47
B1.4 PRIZES FOR THE BEST PROPÄDEUTIC PHASE STUDENTS .......................... 47
B1.5 STUDENT ASSISTANT POSITIONS ................................................................. 47
B1.6 MASTER'S DEGREE PROGRAMMES ............................................................. 48

B2 BACHELOR'S DEGREE PROGRAMMES IN MATHEMATICS AND APPLIED
MATHEMATICS ............................................................................................... 49
B2.1 INTRODUCTION .............................................................................................. 49
B2.2 SUPPORTIVE STAFF AND COMMITTEES ...................................................... 50
   B2.2.1 Supportive staff .......................................................................................... 50
   B2.2.2 Programme Committee ............................................................................ 51
   B2.2.3 Board of Examiners ................................................................................ 51
B2.3 STUDY ASSOCIATION: FYSISCHE-MATHEMATISCHE
   FACULTEITSVERENIGING ................................................................................. 52
B2.4 AIMS AND LEARNING OUTCOMES OF THE DEGREE PROGRAMMES .......... 53
B2.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR
   DEGREE PROGRAMMES MATHEMATICS AND APPLIED MATHEMATICS ...... 55
B2.6 CAREER ORIENTATION ............................................................................... 56
B2.7 BACHELOR'S DEGREE PROGRAMME IN MATHEMATICS ............................... 58
   B2.7.1 Options within the degree programme in Mathematics ................................ 60
   B2.7.2 General Mathematics Track ..................................................................... 61
   B2.7.3 Statistics and Econometrics Track ............................................................. 63
   B2.7.4 Bachelor's Project in Mathematics ............................................................ 64
B2.8 BACHELOR'S DEGREE PROGRAMME IN APPLIED MATHEMATICS ............. 65
   B2.8.1 Options within the degree programme in Applied Mathematics .................. 67
   B2.8.2 Bachelor's Project on Applied Mathematics ............................................... 68
B2.9 DOUBLE BACHELOR'S DEGREE IN MATHEMATICS AND PHYSICS .......... 68
B2.10 OVERVIEW OF CURRICULUM CHANGES ................................................ 70
   B2.10.1 For cohort 2014-2015 .............................................................................. 70

B3 BACHELOR'S DEGREE PROGRAMMES IN PHYSICS AND APPLIED
PHYSICS .............................................................................................................. 71
B3.1 INTRODUCTION .............................................................................................. 71
B3.2 SUPPORTIVE STAFF AND COMMITTEES ...................................................... 71
   B3.2.1 Supportive Staff ........................................................................................ 72
   B3.2.2 Programme Committee ............................................................................ 72
   B3.2.3 Board of Examiners ................................................................................ 73
B3.3 STUDY ASSOCIATIONS ............................................................................... 73
   B3.3.1 Fysisch-Mathematische Faculteitsvereniging (FMF) ..................................... 73
   B3.3.2 T.F.V. ‘Professor Francken’ ..................................................................... 74
B3.4 LEARNING OUTCOMES OF THE DEGREE PROGRAMMES ............................. 75
B3.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR
   DEGREE PROGRAMMES PHYSICS AND APPLIED PHYSICS .......................... 77
B3.6 BACHELOR'S DEGREE PROGRAMME IN PHYSICS ........................................ 78
   B3.6.1 Options within the degree programme in Physics ...................................... 80
   B3.6.2 Experimental and Theoretical Physics (NExT) Track .................................. 80
Rule 1.1

B4 BACHELOR'S DEGREE PROGRAMME IN ASTRONOMY .................................. 89

B4.1 INTRODUCTION .................................................................................. 89
B4.2 SUPPORTIVE STAFF AND COMMITTEES .......................................... 91
B4.2.1 Supportive Staff ............................................................................. 91
B4.2.2 Programme Committee ................................................................. 91
B4.2.3 Board of Examiners .................................................................... 92
B4.3 STUDY ASSOCIATION: FYSISCHE-MATHEMATISCHE
FACULTEITSVERENIGING (FMF) ................................................................. 92
B4.4 AIMS AND LEARNING OBJECTIVES OF THE DEGREE PROGRAMME .... 93
B4.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR
DEGREE PROGRAMME ASTRONOMY ........................................................ 95
B4.6 BACHELOR'S DEGREE PROGRAMME IN ASTRONOMY .................. 96
B4.6.1 Options within the degree programme in Astronomy .................... 97
B4.6.2 Bachelor's Research Project on Astronomy .................................. 99

B5 BACHELOR'S DEGREE PROGRAMMES IN CHEMISTRY AND CHEMICAL
ENGINEERING ......................................................................................... 101

B5.1 INTRODUCTION .................................................................................. 101
B5.2.1 Supportive Staff ............................................................................. 102
B5.2.2 Programme committee ................................................................. 102
B5.2.3 Board of Examiners .................................................................... 103
B5.3 STUDY ASSOCIATION: DE CHEMISCHE BINDING ........................... 103
B5.4 AIMS AND LEARNING OUTCOMES OF THE DEGREE PROGRAMMES ...... 105
B5.5 RESEARCH AND ACADEMIC SKILLS ............................................. 109
B5.6 BACHELOR'S DEGREE PROGRAMME IN CHEMISTRY .................. 110
B5.6.1 Options within the degree programme in Chemistry .................... 111
B5.6.2 Chemistry of Life Track ............................................................... 112
B5.6.3 Smart Materials Track .................................................................. 112
B5.6.4 Sustainable Chemistry and Energy Track .................................... 113
B5.6.5 Bachelor's Research Project on Chemistry .................................. 113
B5.7 BACHELOR'S DEGREE PROGRAMME IN CHEMICAL ENGINEERING .... 114
B5.7.1 Options within the degree programme in Chemical Engineering ...... 115
B5.7.2 Bachelor's project on Chemical Engineering ............................... 115
B5.7.3 CHANGES IN THE CURRICULUM ............................................... 115

C Rules, Regulations and Addresses ......................................................... 117

C1 RULES AND REGULATIONS .................................................................. 119
C1.1 STUDENT CHARTER ......................................................................... 119
C1.2 TEACHING AND EXAMINATION REGULATIONS (OER) ......................... 120
C1.3 RULES AND REGULATIONS OF THE BOARD OF EXAMINERS .......... 120

C2 ADDRESSES CENTRAL BODIES UNIVERSITY OF GRONINGEN ............. 121
  C2.1 GENERAL ADDRESSES .................................................................. 121
  C2.2 ADDRESSES FOR STUDENTS ...................................................... 122

C3 FACULTY ADDRESSES .................................................................. 123
  C3.1 BUILDINGS ................................................................................. 123
  C3.2 LIBRARY .................................................................................... 123
  C3.3 EXCHANGE OFFICE ................................................................. 123
  C3.4 EDUCATION SUPPORT DESK ................................................... 124

C4 LOCATIONS .................................................................................. 125
  C4.1 ZERNIKE ..................................................................................... 125
  C4.2 ADL ........................................................................................... 126
A

General part
A1

GENERAL INFORMATION

A1.1 INTRODUCTION
Welcome to the Study Guide for all degree programmes offered by the Faculty of Mathematics and Natural Sciences (FMNS). This Study Guide aims to provide students and lecturers with information about the various degree programmes. The Study Guide comprises a general section, which is identical for all FMNS degree programmes, and a programme-specific section.

The general section of this Study Guide contains a wide range of information, for example about facilities, student matters and what to do if you run into problems, whereas the degree programme-specific section discusses matters such as the study programme, study associations and important addresses.

A1.2 FACULTY ORGANIZATION
The Bachelor’s and Master’s degree programmes are offered by the Faculty of Mathematics and Natural Sciences (FMNS). FMNS is one of the largest natural sciences faculties in the Netherlands. Teaching within FMNS is organized in an Undergraduate and a Graduate School of Science. The Undergraduate School of Science organizes the teaching of Bachelor’s programmes, while the Graduate School of Science organizes the teaching of Master’s programmes and PhD projects in strong relationship with the research institutes. In general the lecturers of the programmes are researcher in one of the research institutes as well.

All Bachelor’s degree programmes within FMNS except Biology, Life Science and Technology, and Pharmacy are offered in English. All Master’s degree programmes, except Education and Communication and Pharmacy, are offered in English as well. This increases student exchange and reflects the international character of research within the faculty.

A1.3 DEGREE PROGRAMMES IN BRIEF
All FMNS degree programmes start with a three-year (180 ECTS) Bachelor’s phase, each year comprising two semesters. A completed Bachelor’s degree can be followed by a Master’s degree programme lasting at least two years (120 ECTS). Students who successfully complete an FMNS degree programme are awarded the title of Bachelor of Science (BSc) or Master of Science (MSc). In addition, some degree programmes also lead to the conferral of the Dutch ‘ingenieur’ degree, a teaching qualification or a pharmacist’s diploma.

<table>
<thead>
<tr>
<th>Bachelor</th>
<th>ECTS</th>
<th>Bachelor</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Mathematics</td>
<td>180</td>
<td>Computing Science</td>
<td>180</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>180</td>
<td>Industrial Engineering and Management</td>
<td>180</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>180</td>
<td>Life science and technology *</td>
<td>180</td>
</tr>
<tr>
<td>Astronomy</td>
<td>180</td>
<td>Mathematics</td>
<td>180</td>
</tr>
<tr>
<td>Biology *</td>
<td>180</td>
<td>Pharmacy *</td>
<td>180</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>180</td>
<td>Physics</td>
<td>180</td>
</tr>
<tr>
<td>Chemistry</td>
<td>180</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Only offered in Dutch.
<table>
<thead>
<tr>
<th>Master</th>
<th>ECTS</th>
<th>Master</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Applied Mathematics</td>
<td>120</td>
<td>Education and Communication**</td>
<td>120</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>120</td>
<td>Energy and Environmental Sciences</td>
<td>120</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>120</td>
<td>Human-Machine Communication</td>
<td>120</td>
</tr>
<tr>
<td>Astronomy</td>
<td>120</td>
<td>Industrial Engineering and Management</td>
<td>120</td>
</tr>
<tr>
<td>Behavioural &amp; Cognitive Neurosciences *</td>
<td>120</td>
<td>Marine Biology</td>
<td>120</td>
</tr>
<tr>
<td>Biology</td>
<td>120</td>
<td>Mathematics</td>
<td>120</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>120</td>
<td>Medical Pharmaceutical Sciences</td>
<td>120</td>
</tr>
<tr>
<td>Biomedical Sciences</td>
<td>120</td>
<td>Molecular Biology and Biotechnology ##</td>
<td>120</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>120</td>
<td>Nanoscience *</td>
<td>120</td>
</tr>
<tr>
<td>Chemistry</td>
<td>120</td>
<td>Pharmacy **</td>
<td>180</td>
</tr>
<tr>
<td>Computing Science</td>
<td>120</td>
<td>Physics</td>
<td>120</td>
</tr>
<tr>
<td>Ecology and Evolution *</td>
<td>120</td>
<td>Water Technology (Joint Degree) ***</td>
<td>120</td>
</tr>
</tbody>
</table>

* Top/Research master.
** Only offered in Dutch.
*** The Joint Degree programme is offered in collaboration with other institutions skilled in this field of expertise: two other Dutch universities (Wageningen University, University of Twente) and the Technological Top Institute for Water Technology Wetsus, Leeuwarden.
# The top track Evolutionary Biology is part of the master Ecology & Evolution.
## The top track Biomolecular Sciences is part of the master Molecular Biology and Biotechnology.

A1.3.1 Research and academic skills in undergraduate education

**Introduction**

Since the introduction of the undergraduate and graduate educational degree-programmes at the University of Groningen in 2002, bachelor and master studies are essentially separate and independent degree-programmes. As the University of Groningen is an academic institution, the education of both graduate and undergraduate degree-programmes thus need to be thoroughly intertwined with academic research and students should be familiarized with academic research skills.

Academic skills cannot be regarded as just a separate learning pathway in academic education in which students are trained to retrieve information, communicate, reflect etc., but these skills should be fully connected to and embedded in the academic context in which they are practiced. Academic skills are thus an important precondition and a logical consequence of academic training.

Finally, research and academic skills require an academic attitude, which can be described as a positive predisposition and orientation towards an academic approach of research problems and issues. It requires the tendency to be curious and critical and to work analytical, systematical, fact-based and accurate.

**Research-based undergraduate education at the Faculty of Mathematics and Natural Sciences**

At the Faculty of Mathematics and Natural Sciences (FMNS) the education of undergraduate programmes is based on the latest academic theories and research outcomes, in the sense that these form an integral part of courses and research projects of bachelor degree-programmes. Furthermore, each undergraduate programme contains an explicit learning pathway introducing, practicing and assessing research and academic skills such as:

- Formulating adequate research goals, questions and/or hypotheses;
- Searching for, assessing and reflecting on scientific literature;
- Setup of basic research experiments, analysis of and reflection on its outcomes and drawing appropriate conclusions;
- Critical thinking, reflection, analytic attitude and capacity;
Reflecting on research methods and research methodology;
Communicate about research progress and outcomes (both orally and in writing);
Cooperate in a (multi-disciplinary) team.

The educational mission of the FMNS is to train students to be able to perform scientific research independently, with a critical and academic attitude, accompanied with a clear ethical conduct, thus preparing them for an excellent starting position for an academic or professional career.

**Implementation of research-based education in curricula of FMNS undergraduate studies**

Research-based education is implemented in virtually all teaching methods used at the faculty; each with its own specific learning objectives, as exemplified below:

- **Lectures**: The vast majority of lecturers of the FMNS (>95%) are actively involved in academic research and thus are inspired to present the latest academic theories and research outcomes within lectures.

- **Initial literature (re)search, analysis and assessment** is carried out already in first year symposium type of courses. These assignment-based courses connect students closely to research groups of the FMNS, carrying out literature research linked to or relevant for these research groups.

- **Practical courses, tutorials and assignments** have the following objectives:
  - Practicing and familiarizing students with experimental work and skills
  - Designing and executing basic research experiments
  - Analysis of data and outcome of these experiments
  - Draw adequate conclusions from and reporting on experimental data
  - Reflect and report on experimental results and conclusions

- **Science, Ethics, Technology, and Society course**: In this course basic concepts of science philosophy, ethics, innovation theory, argumentation theories and policy making are introduced. This course not only introduces important philosophical and societal considerations and implications of research on society, but also aims to create awareness on ethical and societal conduct of students.

- **Bachelor research thesis**: During the Bachelor thesis, students are actively involved in research carried out in research groups of the FMNS. Students are challenged as much as possible to excel in their research assignment, while getting regular feedback from their supervisor(s) and other members of research groups in which they are allocated.

As the degree programme progresses, the complexity of the research pathway increases, while the students' involvement will shift from a more passive to a more active stance. Each degree-programme has realized and detailed its research learning line in its own specific way, depending on the focus, scope, and learning outcomes of the study. More details on the research learning pathway are available in the programme-specific study guide of each degree-programme or in the digital course catalogue Ocasys:

- [www.rug.nl/ocasys/fwn](http://www.rug.nl/ocasys/fwn)

**A1.3.2 Erasmus programmes**

At the moment FMNS participates in two Erasmus+ (formerly known as Erasmus Mundus) Master's degree programmes:

- **MEME** (as part of the Master’s programme Ecology and Evolution), [www.evobio.eu](http://www.evobio.eu)
- **TCCM** (as part of the Master’s programme Chemistry), [tccm.qui.uam.es](http://tccm.qui.uam.es)
Erasmus Mundus aims to enhance quality in higher education through scholarships and academic cooperation between Europe and the rest of the world by supporting joint programmes provided by academic consortia. Erasmus Mundus offers financial support for institutions and scholarships for individuals.

**A1.3.3 Science, Business and Policy profile**
The Science, Business and Policy profile (SBP-variant) is the option to choose if you are interested in the social and commercial aspects of your subject. This profile will prepare you for a career within a company or policy organization. In addition to gaining scientific knowledge, you will learn effective presentation skills, how to deal with tough deadlines, how to apply for an internship at a company or organization outside the University, how to give and receive feedback, and how to work efficiently in groups.
The Science, Business and Policy profile is part of many of the Master's programmes of FMNS and consists of one year of course units and research in the field of your Master's degree programme complemented with one year of course units and internship focusing on business and policy.

For more information, consult the website: [www.rug.nl/fwn/sbp](http://www.rug.nl/fwn/sbp) and the programme-specific part of the study-guide to see whether the Science, Business and Policy profile is part of your Master's degree programme.

**A1.3.4 How to become a high school teacher**
Since the different trajectories for becoming a high school teacher are taught in Dutch only, this subsection is in Dutch.

Altijd al gewild...
- Voor de klas staan;
- Je kennis van het vak delen, maar ook je passie;
- Leerlingen motiveren en inspireren.

In dat geval zijn de hieronder genoemde mogelijkheden om een onderwijsbevoegdheid te behalen wellicht interessant voor jou.

**Minor Educatie**
Als je de mogelijkheid hebt om binnen je Bacheloropleiding een vrije minor te kiezen, kun je kiezen voor de Educatieve Minor. Deze minor is een intensieve fulltime opleiding van een halfjaar die - in combinatie met een Bacheloropleiding in een schoolvak - opleidt tot leraar. Je gaat drie dagen per week aan de slag op een middelbare school. Daarnaast verdiep je je bij de Lerarenopleiding in vakdidactiek, ontwikkelingspsychologie en onderwijskunde.

Als je de Educatieve Minor en je Bacheloropleiding met goed gevolg hebt doorlopen, krijg je een onderwijsbevoegdheid 'beperkt tweedegraads' voor de onderbouw van zowel vmbo-tl als havo-vwo.

Voor meer informatie zie:
- [www.rug.nl/lerarenopleiding/onderwijs/educatieveminor](http://www.rug.nl/lerarenopleiding/onderwijs/educatieveminor)

**Master Educatie en Communicatie**
De richting Educatie van de Master Educatie en Communicatie in de wiskunde en natuurwetenschappen biedt je een tweejarige Masteropleiding tot eerstegraadsleraar in de bovenbouw havo-vwo. Met deze opleiding verdiep je je bètakennis én leer je hoe je die kennis kunt delen, communiceren en onderwijzen.

Voor meer informatie zie:
Master LVHO
Behalve via een tweejarige opleiding, kun je ook eerstegraads docent worden via een éénjarige variant, Leraar Voorbereidend Hoger Onderwijs (LVHO). Voorwaarde daarvoor is dat je een Masterdiploma hebt in de richting van het schoolvak waarvoor je een eerstegraads lesbevoegdheid wilt halen. Dus als je eerst een Masteropleiding in je eigen wetenschappelijke discipline wilt volgen en daarna pas een lerarenopleiding wilt doen, kun je voor de Master LVHO kiezen. Je wordt dan eerstegraadsleraar in bovenbouw havo-vwo.

Voor meer informatie zie:
- www.rug.nl/fwn/beta-master/postmaster

A1.4 UNIVERSITY OF GRONINGEN HONOURS COLLEGE
If you would like an extra intellectual challenge in addition to your regular degree programme, the Honours College may be just what you are looking for. Talented and ambitious students are offered the opportunity to participate in the University of Groningen Honours College during their Bachelor’s and Master’s phases.

A.1.4.1 Honours College during the Bachelor’s phase
The Bachelor’s honours programme comprises an extra 45 ECTS in addition to your regular Bachelor’s programme. Within this interdisciplinary programme, 25 ECTS are intended for in-depth study and 20 ECTS for broadening your horizon. The deepening part consists of course units offered by your own faculty in which you get the opportunity to develop and experience research on a subject of your interest. The broadening part consists of course units (unrelated to your faculty), development of a range of skills and also attention is paid to your personal development.

Next to this interdisciplinary programme, the Honours College offers also a Honours programme in Philosophy.

Admission to the programme is by selection, since the number of places available is limited. The top 15% of students on the Bachelor’s degree programme are invited to apply, but students who have not received an invitation can also apply (on a ‘wild card’ basis).

For more information on the application procedure see:
- www.rug.nl/education/honours-college

Or contact the coordinator Han van der Strate:
- fwn.honours@rug.nl

A.1.4.2 Honours College during the Master’s phase
The Master’s honours programme is a one-year extracurricular programme with a student workload of 15 ECTS. It offers students who are able and willing to excel, the possibility to deepen their theoretical knowledge about leadership and to improve their leadership skills. This programme will provide a solid starting point for your future academic or social career and it will contribute to your personal development.

For information, see:
- www.rug.nl/education/honours-college

Or contact the coordinator Han van der Strate:
- fwn.honours@rug.nl
A.1.4.3 HTSM Honours programme
The focus of this Master's honours programme is on High Tech Systems and Materials (HTSM). The HTSM honours programme is offered by the University of Groningen – in cooperation with Philips Consumer Lifestyle, University Campus Fryslân and University of Twente – and aims to equip talented, motivated students with the knowledge and skills needed to excel at the frontiers of High Tech Systems and Materials (HTSM).

The 1.5 year HTSM honours programme worth 20 ECTS is followed in addition to the standard Master's programme. It has been developed especially for students who want to get more from their studies. The Honours programme offers intensive, small-group teaching with a group of like-minded, motivated students. Furthermore, it offers a unique opportunity to collaborate with students from different disciplines on challenging, real-life product development assignments by the industry.

For more information, see:
- [www.rug.nl/education/honours-college/htsm-masterprogramme](http://www.rug.nl/education/honours-college/htsm-masterprogramme)

Or contact the coordinator Vanessa van Hest:
- [htsm-honours@rug.nl](mailto:htsm-honours@rug.nl)
A2 STUDENT MATTERS

A2.1 ADMISSION TO THE PROGRAMME

In order to be able to participate in course units and examinations, you must be registered at the University of Groningen as a student of a certain degree programme. Registration for a programme is done via Studielink (www.studielink.nl). You must reregister every year. Please contact the University Student Desk if you have any questions concerning your registration.

Practical information, such as application procedures, can be found on the University website. The University website can also be consulted for the top programmes and the Erasmus Mundus deadlines.

International students please look at:

- www.rug.nl/fwn/fmns-programme
- www.rug.nl/education/international-students/application-procedure

Dutch students please look at:

- www.rug.nl/fwn/beta-studie
- www.rug.nl/education/nederlandse-studenten/inschrijven/

For international students, sufficient proficiency in English (a minimum IELTS test score of 6.5 or a TOEFL test score of 580 (paper-based)) is required for the English taught programmes and sufficient proficiency in Dutch (NT2-II) is required for the Dutch taught programmes.

A2.1.1 Admission to bachelor’s programmes

In case you have a Dutch diploma that according to Dutch higher education law gives entry to the degree programme of your choice, admission is automatic and is handled by Studielink:

- www.studielink.nl

In all other cases (e.g. when you have a non-Dutch diploma or a Dutch diploma that does not give automatic access to the degree programme), besides registering through Studielink, you have to go through an admission procedure in which the Admission Board BSc Programmes of FMNS based on information provided by you, decides whether or not you meet the admission requirements of the programme of your choice.

A2.1.2 Admission to master’s programmes

Students can be admitted to a Master’s degree programme once they have successfully completed a related Bachelor’s degree programme at the University of Groningen.

Students with a Bachelor’s degree from another Dutch or foreign university may also qualify for admission. However, admission is then granted on an individual basis by the Admissions Board. The Admissions Board will check whether you have the appropriate qualifications. In case of a Bachelor’s degree from a foreign university after registration in Studielink you will be contacted by the Admissions Office who will provide you with information on how to proceed with the admissions process. In case of a Bachelor’s degree from another Dutch university please contact the relevant academic advisor for information on how to proceed with the admissions process.
Pre-master programme
In certain cases a pre-master programme is required for Dutch students with a partially suitable Bachelor of Science or a suitable Bachelor’s degree in Applied Sciences (HBO). For more information and assistance with applying ask the relevant academic advisor.

A2.2 ACADEMIC YEAR
The general academic year overview for FMNS is set out on the next page.
The course units offered by the Life Science programmes are offered in blocks. Each block takes three weeks. During a block a student is engaged in one course unit.
The course units offered by the other degree programmes are offered in periods of ten weeks (eight weeks of classes followed by two weeks of exams). A student is in general engaged in three course units during a period.

Some course units, for example for the degree programmes in Artificial Intelligence and Industrial Engineering and Management, are offered by other faculties. As their academic year overviews may differ from the one set out in the schedule presented here, for these course units you should consult the timetables on the web or the programme-specific part of this Study Guide.

Information about timetables and national holidays can be found via the following website:
- rooster.rug.nl
### Academic calendar 2016–2017

<table>
<thead>
<tr>
<th>Week Nr.</th>
<th>Start &amp; end date</th>
<th>Life Science degree programmes</th>
<th>Non-life Science degree programmes</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>mo. 05-09-16 - fri. 09-09-16</td>
<td>L1</td>
<td>L1</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>mo. 12-09-16 - fri. 16-09-16</td>
<td>L2</td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>mo. 19-09-16 - fri. 23-09-16</td>
<td>L3/E</td>
<td>L3</td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>mo. 26-09-16 - fri. 30-09-16</td>
<td>L4</td>
<td>L4</td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>mo. 03-10-16 - fri. 07-10-16</td>
<td>L5</td>
<td>L5</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>mo. 10-10-16 - fri. 14-10-16</td>
<td>L6/E</td>
<td>L6</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>mo. 17-10-16 - fri. 21-10-16</td>
<td>L7</td>
<td>L7</td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>mo. 24-10-16 - fri. 28-10-16</td>
<td>L8</td>
<td>L8</td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>mo. 31-10-16 - fri. 04-11-16</td>
<td>L9/E</td>
<td>Examinations 1.1</td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>mo. 07-11-16 - fri. 11-11-16</td>
<td>Resits 1.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>46</td>
<td>mo. 14-11-16 - fri. 18-11-16</td>
<td>L1</td>
<td>L1</td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>mo. 21-11-16 - fri. 25-11-16</td>
<td>L2</td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>48</td>
<td>mo. 28-11-16 - fri. 02-12-16</td>
<td>L3/E</td>
<td>L3/R**</td>
<td>L3/R: lectures &amp; resits &gt; 17:00 h</td>
</tr>
<tr>
<td>49</td>
<td>mo. 05-12-16 - fri. 09-12-16</td>
<td>L4</td>
<td>L4/R**</td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>mo. 12-12-16 - fri. 16-12-16</td>
<td>L5</td>
<td>L5/R**</td>
<td></td>
</tr>
<tr>
<td>51</td>
<td>mo. 19-12-16 - fri. 23-12-16</td>
<td>L6/E</td>
<td>L6</td>
<td></td>
</tr>
<tr>
<td>52–1</td>
<td>mo. 26-12-16 - fri. 06-01-17</td>
<td>Vacation</td>
<td>Vacation</td>
<td>Christmas and New Year</td>
</tr>
<tr>
<td>2</td>
<td>mo. 09-01-17 - fri. 13-01-17</td>
<td>L7</td>
<td>L7</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>mo. 16-01-17 - fri. 20-01-17</td>
<td>L8</td>
<td>L8 (Resits AI*)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>mo. 23-01-17 - fri. 27-01-17</td>
<td>L9/E</td>
<td>Examinations 1.2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>mo. 30-01-17 - fri. 03-02-17</td>
<td>Resits 1.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>mo. 06-02-17 - fri. 10-02-17</td>
<td>L1</td>
<td>L1 (Resits***)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>mo. 13-02-17 - fri. 17-02-17</td>
<td>L2</td>
<td>L2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>mo. 20-02-17 - fri. 24-02-17</td>
<td>L3/E</td>
<td>L3/R**</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>mo. 27-02-17 - fri. 03-03-17</td>
<td>L4</td>
<td>L4/R**</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>mo. 06-03-17 - fri. 10-03-17</td>
<td>L5</td>
<td>L5/R**</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>mo. 13-03-17 - fri. 17-03-17</td>
<td>L6/E</td>
<td>L6</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>mo. 20-03-17 - fri. 24-03-17</td>
<td>L7</td>
<td>L7</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>mo. 27-03-17 - fri. 31-03-17</td>
<td>L8</td>
<td>L8 (Resits AI*)</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>mo. 03-04-17 - fri. 07-04-17</td>
<td>L9/E</td>
<td>Examinations 2.1</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>mo. 10-04-17 - th. 13-04-17</td>
<td>Resits 2.1</td>
<td></td>
<td>Fri. 14-04 Good Friday</td>
</tr>
<tr>
<td>16</td>
<td>tu. 18-04-17 - fri. 21-04-17</td>
<td>L1</td>
<td>L1 (Resits***)</td>
<td>Mo. 17-04 Easter Monday</td>
</tr>
<tr>
<td>17</td>
<td>mo. 24-04-17 - fri. 28-04-17</td>
<td>L2</td>
<td>L2</td>
<td>Th. 27-04 Kings Day</td>
</tr>
<tr>
<td>18</td>
<td>mo. 01-05-17 - th. 04-05-17</td>
<td>L3</td>
<td>L3/R**</td>
<td>Fr. 05-05 Liberation Day</td>
</tr>
<tr>
<td>19</td>
<td>mo. 08-05-17 - fri. 12-05-17</td>
<td>L4/E</td>
<td>L4/R**</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>mo. 15-05-17 - fri. 19-05-17</td>
<td>L5</td>
<td>L5/R**</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>mo. 22-05-17 - fri. 26-05-17</td>
<td>L6</td>
<td>L6</td>
<td>Th. 25-05 Ascension Day</td>
</tr>
<tr>
<td>22</td>
<td>mo. 29-05-17 - fri. 02-06-17</td>
<td>L7/E</td>
<td>L7</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>tu. 06-06-17 - fri. 09-06-17</td>
<td>L8</td>
<td>L8</td>
<td>Mo. 05-06 Whit Monday</td>
</tr>
<tr>
<td>24</td>
<td>mo. 12-06-17 - fri. 16-06-17</td>
<td>L9</td>
<td>L9 (Resits AI*)</td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>mo. 19-06-17 - fri. 23-06-17</td>
<td>L10</td>
<td>Examinations 2.2</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>mo. 26-06-17 - fri. 30-06-17</td>
<td>L11/E/R</td>
<td>Resits 2.1**</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>mo. 03-07-17 - fri. 07-07-17</td>
<td>Resits 2.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>mo. 10-07-17 - fri. 14-07-17</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29–35</td>
<td>mo. 17-07-17 - fri. 01-09-17</td>
<td>Vacation</td>
<td>Summer holidays</td>
<td></td>
</tr>
</tbody>
</table>

*L*: lectures  
*E*: exams  
*R*: resits  

*For Artificial Intelligence courses the resits are scheduled in the last week of the following block.  
**For Computing Science courses the resits are scheduled either in week 3, 4, 5 of the following block or at the end of the next exam period.  
***For some Non-Life Sciences courses (mainly IEM and (Applied) Physics) the resits will take place in the first lecture week of the following block.*
A2.3 FINANCIAL MATTERS
The University Student Desk (USD, see C2.2) provides information about registration procedures, tuition fees and everything you need to do to ensure that your registration becomes and remains valid. They also provide students who have paid their fees and have registered as students at the University of Groningen with a University Pass, the so called RUG-pass.

A2.3.1 Tuition fees
Information regarding tuition fees can be found on the website:
- myuniversity.rug.nl/infonet/studenten/inuitschrijving/collegegeld/
International students can find information on tuition fees on the following website:
- www.rug.nl/education/international-students/financial-matters
You can also contact the USD for further information.

A2.3.2 Student finance – DUO grants
For more information about Student Finance and grants (and the changes as of 1 September 2015 in this system) for Dutch students, please contact the Dienst Uitvoering Onderwijs (DUO) Groningen office:
- www.duo.nl

A2.3.3 Study costs
The University of Groningen has a policy on study costs. The policy aims to control costs so that the study cost component does not exceed the grant/loan budgets for Dutch students. The amount that students are required to spend on study materials will therefore not exceed the government grant. The standard sum for 2016-2017 is € 740,-. Each programme phase has a cost ‘ceiling’ (standard sum x length of programme phase, i.e. propaedeutic, bachelor, master, major, minor).

Sometimes it is not possible to avoid exceeding the ceiling amount. In such cases it is possible to apply to the Faculty Board for reimbursement of half the extra expenditure on the basis of receipts submitted as proof. Sometimes other arrangements may be possible. Students can obtain information on the cost policy at www.rug.nl/insandouts or Frequently asked questions on /myuniversity. They can also visit the University Student Desk or their academic advisor.

A2.4 REGISTRATION FOR COURSE UNITS AND EXAMS
Registration for course units and exams is compulsory and should be completed in time and is done via ProgRESS WWW:
- progRESSwww.nl/rug

- Timely registration for course units is considered to be registration at least 4 weeks before the period the relevant course unit starts in.
- Registration for a course unit obliges the registered person to appear for the first session of the course unit.
- ProgRESS WWW does not allow you to register for more than four courses in a period. In case you want to register for more courses in a period please contact your academic advisor.
- Please deregister for a course unit in case you decide not to attend.
- Registration for written examinations is coupled to the registration for course units! Students are responsible for a timely registration at least one week before the date of the exam:
  - In case you attend a (re-)exam you need to be present at the start of the (re-)exam.
• In case you register for a course unit you will automatically be registered for the exam.
• In case you fail the exam you will automatically be registered for the re-exam.
• It is possible to register separately for an exam or re-exam, i.e. you can register for a (re-)exam without registering for the course.
• Despite the automatic exam registration the student remains responsible for being properly registered for (re-)exams.
• **Please deregister for a (re-)exam in case you decide not to attend.**
  There is an opportunity to sign out until at least 1 week before the date of the (re-)examination.

**Note:** Some degree programmes, for example Artificial Intelligence and Industrial Engineering and Management, include a lot of course units offered by other faculties. Different registration procedures apply to these course units! Please check the programme-specific section of this Student Handbook for the registration deadlines for these course units, or contact the Education Office of the relevant degree programme or faculty.

You can always contact the student information desk of the faculty that offers the course unit, i.e. the Education Support Desk (see Section A3.1.1) for courses offered by the Faculty of Mathematics and Natural Sciences, if you have trouble registering. The Board of Examiners may grant permission to take a course unit or examination, even when a student is not properly registered, in special cases of force majeure. Please contact the academic advisor for more information.

**Coupling between ProgRESS WWW and Nestor**

*Nestor* is the electronic learning environment of the University of Groningen (see Section A4.3.6) and is used by the lecturer of a course to provide course material (like slides, reader, exercises) and post announcements.

Registration in *ProgRESS WWW* and enrolment in a *Nestor* course are coupled:
- Registration in *ProgRESS WWW* for a course or exam automatically results in enrolment in the corresponding *Nestor* course.
- Enrolment in a *Nestor* course does not mean you are allowed to participate in the course itself, therfore you need to be registered in *ProgRESS WWW* for the course.
- If you are planning a resit only, please do not register in progress for the whole course unit (including practicals and or group assignments) but sent a request to be admitted to Nestor to have access to the learning environment of the course unit.

<table>
<thead>
<tr>
<th>Registered/access in</th>
<th>I have access to the course in Nestor</th>
<th>I am allowed to participate in the course</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>ProgRESS WWW</em></td>
<td>Course</td>
<td>Yes (if available)</td>
</tr>
<tr>
<td><em>ProgRESS WWW</em></td>
<td>Exam</td>
<td>Yes (if available)</td>
</tr>
<tr>
<td><em>Nestor</em></td>
<td>Course</td>
<td>Yes (if available)</td>
</tr>
</tbody>
</table>
A2.5 CREDIT POINTS AND MARKING SYSTEM

University degree programmes comprise several course units. Each course unit is awarded a number of ECTS credit points (ECTS: European Credit Transfer and Accumulation System). ECTS is an EU standardized system for measuring student workload as a means of facilitating international mobility. One ECTS credit point represents 28 hours of full-time study (including contact hours, reading, independent study, preparation for exams, etc.). 60 ECTS credit points represent one year.

A2.5.1 Marking system

After an exam is completed, the results are administered in the automated results registration system (ProgRESS WWW). A list of the results you have achieved can be found on the internet:

- progRESSwww.nl/rug

Please contact the Education Support Desk (ESD) immediately if you find an error in your registered marks.

If an official results transcript is required, a printout can be requested from the Education Support Desk (ESD, see Section A3.1.1).

In general, each course unit is examined either by an examination (written or oral), a written assignment, or a presentation. The Dutch marking scale ranges from 1 (lowest) to 10 (highest). As an indication, 6 is the minimum pass mark, and 10 and marks lower than 3 are highly exceptional:

- 10 Outstanding; a remarkable performance; seldom given
- 9 Excellent
- 8 Very good
- 7 Good
- 6 Satisfactory
- <6 Unsatisfactory

A mark below 6 requires the course unit to be repeated until a 6 or higher is achieved. The final cumulative mark for the whole programme is the weighted average of the individual marks for each of the elements, taking into account the student workload. Alternatively, an assessment can be registered as pass or fail only. This type of assessment is used for practicals and also for the registration of results from abroad (based on the transcript of records of the foreign University).

A2.5.2 Fraud

Fraud and plagiarism are not accepted at this University or anywhere else in the academic community. In all cases where plagiarism is found or suspected, the Board of Examiners will act accordingly. If the Board decides that plagiarism has occurred, it will impose a sanction in accordance with the Rules and Regulations (see Section C1.3). In general, this will result in the student being excluded from participation in examinations or other forms of testing for the relevant course unit for the current academic year.

A2.6 BINDING STUDY ADVICE: THE BSA SYSTEM

A binding (negative) study advice is a binding decision regarding the continuation of the Bachelor’s degree programme.

To be allowed to continue your Bachelor’s degree programme, you must have earned at least 45 ECTS credit points by the end of your first year and have gained your propaedeutic certificate by the end of your second year.

If you fail to satisfy these requirements, you will be issued a binding (negative) study advice. This means you are not allowed to continue your degree programme and will not
be allowed to register for the same Bachelor's degree programme for the next two years. You can, however, register for other degree programmes. However, a negative BSA for a certain degree programme may also apply to a cluster of related degree programmes (see the website below for the clusters within FMNS).

If you decide in your first year to deregister for your degree programme before the 1st of February, it is possible to register in a later academic year for the same degree programme again, thereby avoiding a binding study advice in the academic year of deregistration.

If you fail to satisfy the BSA requirements due to personal circumstances, you can apply for an adapted BSA threshold. Please contact the academic advisor as soon as the circumstances arise.

More information about the BSA system can be found on:
- myuniversity.rug.nl/infonet/studenten/bindend-studie-advies/

A2.7 STUDY DELAY AND GRADUATION FUND (PROFILERINGSFONDS)

If circumstances beyond your control affect your progress during your studies, you may be eligible for financial assistance from the Graduation Fund (Profileringsfonds). The conditions are set out in the regulations pertaining to the Fund:
- myuniversity.rug.nl/infonet/studenten/profileringsfonds/

If you experience study delay due to circumstances beyond your control, and if the delay is expected to amount to more than four weeks, you must report this immediately to the academic advisor. The following can constitute grounds for financial assistance:
- Illness;
- Family circumstances;
- A disability (physical limitations);
- Pregnancy;
- Lack of a degree programme that meets objective standards;
- Loss of certification for your degree programme;
- Other circumstances of an exceptional nature.

The academic advisor will direct you to a student counsellor if your delay amounts to or is expected to amount to more than 15 ECTS credit points. You will have to make an appointment with a student counsellor for a follow-up report yourself.

If during the academic year the delay amounts to more than 15 ECTS after the first report to the academic advisor, you must contact a student counsellor immediately, even if you have not been told to do so by the academic advisor.

You must follow the advice of and the agreements made with the academic advisor and the student counsellor or you will not be eligible for financial support from the Graduation Fund.

Apply in good time for financial assistance. If you apply late you will not receive any financial compensation.
**A2.8 GRADUATION AND APPROVAL OF STUDY PROGRAMME**

The degree application comprises two steps:
1. The approval of your study program by the Board of Examiners.
2. The actual degree application ultimately resulting in the graduation ceremony.

Starting the application process takes place by means of registration in *ProgRESS WWW* the same way you register for a module, exam or re-sit, and subsequently composing your study program in *ProgRESS WWW* (see Section A4.3.7).

In *ProgRESS WWW* you go to:
Enrolments RuG > Mathematics and Nat. Sciences > (Under)Graduate school > BSc /MSc “Program” > Aanvraag examen BSc/MSc “Program”

Once you have submitted your programme the Board of Examiners will decide about approval of your programme.

*ProgRESS WWW* detects when you have finished all modules of your approved study programme. The administration will then start the process of the degree application. You can follow the progress of this process in the degree application module in *ProgRESS WWW*.

Information regarding ceremony dates can be found on the Student Portal or the programme-specific section of the Study Guide.

On request, students who drop out can receive a statement of their academic record including the course units passed.

**Honours predicate**

In some cases a student will be awarded an honours predicate, Cum Laude or Summa Cum Laude. The specific guidelines for this predicate can be found for the Bachelor’s programmes in the Teaching and Examination Regulations (see Section C1.2) and for the Master’s programmes in the Rules and Regulations of the Board of Examiners (see Section C1.3).

**A2.9 OBJECTION AND APPEAL PROCEDURES**

If you have a complaint, or if you disagree with a certain decision, you can voice your concerns in an informal and/or a formal way:

- **Informal** - The quickest way to solve a problem is to talk to the person or body with whom you have the problem. If the relationship or atmosphere between you and the person in question does not allow for informal talks, you can ask your academic advisor or the SSC student counsellors for advice.

- **Formal** - You can lodge an official complaint, objection or appeal if there are degree programme-related matters that you are not happy with or do not agree with.
A2.9.1 Board of Appeal for Examinations (CBE)
The Board of Appeal for Examinations (CBE) is an independent body where administrative appeals can be lodged against individual decisions by Boards of Examiners, examiners and Admissions Boards on the basis of Article 7.60 of the Higher Education and Research Act (WHW). This may concern decisions about subjects specifically related to teaching, such as:
- Marking of examinations and final assessments;
- Admission to examinations;
- Admission to a degree programme;
- Assessment of the entrance examination (colloquium doctum);
- Establishing the number of ECTS credits earned;
- Granting of exemptions.

For more information, see the Student Portal.

Appeals can be submitted to the Central Portal for the Legal Protection of Student Rights (CLRS, see A2.9.3).

A2.9.2 Complaints, concerning sexual harassment, aggression, violence and discrimination (SIAGD)
Complaints concerning, for example, sexual harassment, aggression, violence or discrimination should be reported to the University of Groningen Confidential Advisor. The Confidential Advisor is available to both students and staff members. The Confidential Advisor has an independent position within the University and all consultations are treated confidentially. For more information, see the Student Portal.
If you feel you are the victim of unwanted behaviour, you can also submit a written complaint to the Central Portal for the Legal Protection of Student Rights (CLRS, see A2.9.3). All documents related to such complaints are treated strictly confidentially.

A2.9.3 Central Portal for the Legal Protection of Student Rights (CLRS)
Appeals against individual decisions by Boards of Examiners or official complaints concerning sexual harassment, aggression, violence or discrimination can be submitted in writing to the Central Portal for the Legal Protection of Student Rights at the following address:

CONFIDENTIAL University of Groningen
Central Portal for the Legal Protection of Student Rights (CLRS)
P.O. Box 72
9700 AB Groningen
the Netherlands

Every complaint will be treated as confidential. More information can be found on:
- www.rug.nl/education/laws-regulations-complaints/complaintobjectionappeal

A2.10 COMMITTEES
The Faculty of Mathematics and Natural Sciences has a number of managerial bodies, including:

A2.10.1 Board of Examiners
The Board of Examiners [Examencommissie, EC] draws up rules related to the practical aspects of examinations, such as how exams may be taken, what the criteria for a ‘cum laude’ predicate are and how registration is arranged. In addition to these general rules, the Board of Examiners is also responsible for individual matters such as approval of individual study programmes, granting exemption from course units, admission to course units to which you would normally not be admitted, assessing force majeure in
situations related to registration and examinations and investigating potential cases of fraud. The Board of Examiners is also your point of call for complaints about examinations and marking.

Each degree programme has its own Board of Examiners, which is only authorized to rule in matters concerning that specific degree programme. Some degree programmes include course units offered by other degree programmes. The Board of Examiners for the degree programme setting the examinations is authorized to assess the examinations, deal with any complaints and decide upon requests for alternative exam regulations. Course units taught by other degree programmes or faculties are the responsibility of the Board of Examiners of the degree programme in question.

The Board of Examiners comprises at least of one member who is a lecturer in the degree programme and one member from outside the programme. Please see the programme-specific section of the Study Guide for more information and a list of members of the relevant Board of Examiners.

A2.10.2 Programme Committee
The Programme Committee [PC, Opleidingscommissie, OC] handles all important matters regarding a degree programme, with the exception of individual problems. This committee directly advises the Faculty Council with regard to the content of the Teaching and Examination Regulations [OER, onderwijs- en examenregeling]. Additionally, the Committee is responsible for the evaluation of course units and the evaluation of the degree programme. It also issues solicited and unsolicited advice to the Programme Director about educational issues. A Programme Committee consists of both staff members and students. Information on the Programme Committee members for your degree programme can be found in the programme-specific section of the Study Guide.

Student platforms and Bètastuf
Most degree programmes also have a student platform, in which students from all cohorts meet to discuss their degree programme. This way, problems can be identified at an early stage and possibly even resolved before the end of the course unit in question. Student representatives from the Programme Committees (OCs) also attend these meetings, which may therefore also serve as input for the OCs. Please check the programme-specific section of the Study Guide for more information about your degree programme’s student platform and how to contact it. Bètastuf is the overarching organisation for all the student-representation in FMNS.

See for more information:
- www.rug.nl/fwn/organization/betastuf

A2.10.3 Admission Board BSc Programmes
Students who apply for admission to a Bachelor’s degree programme based on prior education that according to Dutch higher education law does not give entry to the degree programme of your choice (e.g. a non-Dutch diploma, Dutch diploma without the proper profile, or Dutch propaedeutic certificate of a university of applied sciences) will be assessed by the Admission Board BSc Programmes (CBT, Commissie Bijzondere Toelating). For more information about the admissions procedure, see Section A2.1.

Contact information can be found on the FMNS website:
- www.rug.nl/fwn/beta-studie/praktisch/toelating-inschrijving/
A2.10.4 Admissions Board for the Master’s programme
Students can be admitted to a Master’s degree programme once they have successfully completed a related Bachelor’s degree programme at the University of Groningen. Students with a Bachelor’s degree from another Dutch or foreign university may also qualify for admission. However, admission is then granted on an individual basis by the Admissions Board of the programme. Each (cluster of) Master’s degree programmes has its own Admissions Board. For more information about the admissions procedure, see Section A2.1.

A2.10.5 Faculty Board
The Faculty Board (Faculteitsbestuur, FB) is responsible for the management and administration of the Faculty, and for the supervision of the quality of the teaching and research. The FB also draws up the budgets and allocates the staff.

After each meeting, the Faculty Board sends an overview of the topics discussed and decisions taken to the Faculty Council, the Director of Undergraduate and Graduate Studies and the directors of the research institutes for their information, unless the interests of the University or of the involved persons preclude this.

A2.10.6 FMNS Faculty Council
The Faculty Council [Faculteitsraad] is FMNS's consultative participation body. It has staff and student members and is authorized to discuss the general affairs of the Faculty with the Faculty Board, to make suggestions and to voice its opinions. The Faculty Council has rights of approval and rights to advise the Faculty Board about matters that are specifically relevant to the Faculty. In addition, the Faculty Council has rights of approval with regard to the Faculty Regulations and a large part of the Teaching and Examination Regulations. Where the Faculty Board has the right to take certain measures independently, the staff section of the Faculty Council has rights to advise as well as rights of approval.

More information can be found on the website:

- www.rug.nl/about-us/organization/administrative/participation/faculty-councils/faculty-council-fwn
A3
STUDENT SUPPORT

A3.1 EDUCATION SUPPORT CENTRE
The staff of the FMNS Education Support Centre (ESC) provides support to the teaching organization. Staff members are academic advisors, degree programme coordinators, schedulers, exchange coordinators, student administration, and secretaries. Their support involves:
- Providing information for students and prospective students about the teaching programme;
- Helping students with study-related problems;
- Organizing registration for course units and examinations;
- Administering examination results and degree certificates;
- Compiling lecture and examination timetables;
- Providing information about study abroad and financial support;
- Formulating and implementing education policy, etc.;
- Conducting and processing surveys in the field of teaching quality assurance;
- Supporting the Programme Committees and Board of Examiners.

The ESC has offices at Zernike and at the A. Deusinglaan (ADL) location. Although FMNS students are welcome to visit both locations if they have general questions, programme-specific knowledge is mainly concentrated at the location where the students follow most of their course units.

A3.1.1 Education Support Desk
The Education Support Desk (ESD) is the ESC’s front office. This is where students can turn to with questions and comments about the teaching organization. Please feel free to contact the ESD via e-mail or phone, or drop by during opening hours.

You may visit the ESD for the following kind of matters:
- To hand in programme-related forms or documents;
- To get a certified transcript of records (free of charge);
- In case of questions about the processing of grades in ProgRESS WWW;
- In case of enrolment problems in ProgRESS WWW;
- If you have questions about graduation (after reading the relevant information on this Nestor page).

ESD Zernike
Location: Bernoulliborg, Nijenborgh 9, building 5161, first floor
Opening hours: 10:30 – 12:00 (all week days)
13:00 – 15:00 (not on Wednesday and Friday)
Telephone: (050) 363 4422
(between 9.00 – 12:00 and 13:00 – 16.00)
E-mail: esc.fwn@rug.nl
**ESD ADL**
Location: UMCG, Antonius Deusinglaan 1, building 3214, ground floor
Opening hours: 12:00 – 14:00
Telephone: (050) 363 3315 or (050) 363 3343
(between 9:00 – 12:00 and 13:00 – 16:00)
E-mail: esc.fwn@rug.nl

For detailed information about closing days (for instance due to holidays) see the Student Portal.

A3.1.2 Academic Advisor
Successful study depends on many different factors, and it is therefore understandable that students sometimes need to consult an impartial expert. The task of the academic advisor (studieadviseur) is to assist students in finding solutions to any problems encountered while studying. In practice, this concerns matters like the choice of degree programme, study pace or an improvement in study methods. You can visit the open office hours of an academic advisor or make an appointment via the Education Support Desk or using youcanbook.me. For an overview of the academic advisors see the Nestor page of the Education Support Centre and for the contact information of the academic advisor relevant for you see the programme-specific section of the Study Guide.

During the academic year academic advisors organize meetings to support students with certain aspects of their study. In the Thesis Support Group students, who have problems keeping pace when working on a large research project, meet weekly under the supervision of an academic advisor. They discuss their progress and set goals for the coming week. Similarly, other groups of students meet on a regular basis to increase their general study progress.

Problems of a more general nature (e.g. the financial consequences of study delay) are often dealt with by consulting the University student counsellors. You can also discuss social matters with the academic advisor if you need a confidant for personal problems. In some of these cases the academic advisor will recommend the more specialized assistance provided by the Student Service Centre (SSC, see section A3.4.2).

Students can book their own appointment with an academic advisor, using an online booking system (https://youcanbook.me), for which the specific URL can be found at Nestor.

A3.1.3 Degree Programme Coordinator
The degree programme coordinator (onderwijscoördinator) supports the teaching process within the programme, is the secretary of the Board of Examiners and advises the Programme Committee. Consult the contact information in the programme-specific section of the Study Guide if you wish to contact the degree programme coordinator.

A3.2 STUDYING WITH A PERFORMANCE DISABILITY
Sometimes personal circumstances necessitate adjustments in teaching or testing. This can occur when students have dyslexia or performance disabilities due to a physical disability, a psychiatric problem or a chronic illness. Adjustments usually involve:
- Making certain facilities available (extra exam time, adapted exam material, etc.) permitting exceptions from the Teaching and Examination Regulations (see section C1.2);
- Extracurricular individual examinations;
- Different examination time or place;
- Relaxation of study progress rules;
- Replacement assignment for compulsory lectures or practical’s, etc.

In consultation with the academic advisor, you can examine what is necessary or determine which facilities you can use, which departures from the OER will be requested, whether it will be necessary to adapt your study pace or study planning, etc.

Please inform as soon as possible the academic advisor in case you have a performance disability.

A3.3 STUDYING ABROAD
Several FMNS Bachelor’s and/or Master’s degree programmes offer students the opportunity to gain academic and social experience abroad. Next to attending regular courses at a host university, you can also opt for other projects, such as: work placements, minors (3rd year BA) or MA research projects. Please ask your academic advisor whether an exchange period or a project fits in your programme. If your academic advisor finds your project feasible, go to the Exchange Office (see A3.3.2) who will tell you how to proceed.

A3.3.1 Organizing study period abroad
Where can you go?
If you want to study at another European university, you can be hosted at the following Erasmus partner universities of the FMNS Faculty: check the Student Portal.

Note: contact the Exchange Office (Bernoulliborg) to know whether you are eligible for an Erasmus exchange period and to check which places are still available.

If you would like to spend a study period outside Europe, you could leave within the framework of the Multi-Faculty Exchange (MFE). The RUG has university-wide agreements with some highly ranked universities worldwide, see the Student Portal.

Bear in mind that the deadline for MFE is extremely early (last year: February 1st) and that many documents (as an official language test) should be handed in by then. The deadline for the academic year 2015-16 was not known at the moment this study guide was prepared.

In case you wish to conduct an internship, be aware that you can go anywhere in Europe (with an Erasmus funding) or outside Europe (with a Marco Polo scholarship). For information about funding and/or eligibility, contact the Exchange Office.

How can you finance your study period abroad?
The easiest way to finance a study period or a work placement abroad - within Europe - is with an Erasmus grant. This scholarship entitles you to an allowance of 12 months, which you can use in several (interrupted) times. For destinations outside Europe (be it for a study programme or for an internship), you can apply for a grant from the University’s Marco Polo travel fund. Know that a combination of both these grants (Erasmus and Marco Polo) is not possible. For more details about these grants or any additional funding, please contact the Exchange Office (see A3.3.2).

Are you eligible for a grant?
To be eligible for an Erasmus or Marco Polo grant, you must at least have completed the first year Bachelor’s degree programme. Besides, the following conditions apply to both grants:
- Internship duration: min. 2 months/ max. 12 months.
- Study period: min. 3 months/ max. 12 months.
**Which requirements must your study programme abroad meet?**
Before your departure, the Board of Examiners must approve the study programme you compiled for your study period at the hosting university. Be aware that, without this approval, your results will not be included in your list of marks after your return.

**How do you prepare your stay abroad?**
There are a number of things to arrange before you can go abroad: the application procedure at the host universities, a housing request, etc. Keep in mind that hosting universities all have different application deadlines. The deadlines for the grants also vary according to your dates of departure and arrival.
This being said, remember that you first have to be officially nominated as an exchange student by the Exchange Office before you can start applying at the host university.

**When should you start preparing your stay abroad?**
For an Erasmus exchange, it is recommended to contact the Exchange Office at least 8 months before the start of the semester abroad.
For a MFE application, please pass by 4 months before the deadline.

**A3.3.2 Exchange Office**
The Exchange Officers for FMNS are:
- Henriëtte Mulder (at Zernike)
- Margriet Hulshof (at ADL)
They can advise and help you complete all the necessary procedures.

You can contact them by e-mail:
- exchange.science@rug.nl
- m.a.hulshof@rug.nl
Or come by during the Office Hours:
- Exchange Office, Bernoulliborg, room 5161.0050
- ADL 1, room 3213.0017

For additional information, see:
- www.rug.nl/fwn/informatievoor/studenten/studerenbuitenland

**A3.4 NON-DEGREE-PROGRAMME-RELATED SUPPORT**
During your studies you may run into all kinds of problems and questions. The following organizations may be able to help you:

**A3.4.1 University Student Desk**
If you have any questions about application, admission, registration or deregistration, study delay, student finance and other financial matters, please consult the knowledge base at:
- www.rug.nl/education/hoezithet

If you cannot find the answer to your question, just click the contact button to send an e-mail.

You can also contact the University Service Desk (USD) at the Academy Building about any of these issues. If the USD cannot help you, they will refer you on, for example to the Student Service Centre. You can make an appointment for the SSC student counsellors’ office hours via the USD. At the end of August and the first weeks of the academic year the USD holds office at the Zernike Complex as well.

For the contact details and the opening hours of the USD, go to:
- www.rug.nl/usd
A3.4.2 Student Service Centre (SSC)
The Student Service Centre is the student counselling expertise centre of the University of Groningen. The student counsellors, psychologists and trainers work together to provide an integrated package of student support with the aim of helping students with their studies. They can prevent or remove possible impediments to your study progress so that you can develop fully during your time at university. The SSC has a wide range of support facilities – information and advice, individual sessions, short-term therapy and a wide variety of workshops and training courses.

For more information see the Student Portal.

Information, advice and counselling
The student counsellors have been appointed by the University to provide confidential counselling for students. They deal with all kinds of non-degree-programme-related matters such as significant study delay (more than 3 months (15ECTS)), legal matters, complaints, objections and appeals, but also questions concerning choice of degree programme, financial help and personal and confidential matters.

You can make an appointment with a student counsellor via the Student Service Centre, Uurwerkersgang 10, telephone: (050) 363 8066 or via the University Student Desk (USD), Broerstraat 5, telephone: (050) 363 8004.

Short-term therapy
Not everyone will have an easy time adjusting to a new environment, strange customs and a different language. This does not necessarily mean that you will need professional help, but if problems begin to affect your studies and your personal life, you can always ask the psychological counsellors for help. This help is available to all students at the University. An initial assessment is free of charge, follow-up sessions will cost EUR 40 (once-off payment).

For more information, see the Student Portal.

You can make an appointment with a psychological counsellor via the Student Service
Location: Uurwerkersgang 10, 9712 EJ Groningen
Telephone: (050) 363 8066
E-mail: ssc-secretariaat@rug.nl

Training courses and workshops
Do you have a tendency to procrastinate? Are you not sure how to deal with Multiple-choice exams? Is learning how to study effectively still a challenge for you? For all these study issues and more you can find a course or workshop at the Student Service Centre.

Please visit the Student Portal for more information.
**Open office hours for International Students**
Living and studying in a foreign country is a great experience, but sometimes problems can stand in the way of studying successfully. Do you doubt your study methods? Are you encountering study problems? Or are you experiencing personal difficulties? Come to the open office hours for international students at the Student Service Centre of the University of Groningen. An expert from the Student Service Centre will try to help you solve your problems. In some cases they might refer you to a student counsellor, a psychological counsellor or one of the workshops of the Student Service Centre. Participation is free. You don’t have to register. Just come in during the hours that are stated on the Student Portal and report to the information desk at the Student Service Centre, Uurwerkersgang 10 in Groningen.

**A3.4.3 International Service Desk (ISD)**
The International Service Desk (ISD) provides information to foreign students, prospective students and foreign researchers, specifically with regard to studying, doing a PhD and temporary residence at the University of Groningen for research or other purposes. The ISD also assists foreign guests staying in Groningen or those responsible for their stay with any queries they may have about issues such as regulations relating to foreigners, study advice, medical care, financial matters, accommodation, and facilities and official organizations within the city. The ISD also organizes and coordinates a number of introductory and social activities jointly with organizations such as Wings, the Global Club and the Foreign Guest Club. In some cases, the ISD is solely responsible for looking after foreign guests – if, for example, they have been invited to Groningen as guests of the Board of the University or have come to the University of Groningen within the framework of a joint project with a developing country.

For more information, see:
- [www.rug.nl/education/international-students/international-service-desk](http://www.rug.nl/education/international-students/international-service-desk)

**A3.4.4 International students’ association ESN-Groningen**
ESN-Groningen coordinates and stimulates the international activities of the student community in Groningen. It was founded in 1988. ESN-Groningen is part of the Erasmus Student Network (ESN) and works closely with the University of Groningen. One of the functions of ESN-Groningen is to support international students. This includes finding a student mentor – a Dutch student who can help with practical matters and aid foreign students in getting to know the city of Groningen and student facilities such as the libraries and the sports centre. ESN mentors also ensure that the first taste of student life in Groningen is an enjoyable one. During your stay in Groningen, ESN-Groningen will organize various activities to make you feel at home, such as an introductory weekend, a weekly social in the pub Rumba, trips to the island of Schiermonnikoog and to Amsterdam, ice-skating, sailing, theme parties and much more. ESN-Groningen wants you have a great time in Groningen. A small-scale activity such as a dinner or movie is organized every Sunday. And last but not least, ESN-Groningen publishes a magazine especially for international students, the WaM.

**Location:** Pelsterstraat 23, 9711 KH Groningen
**Telephone:** (050) 363 7176
**E-mail:** info@esn-groningen.nl
**Website:** [www.esn-groningen.nl](http://www.esn-groningen.nl)

If you want to be kept informed of all the upcoming events and activities send a mail to their e-mail address.
A3.4.5 Careers advice before, during & after your degree

The University of Groningen wants to offer its students the best possible facilities to prepare and develop their careers. Within the framework of NEXT, various activities are organized to help students make choices – and study choices in particular – and prepare them for the job market. In order to achieve this, NEXT is working actively with faculties, study associations, alumni organizations and other providers in the field of careers services. Announcements can be recognized by the NEXT logo.

Visit for more information:
- www.rug.nl/next

The Faculty of Mathematics and Natural Sciences will make student career events, student-assistant positions and regular job vacancies related to their degree programmes available in the Student Portal at the tab Career.

A3.5 HEALTH AND SAFETY

A3.5.1 Fire and emergencies

Dial (050 363) 8050 in the event of fire or an accident. Clearly explain the situation and location. For other less urgent matters, call (050 363) 5520 to report malfunctions or irregularities.

A3.5.2 Computers and RSI

Students spend a lot of time working at computers and are at risk of developing RSI complaints. RSI is the abbreviation for Repetitive Strain Injury and is a generic term for all conditions involving the neck, shoulders, arms, wrists and hands. These conditions can become chronic and lead to incapacity for work and cause serious limitations to everyday life.

**Symptoms**

RSI symptoms may vary from stiffness, pain and tingling sensations to loss of strength in the above-mentioned body parts. Initially, the symptoms occur only while working at a computer, but at later stages they also occur during rest. Ultimately, the complaints can occur continuously, causing pain during even the simplest of actions or even rendering them completely impossible.

**How to prevent RSI**

There is no standard method to prevent RSI. The measures you can take mainly involve relaxation of the muscles and the mind, and stimulation of blood flow. To minimize the risks of developing RSI, five points should be considered. This is also known as the ‘5W approach’.

**Workload**

Undertake regular time planning and prevent creating peaks in workload. If necessary, take a ‘study skills’ course at the Student Service Centre (tel. (050) 363 8066).
Realize that your productivity is higher if you take regular breaks than if you work without interruption.
Try to keep things in perspective – it will help you avoid working for too long, stimulate you to take regular breaks and help you unwind. If you do not feel on top of things drop by your academic advisor, student counsellor or student psychologist.
**Work organization**
Incorporate as much variation in your work as possible: reading, writing, typing and browsing on the internet. Also alternate between easy and difficult tasks. Use the shortcut keys on your keyboard more often than your mouse. Take regular breaks. Alert your tutors if you are allocated too many deadlines or too many writing assignments at the same time.

**Working hours**
Do not work on your computer for more than five or six hours a day. Do not forget to count the hours spent gaming and browsing on the internet. Special software has been developed to remind you to take breaks. Take regular breaks. Take a minimum break of ten minutes every two hours of work at a computer.

**Workplace**
Locate the screen directly in front of you, not too close. Avoid having to work with a turned neck. Ensure the top of the screen is at eye level. Avoid annoying reflections from windows. Use large font sizes, so that you do not have to lean forward to read the letters. You need a good chair that permits the height of the back and armrests to be adjusted. The back of the chair should mainly provide support to your lower back. Armrests relieve the shoulders. Adjust them so that the upper arms loosely touch them and form a right angle with your forearms. If necessary, search for more information on the internet on how to equip your workplace. Report unsatisfactory computer workplaces to the Occupational Health, Safety and Environment Coordinator. Never work for longer than two hours a day at a laptop. Connect an unattached keyboard and mouse to your laptop, and place the screen at eye level. Ensure you have a good workplace at home.

**Work posture**
See to it that you are in good physical condition. Sit upright and make sure that your upper and lower legs are at right angles when your feet are flat on the ground. Keep your wrists extended when using the keyboard and mouse. Perform regular physical exercise during work on the computer.

**Finally**
Drink a lot of water (the resulting visits to the toilet make natural breaks). Take early complaints seriously, check the risks applicable to your situation and find a solution. Do not ignore your body’s warning signals. If necessary, visit your family doctor or the physiotherapist at your sports centre. A lot of information about RSI can be found on the internet. For further questions or advice, contact the Occupational Health, Safety and Environment Coordinator: Mr A. Weitenberg, or the Head of the Department of Occupational Safety, Mr J. Jager.

E-mail: a.c.d.weitenberg@rug.nl  Telephone: (050) 363 4618
E-mail: jack.jager@rug.nl  Telephone: (050) 363 4427
A4
FACILITIES

A4.1 BUILDINGS
The teaching and support facilities of the faculty are accommodated in a number of buildings:

- **Linnaeusborg** (buildings U, 5171–5174): Centre for Life Sciences, Nijenborgh 7, 9747 AG Groningen; telephone reception (050) 363 2021. Open: 8:00 – 20:00.
- **Bernoulliborg** (building V, 5161): ESC – Mathematics – Computing Science Artificial Intelligence, Nijenborgh 9, 9747 AG Groningen; telephone reception (050) 363 6868. Open: 8:00 – 20:00.
- **Kapteynborg** (building J, 5419): Astronomy, Landleven 12, 9747 AD Groningen; telephone secretary (050) 3634074. Open during office hours, ring the bell to enter the building.
- **ADL1** (buildings 3211–3217/3219): ESD, Medical Sciences, Dentistry and Pharmacy, Antonius Deusinglaan 1, 9713 AV Groningen; telephone reception (050) 363 8000. Open: Mon–Thurs: 8:00 – 20:30; Fri: 8:00 – 17:30.

For a map, route description and more information about the buildings, see:
- www.rug.nl/fwn/organization/locaties

A4.1.1 House rules, regulations
Staff, students, visiting researchers and visitors are required to obey the facility house rules.

- Smoking ban. In accordance with Dutch law there is a general ban on smoking in public buildings;
- Mobile phones should be switched off in teaching rooms, libraries, laboratories and rooms with computer facilities;
- It is absolutely forbidden to eat or drink in the laboratories, teaching rooms, libraries and rooms with computer facilities;
- Bikes must be stored in the bicycle racks;
- The University accepts no liability for theft or lost property.

Everyone who works or studies at FMNS will come into contact with matters of safety, health and the environment. Many national rules and regulations about health have been formulated in the Working Conditions Act. The Environmental Protection Act contains a lot of rules concerning the environment. The consequences of these regulations for students and staff members are described in several manuals available on the internet:
- myuniversity.rug.nl/infonet/medewerkers/fwn/arbomilieuveiligheid

You will be expected to have read these rules, particularly those concerning important matters such as the location of emergency exits, evacuation procedures and the location of the fire extinguishers. The rules on safety and care for the environment must be observed and complied with.
It is absolutely forbidden:
- To eat or drink in the laboratories;
- To drink from laboratory glassware;
- To store food in laboratory fridges;
- To prepare food in laboratory ovens.

Before you start working in a laboratory:
- Take note of the safety regulations;
- Locate the emergency exits and escape routes;
- Locate the fire extinguishers, absorption equipment for chemicals, fire blankets, fire showers, first-aid boxes and eye-wash fountains;
- Always wear safety goggles and a cotton laboratory coat;
- Working in a laboratory without the supervision of a staff member is not permitted!

**Building rules: Faculty of Medical Sciences**
- All bikes should be placed in the bike parking facilities below building 3219 or in the bicycle racks next to this building. Nowhere else!
- Food and drink are prohibited in the lecture halls with the exception of bottled water;
- All lectures start at the time indicated in the timetables. Someone from the Education Support office will be present (Keuningzaal and 3219.0061) 15 minutes before the scheduled start of the lecture to give technical support where required;
- Doors to the lecture halls will be closed shortly after the start of the lecture to avoid interruption from late comers. It is possible to leave the room at anytime;
- Please be quiet. Noise, even whispering is distracting for lecturers and fellow students.

**Protocol for removal of bikes at Faculty of Medical Sciences**
The Faculty of Medical Sciences has strict rules for the management of bike parking around the Antonius Deusinglaan 1 and 2 buildings because bikes which are not parked in the parking facilities cause a lot of inconvenience: bikes which are not parked correctly will be fixed on the spot and removed upon repeated violation.

**A4.2 LIBRARIES**
The mission of the library of the University of Groningen is to support and promote academic teaching and research by providing high-quality information services, the aim is to achieve this by adopting a demand-oriented and innovative approach.
The University of Groningen has one central University Library (UL) and three location libraries: the University Library Zernike, the Central Medical Library and the Library of Behavioural and Social Sciences. Many facilities are provided collectively by these libraries. There is, for example, one central catalogue and one lending system, and a large number of online databases can be accessed through the university network.

**A4.2.1 University Library**
The central University Library (UL, or in Dutch ‘UB’) functions as a facility centre for the entire university – for faculties and library users. The collections of Arts, Archeology, Law, Philosophy, Theology and Religious Studies have been moved to the UL recently, and are available in the study halls. For students there are lots of facilities and there is room to study. Furthermore, the library holds vast collections of reference and teaching material, either available in the study halls or in the closed depots. Interdisciplinary works, bibliographical material and a number of special collections can also be found in the UL.
**Electronic library**

An important facility is the electronic library, for consulting catalogues, e-books and e-journals, online databases, etc. Word processing facilities are also provided. Access to this information is limited to students and staff of the University of Groningen, and is for personal study or research only.

A new catalogue has been introduced recently, **SmartCat**: a catalogue containing all printed and electronic works owned by the University of Groningen libraries, with direct links to the full text. Furthermore, the University Library provides access to a large number of academic journals online, see:

- myuniversity.rug.nl/infonet/studenten/bibliotheek/zoeken/elektijdschr/

You can access almost all online catalogues, databases, e-books, e-journals, etc. from any computer within the RuG network, and, even outside the campus through Connect, see:

- myuniversity.rug.nl/infonet/studenten/bibliotheek/zoeken/connect

**Borrowing**

You can use your University Card to borrow publications from the libraries of the University of Groningen. The loan period for books is four weeks unless otherwise stated. Please return books or renew the loan before the loan period expires.

In general, loans can be renewed online through SmartCat by clicking on Borrower Information, provided that the loan period has not expired, that nobody has put a hold on the book and there are no fines outstanding. Borrowed material can be returned to any UL location. You can e-mail any questions to:

- bibliotheek@rug.nl

For more information, go to the Student Portal.

**Address University Library**

Location: Broerstraat 4, 9712 CP Groningen
Telephone: (050) 3635020 and/or (050) 3635000
E-mail: bibliotheek@rug.nl

**A4.2.2 Library at Zernike campus**

The UL Zernike is the joint library of three faculties located on the Zernike Campus: Economics and Business, Mathematics and Natural Sciences and Spatial Sciences. The library is responsible for the scientific information supply for students and staff of these faculties, and offers an extensive collection of journals, books and databases, printed and/or electronic. The electronic collection can be found through the Student Portal.

You can access most databases from anywhere, using the internet. For instance your home computer. In the UL Zernike you can find literature in one of the discipline-related collections, you can borrow or return books, you can use one of the 84 university workstations, or simply find a quiet place to study. The library offers tutorials and support in literature searches. For instance an information literacy training and RefWorks workshops. Visit our library and have a look at what it has to offer. You are very welcome!

For current opening hours, address details and a range of scientific information and workshops, please go to the Student Portal.
Here you will find both general and location-specific information.

**Address University Library Zernike**
Location: Nettelbosje 2, 9747 EA Groningen  
2nd floor of the Duisenberg building  
Telephone: (050) 363 3708  
E-mail: zernike-bibliotheek@rug.nl

**A4.2.3 Library of the University Medical Center Groningen**
More information on the Central Medical Library can be found on the Student Portal.

**Address Central Medical Library**
Location: Hanzeplein 1, 9713 GZ Groningen  
Winkelstraat 1 or Poortweg 12, 4th floor, Y 4.202  
Telephone: (050) 363 3048 and/or (050) 361 2596  
E-mail: cmb@umcg.nl

**A4.3 INFORMATION AND COMMUNICATION CHANNELS**

**A4.3.1 Personal account**
After enrolment, you will receive a student number and a personal computer account by email. A student computer account, consisting of a login name and a password, provides access to several web-systems and storage servers. This includes:

- Access to the Faculty Novell servers, for the use of computer applications;
- Access to the Internet;
- Use of a personal data storage server;
- Use of an e-mail account;
- Access to Nestor, the electronic learning environment of the University of Groningen;
- Access to ProgRESS WWW, where you can enrol in courses and exams, and view your study results.

You will need the following to log in: the name or address of the server, a login name and a password. Your login name is made up of your student number preceded by an ‘s’. Your initial password will be sent per email. You can change your password at:

- [myuniversity.rug.nl/infonet/studenten/ict/werkplek/](http://myuniversity.rug.nl/infonet/studenten/ict/werkplek/)

For information about IT facilities for students accessible with your account see the IT knowledge base for students on the Student Portal.

**A4.3.2 Student Portal**

The Student Portal is a protected environment that contains information for students of the University of Groningen. You can log in with your student number.

**Personalize your dashboard**

Once you log in to the Student Portal you will be taken straight to your personal homepage, known as the Dashboard. A small part of the Dashboard contains information for everyone. The rest can be furnished to taste, using what are known as widgets. You can, for example, install widgets for Twitter, the UK, the CIT Service Desk, the Library or My News. Have a look in the Widget Store (via the button Options on the Dashboard) to get an idea.
All information from the RUG Planner, ProgRESS WWW and Nestor, to name but a few applications, are also easily accessible via your own Dashboard.

*The Student Portal* is also the primary source for the Education Support Desk to provide you with up-to-date information concerning your study program. This involves important announcements about your program (such as deadlines, procedures, changes, workshops), but also documents that you will need to apply for graduation, a minor or a bachelor project, documents about studying abroad, information about minor, master possibilities, etc.

Students are urged to check this site daily, to avoid missing important events. All information that is published on *the Student Portal* is considered to be known by students. Practically, this means that any problems arising from not having read the information on *the Student Portal*, will be solely the responsibility of the student.

**A4.3.3 E-mail**

- googleapps.rug.nl

Your e-mail address is one of the primary means of personal communication of the University and the Faculty. For example, if one of the University employees (teacher, academic advisor, etc.) would like to send you a personal message, he/she will send it to your University e-mail address. Your e-mail address consists of name@student.rug.nl. Your name is made up of your initials and your surname, separated by dots.

Your University e-mail may also be used by the university to send you important messages such as requests for enrolment for certain courses or alterations to the timetables.

Students are expected to check their mailbox every day. For your own convenience, you may choose to forward your University mail to your private mail (use the settings after login).

The University of Groningen uses Google Apps for Education which gives students permanent access to their e-mail (Gmail), calendar (Google Calendar), chat (Google Talk), documents (Google Drive) and web pages (Google Sites).

For more information, see the Student Portal.

You can access your Google Apps University of Groningen account via:

- googleapps.rug.nl

This is where you log in with your student number and password (RUG account). The first time you log in, you will see a screen with a request from SURFconext. Click on *Yes, share this information* to activate your Google Apps for Education account.
A4.3.4 Ocasys
- www.rug.nl/ocasys

Ocasys is the university course catalogue. It contains information about the content of courses, learning objectives of courses, necessary literature of courses, assessment form and computation of final grade of courses, and the general outline of the degree programmes. You can search in Ocasys for courses as well as for degree programmes. However, the full description of the degree programmes can only be found in the programme specific part of the studyguide. Ocasys serves with regard to the assessment form of courses as an appendix of the Teaching and Examination Regulations (see Section C1.2). It contains the official information about the way courses are assessed.

A4.3.5 Schedules
- rooster.rug.nl

You can compose your own schedule by searching for courses or a degree programme. Please check the schedules on a regular basis, changes are still being made.

A4.3.6 Nestor
- www.nestor.rug.nl

Nestor is the electronic learning environment of the University of Groningen. Lecturers use Nestor to provide information about courses, to set electronic examinations and to exchange documents within their students. Students use Nestor to read important announcements, to cooperate with group members and to submit assignments.

You will be enrolled in a Nestor-course environment after you enrol for the specific course or corresponding exam in ProgRESS WWW. However, enrolment in a Nestor course does not mean you are allowed to participate in the course itself, therefore you need to be registered in ProgRESS WWW for the course (see also Section A2.4).

A4.3.7 ProgRESS WWW
- progRESSwww.nl/rug

ProgRESS WWW is a web-based application used by the University of Groningen. Students need to register for modules and exams well in advance. You may also use ProgRESS WWW to view your study results.

A4.3.8 Student PCs

You can use PCs at various University facilities by logging onto the student network. You will then have access to applications, your own data on the home directory (X:\) and the internet. Some of the rooms are used for practicals and courses, but when these are not scheduled you can use the room for self-study. Printers are also available for students.

A4.3.9 Usage rules

Using the University IT facilities implies that you agree to the usage rules for University IT facilities as published on:
- www.rug.nl/rc/security/aup

Users of the university computer systems should be aware they are not the only users of these computers. Many computers are multi-user systems, and the users of these computers belong to a community. Therefore, the ground rule on which this AUP (Acceptable Use Policy) is based is similar to the ground rule on which traffic is based:
users of the University computer systems may not endanger these systems, nor may they hinder other users. Some of the implications of this ground rule are that users are not allowed to send unsolicited e-mail or try to obtain or use other users’ passwords, either accidentally or ‘for fun’. **Abusing University computer systems may result in disciplinary action!**

**A4.4 PRINTING, COPYING AND SCANNING**

Students can use the multifunctional printers for printing, copying and scanning. Printing facilities are located close to the student computer rooms. The printers and copiers for students have equipment for reading and devaluating the card and choosing the job to print.

You can pay your printouts with a credit on your University Card. This credit can be topped up through MyOrder or through Webdeposit. Identify yourself at a printer with a University Card or by entering your student number and password, to release the machine or print job.

For more information, see the Student Portal.
B
Programme Specific part
B1

PROGRAMME-SPECIFIC EDUCATION-RELATED MATTERS AND FACILITIES

In this part of the study guide programme-specific information about the bachelor’s degree programmes in Astronomy, (Applied) Physics, (Applied) Mathematics, Chemistry, and Chemical Engineering is given. This part starts with a chapter which treats subject which are of interest for all these programmes and continues with chapters with information about the organization, learning outcomes, and outline of each programme.

B1.1 LECTURE ROOMS AND STAFF AT ZERNIKE COMPLEX

[Map] of part of the Zernike Complex

Translation:
Ingang=Entrance
Chemie-Fysica-Milieukunde = Chemistry – Physics – Environmental Sciences – Nano Science
**B1.1.1 Lecture rooms**
The lecture rooms of the Astronomy, (Applied) Physics, (Applied) Mathematics, Chemistry, and Chemical Engineering programmes are located at the Zernike complex. In the schedules the rooms are denoted by their building numbers (see the above map).

**B1.1.2 Computer rooms**

**Computer facilities at Nijenborgh 4**
In Nijenborgh 4 the computer rooms are situated at:
- Building 5113: rooms 5113.0303 and 5113.0317
- Building 5116: rooms 5116.0310, 5116.0315 and 5116.0303

If these computers are not used for lectures, they can be used as an individual workplace. Furthermore, a large number of computers is placed in an oval room in the entrance hall of building 5111. These computers are for individual use.

**Computer facilities at Bernoulliborg**
In the Bernoulliborg the computer rooms are situated at the second floor of the building (5161.02..). These computers can be used as an individual workplace as well when not in use for lectures. These computer have a dual boot for a logon to either Windows or Linux. Furthermore, individual computer workplaces are available at both the first and ground floor of the ESC.

**Computer facilities at Kapteynborg for Astronomy students**
Computers play a key role in astronomy research. It is therefore essential that students of Astronomy familiarize themselves as quickly as possible with the most commonly used computer systems and programmes for astronomy. A student computer cluster has been set up for this purpose in the Zernike Building (5419.0134). All students who have chosen to study Astronomy can request an account from one of the system administrators, Mr W. Zwitser (5419.0162, w.zwitser@rug.nl) or Mr E. Tiesinga (5419.0194, e.tiesinga@rug.nl).

**B1.1.3 Rooms of Staff**
The staff is housed at these buildings as well:
- (Applied) Mathematics staff: Bernoulliborg, third and fourth floor
- Chemistry and Chemical Engineering staff: Nijenborgh 4 and Linnaeusborg
- (Applied) Physics staff: Nijenborgh 4
- Astronomy staff: Kapteynborg/Zernike Building (building J, 5419, not visible on the map, located opposite to the Bernoulliborg on the other side of the Zernikelaan)

**B1.2 ADMISSION REGULATIONS**

**Admission to Master’s course units**
In order to be admitted to course units that are part of a Master’s degree programme, students must complete their Bachelor’s programme. Registration for Master’s course units will be blocked in Progress for students who have not gained their Bachelor’s degree.
**B1.3 TRANSITIONAL ARRANGEMENTS**

Over the years the programmes are liable to minor or major changes. The following transitional arrangements apply to students who are affected by such changes:

1. Two further resits will be scheduled for the course unit in the year following the year in which it was last taught.

2a. If students have a limited study deficit and the arrangement under point 1 is not sufficient (and, for example, they need or wish to follow teaching sessions for a course unit they have not yet passed), course units that are no longer offered can be substituted with new ones.

2b. A certain number of substitutions is permitted as standard. These are specified in the study guide.

2c. All other substitutions will be considered individually by the Board of Examiners at the student’s request, and set out in writing if they are approved.

When seeking approval within the meaning of point 2, students should submit their request to the Board of Examiners for their degree programme. In all cases, it is best to consult the academic advisor first.

**B1.4 PRIZES FOR THE BEST PROPAEDEUTIC PHASE STUDENTS**

Every year, the Royal Holland Society of Sciences and Humanities (KHMW) in Haarlem awards the Young Talent Encouragement Prizes. There are prizes for various disciplines, funded by different donors. The encouragement prizes are awarded to students who have achieved the best results in the first year of a degree programme at an academic institution in the Netherlands. The award consists of a certificate and prize money of € 500. The **Encouragement Prizes for first-year students** are donated by PWN, Stichting Physica, Shell Global Solutions International, NGI Platform voor ICT-professionals, NWO-Chemische Wetenschappen, Philips, Kennispark Twente, NLR and KVGN.

There are KHMW prizes for the following disciplines (among others):

- Physics (incl. Applied Physics and Astronomy)
- Mathematics (incl. Applied Mathematics)
- Chemistry
- Chemical Engineering

Every year the programmes nominate the mathematics or applied mathematics student, the physics or applied physics student, the chemistry, and chemical engineering student who has achieved the best results in the propaedeutic phase and who has passed the propaedeutic examination *cum laude*. The KHMW prizes are presented in Haarlem in November. The nomination is announced at the propaedeutic certificate ceremony in October.

**B1.5 STUDENT ASSISTANT POSITIONS**

Students are more than ‘consumers’ who pay to follow the University’s degree programmes. Students often take on the role of ‘student assistant’ in first- and second-year course units, for example. Student assistants perform various duties such as supervising practicals, correcting homework and examinations, and holding tutorials. Naturally, student assistants receive remuneration for this.

Student assistant positions are not only a useful source of income, but also a valuable learning experience for the majority of people involved. Usually each period, the student assistant vacancies are announced via mail or Nestor.
**B1.6 MASTER’S DEGREE PROGRAMMES**

Students must have obtained their Bachelor's degree before progressing to a (follow-on) Master's programme ('Bachelor's before Master's' rule, or 'harde knip').

Many Bachelor's students go on to study for a Master's degree when they have graduated. Each Bachelor's programme has at least one follow-on Master's programme to which the Bachelor's degree guarantees admission. The Master's degree programme with the same title (in some cases an English title) as the Bachelor's programme is usually the follow-on programme. In addition, the Master's degree programme in Energy and Environmental Sciences (EES) and the Master's programme in Education and Communication in the Natural Sciences (ECNS, a Dutch taught programme) are follow-on programmes for all the Bachelor's programmes covered in this study guide.

The ECNS master's degree programme offers two tracks, one focusing on science communication and one focusing on science education in Dutch secondary schools. The EES master's degree programme offers two tracks as well, the track System Studies on Energy and Environment and the track Experimental Studies of Energy and Climate. Further information on these master's degree programmes can be found at [http://www.rug.nl/fwn/beta-master/](http://www.rug.nl/fwn/beta-master/)

<table>
<thead>
<tr>
<th>Bachelor's degree programmes in Groningen</th>
<th>Automatic admission to the following Master’s degree programme(s) in Groningen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics</td>
<td>Mathematics; EES; ECNS</td>
</tr>
<tr>
<td>Applied Mathematics</td>
<td>Applied Mathematics; EES; ECNS</td>
</tr>
<tr>
<td>Physics</td>
<td>Physics; EES; ECNS</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>Applied Physics; EES; ECNS</td>
</tr>
<tr>
<td>Astronomy</td>
<td>Astronomy; EES; ECNS</td>
</tr>
<tr>
<td>Chemistry</td>
<td>Chemistry; EES; ECNS</td>
</tr>
<tr>
<td>Chemistry with 'Chemistry of Life' track</td>
<td>Chemistry; EES; ECNS; Molecular Biology and Biotechnology</td>
</tr>
<tr>
<td>Chemical Engineering</td>
<td>Chemical Engineering; EES; ECNS; Water Technology</td>
</tr>
</tbody>
</table>

The Mathematics, Physics, Astronomy and Chemistry Master's degree programmes all have two profiles, one aimed at research and academia (P-profile) and one aimed at business and management (the Science, Business & Policy profile, SBP profile). The SBP-profile consists of one year of course units and research in the field of your master’s degree programme complemented with one year of course unit (a 10 EC course on science and business, a 10 EC on science and policy) and an internship (40 EC) focusing on business and policy. Further information on the SBP-profile can be found at: [http://www.rug.nl/research/science-society-group/onderwijs/sciencebusinessandpolicy/](http://www.rug.nl/research/science-society-group/onderwijs/sciencebusinessandpolicy/)

In case a student wishes to proceed with a master's degree which is not a follow-on programme approval of the Board of Admissions of that particular master’s degree programme is needed (see section A.2.1). In case of minor deficiencies the Board of Admissions may decide that the student should complete a pre-master programme before being admissible to the master's degree programme.
B2
BACHELOR’S DEGREE PROGRAMMES IN MATHEMATICS AND APPLIED MATHEMATICS

B2.1 INTRODUCTION
Mathematics is an indispensable part of the world we live in. It is the foundation of technology – and where would we be without technology? But mathematics plays a role in many other spheres of life too. All around us we see increasing use being made of quantitative data, for model-based descriptions of reality. This can be a single differential equation for the movement of a spring, or it could be a large set of related equations (a ‘Dynamic System’) that makes weather forecasting possible. We can safely say that, without mathematics, the scientific advances made in recent decades – not only in the natural sciences and technology but also in social sciences such as economics and sociology – would have been less far-reaching.

Nevertheless a considerable number of areas of mathematics are developed not because mathematicians have practical applications in mind, but rather out of intellectual curiosity; they enjoy devising them. From the very beginning, they have practised their discipline because it is satisfying to solve problems. The certainty that a calculation is correct, the detours you have to take to eventually reach your goal; these are aspects that are literally and figuratively the breath of life for some mathematicians.

In fact, we should say that some aspects do not yet have a practical application. Sometimes that can change from one day to the next, and a purely theoretical result can suddenly be of great practical value. Here is a good example. No-one ever thought that money could be earned by factoring into prime numbers (try 2021). Mathematicians were already doing this well before the Christian calendar was adopted but it wasn’t until 1970 that the mathematicians Rivest, Shamir and Adlemen formulated a method for encrypting messages that can only be decrypted with a key generated using prime numbers. Even number theory has acquired applications in this context, as well as prizes and records. The company RSA Security awards monetary prizes to people who manage to factor a number from the list of ‘RSA challenge numbers’ at:

- www.emc.com/emc-plus/rsa-labs/historical/cryptographic-challenges.htm

The mathematics taught at the University of Groningen has both these ‘faces’. There is teaching and research in the applied – and sometimes highly applied – domain (statistics and econometrics, systems and control theory, fluid dynamics and numerical mathematics), but work is also done on fundamental problems (algebra, geometry, analysis, dynamic systems, logic).

Education-related matters for Mathematics and Applied Mathematics
Education-related matters and announcements can be found via your start page on Nestor. The lecture and examination timetables can be found at:

- rooster.rug.nl
  (schedule generator)
B2.2 SUPPORTIVE STAFF AND COMMITTEES

The bachelor’s degree programmes in Mathematics and Applied Mathematics are part of the Undergraduate School of Sciences of the Faculty of Mathematics and Natural Sciences. The person responsible for the content of the degree programmes is the programme director. The programme director manages the programme with support from the degree programme coordinator and the academic advisor. The task of the academic advisor is to assist students in finding solutions to any problems encountered while studying (see Section A3.1.2, A2.6, and A2.7). The degree programme coordinator supports the teaching process within the programme and is the secretary of the Board of Examiners and the Programme Committee.

B2.2.1 Supportive staff

Programme director
• Prof. Dr. R.W.C.P. (Roel) Verstappen
  r.w.c.p.verstappen@rug.nl
  +31 50 363 3958
  http://www.rug.nl/staff/r.w.c.p.verstappen/

Academic advisor
• Until the end of October 2016:
  A. (Anna) B.M. de Koster, MA
  academicadvisor.math@rug.nl
  +31 50 363 6835
  room 5161.0077 (ESC)
  Open office hours: each Tuesday and Thursday 10.30-12.00h
  You can book appointments via: abmdekoster.youcanbook.me

• November 2016 –
  • M. (Mirjam) Nederveen, MA
    academicadvisor.math@rug.nl
    +31 50 363 6835
    room 5161.0078 (ESC)
    Open office hours: each Tuesday and Thursday 10.30-12.00h
    • You can book appointments via: mnederveen.youcanbook.me

Programme coordinator
• Dr. ir. G. (Ena) Tiesinga
  escmath@rug.nl
  +31 50 363 6877
  room 5161.0046 (ESC)
  http://www.rug.nl/staff/g.tiesinga/

General announcements of the academic advisor and the degree programme coordinator addressed to all students are generally placed on the student portal to which all bachelor’s degree students in Mathematics and Applied Mathematics have access (“Need-to-know” messages). The student portal also contains all kind of information about the programme. You get access to this portal with your student-ID and password.

http://student.portal.rug.nl/infonet/studenten/fwn/bachelors/mathematics-applied-mathematics/
B2.2.2 Programme Committee
The task of the Programme Committee is to advise on the teaching and examination regulations, (i.e. the implementation of the teaching programmes in the relevant discipline), on matters relating to the implementation of the teaching programmes (i.e. the annual evaluation of how the teaching and examination regulations are implemented) and to give solicited and unsolicited advice on all education-related matters in the relevant discipline. The Programme Committee can issue its advice to the programme director, to the Faculty Board (usually through the programme director), or to individual lecturers. Half of the members of the Programme Committee are students and half are staff. Members are appointed by the Faculty Board on the recommendation of the programme director

Programme committee Mathematics and Applied Mathematics
Chairman: Prof. dr. E.C. (Ernst) Wit
Secretary: Dr. ir. G. Tiesinga
Secretarial Support: H.R.T. (Henriëtte) Kruizinga
h.r.t.kruizinga@rug.nl
+31 50 363 9773

Further information about the Programme Committees can be found at:
- myuniversity.rug.nl/infonet/medewerkers/fwn/faculteit/opleidingscommissies/

Mathematics Feedback Meetings (MFM)
One task of the Programme Committee is to evaluate course units. At each examination, each student gets an evaluation form on which he/she can give his/her opinion about the course unit. Questions on this form are for example about the background that you needed, the book you used, the level of explanation, the linguistic skills of the teacher and the clarity of the way in which your final grade was calculated.
The evaluation of the course units are discussed in a meeting of the Programme Committee. Besides these formal meetings, there are smaller meetings (the so called Mathematics Feedback Meetings or MFM) to which all students of (Applied) Mathematics are invited to give their opinion about the course units they follow and have followed. In this way the students participating in the Programme Committee know exactly what is going on, so if there are problems those can be solved. If you want to report something to the students participating in the Programme Committee while there is no MFM soon, you can always e-mail them:
- pcmath@betastuf.nl

B2.2.3 Board of Examiners
The Board of Examiners is responsible for assuring the quality of assessment procedures, ensuring that examinations and final assessments proceed satisfactorily, and for assessing whether individual students have fulfilled the requirements for the award of the degree certificate. The Boards of Examiners are also responsible for special arrangements, exemptions etc. for individual students. The complete Board of Examiners is formed by three staff members and is appointed by the Faculty Board.
Board of Examiners for Mathematics and Applied Mathematics

Chairman: Prof. dr. J. (Jaap) Top,
Secretary: Dr. ir. G. (Ena) Tiesinga
Secretarial support: H.R.T. (Henriëtte) Kruizinga

Further information about the Boards of Examiners can be found at:
- myuniversity.rug.nl/infonet/medewerkers/fwn/faculteit/examencommissies/

Please note that requests must be submitted by means of an online form:
- http://goo.gl/forms/QjJvMA4Vgzl6pmdD2

N.B.: This link may be subject to change. Please look up the board of examiners on the student portal for up-to-date information, including the latest version of the link.

B2.3 STUDY ASSOCIATION: FYSISCHE-MATHEMATISCHE FACULTEITSVERENIGING

The Fysisch-Mathematische Faculteitsvereniging (FMF) is the association for students in (Applied) Physics, (Applied) Mathematics, Astronomy and Computer Science. The FMF organizes a wide range of activities on social, academic and career level. As a student you want to enjoy an educational and pleasant experience in the most exciting student city in The Netherlands! To make it truly unforgettable, the FMF can help you experience your time as a student to its full potential.

Enthusiastic active members of the FMF organize fun activities, sometimes study related. For example, every month you can enjoy a low cost meal and watch a film afterwards. You can also get to know your fellow students at the monthly drinks, the yearly barbecue, or during the members weekend. Or go head-to-head with other members at activities like crossbow shooting, a hitchhiking contest, karting, paintball, curling or the annual soccer-competition.

On top of that the FMF has a broad repertoire for anyone interested in a more scientific programme or career oriented activities. We organize lectures, the annual scientific FMF-symposium, visits to companies and the Science Quiz. Furthermore, every year members go on a foreign excursion with a scientific and cultural programme. Previously we’ve been to Singapore and Indonesia where we enjoyed trips to universities, companies, the rainforest and cultural activities. This year we will go to Japan in April for our foreign excursion. On top of that, the FMF has a broad repertoire for anyone interested in a more scientific programme or career orientated activities. We organise several lectures, the annual scientific FMF-symposium, in-house days at companies and Olympiads.

The FMF also takes care of the book sale at our faculty. As a member of our study association you can get your books for a lower price than in the stores. If you want to order your books you can find more info on:
- www.fmf.nl/books

Are you curious as to what the FMF has in stock for this year, how you can get active at the FMF or do you just want to have a chat? Drop by the FMF room at 5111.0053, behind the canteen at the Nijenborgh 4. Equipped with a seating area and a large table it is perfect to: relax, lunch, socialize or play games (we have different board and card games to use). For free coffee, tea and cheap snacks, candy and beverages this is also the place to be. The room is open on a daily basis from 09:00 – 17:00.
You can also go to our website www.fmf.nl. Besides information about our association and our agenda, you can also find a large database with old exams to make sure you are well-prepared for your exams.

We hope to see you soon at one of our activities!
The FMF Board

B2.4 AIMS AND LEARNING OUTCOMES OF THE DEGREE PROGRAMMES

The degree programmes in Mathematics and Applied Mathematics aim to impart the knowledge, skills, understanding and attitude relating to Mathematics by means of a broadly based curriculum in such a way that graduates can progress to the follow-on Master's degree programme in Mathematics or Applied Mathematics. Graduates of the Bachelor's degree programmes should also be able to take the Master's degree programme in Education and Communication. In addition, Bachelor's graduates who have taken the 'Educatieve Minor' (teacher-training Minor) gain a Grade Two teaching qualification in mathematics. Bachelor's graduates must be able to pursue an independent career, in general as a novice professional. This aim has been translated into a set of learning outcomes, formulated in a broad context within the Natural Sciences and Technology teaching institute of the Faculty of Mathematics and Natural Sciences of the University of Groningen. First, generic learning outcomes have been formulated for the Bachelor's degree programmes in Astronomy, Physics, Applied Physics, Chemistry, Chemical Engineering, Mathematics and Applied Mathematics, and specific learning outcomes for each degree programme have subsequently been added.

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 their own discipline.
- A2. Bachelor's graduates have mastered the basic concepts of their discipline (see Appendix I for a specification) to a certain extent and know how the concepts relate to each other within the discipline and how they relate to other disciplines.
- A3. Bachelor's graduates have in-depth knowledge of several current topics within their own discipline.
- A4. Bachelor's graduates are familiar with the quantitative nature of mathematics and the natural sciences and have an understanding of the methods (including the use of computers) used in these disciplines, in particular in their own discipline.
- A5. Bachelor's graduates have sufficient knowledge and understanding of mathematics and the natural sciences to successfully complete a follow-up Master's degree programme in their own discipline.
- A6. Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

B. Generic learning outcomes - Skills

- B1 (Research) Bachelor's graduates are able to draw up a research question and to design, plan and conduct research and report on it independently with a certain 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 problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – 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 (including multidisciplinary teams) on technical-scientific problems.
- B5 (Communicating) Bachelor's graduates are able to communicate orally and in writing in academic and professional contexts, both with colleagues and others, in English. 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 II.

Appendix I Programme-specific learning outcomes – Basic Knowledge
1.1 Bachelor's graduates have mastered the basic concepts and techniques of mathematics, in particular single and multivariable calculus, linear algebra, analysis, regular differential equations, probability theory and statistics, and algebra.
1.2 Bachelor's graduates have knowledge of more advanced subjects within the fields of algebra and geometry, analysis and numerical mathematics, as well as dynamic systems and systems theory.
1.3 (Mathematics) Bachelor's graduates have specific knowledge of one of the fields of Pure Mathematics, Physics, Logic, Philosophy, Statistics or Econometrics.
1.4 (Applied Mathematics) Bachelor's graduates have knowledge of more advanced subjects from Computational and Engineering Mathematics.
1.5 Bachelor's graduates have gained knowledge and experience of the 'heart' of mathematics, i.e. the truth and value of exact mathematical proof.
1.6 Bachelor's graduates have knowledge of mathematical applications in various other fields of study.
1.7 Bachelor's graduates can make effective use of mathematical software packages, or if necessary develop their own programmes.
1.8 (optional Minor) Bachelor's graduates have a broad-based knowledge of subjects within their own or a different discipline.

Appendix II Degree programme-specific learning outcomes - Skills
Investigating
2.1 Bachelor's graduates have an academic attitude, which means they are curious, critical, creative and dare to show initiative.
2.2 Bachelor's graduates are able precisely to formulate relatively straightforward mathematical questions and, if necessary, adapt them in order to make them 'tractable'. Bachelor's graduates can articulate mathematical assumptions, are aware of the importance of precise definitions, can apply precise logical reasoning to solve problems, and can generalize and extrapolate.
2.3 Bachelor's graduates are able to analyse and abstract simple problems that are outside the scope of their own study programme and to independently acquire new knowledge to this end.

Designing and Modelling
2.4 Bachelor's graduates are able, under supervision and from the perspective of their field of interest, to translate a problem into a relevant mathematical problem definition and to this end formulate and evaluate a solution based on source research.
2.5 Bachelor's graduates are able to formulate concrete problems from application areas as
mathematical problems.

2.6 Bachelor’s graduates are able to approach mathematical problems on the basis of a certain logical system, and with determination to find the right method of approach.

2.7 Bachelor’s graduates are aware of the importance of researching specific cases and examples and have the attitude and skills necessary to critically evaluate the solutions found, test them for correctness and interpret them.

2.8 Bachelor’s graduates are able, by abstracting and modelling, to delve to the root of a problem and determine whether existing methods can be applied or if a new method needs to be developed.

B2.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR DEGREE PROGRAMMES MATHEMATICS AND APPLIED MATHEMATICS

In Section A1.3.1 [2] of the general part of the study guide provides a description the faculty’s view on the embedding of research and academic skills in the faculty’s programmes. The table below presents an overview on how research and academic skills are integrated in the various course units of the Bachelor degree programmes in Mathematics and Applied Mathematics. In this table the following research and academic skills are distinguished:

1. Formulating adequate research goals, questions and/or hypotheses;
2. Searching for, assessing and reflecting on scientific literature;
3. Setting up basic research experiments, analysing and reflecting on its outcomes and drawing appropriate conclusions;
4. Training critical thinking, reflection, analytic attitude and capacity;
5. Reflecting on research methods and methodology;
6. Communicating research progress and outcomes (both orally and in writing);
7. Cooperating in a (multi-disciplinary) team;
8. Degree programme specific research or academic skills.
Table: Overview of the research and academic skills in the Bachelor’s degree programme in Mathematics and Applied Mathematics.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>2</td>
<td>x</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>2</td>
<td>xx</td>
<td></td>
<td>xx</td>
<td></td>
<td>xx</td>
<td></td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>x</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>xx</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>xx</td>
<td></td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>3</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>xx</td>
</tr>
</tbody>
</table>

XX: a skill to which the course strongly contributes.
X: a skill to which the course contributes to a lesser extent.

More details on these Research or Academic skills and the way they are assessed, can be found in the course units descriptions in Ocasys:
- [www.rug.nl/ocasys/fwn/](http://www.rug.nl/ocasys/fwn/)

**B2.6 CAREER ORIENTATION**

To give students insight in their career perspectives the bachelor’s degree programmes in Mathematics and Applied Mathematics offers career orientation activities that students can take part in.

**Implementation**

Career orientation is implemented in the following way:
- The student attends activities related to career orientation throughout the whole programme.
- Each student has to attend at least 6 activities related to career orientation, more specifically 2 guest lectures and 4 career activities organized by FMF (or similar activities organized by other parties), during his/her bachelor programme.
- Career orientation will be assessed at the end of the third year, based on a portfolio created (in Nestor) by the student throughout the programme.
**Guest Lectures**
A student needs to attend at least 2 guest lectures during the programme. Each academic year two guest lectures will be given: one incorporated in a mandatory module from the first year, and one incorporated in a mandatory module from the second year. At most one of these two guest lectures can be given by a PhD student as an orientation on a career in research. The programme director will determine each year in which modules a guest lecture will be incorporated. The lecturers of these modules are responsible for organizing the guest lecture (i.e. inviting the guest speaker). The guest lecture will be given during one of the scheduled hours of the module.

**Career activities organized by the FMF/NEXT/other parties**
A student will need to attend at least 4 career activities organized by FMF (or similar activities organized by other parties) or NEXT.

The following activities are available:
- In Groningen (or with organized transport):
  - WAS-day (FMF, in February); alumni day, with talks from former graduates
  - Lunch/Diner/Borrel lectures (FMF, through the year)
  - Inhouse days (FMF, through the year)
  - Excursions to foreign countries (FMF, April/May and Francken)
  - Bèta bedrijvendagen (in March): career market days.
  - Staff colloquia (through the year)
  - Student colloquia (through the year, most in June/July)
  - Symposia (FMF, Francken)
- Outside Groningen
  - Kaleidoscoop
  - Nationale Carrièrebeurs (in Amsterdam, in spring)
  - Vrouw & Carrière (in Utrecht, in November)
  - Nederlandse Carrièredagen (in Utrecht, in November)
  - Inhouse days
  - Business courses
  - Summer Schools
  - Techniek op Hakken (in June)
- NEXT (Career Services of the University of Groningen, [www.rug.nl/next](http://www.rug.nl/next))
  - Networking and LinkedIn
  - Master your choice
  - Who am I? Discover your drive
  - Working in the Netherlands
  - Writing a CV

In order to attend (certain) activities of FMF a membership of FMF (approximately 5 euros a year) is required. These costs are considered as regular study costs and will therefore be at the expense of the students.

**Broad orientation**
The purpose of career orientation is to give the students a broad overview of the career possibilities. To reach this objective students need to attend career activities focusing both on an academic career and on a career outside academia. A student is not allowed to attend more than two colloquia in the context of career orientation.

**Portfolio**
After attending an activity (guest lecture/career activity organized by FMF) the student has to reflect on the activity and add a short text on the activity itself and on its effect on the
student’s view on his/her own career to the portfolio. To complete the portfolio, finally the student has to add a short reflection on the overall influence of the career activities on the student’s view on his/her own career.

More information
Information about the career orientation and its corresponding portfolio will be provided throughout the programme by the academic advisor.

B2.7 BACHELOR’S DEGREE PROGRAMME IN MATHEMATICS
The Mathematics degree programme offers two Tracks. In the General Mathematics Track, students can choose three structured study programmes from the interest fields ‘Mathematics & Physics’, ‘Mathematics, Logic & Philosophy’ and ‘Mathematics’. The Statistics and Econometrics Track is for students who wish to study, in depth, statistics and mathematics as they are used in many areas of economics, from economic analyses and forecasts to optimum stock control and planning.

Formally, the programme consists of the Major in Mathematics (150 ECTS) and a Minor (30 ECTS). The Minor is scheduled in the first semester of Year 3.

Major
In terms of content, the Major can be divided into a core programme and an elective component. The Mathematics and Applied Mathematics bachelor’s degree programme share the core programme. The elective component (worth 25 ECTS) of the Major in Mathematics is used to choose a Track. The programme offers the following Tracks, divided into interest fields:

- General Mathematics Track
  - Mathematics interest field
  - Physics interest field
  - Philosophy and Logic interest field
  - General Mathematics with a ‘broadening’ Minor
- Statistics and Econometrics Track

Minor
The minor offers students the possibility to either broaden their knowledge to a discipline different from their own discipline or deepen their knowledge in their own discipline. Students of the General Mathematics Track can choose a free, either broadening or deepening minor that relates to their interest field. Students of the Statistics and Econometrics Track need to take the deepening minor Statistics and Econometrics.

The Minor can be:
- A University Minor: The University Minors are listed at: http://www.rug.nl/education/minor-programmes/aanbod-universitaire-minoren
  These minors are coherent packages of course units to broaden the knowledge.
- A Personal Minor: Students can compile a package of University of Groningen course units themselves. They may take the Minor abroad within the context of internationalization as well. In both cases they need permission from the Board of Examiners of their degree programme who will check whether the minor is coherent and of sufficient level. Students should thus make sure they consult their academic advisor in good time!

A minor which is worth mentioning separately is the teaching-training Minor (‘Educatieve Minor’). Students considering teaching as a career can choose the teacher-training Minor in the first semester of Year 3. This Minor, combined with a Bachelor’s degree in Mathematics, will qualify them to teach at lower secondary school level (‘onderbouw’). During the Minor
students spend three days per week at a secondary school, where they observe experienced teachers and learn how to teach independently. At the University they study didactics (including subject-specific didactics) and developmental psychology. They learn how to lead a class, how to communicate knowledge, design lessons and produce teaching material. In all components of the teacher-training Minor, students are supervised by experienced teacher-trainers.

The Ministry of Education, Culture and Science awards a special qualification to Bachelor’s graduates who have passed this Minor programme. Students are then qualified to teach in VMBO-TL education (the theoretical learning pathway in preparatory senior secondary vocational education) and the first three years of HAVO (senior general secondary education) and VWO (pre-university education). This qualification is known as ‘beperkt tweedegraads’ (‘limited Grade Two’ teaching qualification). For more information see:
- www.rug.nl/lerarenopleiding/onderwijs/educatieveminor

As of 2015-2016 student who are interested in Education and Communication but prefer not to take a full minor in Education can enrol in the course Educatie en Communicatie (taught in Dutch, 5 EC) which gives a taste of the master’s degree programme in Education and Communication.

Programme of year 1 (Propaedeutic phase)
The Propaedeutic phase consists of a programme with mostly mandatory course units and two electives which shape the chosen interest field.

<table>
<thead>
<tr>
<th>Year 1 (propaedeutic phase)</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Calculus 1</td>
<td>5</td>
<td>2a</td>
<td>Calculus 2</td>
</tr>
<tr>
<td></td>
<td>Introduction to Mathematics</td>
<td>5</td>
<td></td>
<td>Computer-Aided Problem-Solving Linear Algebra 2</td>
</tr>
<tr>
<td></td>
<td>Electives period 1a (see table below)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Linear Algebra 1</td>
<td>5</td>
<td>2b</td>
<td>Analysis Probability Theory Propaedeutic Project</td>
</tr>
<tr>
<td></td>
<td>Mechanics for Mathematics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Elective period 1b (see table below)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td></td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

Electives in year 1 (propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>One from:</td>
<td>5</td>
<td>2a</td>
</tr>
<tr>
<td></td>
<td>- Physics Laboratory 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Introduction to Logic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>One from:</td>
<td>5</td>
<td>2b</td>
</tr>
<tr>
<td></td>
<td>- Operations research 1#</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Physics of the Quantum Universe</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

# Mandatory for track Statistics and Econometrics.
Programme of years 2 and 3
The programme for the second and third year for the tracks ‘General Mathematics’ and ‘Statistics and Econometrics’ consists of a collection of mandatory course units (the core), electives that are characteristic for the chosen interest field, and a minor.

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Statistics</td>
<td>5</td>
<td></td>
<td>One from:</td>
</tr>
<tr>
<td></td>
<td>Ordinary Differential Equations</td>
<td>5</td>
<td></td>
<td>- C.S.: Ethical and Professional Issues</td>
</tr>
<tr>
<td></td>
<td>Elective period 1a (see B2.7.1 to B2.7.3)</td>
<td>5</td>
<td>2a</td>
<td>- History of Mathematics</td>
</tr>
<tr>
<td></td>
<td>Metric Spaces</td>
<td>5</td>
<td></td>
<td>Elective period 2a (see B2.7.1 to B2.7.3)</td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Complex analysis</td>
<td>5</td>
<td>2b</td>
<td>Numerical Mathematics 1</td>
</tr>
<tr>
<td></td>
<td>Group Theory</td>
<td>5</td>
<td></td>
<td>Project Dynamical Systems</td>
</tr>
<tr>
<td></td>
<td>Project Systems Theory</td>
<td>5</td>
<td></td>
<td>Elective period 2b (see B2.7.1 to B2.7.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Minor</td>
<td>15</td>
<td>2a</td>
<td>Analysis on Manifolds</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Functional Analysis</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Elective period 2a (see B2.7.1 to B2.7.3)</td>
</tr>
<tr>
<td>1b</td>
<td>Minor</td>
<td>15</td>
<td>2b</td>
<td>Bachelor's research project</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

B2.7.1 Options within the degree programme in Mathematics

Choice in the first period of the propaedeutic phase
The first period (semester 1a) of Year 1 consists of a number of compulsory course units and an elective: ‘Physics Laboratory 1’ or ‘Introduction to Logic’. The course ‘Introduction to Logic’ provides some insight in the Philosophy and Logic interest field of the General Mathematics Track. Whichever course unit students choose, they can continue without study delay with the degree programme in Mathematics or the programme in Applied Mathematics.

Choice in the second period of the propaedeutic phase
The choice students make in the second period anticipates the Track they will choose later in the programme. Students who are not sure whether to choose General Mathematics or Statistics and Econometrics as a specialization should choose ‘Operations Research 1’ in the second quarter. After Year 1 they can then transfer between specializations without incurring study delay. It is still possible to transfer to Applied Mathematics after Year 1 regardless whether one chooses ‘Physics of the Quantum Universe’ or ‘Operations Research 1’ in the second period.

Choice in Years 2 and 3: related to track/interest field
Students can use the optional part of the programme to compile a study programme geared towards their particular interests in the General Mathematics Track or Statistics and Econometrics Track. Within the General Mathematics Track they can study the theoretical aspects of mathematics in greater depth (Mathematics interest field). Students can also
choose course units on the principles of mathematics, core concepts of classic and modern logic, and the relationship between the natural sciences and philosophy (Mathematics, Logic and Philosophy interest field). A third option is to study an advanced mathematical perspective on physics (Mathematics and Physics interest field).

In the first semester of Year 3, students follow a Minor. Students who choose the General Mathematics Track can choose a free (either deepening or broadening) Minor, students who choose the Statistics and Econometrics Track should choose a deepening Minor.

The following sections explain how the optional part of each track/interest field is structured in years 2 and 3.

**B2.7.2 General Mathematics Track**
The following tables show how the electives in year 2 and 3 should be chosen in order to obtain a programme which focuses on one of the interest fields within the General Mathematics Track.

**General Mathematics with a ‘deepening’ Minor: Mathematics interest field**
The following track-related choices are offered:

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>One from: Project Mathematical Physics, Statistical Reasoning</td>
<td>5</td>
<td>2a</td>
<td>Partial Differential Equations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Measure Theory and Integration, Mathematical Modelling, Security and Coding</td>
<td>5</td>
<td>5 5 5 2a</td>
<td>Statistical Modelling</td>
</tr>
<tr>
<td>1b</td>
<td>Geometry One from: Chaos Theory Calculus of Variations and Optimal Control, One from: Advanced Algebraic Structures, Advanced Systems Theory</td>
<td>5 5 5</td>
<td>2b</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Measure Theory and Integration, Mathematical Modelling, Security and Coding</td>
<td>5</td>
<td>5 5 5 2a</td>
<td>Statistical Modelling</td>
</tr>
<tr>
<td>1b</td>
<td>Geometry One from: Chaos Theory Calculus of Variations and Optimal Control, One from: Advanced Algebraic Structures, Advanced Systems Theory</td>
<td>5 5 5</td>
<td>2b</td>
<td>5</td>
</tr>
</tbody>
</table>
**General Mathematics with a ‘deepening’ Minor: Physics interest field**

The following track-related choices are offered:

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Project Mathematical Physics</td>
<td>5</td>
<td>2a</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td></td>
<td>2b</td>
<td>Physics Laboratory II</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Measure Theory and Integration</td>
<td>5</td>
<td>2a</td>
<td>Electronics and Signal Processing</td>
</tr>
<tr>
<td></td>
<td>Computational Methods of Science</td>
<td>5</td>
<td>Or Structure of Matter I</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quantum Physics I</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Chaos Theory</td>
<td>5</td>
<td>2b</td>
<td>Advanced Logic</td>
</tr>
<tr>
<td></td>
<td>Waves and Optics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>One from:</em></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Geometry</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Calculus of Variations and Optimal Control</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Advanced Systems Theory</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**General Mathematics with a ‘deepening’ Minor: Philosophy and Logic interest field**

The following track-related choices are offered:

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td><em>One from:</em></td>
<td>5</td>
<td>2a</td>
<td>Partial Differential Equations</td>
</tr>
<tr>
<td></td>
<td>- Project Mathematical Physics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Statistical Reasoning</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Introduction to Logic*</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td></td>
<td>2b</td>
<td>Advanced Logic</td>
</tr>
</tbody>
</table>

*Introduction to Logic is obligatory in year 2 if it was not chosen in year 1.*
<table>
<thead>
<tr>
<th>Year 3</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Measure Theory and Integration Mathematical Modelling <strong>One from:</strong> - Security and Coding - Quantum Physics 1</td>
<td>5 5</td>
<td>2a</td>
<td>Statistical Modellings</td>
</tr>
<tr>
<td>1b</td>
<td>Philosophy of Sciences Chaos Theory <strong>One from:</strong> - Calculus of Variations and Optimal Control - Advanced Systems Theory</td>
<td>5 5</td>
<td>2b</td>
<td></td>
</tr>
</tbody>
</table>

**General Mathematics with a ‘broadening’ Minor**

Instead of choosing a programme which focuses on one of the interest fields, it is also possible to select individually from the electives of the various interest fields or the Track Statistics and Econometrics in each period. The Minor can be freely chosen. However, please note that in case the minor is not chosen from one of the University Minors or from a minor of one of the interest fields or the track Statistics and Econometrics, **prior approval is needed by the Board of Examiners** who will decide whether the minor is coherent and of sufficient level.

**B2.7.3 Statistics and Econometrics Track**

The Statistics and Econometrics track is for students who wish to study statistics and mathematics as they are applied in many areas of economics, from economic analyses and forecasts to optimum stock control and planning. In the first semester of Year 3, students follow the ‘deepening’ Minor in Statistics and Econometrics in order to study the subject in greater depth.

The following track-related choices are offered:

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Statistical Reasoning</td>
<td>5</td>
<td>2a</td>
<td><strong>One from:</strong> - Introduction to Econometrics - Introduction to Actuarial Sciences</td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>2b</td>
<td><strong>One from:</strong> - Risk Insurance - Dynamic Econometrics - Game Theory</td>
<td>5</td>
</tr>
</tbody>
</table>
### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Title</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course Title</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Measure Theory and Integration</td>
<td>5</td>
<td>2a</td>
<td>Statistical Modelling</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Mathematical Modelling</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asymptotic Statistics</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Calculus of Variations and Optimal Control</td>
<td>5</td>
<td>2b</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stochastic Models</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>One from:</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Advanced Systems Theory</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Numerical Mathematics 2</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Emperical Econometrics</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### B2.7.4 Bachelor’s Project in Mathematics

In the period before they intend to begin their Bachelor’s project, students must register for the project in ProgressWWW. The entry requirements for the Bachelor’s project are completion of the propaedeutic phase and 150 ECTS earned in the Bachelor’s programme.

The Bachelor’s project must be carried out in one of the Mathematics research groups. An overview of the groups can be found at:

- [www.rug.nl/research/fmns/group/mathematics-oriented](http://www.rug.nl/research/fmns/group/mathematics-oriented)

At the beginning of the project, students must hand in a Planning Form to the board of examiners. As of 2015-2016, this can is done *by means of an online form*. The link to this form will be published on the student portal. Please consult the section on year 3 of the BSc Mathematics for more information.

During the research project students will have regular discussions with their supervisor, and at the end of the period they will present their results in a report and an oral presentation (graduation colloquium).

Once a year, the programme organizes a meeting at which students are informed about the Bachelor research project and about the possible master’s degree programme choices. Students can choose a supervisor and subject for the Bachelor’s project themselves by contacting a staff member of one of the Mathematics research groups to discuss the possibilities, students can then propose their own idea for a subject as well.

*Please always consult the information on the student portal for up-to-date information on the procedure with respect to the bachelor’s project.*

#### Graduation colloquia

All students receive announcement of the Bachelor’s and Master’s research project colloquia. Attending these colloquia will increase the students insight in the possible subjects for research projects.
**Staff colloquia**
A staff colloquium is held almost every week during teaching periods. Researchers from within and outside the Netherlands attend the colloquia to talk about their area of research. The colloquia are useful to students because they provide insight into a range of research areas. They can therefore help students decide on options within their degree programme. Throughout the year, a fixed room is booked for Tuesdays: 4 p.m. to 5 p.m.
Coordinators: Prof. A.C.D. van Enter

**B2.8 BACHELOR’S DEGREE PROGRAMME IN APPLIED MATHEMATICS**
The degree programme in Applied Mathematics is ideal for students who are interested in the mathematics underlying applications such as models for calculating the flow of water, air or blood, or the analysis of stable control systems such as operating systems for robots, aircraft and satellites. The programme focuses on two fields: Computational Science and Numerical Mathematics, and Systems, Control and Optimization.

As of 2014-2015 the curriculum of the bachelor’s degree programme has changed. The programme as described in this section is for students who started with the programme in 2014-2015 or later.

Students who started the programme in 2013-2014 or earlier should study according to the programme described in the study guide of their starting year. However, these programmes are subject to some changes as well. For an overview of these changes see Section B2.9.2.

The curriculum of the degree programme in Applied Mathematics is shown in the tables below. The programme consists of a core programme which is shared with the Mathematics programme, with added thereto specific Applied Mathematics course units in semester 1a and 2b of year 2, a deepening Minor Applied Mathematics in semester 1 of year 3, and an elective relevant for the Applied Mathematics programme in semester 2a of year 3. Descriptions of the course units can be found at:
- [www.rug.nl/ocasys](http://www.rug.nl/ocasys)

**Programme of year 1 (Propaedeutic phase)**
Year 1 consists of a mandatory programme and two electives.

<table>
<thead>
<tr>
<th>Year 1 (propaedeutic phase)</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Calculus 1 Introduction to Mathematics</td>
<td>5</td>
<td>Calculus 2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Elective in period 1a (see table below)</td>
<td>5</td>
<td>Computer-Aided Problem-Solving</td>
<td>5</td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td>10</td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Linear Algebra 1 Mechanics for Mathematics</td>
<td>5</td>
<td>Linear Algebra 2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Elective in period 1b (see table below)</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td></td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Analysis Probability Theory</td>
<td>5</td>
<td>Propedeutic Project</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td>30</td>
</tr>
</tbody>
</table>

Total 30
### Electives in year 1 (propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>Physics Laboratory 1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Introduction to Logic</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>Operations research 1</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Physics of the Quantum Universe</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

### Programme of year 2 and 3

Year 2 and 3 consist of a mandatory programme and five electives. In the first semester of Year 3, students follow the ‘deepening’ Minor in Applied Mathematics in order to study the subject in greater depth.

<table>
<thead>
<tr>
<th>Year 2</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>ECTS</td>
<td>Semester</td>
<td>ECTS</td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>Statistics</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Project Mathematical Physics</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Ordinary Differential Equations</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>One from:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- CS: Ethical and professional issues</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- History of Mathematics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metric Spaces</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial Differential Equations</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>Complex analysis</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Group Theory</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Project Systems Theory</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Numerical Mathematics 1</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Dynamical Systems</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fluid Dynamics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>
### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Mathematical Modelling</td>
<td>5</td>
<td>2a</td>
<td>Analysis on Manifolds</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Computational Methods of Science</td>
<td>5</td>
<td></td>
<td>Functional Analysis</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>One from: - Control Engineering</td>
<td>5</td>
<td></td>
<td>One from: - Statistical Modelling</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>- Imperative Programming</td>
<td>5</td>
<td></td>
<td>- Electronics and Signal Processing</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>- Structure of Matter I</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>- Physical Transport</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>Phenomena II</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5</td>
<td></td>
<td>- Astrophysical Hydrodynamics</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>Calculus of Variations and Optimal Control</td>
<td>5</td>
<td>2b</td>
<td>Bachelor’s Research Project</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>One from: - Advanced Systems Theory</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>- Numerical Mathematics 2</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>One from: - Waves and Optics</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>- Chaos Theory</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>- Advanced Systems Theory</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>- Numerical Mathematics 2</td>
<td>5</td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td></td>
<td>Total</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

**B2.8.1 Options within the degree programme in Applied Mathematics**

**Choice in the first period of the propaedeutic phase**

The first period (semester 1a) of Year 1 consists of a number of compulsory course units and an elective: *Physics Laboratory 1* or *Introduction to Logic*.

Whichever course unit students choose, they can continue without study delay with the degree programme in Applied Mathematics or the programme in Mathematics.

**Choice in the second period of the propaedeutic phase**

The degree programme in Applied Mathematics focuses on two fields: Computational Science and Numerical Mathematics, and Systems, Control and Optimization. Each of the electives in the second period of the propaedeutic phase relates to one of these fields: the course *Physics of the Quantum Universe* relates to Computational Science and Numerical Mathematics and the course *Operations Research 1* to Systems, Control and Optimization. Irrespective of their choice, students can still transfer to the Mathematics degree programme after Year 1.

**Choice in Year 3**

In the first, second, and third period of Year 3 of the degree programme, students can choose electives. Each elective relates to either Computational Science and Numerical Mathematics, or Systems, Control and Optimization.
Below is a list of which course units relate to each field.

<table>
<thead>
<tr>
<th>Electives</th>
<th>Tracks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Engineering</td>
<td>Systems, Control and Optimization</td>
</tr>
<tr>
<td>Advanced Systems Theory</td>
<td></td>
</tr>
<tr>
<td>Statistical Modelling</td>
<td></td>
</tr>
<tr>
<td>Imperative Programming</td>
<td>Computational Science and Numerical Mathematics</td>
</tr>
<tr>
<td>Numerical Mathematics 2</td>
<td></td>
</tr>
<tr>
<td>Chaos Theory</td>
<td></td>
</tr>
<tr>
<td>Physical Transport Phenomena 2</td>
<td></td>
</tr>
<tr>
<td>Astrophysical Hydrodynamics</td>
<td></td>
</tr>
<tr>
<td>Electronics and Signal Processing</td>
<td></td>
</tr>
<tr>
<td>Structure of Matter II</td>
<td></td>
</tr>
</tbody>
</table>

**B2.8.2 Bachelor's Project on Applied Mathematics**

Please compare the relevant subsection in the section on the BSc Mathematics, as the procedures are identical for both programs.

**B2.9 DOUBLE BACHELOR’S DEGREE IN MATHEMATICS AND PHYSICS**

Talented students can study for a Bachelor’s degree in Mathematics as well as a Bachelor’s degree in Physics. The programme is a combination of the Bachelor’s programme in Mathematics (General Mathematics track with interest field Physics) and the Bachelor’s programme in Physics (specialization NEXT). The students are allowed to conduct only one research project. To make sure that the total amount of ECTS for the combined programme is large enough to justify giving two degrees four minor course units are made mandatory. This results in the following programme. Descriptions of the course units can be found at: www.rug.nl/ocasys

<table>
<thead>
<tr>
<th>Year 1 (Propaedeutic phase)</th>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1a</td>
<td>5</td>
<td>2a</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>1b</td>
<td>5</td>
<td>2b</td>
<td>2</td>
</tr>
<tr>
<td>Calculus 1</td>
<td>5</td>
<td>Calculus 2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Physics Laboratory 1</td>
<td>5</td>
<td>Linear Algebra 2</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Introduction to Mathematics</td>
<td>5</td>
<td>Computer-Aided Problem-Solving</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Mechanics and Relativity (1a and 1b)</td>
<td>5</td>
<td>Electricity and Magnetism (2a &amp; 2b)*</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Probability Theory</td>
<td>One from:</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Physics Laboratory 2</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Propaedeutic project</td>
<td>-</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
<td>Total</td>
<td>45</td>
<td></td>
</tr>
</tbody>
</table>

* 10-ECTS course
# Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Quantum Physics 1</td>
<td>5</td>
<td>2a</td>
<td>Metric Spaces</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Electricity and Magnetism 2</td>
<td>5</td>
<td></td>
<td>Electronics and Signal Processing</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Ordinary Differential Equations</td>
<td>5</td>
<td></td>
<td>Science, Ethics, Technology and Society</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Project Mathematical Physics</td>
<td>5</td>
<td></td>
<td>Partial Differential Equations</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Structure of Matter 1</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Complex Analysis</td>
<td>5</td>
<td>2b</td>
<td>Numerical Mathematics 1</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Group Theory</td>
<td>5</td>
<td></td>
<td>Project Dynamical Systems</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Statistical Physics</td>
<td>5</td>
<td></td>
<td>Structure of Matter 2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Waves and Optics</td>
<td>5</td>
<td></td>
<td>Quantum Physics 2</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Physics Laboratory 3</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>40</td>
<td><strong>Total</strong></td>
<td></td>
<td>50</td>
</tr>
</tbody>
</table>

The Year 2 Mathematics courses Statistics and Project Systems Theory are scheduled in Year 3 of the Double Bachelor’s programme in order to spread the student workload more evenly. It is also possible to move other course units to Year 3 in this way.

# Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Statistics#</td>
<td>5</td>
<td>2a</td>
<td>Analysis on Manifolds</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Measure and Integration Theory^</td>
<td>5</td>
<td></td>
<td>Functional Analysis</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Physics Laboratory 4^</td>
<td>5</td>
<td></td>
<td>Astroparticle Physics</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Atoms and Molecules *</td>
<td>5</td>
<td></td>
<td>One from: *</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Symmetry in Physics</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>- Relativistic Quantum Mechanics</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Project on Systems Theory#</td>
<td>5</td>
<td>2b</td>
<td>Bachelor’s Project **</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>One from:^</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Chaos Theory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Geometry</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>One from:^</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Subatomic Physics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Advanced Mechanics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>35</td>
<td><strong>Total</strong></td>
<td></td>
<td>40</td>
</tr>
</tbody>
</table>

# These course units are second year Mathematics course units, to spread the workload more evenly over the years it is possible to take these course units in the third year.

^ These course units are a compulsory part for the Minor.

* For the Double Bachelor’s programme it is possible to deviate from the regular Physics programme by taking ‘Atoms and Molecules’ instead of ‘Symmetry in Physics’ or ‘Relativistic Quantum Mechanics’. So actually it is a choice of two courses out of three.

** The subject of the Bachelor’s project should be relevant for both the Mathematics and Physics programme and be supervised by both a Mathematics and Physics staff member.
B2.10 OVERVIEW OF CURRICULUM CHANGES

B2.10.1 For cohort 2014-2015

In 2014-2015 the Bachelor’s degree programmes in Mathematics and Applied Mathematics started with a new curriculum. The second and the third year of that curriculum have been adjusted slightly compared to the description of the curriculum given in the study guide of 2014-2015. Below all changes are given.

Year 2

For the bachelor’s degree programme in Mathematics, specialization Statistics and Econometrics: In period 2a students can choose between the two courses Introduction to Econometrics and Introduction to Actuarial Sciences. The course Partial Differential Equations is removed from period 2a and will no longer be part of this specialization.

Year 3

For the bachelor’s degree programme in Mathematics, specialization General Mathematics: In period 1b, there is now a course Philosophy of Science.

For the bachelor’s degree programme in Mathematics, specialization Statistics and Econometrics: In period 1b students can not only choose between the courses Numerical Mathematics 2 and Advanced Systems Theory but the course Empirical Econometrics as well.
B3
BACHELOR'S DEGREE PROGRAMMES IN PHYSICS AND APPLIED PHYSICS

B3.1 INTRODUCTION
Physics is one of the most fundamental scientific disciplines. All sciences have their roots in physics to a greater or lesser extent. Fundamental natural laws are not only the basis for everything that happens in nature, but are also the foundation of technical applications. The development of physics is an exciting interplay of theory, experiment and technological application.

In Groningen, too, a number of institutes are committed to advancing our knowledge of nature and making new applications possible:
- At the Zernike Institute for Advanced Materials (ZIAM), research is conducted into materials in the broadest sense, from biological and complex materials to rock-hard ceramics. Theoretical and experimental methods are used to study highly fundamental aspects, and to explore possible applications. The research is characterized by close collaboration with chemistry and biology, with a strong emphasis on nanoscience and nanotechnology.
- KVI-CART is a centre of the University of Groningen performing basic research on subatomic and astroparticle physics and application-driven research on accelerator physics and physics in medicine. Along this two different lines we develop together advanced detection system and detection technologies which can be applied in science and society.
- The Energy and Sustainability Research Institute Groningen (ESRIG), which opened in 2010, unites research activities in the field of energy and sustainability within the Faculty of Mathematics and Natural Sciences. The institute conducts research into various sustainable energy sources and forms of energy conversion, with shared emphasis on the societal context. Within ESRIG, the Centre for Isotope Research (ISO) carries out research into the terrestrial carbon cycle and other fields.
- The Van Swinderen Institute for Particle Physics and Gravity (VSI) focuses on areas including the development of string theory for elementary particles.

To find out more about physics-oriented research at Groningen, visit:
- www.rug.nl/research/fmns/group/physics-oriented
- www.rug.nl/research/fmns/institutes-and-centres

Education-related matters for Physics and Applied Physics
Education-related matters and announcements can be found via your start page on Nestor.
The lecture and examination timetables can be found at:
- www.rooster.rug.nl/

B3.2 SUPPORTIVE STAFF AND COMMITTEES
The bachelor's degree programme in Physics and Applied Physics are part of the Undergraduate School of Sciences of the Faculty of Mathematics and Natural Sciences. The person responsible for the content of the degree programmes is the Programme Director.
During your studies you will get to know the various teachers and researchers of the degree programme. For many problems you can ask the teacher of your course for help, but there are also other staff members who can assist you in your studies.
B3.2.1 Supportive Staff

Programme director
- Prof. dr. D. Boer
d.boer@rug.nl
(050) 363 3656

Programme coordinator
- N. Bos, MSc
escphysics@rug.nl
(050) 363 4873

Academic advisor
- Drs. G.J. Zondervan
g.j.zondervan@rug.nl
(050) 363 4130

Education administration
- Ms. D. Klasens
esc.fwn@rug.nl
(050) 363 2446

Practicals
- Dr. R.J.H. Klein-Douwel (coordinator)
r.j.h.klein-douwel@rug.nl
(050) 363 4931
- H. de Vries
hans.de.vries@rug.nl
(050) 363 4858

B3.2.2 Programme Committee
Matters related to the course curriculum are discussed in the Programme Committee (PC). The Programme Committee has an advisory responsibility with respect to the content of course programmes, with respect to the evaluation of course units and with respect to various other educational issues that may arise. The Programme Committee also reviews the Teaching and Examination Regulations (OER) annually. The committee advises the Board of the Undergraduate School of Science (USS) and Graduate School of Science (GSS), the Faculty Board and individual professors.

The Programme Committee consists of six staff members and six student members. The adjunct programme director, academic advisor and programme coordinator generally also attend the meetings of the committee, but they are not members of the PC. Student members of the PC are elected annually; staff members hold office for two years. For contact you can send an e-mail to:

- escphysics@rug.nl

Chairman: Prof. dr. ir. P.R. Onck
p.r.onck@rug.nl
(050) 363 8039

Secretary: N. Bos, MSc
escphysics@rug.nl
(050) 363 4873
B3.2.3 Board of Examiners

The Board of Examiners is responsible for examinations and checks whether individual students have met the requirements for graduation. Also the individual adaptations of the degree programme are the responsibility of the Board of Examiners. For requests to the Board of Examiners you can send an e-mail to:

- escphysics@rug.nl

Chairman: Prof. dr. ir. E. van der Giessen
Secretary: N. Bos, MSc

e.van.der.giessen@rug.nl
(050) 363 8046
escphysics@rug.nl
(050) 363 4873

B3.3 STUDY ASSOCIATIONS

B3.3.1 Fysisch-Mathematische Faculteitsvereniging (FMF)

The Fysisch-Mathematische Faculteitsvereniging (FMF) is the association for students in (Applied) Physics, (Applied) Mathematics, Astronomy and Computer Science. The FMF organizes a wide range of activities on social, academic and career level. As a student you want to enjoy an educational and pleasant experience in the most exciting student city in The Netherlands! To make it truly unforgettable, the FMF can help you experience your time as a student to its full potential.

Enthusiastic active members of the FMF organize fun activities, sometimes study related. For example, every month you can enjoy a low cost meal and watch a film afterwards. You can also get to know your fellow students at the monthly drinks, the yearly barbecue, or during the members weekend. Or go head-to-head with other members at activities like crossbow shooting, a hitchhiking contest, karting, paintball, curling or the annual soccer-competition.

On top of that the FMF has a broad repertoire for anyone interested in a more scientific programme or career orientated activities. We organize lectures, the annual scientific FMF-symposium, visits to companies and the Science Quiz. Furthermore, every year members go on a foreign excursion with a scientific and cultural programme. Previously we’ve been to Singapore and Indonesia where we enjoyed trips to universities, companies, the rainforest and cultural activities. This year we will go to Japan in April for our foreign excursion. On top of that, the FMF has a broad repertoire for anyone interested in a more scientific programme or career orientated activities. We organise several lectures, the annual scientific FMF-symposium, in-house days at companies and Olympiads.

The FMF also takes care of the book sale at our faculty. As a member of our study association you can get your books for a lower price than in the stores. If you want to order your books you can find more info on:

- www.fmf.nl/books

Are you curious as to what the FMF has in stock for this year, how you can get active at the FMF or do you just want to have a chat? Drop by the FMF room at 5111.0053, behind the canteen at the Nijenborgh 4. Equipped with a seating area and a large table it is perfect to: relax, lunch, socialize or play games (we have different board and card games to use). For free coffee, tea and cheap snacks, candy and beverages this is also the place to be. The room is open on a daily basis from 09:00 – 17:00.

You can also go to our website www.fmf.nl. Besides information about our association and our agenda, you can also find a large database with old exams to make sure you are well-prepared for your exams.
We hope to see you soon at one of our activities!
The FMF Board

Fysisch-Mathematische Faculteitsvereniging
Room: Nijenborgh 4, room 5111.0053
E-mail: bestuur@fmf.nl
Website: www.fmf.nl

B3.3.2 T.F.V. 'Professor Francken'
T.F.V. 'Professor Francken' is the study association for Applied Physics students in Groningen. It has been established in 1984 and named after the professor who brought Applied Physics to Groningen in 1962. Currently the association has about 700 members. Even though the intention of T.F.V. 'Professor Francken' is to fulfill the interests of the still growing number of Applied Physics students, the association also has a lot of members who study Theoretical Physics, Mathematics, Astronomy or Chemistry.
The room for the members, often called the Franckenroom, is a popular place to be. The members can come here to drink a free cup of coffee, relax between classes, get help with their homework or play (computer)games. On a regular basis there will be activities organized by the committees ranging from poker tournaments and movie nights to barbecues and members weekends. Next to these social activities, the association also has a lot of study related activities to offer. To help our members prepare for their exams we organize symposia and excursions to interesting companies. We even go to a foreign country once a year to teach the students about their opportunities abroad, and last year we went to Scotland! T.F.V. 'Professor Francken' also cooperates with other associations to set up some great activities like the “Bèta-Bedrijvendagen”, which are two days of lectures, case-studies and individual conversations with all kinds of companies from different sectors. Another example is “Expedition Strategy”, which is a three-day excursion to the urban agglomeration to let a selected group of students become acquainted with strategy consulting.

As you can tell, a lot is being organized for and by the members of T.F.V. 'Professor Francken'. The association is a great complement to your studies for Applied Physics, but also for other students. If you like to become a member or if you just want to drink a free cup of coffee, just come by the Franckenroom in room 5113.0002.

T.F.V. 'Professor Francken'
Room: Nijenborgh 4, room 5113.0002
E-mail: bestuur@professorfrancken.nl
Website: http://www.professorfrancken.nl
Phone number: 050 - 363 4978
B3.4 LEARNING OUTCOMES OF THE DEGREE PROGRAMMES

The Bachelor's degree programmes in Physics and Applied Physics lead to the title 'Bachelor of Science' (BSc).

They aim to impart the knowledge, skills, understanding and attitude relating to Physics or Applied Physics by means of a broadly based curriculum in such a way that graduates can become independent professionals and be considered for further training as an academic researcher in this field.

This aim has been translated into a set of learning outcomes, formulated in a broad context by the former Natural Sciences and Technology teaching institute of the Faculty of Mathematics and Natural Sciences at the University of Groningen. First, generic learning outcomes were formulated for the Bachelor's degree programmes in Astronomy, Physics, Applied Physics, Chemistry, Chemical Engineering, Mathematics and Applied Mathematics, and specific learning outcomes for each degree programme were subsequently added.

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 their own discipline.

A2. Bachelor's graduates have mastered the basic concepts of their own discipline (see Appendix 1a and 1b for further specification) to a certain extent and are familiar with the interrelationships of these concepts within their own discipline as well as with other disciplines.

A3. Bachelor's graduates have in-depth knowledge of several current topics within their own discipline.

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 their own discipline, 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 their own discipline.

A6. Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

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 a certain 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 Modeling) Bachelor's graduates are able to translate a problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – 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 (including multidisciplinary teams) on technical-scientific problems.
B5 (Communicating) Bachelor’s graduates are able to communicate 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 2a and 2b.

Appendix 1a Degree programme-specific learning outcomes – Basic Knowledge – Bachelor programme Physics
The Bachelor’s graduate in Physics has:

1.1. Knowledge of the most important subjects in the field of:
   a) Classical Mechanics/Mechanics
   b) Electromagnetism
   c) Quantum Physics
   d) Thermodynamics
   e) Statistical Physics
   f) Wave phenomena, Oscillations and Optics
   g) Materials: structure and interactions
   h) Calculus and Linear Algebra

1.2. Knowledge of topics in at least one of the following research fields:
   a) Theoretical Physics
   b) Particle Physics
   c) Nano Physics
   d) Energy and Environment
   e) Life and Health

1.3. Achieved in the Minor, a deeper knowledge of subjects within their own discipline or a broad general knowledge of a different discipline.

Appendix 2a Degree programme-specific learning outcomes – Skills– Bachelor programme Physics
The Bachelor’s graduate in 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 (symbolical) software package,
2.3. setup and carry out an experiment, while taking into account the safety and environmental issues,
2.4. analyze experimental data in a proper and ethical manner, including an error analysis.
Appendix 1b Degree programme-specific learning outcomes – Basic Knowledge – Bachelor programme Applied Physics

The Bachelor's graduate in Applied Physics has:

1.1. Knowledge of the most important subjects in the field of:
   a) Classical Mechanics / 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 2b Degree programme-specific learning outcomes – Skills – Bachelor programme Applied Physics

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 the safety and environmental issues,
2.4. calculate with models / mathematical models with design as a purpose.

B3.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR DEGREE PROGRAMMES PHYSICS AND APPLIED PHYSICS

In Section A1.3.1 [s3] of the general part of the study guide provides a description the faculty’s view on the embedding of research and academic skills in the faculty’s programmes. The table below presents an overview on how research and academic skills are integrated in the various course units of the Bachelor degree programmes in Physics and Applied Physics. In this table the following research and academic skills are distinguished:

1. Formulating adequate research goals, questions and/or hypotheses;
2. Searching for, assessing and reflecting on scientific literature;
3. Setting up basic research experiments, analysing and reflecting on its outcomes and drawing appropriate conclusions;
4. Training critical thinking, reflection, analytic attitude and capacity;
5. Reflecting on research methods and methodology;
6. Communicating research progress and outcomes (both orally and in writing);
7. Cooperating in a (multi-disciplinary) team.
Table: Overview of the research and academic skills in the Bachelor's degree programme in Physics and Applied Physics.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics Laboratory 1</td>
<td>1 xx xx xx x x</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
<tr>
<td>First year's electives</td>
<td>1 xx xx x x</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
<tr>
<td>Physics Laboratory 2</td>
<td>1 xx xx xx x x</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
<tr>
<td>Science, Ethics, Technology and Society</td>
<td>2 x x xx xx xx xx xx xx</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
<tr>
<td>Physics Laboratory 3</td>
<td>2 xx xx xx xx xx xx xx</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
<tr>
<td>Bachelor Project</td>
<td>3 xx xx xx xx xx xx xx xx</td>
<td>xx</td>
<td>x x</td>
<td>xx xx xx</td>
<td>x xx</td>
<td>xx xx</td>
<td>xx</td>
</tr>
</tbody>
</table>

xx: a skill to which the course strongly contributes.

x: a skill to which the course contributes to a lesser extent.

B3.6 BACHELOR'S DEGREE PROGRAMME IN PHYSICS

Formally, the programme consists of the Major in Physics (150 ECTS) and a Minor (30 ECTS). The Minor is taken in the first semester of Year 3. The other components together form the Major. In terms of content, the degree programme can be divided into a core programme and an elective component. Physics and Applied Physics have the same core programme. The elective component (worth 55 ECTS, and therefore comprising more than the Minor) is used to choose a track. The tracks are as follows:

- Experimental and Theoretical Physics (NExT)
  Within the NExT Track there are various fields of interest:
  - Particle Physics
  - Nanophysics
  - Theoretical Physics

Within NExT, students can choose an optional Minor course unit in semester 1 of Year 3.

- Life and Health
- Energy and Environment
The tables below show the core programme and the composition of each of the tracks. Descriptions of the course units can be found at [http://www.rug.nl/ocasys](http://www.rug.nl/ocasys)

**Bachelor’s degree programme in Physics**

### Year 1 (propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

**Year 2**

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>5</td>
<td>2a</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

**Total** | 30   | **Total** | 30   |
B3.6.1 Options within the degree programme in Physics

Choice in the first quarter of the propaedeutic phase
The second quarter (semester 1b) of Year 1 consists of a number of compulsory course units and an elective: 'Introduction to Astronomy', 'Introduction to Energy & Environment 1', 'Medical Physics', 'Physics of Modern Technology', or 'Physics of the Quantum Universe'. The choice is the first option to specialize in a specific track. It is also intended for students who would like to briefly explore the tracks and closely related degree programmes, and for students who are unsure which programme to choose. Whichever course unit students choose, they can continue without study delay with the degree programmes in Physics, Applied Physics or Astronomy.

Choice in the third quarter of the propaedeutic phase
In the third quarter (semester 2a) of the propaedeutic phase, another 5 ECTS are reserved for one of three optional course units. The course units further explore specific tracks, but the unit chosen at this stage does not necessarily determine the final track choice. After the propaedeutic phase students can still transfer to another track without incurring study delay.

Choice in Years 2 and 3: track-related
In Year 2 students choose one of the tracks listed in Section B3.5. The course units are largely the same for all tracks, but there are two electives that focus on different tracks. Year 3 is dedicated entirely to the chosen track. In the Experimental and Theoretical Physics (NExT) track, students can choose an Optional Minor in the first semester of Year 3.

B3.6.2 Experimental and Theoretical Physics (NExT) Track
Within the NExT track there are various fields of interest: particle physics, nanophysics and theoretical physics. The track-oriented course units in Year 2 are the same for all NExT interest fields:
Within NExT, students can choose an optional Minor course unit in semester 1 of Year 3. In semester 2a, students then follow course units specified for one of the interest fields.

### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Complex Analysis</td>
<td>5</td>
<td>2b</td>
</tr>
</tbody>
</table>

The Minor can be
- a University Minor offered by another faculty
- a Faculty Minor (e.g. the teacher-training Minor).
- Course units under the Minor ‘Science for Scientists’ for Physicists (see Ocasys)
- A package of course units on an individual basis approved by the board of examiners (e.g. a study abroad).

More information about Minors can be found via your start page on Nestor.

In semester 2a students follow the course units within their chosen field of interest. However, students can also choose a combination of course units from the various tracks (‘Science for Scientists’), or choose a Minor as described above. The tables below show the course units in Semester 1 that are relevant and useful for each field of interest field.

### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>minor</td>
<td>15</td>
<td>2a</td>
</tr>
<tr>
<td>1b</td>
<td>minor</td>
<td>15</td>
<td>2b</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

**NExT: Particle Physics**

Particle physics relates to the smallest building blocks of matter and the way in which they interact - not only matter as we know it in daily life today, but also as it was in the first moments after the Big Bang. We use accelerators and lasers to explore the boundaries of our knowledge about matter in order to answer questions such as ‘have we identified all particles and forces?’ and ‘where is the antimatter in the Universe?’.

Within this interest field students will study fundamental topics, as well as themes that play a role in daily life and themes relating to energy (nuclear fission and fusion, radioactivity), and medical applications (PET, MRI, proton therapy).
### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>Physics Laboratory 4</td>
<td>5</td>
<td>Astroparticle physics</td>
<td>5</td>
</tr>
<tr>
<td>Atoms and Molecules</td>
<td>5</td>
<td>Symmetry in Physics</td>
<td>5</td>
</tr>
<tr>
<td>One from:</td>
<td></td>
<td>Fundamentals of Particle Physics</td>
<td>5</td>
</tr>
<tr>
<td>• Ionizing Radiation in Medicine</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Nuclear Energy</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>Subatomic Physics</td>
<td>5</td>
<td>Bachelor’s Research Project</td>
<td>15</td>
</tr>
<tr>
<td>Experimental Techniques</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particle Physics</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Principles of measurement systems</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

**NExT: Nanophysics**

Research into and applications for materials on the nanometer scale are becoming increasingly important in science and technology. Usually, properties do not depend on the size of the object. This is not true on the nanoscale, where physical properties are governed by quantum mechanical principles. This leads to many unexpected phenomena and fundamentally different behaviours. This fascinating field has become accessible partly as a result of technical advances that made it possible to manufacture, study and manipulate matter on a nanoscale. The Nanophysics interest field in the Bachelor’s programme shows why ‘size matters’ in the nanoworld, and the exciting applications of this.
NExT: Theoretical Physics

Theoretical physics is based on universal principles. The area of application for new discoveries often extends well beyond the area in which they are made. Often, methods developed in a particular field can be put to use in a completely different field. Therefore theoretical physics is characterized by ‘unity in diversity’.

The Theoretical Physics interest field is an introduction to a wide range of physics topics in which theory has an important and inspiring role. Students learn about relativity theory and study questions such as ‘Is travelling faster than the speed of light possible?’ or ‘What is a black hole?’. Lectures are given in the field of condensed matter, in which theory concerns itself with questions such as ‘How do we explain high-temperature superconductivity?’ The Theoretical Physics track is an introduction to the theory behind the CERN LHC particle accelerator experiment that is searching for new proof for theoretical concepts such as ‘supersymmetry’.

<table>
<thead>
<tr>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>1b</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

B3.6.3 Life and Health Track

Important advances in biology and medicine (e.g. understanding cell division and how this can cause cancer) are increasingly made at the interface with chemistry and physics. In addition, increasingly advanced techniques are being used in medicine that are based on physical principles.

As the name indicates, this track offers course units and practicals to introduce students to a wide range of physics-related topics at the heart of life and health. This encompasses the wonderful world of biophysics (from ‘how do cells grow and divide?’ to ‘how do the senses work?’), medical imaging techniques (‘how does a PET scan work?’), the principles underlying the functioning (and side effects) of radiation, and topics from biomedical technology such as tissue engineering.

<table>
<thead>
<tr>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td>1b</td>
</tr>
</tbody>
</table>
### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Physics Laboratory 4&lt;br&gt;Ionizing Radiation in Medicine&lt;br&gt;<strong>One from:</strong>&lt;br&gt;• Atoms and Molecules&lt;br&gt;• Solid State Physics 1</td>
<td>5</td>
<td>2a</td>
</tr>
<tr>
<td>1b</td>
<td>Imaging Techniques in Radiology 1&lt;br&gt;Nanophysics and Nanotechnology&lt;br&gt;Principles of Measurement Systems</td>
<td>5</td>
<td>2b</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### B3.6.4 Energy and Environment Track

The availability of large quantities of energy is crucial to our prosperity, our health and quality of life. In the long term, the availability of energy sources will come under pressure. Moreover, there is concern about how energy consumption affects the Earth’s climate. This track offers course units and practicals that cover the whole range of aspects, from energy use in all its form, and its consequences, and interaction with society.

Energy is typically a concept that relates to physics. The whole chain involving the extraction, production, transport and ‘consumption’ (physicists of course refer to this as ‘conversion’, since energy is neither created nor destroyed) of fossil fuels revolves around physics. For alternative forms of energy – wind and solar power – and nuclear energy, the consequences of how we extract and generate them today, i.e. increasing concentrations of greenhouse gases in the atmosphere and all the related consequences, involve other aspects of physics that relate more closely to meteorology, spectroscopic detection methods and the use of trace elements. Finally, the theme ‘Energy and Environment’ is so closely interwoven with society that the track also covers the whole chain of energy systems and its consequences, including interaction with society.

### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Geo-energy</td>
<td>5</td>
<td>2b</td>
</tr>
<tr>
<td>Semester</td>
<td>ECTS</td>
<td>Semester</td>
<td>ECTS</td>
</tr>
<tr>
<td>----------</td>
<td>------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>1a</td>
<td>Physics Laboratory 4</td>
<td>5</td>
<td>Energy from Gas</td>
</tr>
<tr>
<td>Nuclear Energy</td>
<td>5</td>
<td>Molecular Spectra and Structure</td>
<td>5</td>
</tr>
<tr>
<td>Physical and Chemical Kinetics</td>
<td>5</td>
<td>Physics of Fluids</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>Energy and Society</td>
<td>5</td>
<td>2b</td>
</tr>
<tr>
<td>Principles of Measurement</td>
<td>5</td>
<td>Systems</td>
<td></td>
</tr>
<tr>
<td>Solar Cells</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>

**B3.6.5 Bachelor’s Research Project on Physics**

Prior knowledge: students must pass the propaedeutic phase. In addition, they must have earned 135 ECTS of the Bachelor’s degree programme.

The Bachelor’s project must be carried out in one of the Physics research groups. An overview of the groups can be found at

- [http://www.rug.nl/fmns-programme/physics/research](http://www.rug.nl/fmns-programme/physics/research)

In principle, students choose a research group that is appropriate for their chosen track. Students who have chosen the Optional Minor can choose any of the research groups, but it is advisable to make choices that are relevant to the research group as much as possible.

Once a year, an orientation day is held so that students can visit the research groups. Students who are still uncertain about which research group to choose, and there are only a few weeks to go before they are due to begin the project, should make an appointment as soon as possible with the leaders of the research groups they are considering, so that they can discuss possible projects.

Obviously, the Bachelor’s Research Project must meet certain requirements. These are set out in the Bachelor’s Protocol on the Nestor page for the Bachelor’s Research Project. To have access to that page on Nestor you have to register for the course ‘Bachelor’s Research Project’ on Progress. The research project concludes with a presentation on the research at a symposium.

**B3.7 BACHELOR’S DEGREE PROGRAMME IN APPLIED PHYSICS**

In the Netherlands, physics engineering is a respected profession. In terms of status, engineers are in fifth place, tucked between physicians and mayors. The explanation for this prominent position is that progress is associated with technological advances/innovation, and technology is the area on which engineers concentrate. The distinction made in the Bachelor’s programme in Applied Physics, which leads via the Master’s phase to a diploma in Physics Engineering, and other natural-science tracks, relates to the extent to which the emphasis is on thinking in a technical way. The emphasis in this track is on design and construction, constructing physical measuring equipment, learning to use advanced instruments, information technology and computational physics. The intrinsic interdisciplinary character of an engineering degree programme relates primarily to integrating course units, with an emphasis on combinations of subjects: physics with design studies, electrotechnology, systems and control engineering, energy and environmental studies, the physics of life, and nanotechnology.
The programme is shown in the table below. Descriptions of the course units can be found at [http://www.rug.nl/ocasys](http://www.rug.nl/ocasys)

### Year 1 (propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mechanics and Relativity</td>
<td>10</td>
<td>2</td>
<td>Electricity and Magnetism</td>
<td>10</td>
</tr>
</tbody>
</table>
| 1a       | Calculus 1 Physics Laboratory 1 | 5    | 2a       | Calculus 2 One from:  
  - Biophysics  
  - Introduction to Energy & Environment 2  
  - Nanophysics | 5    |
| 1b       | Linear Algebra 1 One from:  
  - Introduction to Astronomy  
  - Introduction to Energy & Environment 1  
  - Medical Physics  
  - Physics of Modern Technology  
  - Physics of the Quantum Universe | 5    | 2b       | Mathematical Physics Physics Laboratory 2 | 5    |

**Total** | **30**  | **Total** | **30**

### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course Units</th>
<th>ECTS</th>
</tr>
</thead>
</table>
| 1a       | Introduction to Programming and Numerical Methods  
Electricity and Magnetism II  
Quantum Physics 1 | 5    | 2a       | Electronics and signal processing  
Structure of Matter 1  
Science, Ethics, Technology, and Society | 5    |
| 1b       | Waves and optics  
Statistical Physics  
Materials Science | 5    | 2b       | Numerical Mathematics 1  
Structure of Matter 2  
Physics Laboratory 3 | 5    |

**Total** | **30**  | **Total** | **30**
### B3.7.1 Options within the degree programme in Applied Physics

#### Choice in the first quarter of the propaedeutic phase

The second quarter (semester 1b) of Year 1 consists of a number of compulsory course units and an elective: 'Introduction to Astronomy', 'Introduction to Energy & Environment 1', 'Medical Physics', 'Physics of Modern Technology', or 'Physics of the Quantum Universe'. The choice is the first option to specialize in a specific programme or track. It is also intended for students who would like to briefly explore closely related degree programmes, and for students who are unsure which programme to choose. Whichever course units students choose, they can continue without study delay with the degree programmes in Physics, Applied Physics or Astronomy.

#### Electives

<table>
<thead>
<tr>
<th>Programme / track</th>
<th>Electives</th>
</tr>
</thead>
<tbody>
<tr>
<td>NExT (Experimental and Theoretical Physics)</td>
<td>Physics of the Quantum Universe &amp; Nanotechnology</td>
</tr>
<tr>
<td>Physics of Life and Health</td>
<td>Medical Physics &amp; Biophysics</td>
</tr>
<tr>
<td>Physics of Energy and Environment</td>
<td>Introduction to Energy and Environment 1 &amp; 2</td>
</tr>
<tr>
<td>Applied Physics</td>
<td>Physics of Modern Technology &amp; Nanotechnology</td>
</tr>
<tr>
<td>Astronomy</td>
<td>Introduction Astronomy</td>
</tr>
</tbody>
</table>

#### Choice in the third quarter of the propaedeutic phase

In the third quarter (semester 2a) of the propaedeutic phase, another 5 ECTS are reserved for one of three optional course units. The course units further explore specific tracks, but the unit chosen at this stage does not necessarily determine the final track choice. After the propaedeutic phase students can still transfer to another track without incurring study delay.

#### B3.7.2 Bachelor’s research project on Applied Physics

Prior knowledge: students must pass the propaedeutic phase. In addition, they must have earned 150 ECTS of the Bachelor’s degree programme.

The Bachelor’s project can be carried out in one of the Applied Physics research groups.
- Photophysics and Opto-electronics
- Materials Science
- Micromechanics
- Physics of Nanodevices
- Nanostructured Materials and Interfaces
- Device Physics of Complex Materials

or, with the permission of the board of examiner, in another research group, provided there is sufficient emphasis on elements of applied physics in the research.

More information about the research groups can be found at:

Once a year, an orientation day is held so that students from any year can visit the research groups. Students who are still uncertain about which research group to choose, and there are only a few weeks to go before they are due to begin the project, should make an appointment as soon as possible with the leaders of the research groups they are considering, so that they can discuss possible projects.

Obviously, the Bachelor’s Research Project must meet certain requirements. These are set out in the Bachelor’s Protocol on the Nestor page for the Bachelor’s Research Project. The research project concludes with a presentation on the research at a symposium.

**B3.8 DOUBLE BACHELOR’S DEGREE PROGRAMME IN MATHEMATICS AND PHYSICS**

See Section B2.7 for the Double Bachelor’s degree programme in Mathematics and Physics.
B4
BACHELOR'S DEGREE PROGRAMME IN ASTRONOMY

B4.1 INTRODUCTION
Astronomy is physics on a large scale, with the limitation that it is not possible to influence the conditions under which experiments are conducted. On the other hand, the astronomer's laboratory is 'infinitely' large, and many astrophysical conditions cannot be created in a laboratory. Astronomers obtain their experimental data by 'observing'.

In optical astronomy (visible light and near-infrared; classic telescopes) and radioastronomy (wavelengths from a few millimetres to several metres), it is still customary for astronomers to do this themselves, individually or as part of a team, assisted by specialists who are familiar with the advanced and technically complex equipment. Astronomers play an important role in space research (X-ray, ultraviolet, infrared), namely defining experiments to draw up good specifications for the instrument to be developed.

Processing observation material into a coherent whole is generally a time-consuming exercise and, almost without exception, advanced computer and software systems are used for this purpose. The interpretation of the data results in a contribution to the knowledge of the subject studied, an interpretation that must be comprehensible to fellow astronomers and able to be discussed with them. The theory is somewhat further from the observation material, but often provides important stimuli for the design of new observation programmes. The progress and conclusion of research are often reported in publications and at colloquia or symposia. It goes without saying that a genuine contribution to the knowledge of the subject is only possible if the research results are considered in the context of recent observational and theoretical developments in the area concerned.

The astronomical institute in Groningen is officially called the Kapteyn Institute. It is named after its founder, Professor J.C. Kapteyn (1851-1922). More than a century ago, Kapteyn founded what was then known as the Sterrenkundig Laboratorium (Astronomical Laboratory). Kapteyn concentrated on an enormous project, the aim of which was to map the structure of our galaxy by counting and cataloguing the stars. At the time, it was not yet known that our view of the galaxy at optical wavelengths is obscured by interstellar material. It was not until the development of radio astronomy, after the Second World War, that the whole galaxy was visible without the problem of absorption. Kapteyn's model turned out to include only a very small part of the galaxy; the whole was much more extensive than he had been able to see. But the work of Kapteyn and his colleagues was not in vain; they laid the foundations for modern research into galaxies, and their work was highly important for the development of astronomy in the Netherlands.

Astronomical research and teaching at the University of Groningen are based in the Zernike Building, together with the Groningen branch of SRON (Netherlands Institute for Space Research). The astronomers of the Kapteyn Institute and SRON work together in many fields. There is also close collaboration with astronomers from ASTRON (Netherlands Foundation for Research in Astronomy) at Dwingeloo. The Kapteyn Institute is part of NOVA (Netherlands Research School for Astronomy), one of the top six research schools in the Netherlands.

In total, more than 70 people – including PhD students – work at the Kapteyn Institute. By no means all of these staff members are employed by the University; some are employed by NWO (Netherlands Organization for Scientific Research) via the foundations ASTRON or SRON. The total number of Astronomy students is around 50. On average, approximately 15 of these students have a fixed workstation at the Kapteyn Institute at any one time.

The tradition begun by Kapteyn is still evident in astronomical research at Groningen. The 'structure and evolution of galaxies' is still the main object of study. However, the emphasis has shifted slightly from our own galaxy to galaxies in general, and there is increasing
attention for distant galaxies (i.e. galaxies in the early universe). Another significant
difference compared to the early period is the enormous range of observational facilities
available to astronomers today. Astronomers in the Netherlands not only have their own top-
class radiotelescope, they also have access to a wide range of observation techniques:

- The VLT (Very Large Telescope) operated by the ESO (European Southern
  Observatory) on Cerro Paranal in the Atacama Desert of Chile is the world’s largest
  optical/infrared telescope. The VLT consists of four 8-metre telescopes.
- The optical telescopes operated by the ESO on Cerro La Silla (also in Chile); the two
  largest telescopes are 3.5 metres.
- The Anglo-Dutch optical observatory on the Canary Islands (La Palma): telescopes of
  2.5 and 4.2 metres.
- Also an Anglo-Dutch collaboration: the 15-metre (sub)millimetre JCMT telescope
  and the 4-metre UKIRT infrared telescope on Mauna Kea (Hawaii).
- All manner of satellites, mainly for measurements in the X-Ray/UV wavelength range
  and distant infrared light sources. Two infrared satellites are used, IRAS and ISO, to
  which SRON Groningen made a major contribution. And, of course there is the
  Hubble Space Telescope (HST) and the Herschel space telescope.
- Via the option of guest observer: access to the ‘Very Large Array’ radio telescope in
  New Mexico, and various other optical and radio observatories throughout the world.

This diversity of measurement techniques could lead to far-reaching specialization, but in
fact the reverse tendency is evident: astronomical research is increasingly evolving into a
‘multi-wavelength’ discipline, whereby the astronomer simply chooses or combines
wavelength ranges that are relevant to the research. At Groningen, astronomical research
focuses on:
- The structure and evolution of galaxies
- Active galaxies and quasars, large-scale structure of the universe
- Interstellar matter
- Stars
- Black holes and neutron stars
- Instrumentation

Astronomy is an exciting discipline, and there are many opportunities for graduates:
theoretical research, observation-based research or the development of instruments for
telescopes and satellites. During the programme, students decide themselves which track
interests them the most.

**Education-related matters for Astronomy**
The Education page for the degree programme in Astronomy is at:
  - [http://www.rug.nl/research/kapteyn/onderwijs/](http://www.rug.nl/research/kapteyn/onderwijs/)

Education-related matters and announcements can also be found via your start page on
Nestor.
The lecture and examination timetables can be found at:
  - [http://rooster.rug.nl/](http://rooster.rug.nl/)
B4.2 SUPPORTIVE STAFF AND COMMITTEES

The bachelor’s degree programme in Astronomy is part of the Undergraduate School of Sciences of the Faculty of Mathematics and Natural Sciences. The person responsible for the content of the degree programme is the Programme director.

During your studies you will get to know the various teachers and researchers of the degree programme. For many problems you can ask the teacher of your course for help, but there are also other staff members who can assist you in your studies.

B4.2.1 Supportive Staff

Programme director

- Prof. dr. P.D. Barthel
  pdb@astro.rug.nl
  (050) 363 4070

Programme coordinator

- N. Bos, MSc
  escastronomy@rug.nl
  (050) 363 4873

Academic advisor

- Drs. G.J. Zondervan
  g.j.zondervan@rug.nl
  (050) 363 4130

Education administration

- Ms. D. Klasens
  esc.fwn@rug.nl
  (050) 363 2446

Practicals

- Dr. R.J.H. Klein-Douwel (coordinator)
  r.j.h.klein-douwel@rug.nl
  (050) 363 4931
- H. de Vries
  hans.de.vries@rug.nl
  (050) 363 4858

B4.2.2 Programme Committee

Matters related to the course curriculum are discussed in the Programme Committee (opleidingscommissie, OC). The Programme Committee has an advisory responsibility with respect to the content of course programmes, with respect to the evaluation of course units and with respect to various other educational issues that may arise. The Programme Committee also reviews the Teaching and Examination Regulations (OER) annually. The committee advises the Board of the Undergraduate School of Science (USS) and Graduate School of Science (GSS), the Faculty Board and individual professors.

The Programme committee consists of four staff members and four student members but also the programme director, the academic advisor and the programme coordinator generally attend the meetings of the committee. Student members of the PC are elected annually; staff members hold office for two years. For contact you can send an e-mail to:

- j.f.veenkamp@rug.nl

Chairman: Dr. K.I. Caputi
  karina@astro.rug.nl
  (050) 363 8325

Secretary: N. Bos, MSc
  escastronomy@rug.nl
  (050) 363 4873
B4.2.3 Board of Examiners
The Board of Examiners is responsible for examinations and verifies whether individual students have met the criteria for graduation. The Board of Examiners can also make decisions regarding exemption of courses or other parts of the curriculum and other special regulations.

Chairman: Prof.dr. M.A.M. van de Weijgaert
weygaert@astro.rug.nl
(050) 363 4086

Secretary: N. Bos, MSc
escastronomy@rug.nl
(050) 363 4873

B4.3 STUDY ASSOCIATION: FYSISCHE-MATHEMATISCHE FACULTEITSVERENIGING (FMF)
The Fysisch-Mathematische Faculteitsvereniging (FMF) is the association for students in (Applied) Physics, (Applied) Mathematics, Astronomy and Computer Science. The FMF organizes a wide range of activities on social, academic and career level. As a student you want to enjoy an educational and pleasant experience in the most exciting student city in The Netherlands! To make it truly unforgettable, the FMF can help you experience your time as a student to its full potential.

Enthusiastic active members of the FMF organize fun activities, sometimes study related. For example, every month you can enjoy a low cost meal and watch a film afterwards. You can also get to know your fellow students at the monthly drinks, the yearly barbecue, or during the members weekend. Or go head-to-head with other members at activities like crossbow shooting, a hitchhiking contest, karting, paintball, curling or the annual soccer competition.

On top of that the FMF has a broad repertoire for anyone interested in a more scientific programme or career orientated activities. We organize lectures, the annual scientific FMF symposium, visits to companies and the Science Quiz. Furthermore, every year members go on a foreign excursion with a scientific and cultural programme. Previously we’ve been to Singapore and Indonesia where we enjoyed trips to universities, companies, the rainforest and cultural activities. This year we will go to Japan in April for our foreign excursion. On top of that, the FMF has a broad repertoire for anyone interested in a more scientific programme or career orientated activities. We organise several lectures, the annual scientific FMF symposium, in-house days at companies and Olympiads.

The FMF also takes care of the book sale at our faculty. As a member of our study association you can get your books for a lower price than in the stores. If you want to order your books you can find more info on:

- www.fmf.nl/books

Are you curious as to what the FMF has in stock for this year, how you can get active at the FMF or do you just want to have a chat? Drop by the FMF room at 5111.0053, behind the canteen at the Nijenborgh 4. Equipped with a seating area and a large table it is perfect to: relax, lunch, socialize or play games (we have different board and card games to use). For free coffee, tea and cheap snacks, candy and beverages this is also the place to be. The room is open on a daily basis from 09:00 – 17:00.

You can also go to our website www.fmf.nl. Besides information about our association and our agenda, you can also find a large database with old exams to make sure you are well-prepared for your exams.
B4.4 AIMS AND LEARNING OBJECTIVES OF THE DEGREE PROGRAMME

The Bachelor’s degree programme in Astronomy leads to the title ‘Bachelor of Science’ (BSc).

The aim of the programme is to impart the knowledge, skills, understanding and attitude relating to Astronomy by means of a broadly based curriculum in such a way that graduates are able to become independent professionals and qualify for admission to the follow-up Master’s degree programme.

This aim has been translated into a set of learning outcomes, formulated in a broad context within the former Natural Sciences and Technology teaching institute of the Faculty of Mathematics and Natural Sciences at the University of Groningen. First, generic learning outcomes were formulated for the Bachelor’s degree programmes in Astronomy, Physics, Applied Physics, Chemistry, Chemical Engineering, Mathematics and Applied Mathematics, and specific learning outcomes for each degree programme were subsequently added.

A. Knowledge

A1. Bachelor’s graduates have general knowledge of the foundations and history of mathematics, natural sciences and technology, in particular those of their own discipline.

A2. Bachelor’s graduates have mastered the basic concepts of their discipline (see Appendix 1 for a detailed specification) to a certain level and have knowledge of how the concepts relate to each other within the discipline and how they relate to other disciplines.

A3. Bachelor’s graduates have in-depth knowledge of several current topics within their own discipline.

A4. Bachelor’s graduates are familiar with the quantitative nature of mathematics and the natural sciences and have an understanding of the methods (including the use of computers) used in these disciplines, and in particular in their own discipline.

A5. Bachelor’s graduates have sufficient knowledge and understanding of mathematics and natural sciences to successfully complete a follow-on Master’s degree programme in their own discipline.

A6. Bachelor’s graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

B. Skills

B1. (Research) Bachelor’s graduates are able to draw up a research question and to design, plan and conduct research and report on it independently with a certain 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 problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – 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 (including multidisciplinary teams) on technical-scientific problems.

B5. (Communicating) Bachelor’s graduates are able to communicate orally and in writing in academic and professional contexts, with both colleagues and others, in Dutch and English. 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 II.

Appendix 1 – Programme-specific Basic Knowledge – Bachelor’s degree programme in Astronomy

Bachelor’s graduates in Astronomy
1. have some knowledge of the development of the astronomical world view
2. are familiar with the principles of positional astronomy
3. have mastered the basic astrophysics of stars and galaxies
4. are aware of the basic principles with regard to making astronomical observations in the various wavelength ranges and processing the observation data.
5. have a background knowledge of theoretical astrophysics
6. have a thorough knowledge of general mathematics (calculus, linear algebra, complex analysis, error analysis and statistics)
7. have a thorough knowledge of general physics (classical mechanics, electromagnetism, quantum physics, thermodynamics, statistical physics, wave phenomena, vibrations and optics, matter: structure and interactions)
8. (Minor) have in-depth knowledge of topics in their discipline or broad-based knowledge of topics in a different discipline.

Appendix 2 – Programme-specific skills – Bachelor’s degree programme in Astronomy

Bachelor’s graduates in Astronomy
1. are able, at an elementary level, to obtain, analyse and publish observations, in various wavelength fields, of objects such as stars, galaxies, and regions of star formation.
2. are able to make elementary astronomical observations with an optical telescope
3. are familiar with the use of computers and computing in astronomical research:
4. have experience of working with astronomical observation data and/or astronomical simulations
5. can write programmes in a current programming language.
B4.5 OVERVIEW OF RESEARCH AND ACADEMIC SKILLS OF BACHELOR DEGREE PROGRAMME ASTRONOMY

In Section A1.3.1 [86] of the general part of the study guide provides a description the faculty’s view on the embedding of research and academic skills in the faculty’s programmes. The table below presents an overview on how research and academic skills are integrated in the various course units of the Bachelor degree programme in Astronomy. In this table the following research and academic skills are distinguished:

1. Formulating adequate research goals, questions and/or hypotheses;
2. Searching for, assessing and reflecting on scientific literature;
3. Setting up basic research experiments, analysing and reflecting on its outcomes and drawing appropriate conclusions;
4. Training critical thinking, reflection, analytic attitude and capacity;
5. Reflecting on research methods and methodology;
6. Communicating research progress and outcomes (both orally and in writing);
7. Cooperating in a (multi-disciplinary) team.

Table: Overview of the research and academic skills in the Bachelor’s degree programme in Astronomy.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics Laboratory 1</td>
<td>1</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>First year’s electives</td>
<td>1</td>
<td>xx</td>
<td>xx</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observational Astronomy</td>
<td>1</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td></td>
</tr>
<tr>
<td>Science, Ethics, Technology and Society</td>
<td>2</td>
<td>x</td>
<td>x</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
<tr>
<td>Bachelor Project</td>
<td>3</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
<td>xx</td>
</tr>
</tbody>
</table>

xx: a skill to which the course strongly contributes.
x: a skill to which the course contributes to a lesser extent.
BACHELOR’S DEGREE PROGRAMME IN ASTRONOMY

Formally, the programme consists of a Major (150 ECTS) and a Minor (30 ECTS). Year 1 is largely similar to that of Physics, with the optional course unit ‘Introduction to Astronomy’ in the second quarter (period 1b) being the first dedicated Astronomy course. This course is followed by the compulsory courses ‘Introduction to Programming and Numerical Methods’ (period 2a) and ‘Observational Astronomy’ (period 2b) in the second semester.

In the first semester of Year 3 students follow a Minor. Students who want to focus on Astronomy as much as possible should choose the Minor in Astronomy, for the students who are interested in the observational and instrumentation part of Astronomy there is the minor Instrumentation and Informatics. Students are also free to choose a Minor in a different discipline offered by another faculty.

The programme is shown in the tables on the next page. Descriptions of the course units can be found at [http://www.rug.nl/ocasys](http://www.rug.nl/ocasys).

### Year 1 (propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>1a</td>
<td></td>
<td>2a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td></td>
<td>2b</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Mechanics and Relativity</td>
<td>10</td>
<td>Electricity and Magnetism</td>
</tr>
<tr>
<td>1a</td>
<td>Calculus 1</td>
<td>5</td>
<td>Calculus 2</td>
</tr>
<tr>
<td></td>
<td>Physics Laboratory 1</td>
<td>5</td>
<td>Introduction to Programming and Numerical Methods</td>
</tr>
<tr>
<td>1b</td>
<td>Linear Algebra 1</td>
<td>5</td>
<td>Mathematical Physics</td>
</tr>
<tr>
<td></td>
<td>One from:</td>
<td></td>
<td>Observational Astronomy</td>
</tr>
<tr>
<td></td>
<td>- Introduction to Astronomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Introduction to Energy &amp; Environment 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Medical Physics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Physics of Modern Technology</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Physics of the Quantum Universe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>Total</td>
<td>30</td>
</tr>
</tbody>
</table>
### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>5</td>
<td>2a</td>
<td>5</td>
</tr>
<tr>
<td>Observational Astronomy</td>
<td>5</td>
<td>Science, Ethics, Technology, and Society</td>
<td>5</td>
</tr>
<tr>
<td>Quantum Physics 1</td>
<td>5</td>
<td>Statistical and Numerical Methods</td>
<td>5</td>
</tr>
<tr>
<td>Electricity and Magnetism 2</td>
<td>5</td>
<td>Structure of Matter 1</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>5</td>
<td>2b</td>
<td>5</td>
</tr>
<tr>
<td>Waves and Optics</td>
<td>5</td>
<td>Physics of Galaxies</td>
<td>5</td>
</tr>
<tr>
<td>Complex Analysis</td>
<td>5</td>
<td>Physics of Stars</td>
<td>5</td>
</tr>
<tr>
<td>Statistical Physics</td>
<td>5</td>
<td>Quantum Physics 2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a and 1b</td>
<td>30</td>
<td>2a</td>
<td>5</td>
</tr>
<tr>
<td>Minor</td>
<td>5</td>
<td>Astroparticle Physics</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Astrophysical Hydrodynamics</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Interstellar Medium</td>
<td>5</td>
</tr>
<tr>
<td>2b</td>
<td>15</td>
<td>Bachelor's Research Project</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### B4.6.1 Options within the degree programme in Astronomy

#### Choice in the first quarter of the propaedeutic phase
The second quarter (semester 1b) of Year 1 consists of a number of compulsory course units and an elective: 'Introduction to Astronomy', 'Introduction to Energy & Environment 1', 'Medical Physics', 'Physics of Modern Technology', or 'Physics of the Quantum Universe'. The choice is the first option to specialize in a specific track. It is also intended for students who would like to briefly explore the tracks and closely related degree programmes, and for students who are unsure which programme to choose. Whichever course unit students choose, they can continue without study delay with the degree programmes in Physics, Applied Physics or Astronomy.

#### Electives

<table>
<thead>
<tr>
<th>Programme / track</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics of the Quantum Universe</td>
</tr>
<tr>
<td>Medical Physics</td>
</tr>
<tr>
<td>Introduction to Energy and Environment 1</td>
</tr>
<tr>
<td>Physics of Modern Technology</td>
</tr>
<tr>
<td>Introduction Astronomy</td>
</tr>
</tbody>
</table>

#### Choice in Year 3: the Minor
The Minor can be:
- A University Minor offered by another faculty
- A Faculty-wide Minor
- A Minor offered by the Life Sciences teaching institute or by the Information Sciences teaching institute
- Minor in Astronomy
- Minor in Instrumentation and Informatics
- A package of course units approved on an individual basis by the Board of Examiners.
Minor in Astronomy

Students who want to focus on astronomy in the Minor phase are advised to take the Minor in Astronomy. This comprises the following course units:

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Cosmology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Stellar Structure and Evolution</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One from:</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Atoms and Molecules</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Nuclear Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Advance Mechanics</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Radio Astronomy</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One from:</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Statistical Signal Processing</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Cosmic Structure Formation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Onderwijs en Communicatie</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Minor in Instrumentation and Informatics

Students who want to focus on the observational and instrumentation part of Astronomy and are interested in the computational side of signal processing, are advised to take the minor in Instrumentation and Informatics. This comprises the following course units:

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Control Engineering</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Materials Science and Engineering</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cosmology</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Principles of Measurement Systems</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Statistical Signal Processing</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>One from:</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Radio Astronomy</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Onderwijs en Communicatie</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Certain course units in the Minor are offered every other year. This means that the composition of the Minor changes every year. Obviously, students follow the course unit that is offered in the year in which they take their Minor. The current composition of the Minor in Astronomy is published in Ocasys each year.

B4.6.2 Bachelor’s Research Project on Astronomy

All Bachelor’s students of Astronomy complete a research project with a student workload of 15 ECTS in Year 3.

The purpose of the project is to become acquainted with the practical aspects of scientific research and to learn to present results in writing and orally. A further purpose is to learn to use the various computer systems at the Institute.

Prior knowledge: students must have passed the propaedeutic phase. In addition, they must have earned 135 ECTS of the Bachelor’s degree programme.
Guidelines: before students can begin the Bachelor’s research project, an exploratory discussion is held with the coordinator of student research to determine which types of research align most closely with the student’s interests and capabilities. Students are responsible for arranging an appointment with the coordinator when they wish to begin their Bachelor’s research project. Together they look for a supervisor. The student and supervisor draw up a week-to-week research plan and schedule. The student workload must not exceed 15 ECTS.

Study of the relevant literature should constitute a fixed element of the research. The research project concludes with a report and a presentation on the research given at a student symposium. The report must be written in English. The oral presentation can be in English or in Dutch. The supervisor, second reader and student research coordinator each receive a copy of the report. The report should also be uploaded to the Faculty repository, [http://scriptsies.fwn.eldoc.ub.rug.nl/UDA](http://scriptsies.fwn.eldoc.ub.rug.nl/UDA).

In order to ensure consistent assessment marking, the standard procedure is that the report is read by a second assessor and the coordinator of student research. The final mark is based on the research work, report and presentation, in consultation between the supervisor, second assessor and coordinator of student research. Students give their presentation in the presence of the supervisor, second assessor, coordinator of student research and fellow students.

At the website of the Kapteyn Institute ([http://www.rug.nl/research/kapteyn](http://www.rug.nl/research/kapteyn)) students can find out more about the research conducted by staff members.
B5

BACHELOR'S DEGREE PROGRAMMES IN
CHEMISTRY AND CHEMICAL ENGINEERING

B5.1 INTRODUCTION

How does the human body function? Why do your muscles ache in the morning when you’ve been jogging the evening before? How does the paracetamol work that you take when you have a headache from studying all night? What is the difference between a cotton shirt and a silk shirt? Why does garlic have such a strong odour? Chemistry can answer all these questions – and more.

Chemistry is the study of the structures of molecules and the laws that determine interactions between molecules. Chemistry encompasses aspects of almost all the natural sciences: physics and biology, but also pharmacy and medicine. In very general terms, the aim of chemistry is to try to understand and control all processes in nature. But chemists are primarily engaged in the search for new molecule structures that are of added value for life on this planet.

After graduating, many chemists continue in research, either at a university or in the chemical industry. This can be fundamental or applied research. An example of fundamental research is the identification of DNA mutations that cause particular diseases. This knowledge can then be used to conduct a typical applied study, namely to find a treatment to tackle the cause of the disease. There are researchers in medicine and biochemistry but also, for example, in the food industry and the plastics industry. If you do not want a career in research, there are plenty of other opportunities in various fields. For example, you could work as a manager for the Inspectorate for Consumer Goods (KvW, Keuringsdienst van Waren), leading a team of analysts who check whether food establishments such as restaurants comply with hygiene regulations. In a laboratory, where you lead the team, they examine samples taken from several products to make sure they contain no unwanted bacteria. Chemists also work in secondary and higher professional education.

Education-related matters for Chemistry and Chemical Engineering

Education-related matters and announcements can be found via your start page on Student Portal.

The lecture and examination timetables can be found at

- http://rooster.rug.nl/
**B5.2 SUPPORTIVE STAFF AND COMMITTEES**  
The bachelor's degree programme in Chemistry and Chemical Engineering are part of the Undergraduate School of Sciences of the Faculty of Mathematics and Natural Sciences. During your studies you will get to know the various teachers and researchers of the degree programme. For many problems you can ask the teacher of your course for help, but there are also other staff members who can assist you in your studies.

**B5.2.1 Supportive Staff**

**Programme director**
- prof. dr. D.J. (Dirk) Slotboom  
  chemistry.bsc.rug@gmail.com  
  (050) 363 4187

**Academic advisor**
- Drs. ing. W.G. (Wendy) Hof  
  w.g.Hof@rug.nl  
  (050) 363 4291

**Programme coordinator**
- R.V. (Renske) Elferink-Vonk  
  r.v.elferink@rug.nl  
  (050) 363 5194

**Board of examiners**
- K. (Kim) Winters  
  escchemistry@rug.nl  
  (050) 363 3318

**Practical coordinator**
- Ing. J. (Jort) Robertus  
  j.robertus@rug.nl  
  (050) 363 6967

**Chemistry practicals**
- R. (Roelof) Kloosterman  
  R.Kloosterman@rug.nl  
  (050) 363 4366
- R.M. (Rene) Liewes  
  R.M.Liewes@rug.nl  
  (050) 363 4290
- J. (Jur) van Dijken  
  J.van.Dijken@rug.nl  
  (050) 363 4290

**B5.2.2 Programme committee**
The task of a Programme Committee is to advise on the teaching and examination regulations, (i.e. the implementation of the teaching programmes in the relevant discipline), on matters relating to the implementation of the teaching programmes (i.e. the annual evaluation of how the teaching and examination regulations are implemented) and to give solicited and unsolicited advice on all education-related matters in the relevant discipline. The Programme Committee can issue its advice to the Programme Board, to the Faculty Board (usually through the Programme Board), or to individual teachers and staff members.
Programme committee Chemistry and Chemical Engineering
Chairman: Prof. dr S.J. (Siewert Jan) Marrink  Sec.: drs. R.V. (Renske) Elferink-Vonk
S.J.Marrink@rug.nl r.v.elferink@rug.nl
(050) 363 4345 (050) 363 5194

Secretarial support: K. (Kim) Winters
k.winters@rug.nl
(050) 363 3318

Further information about the Programme Committees can be found on the student portal>tab study info>quick links

B5.2.3 Board of Examiners
The Boards of Examiners is responsible for assuring the quality of assessment procedures, ensuring that examinations and final assessments proceed satisfactorily, and for assessing whether individual students have fulfilled the requirements for the award of the degree certificate. The Boards of Examiners are also responsible for special arrangements, exemptions etc. for individual students. Student requests and questions should be directed to the secretary of the board.

Board of Examiners for Chemistry and Chemical Engineering
Chairman: Prof. dr. J.G. (Gerard) Roelfes  Sec.: K. (Kim) Winters
j.g.roelfes@rug.nl k.winters@rug.nl
(050) 363 7745 (050) 363 3318

Further information about the Boards of Examiners can be found on the student portal>tab study info>quick links

B5.3 STUDY ASSOCIATION: DE CHEMISCHE BINDING
De Chemische Binding is the study association for students of Chemistry and Chemical Engineering at the University of Groningen. It was founded in 1959 as a sub faculty association. Eight years later it became a study association. The goal of our association is to support our students with their study and to look after their interests.

To reach this goal, we supply the books and lab coats for the students. Furthermore, we organize study related activities like lectures, excursions and symposia. We have a committee named de CB-Stem, a participation committee, which evaluates the courses to improve the quality of the education. For third year students we organize a parent day for the parents of the students. They will get a tour through the labs and will do some practical work themselves too. And last but not least, every year we travel to different countries to visit chemistry related companies and universities.

We try to make an almanac every year. In this almanac you will find descriptions of the study associations in Groningen, related study associations throughout the country and research groups of the University of Groningen. Also there is a register of all the students with their picture and phone number, which can be very handy.

After a hard day of studying it is also important to relax! Therefore we organize activities like a board games evening, the night volleyball tournament, the klaverjas competition, the pool tournament, disco bowling, Christmas dinner and a barbecue at the end of the year. We also have the Friday-afternoon-drinks, which are organized every Friday.
Next to these activities we have an association magazine named Het Chemisch Bindmiddel, which contains reports of activities, columns and descriptions of researches. Also every year the Open Nederlandse Chemie Sportdagen (O.N.C.S.) is organized, at which all the related study associations through the country come together to sport.
Most of the activities are organized by our committees, which are all introduced in the almanac. These committees are supported and guided by the board of De Chemische Binding.

You can become a member at the beginning of your study, but of course also later on. If you are interested in one of the committees, in De Chemische Binding or if you have questions, you can come by at our place: het CB-Hok (at the back of the canteen in the NCC, second door on the right). You can also reach us via:

De Chemische Binding, Nijenborgh 4  
Phone: 050-363 4117  
E-mail: board@chemische-binding.nl  
Internet: http://www.chemische-binding.nl

B5.4 STUDY ASSOCIATION: G.T.D. BERNOLLI
The Gronings Technologen Dispuut Bernoulli (G.T.D. Bernoulli) was founded on May 20, 1985 and is the study association for students with an interest in process and product technology. The association is mainly focused on students from the third year of the bachelor programme and from the two years of the master programme of Chemical Engineering.

The main goal of the study association is to enrich the student life of all Chemical Engineers. We do this by small things such as providing coffee and tea during coffee-hours and drinks every Friday afternoon, as well as by organizing lectures and excursions with companies. Typically, G.T.D. Bernoulli organizes such lectures or excursions once a month, as well as a monthly social activity. These are ways to get to know your fellow students better. Also by visiting various companies, you get a better picture of what is possible in the field of Chemical Engineering.

Examples of activities we organize are wokken, theme drinks, paintball, table tennis tournament, hitchhiking and the end of the year BBQ. It is very important that you enjoy your time as a student and by organizing these kind of activities, we hope to contribute to that! We also have a magazine, called the Groningenieur (GRIR), in which research and reports are written. The magazine also contains many pictures of activities and some fun articles as well as a puzzle.

Furthermore, we are in close contact with the Chemical Engineering department. Together we organize for instance information sessions on master thesis subjects or practice sessions for difficult courses. Many of G.T.D. Bernoulli’s members have already followed courses that you might still have to pass, and can help you with any questions you might have. There is also an annual symposium on a typical Chemical Engineering topic organized by us.

All in all, the association provides a foundation for your studies and offers many possibilities. Once you are in the third year of your bachelor’s Chemical Engineering or in your master, you can join G.T.D. Bernoulli. It is possible to subscribe online via the website or ask someone in our Lounge! You can find us here:

G.T.D. Bernoulli, Nijenborgh 4, “Bernoulli Lounge” Room X5118.0238  
Telephone: 050 363 4399  
E-mail: board@gtdbernoulli.nl  
Internet: http://www.gtdbernoulli.nl/
B5.5 AIMS AND LEARNING OUTCOMES OF THE DEGREE PROGRAMMES

The Bachelor’s degree programmes in Chemistry and Chemical Engineering aim to impart the knowledge, skills, understanding and attitude relating to Chemistry or Chemical Engineering by means of a broadly based curriculum in such a way that graduates can become independent professionals and be considered for further training as an academic researcher.

This aim has been translated into a set of learning outcomes, formulated in a broad context within the Natural Sciences and Technology teaching institute of the Faculty of Mathematics and Natural Sciences at the University of Groningen. First, generic learning outcomes were formulated for the Bachelor’s degree programmes in Astronomy, Physics, Applied Physics, Chemistry, Chemical Engineering, Mathematics and Applied Mathematics, and specific learning outcomes for each degree programme were subsequently added.

Learning outcomes of the bachelor’s degree programme Chemistry

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 their own discipline.

A2. Bachelor’s graduates have mastered the basic concepts of their own discipline (see Appendix I for further specification) to a certain extent and are familiar with the interrelationships of these concepts within their own discipline as well as with other disciplines.

A3. Bachelor’s graduates have in-depth knowledge of several current topics within their own discipline.

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 their own discipline, 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 their own discipline.

A6. Bachelor’s graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

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 a certain 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) Bachelor’s graduates are able to translate a problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – 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 (including multidisciplinary teams) on technical-scientific problems.

B5. (Communicating) Bachelor’s graduates are able to communicate 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 II.

Degree programme-specific learning outcomes – Basic Knowledge

The Bachelor’s graduate in Chemistry has:

1.1. knowledge of the most important fields of Chemistry: Inorganic, Organic, Analytical, Physical, Polymer Chemistry and Biochemistry, furthermore general knowledge of more specific field such as Theoretical Chemistry, Materials Chemistry, etc.,

1.2. knowledge of at least one multidisciplinary fields: ‘Chemistry of Life’, ‘Smart Materials’ and ‘Sustainable Energy and Chemistry’,

1.3. a broad general knowledge of subjects within his/her own discipline or of subjects within a different discipline,

1.4. necessary background knowledge of Mathematics and Physics,

1.5. understanding of the position and role of the discipline within science and society, and also in the international character of the discipline.

The Bachelor’s graduate has become familiar with the following key elements of Chemistry:

a. The important aspects of chemical terminology, nomenclature and conventions.

b. Numerical and computational skills, including error analysis, understanding of the proper order of magnitude and correct use of units.

c. The most important types of chemical reactions and their characteristics.

d. The principles and procedures that are used in the chemical analysis and in the characterization of chemical compounds.

e. The fundamental techniques of structural analysis, including spectroscopy.

f. The principles of Quantum Mechanics and its applications in the description of structure and properties of atoms and molecules.

h. The principles of Thermodynamics and its applications in Chemistry.

i. The kinetics of chemical processes, catalysis and mechanical interpretation of chemical reactions.

j. The typical properties of elements and their compounds, including group relationships and trends in the periodic table.

k. The structural properties of chemical elements and their compounds.

l. The typical properties of aliphatic, aromatic, heterocyclic and organometallic compounds.

m. The nature and behavior of functional groups in molecules.

n. Important synthetic routes of organic/inorganic chemistry.

o. The relationship between bulk properties of matter and properties of individual atoms and molecules, including macromolecules (both natural and synthetic).

p. The structure and reactivity of important types of biomolecules and the chemistry of important biological processes.

q. The design of processes (also on industrial scale), taking into account flow and transfer of matter and energy.

r. Properties of chemicals and the involved environmental and safety aspects.
Appendix II Degree programme-specific learning outcomes – Skills

The Bachelor's graduate in Chemistry has developed the skills and competencies mentioned below.

Chemistry-related cognitive skills and competencies

The Bachelor's graduate is:

2.1. able to demonstrate and use his/her knowledge and understanding of essential facts, concepts, principles and theories related to the topics, as defined in Appendix I, in various situations,

2.2. able to apply knowledge and understanding to solve basic qualitative and quantitative problems,

2.3. skilled in evaluating, interpreting and combining chemical information and data,

2.4. able to recognize and implement ‘good laboratory practice’,

2.5. familiar with project work,

2.6. able to adopt a professional attitude regarding environmental and safety aspects and possible ethical implications in the context of research, education and industry.

Chemistry-related practical skills

The Bachelor's graduate is:

2.7. skilled in the use of standard laboratory procedures and in the use of equipment for synthetic and analytical work,

2.8. able to verify chemical properties, to observe and measure events or changes, and to systematically archive and document data,

2.9. able to interpret data, obtained from observations and measurements, and relate it to the right theories,

2.10. able to assess the risks of laboratory procedures and the use of chemicals,

2.11. skilled in the safe handling of chemicals, taking into account physical and chemical properties, including the various specific risks of use, and is also able to act adequately in emergency situations in the laboratory,

2.12. able to use IT skills appropriate to the chosen specialization.

Learning outcomes of the bachelor’s degree programme Chemical Engineering

A. Generic learning outcomes – Knowledge

A7. Bachelor’s graduates have general knowledge of the foundations and history of mathematics, natural sciences and technology, in particular those of their own discipline.

A8. Bachelor’s graduates have mastered the basic concepts of their own discipline (see Appendix I for further specification) to a certain extent and are familiar with the interrelationships of these concepts within their own discipline as well as with other disciplines.

A9. Bachelor’s graduates have in-depth knowledge of several current topics within their own discipline.

A10. 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 their own discipline, including computer-aided methods.

A11. Bachelor’s graduates have sufficient knowledge and understanding of mathematics and natural sciences to successfully complete a follow-up Master's degree programme in their own discipline.
A12. Bachelor's graduates are aware of the societal, ethical and social aspects involved in the fields of mathematics and natural sciences.

B. Generic learning outcomes – Skills
B9. (Research) Bachelor's graduates are able to draw up a research question, design, plan and conduct research and report on it independently with a certain 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.

B10. (Designing) Bachelor's graduates are able to translate a problem, in particular a design problem, into a plan of approach and – taking into account the requirements of the client and/or technical preconditions – find a solution.

B11. (Gathering information) Bachelor's graduates are able to gather relevant information using modern means of communication and to critically interpret this information.

B12. (Collaborating) Bachelor's graduates are able to collaborate in teams (including multidisciplinary teams) on technical-scientific problems.

B13. (Communicating) Bachelor's graduates are able to communicate orally and in writing in academic and professional contexts, with both colleagues and others. They are familiar with the relevant means of communication.

B14. (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.

B15. (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.

B16. Additional subject-specific skills are listed in Appendix II.

Degree programme-specific learning outcomes – Basic Knowledge
The Bachelor's graduate in Chemical Engineering has:
1.1. Knowledge of the most important fields of i) process technology: physical transport phenomena, chemical reactor engineering, separation methods, and process design, ii) product technology: materials science, design methodology, and processing, and iii) basic aspects of chemistry: inorganic, organic, analytical, physical, and polymer chemistry and biochemistry.

1.2. Necessary background knowledge of Mathematics and Physics,

1.3. Understanding of the position and role of the discipline within science and society, and also in the international character of the discipline.

The Bachelor's graduate has become familiar with the following key elements of Chemical Engineering:

a. Important aspects of chemical terminology, nomenclature and conventions.

b. Numerical and computational skills, including error analysis, understanding of the proper order of magnitude and correct use of units.

c. The most important types of chemical reactions and their characteristics.

d. The principles and procedures that are used in the chemical analysis and in the characterization of chemical compounds.

e. The design of industrial processes, taking into account flow and transfer of matter and energy.

f. The principles of Thermodynamics and phase diagrams.

g. Kinetics of various chemical reactions.

h. Dimensional analysis and its application in various (technological) problems.

i. Basic knowledge of fluid dynamics and heat and mass transfer and their application in various parts of process technology.

j. Knowledge of equipment that is used in many chemical processes.

k. The principles of separation methods and their application in industry.

l. Basic knowledge of industrial chemistry and reactor engineering.
m. Materials Science with emphasis on structure-property relationships and their application in various areas of Product Technology (production, analysis, etc.).

n. The principles of production, structure and properties of polymers and the use of these in various types of chemical products.

o. Basic knowledge of Product Technology.

p. Thinking in systems that are relevant for industrial chemistry and technology.

q. The properties of chemicals and the environmental and safety aspects of using them.

**Degree programme-specific learning outcomes – Skills**

The Bachelor’s graduate in Chemical Engineering has developed the skills and competences mentioned below.

**Chemical Engineering-related cognitive skills and competences**

The Bachelor’s graduate is:

2.1 able to demonstrate and use his/her knowledge and understanding of essential facts, concepts, principles and theories related to the topics, as defined in Appendix I, for the (re)design new chemical processes/products.

2.2 able to apply knowledge and understanding to solve basic qualitative and quantitative problems,

2.3 skilled in evaluating, interpreting and combining chemical and process/product technological information and data,

2.4 able to recognize and implement ‘good laboratory practice’,

2.5 familiar with project work,

2.6 able to adopt a professional attitude regarding environmental and safety aspects and possible ethical implications in the context of research, education and industry.

2.7 able to work at different levels of abstraction and detail, including system design level,

2.8 able to see, where necessary, the importance of other disciplines (interdisciplinarity) and their contribution in the design process.

**Chemical Engineering-related practical skills**

The Bachelor’s graduate is:

2.9 skilled in the use of standard laboratory procedures and in the use of equipment for synthetic and analytical work,

2.10 able to verify chemical properties, to observe and measure events or changes, and to systematically archive and document data,

2.11 able to interpret data, obtained from observations and measurements, and relate it to the right theories,

2.12 able to assess the risks of laboratory procedures and the use of chemicals,

2.13 skilled in the safe handling of chemicals, taking into account physical and chemical properties, including the various specific risks of use, and is also able to act adequately in emergency situations in the laboratory,

2.14 able to use IT skills appropriate to the chosen specialization.

**B5.5 RESEARCH AND ACADEMIC SKILLS**

In Section A1.3.1 of the general part of the study guide provides a description the faculty’s view on the embedding of research and academic skills in the faculty’s programmes. The table below presents an overview on how Research and Academic skills are integrated in the various course units of the bachelor’s degree programmes Chemistry and Chemical Engineering. In this table the following research and academic skills are distinguished:

1. formulating adequate research goals, questions and/or hypotheses;

2. searching for, assessing and reflecting on scientific literature;

3. setup of basic research experiments, analysis of and reflection on its outcomes and drawing appropriate conclusions;
4. critical thinking, reflection, analytic attitude and capacity;
5. reflecting on research methods and research methodology;
6. Communicate about research progress and outcomes (both orally and in writing)
7. Cooperate in a (multi-disciplinary) team.

Table: Overview of the research and academic skills in the bachelor’s degree programme.

<table>
<thead>
<tr>
<th>Study year</th>
<th>1. research goals, questions and/or hypotheses</th>
<th>2. searching for, assessing and reflecting on scientific literature</th>
<th>3. basic research experiments</th>
<th>4. critical thinking, reflection, analytic attitude and capacity</th>
<th>5. reflecting on research methods and research methodology</th>
<th>6. Communicate about progress and outcomes</th>
<th>7. Cooperate in a (multi-disciplinary) team</th>
</tr>
</thead>
<tbody>
<tr>
<td>First year symposium</td>
<td>1</td>
<td>x</td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Science, ethics, technology and society</td>
<td>2</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>Bachelor project*</td>
<td>3</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

*(for the chemical engineering curriculum some of the proposed skills should be adapted to the design-oriented character of the curriculum)

More details on these Research or Academic skills and the way they are assessed, can be found in the course units description in Ocasys (https://www.rug.nl/ocasys/fwn/).

**B5.6 BACHELOR’S DEGREE PROGRAMME IN CHEMISTRY**

The Bachelor’s programme in Chemistry consists of a Major (150 ECTS) and a Minor (30 ECTS). The Minor is taken in the first semester of Year 3. The other components together form the Major. The Major is divided in a core programme and a track component. The core programme is the same for each Chemistry student, and you are expected to choose one of three tracks:

- Chemistry of Life
- Smart Materials
- Sustainable Chemistry and Energy
The core programme is shown in the table below. Descriptions of the course units can be found at [http://www.rug.nl/ocasys](http://www.rug.nl/ocasys). More information on the tracks can be found in B5.5.1.

### Year 1 (Propaedeutic phase)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Calculus for Chemistry</td>
<td>5</td>
<td>2a</td>
<td>Biochemistry</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Molecules: Structure, Reactivity and Function</td>
<td>5</td>
<td></td>
<td>Biochemistry Lab Course</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>General Chemistry</td>
<td>5</td>
<td></td>
<td>Physical Chemistry 1</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>Organic Chemistry 1</td>
<td>5</td>
<td>2b</td>
<td>Inorganic Chemistry</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Synthesis and Analysis 1: Practical Introduction to Process and Product Technology</td>
<td>5</td>
<td></td>
<td>First Year Symposium Spectroscopy</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>Physical Properties of Materials 1</td>
<td>5</td>
<td>2a</td>
<td>Science, Ethics, Technology and Society</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Organic Chemistry 2</td>
<td>5</td>
<td></td>
<td>Quantum Chemistry Track-related</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Synthesis 2: Lab Course</td>
<td>5</td>
<td></td>
<td>Track-related</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>Linear Algebra &amp; Multivariable Calculus for Chemistry Physical Chemistry 2</td>
<td>5</td>
<td>2b</td>
<td>Macromolecular Chemistry Macromolecular Chemistry Lab Course</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Track-related</td>
<td>5</td>
<td></td>
<td>Track-related</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
<th>Semester</th>
<th>Course units</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a and 1b</td>
<td>Minor</td>
<td>30</td>
<td>2a</td>
<td>Track-related</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2b</td>
<td>Bachelor’s Research Project</td>
<td>15</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
<td><strong>Total</strong></td>
<td><strong>30</strong></td>
</tr>
</tbody>
</table>

#### B5.6.1 Options within the degree programme in Chemistry

**Choice in Chemistry and Chemical Engineering**
In all cases students can continue with the Chemistry programme or the Chemical Engineering programme without incurring study delay. This is even possible after Year 1!
Choice in Years 2 and 3: Track-related
In Year 2 students choose one track from Chemistry of Life, Smart Materials or Sustainable Chemistry and Energy. Year 2 course units are largely the same for all tracks, but there are three electives that focus on different tracks. Year 3 is dedicated entirely to the chosen track. The first semester of that year comprises of the Minor.

The Minor can be
- a University Minor offered by another faculty: http://www.rug.nl/education/minor-programmes/aanbod-universitaire-minoren
- a Faculty Minor (e.g. the teacher-training Minor, only available for Dutch-speaking students http://www.rug.nl/lerarenopleiding/onderwijs/educatieveminor)
- course units under the Minor ‘Science for Scientists’ for Chemists (see Ocasys).
- a package of course units approved on an individual basis (e.g. for a period of study abroad).

More information about Minors can be found via your start page on Student Portal, via Ocasys or by asking your academic advisor.

The sections below show the relevant course units for each track for each year.

B5.6.2 Chemistry of Life Track
The table below shows the course units that are mandatory for the Chemistry of Life track.

<table>
<thead>
<tr>
<th>Year 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>ECTS</td>
</tr>
<tr>
<td>1a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Bioenergy and Metabolism</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>ECTS</td>
</tr>
<tr>
<td>1</td>
<td>Minor</td>
</tr>
<tr>
<td>2b</td>
<td>Bachelor Research Project (Chemistry)</td>
</tr>
</tbody>
</table>

B5.6.3 Smart Materials Track
The table below shows the course units that are mandatory for the Smart Materials track.

<table>
<thead>
<tr>
<th>Year 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Semester</td>
<td>ECTS</td>
</tr>
<tr>
<td>1a</td>
<td></td>
</tr>
<tr>
<td>1b</td>
<td>Soft Molecular Materials</td>
</tr>
</tbody>
</table>
**Programme specific part**

### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>Minor</td>
<td>30</td>
</tr>
<tr>
<td>2a</td>
<td>5</td>
<td>Materials Design: Theoretical Methods Trends in Polymer Science Track Practical</td>
<td>5</td>
</tr>
<tr>
<td>2b</td>
<td>5</td>
<td>Bachelor Research Project (Chemistry)</td>
<td>15</td>
</tr>
</tbody>
</table>

#### B5.6.4 Sustainable Chemistry and Energy Track

The table below shows the course units that are mandatory for the Sustainable Chemistry and Energy track.

### Year 2

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td></td>
<td>Bioenergy and Bioresources</td>
<td>5</td>
</tr>
<tr>
<td>1b</td>
<td>5</td>
<td>Green Chemistry and Technology</td>
<td>5</td>
</tr>
</tbody>
</table>

### Year 3

<table>
<thead>
<tr>
<th>Semester</th>
<th>ECTS</th>
<th>Semester</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Minor</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>2a</td>
<td>5</td>
<td>(Bio-)catalysis Physical Organic and Photo-chemistry Track Practical</td>
<td>5</td>
</tr>
<tr>
<td>2b</td>
<td>5</td>
<td>Bachelor Research Project (Chemistry)</td>
<td>15</td>
</tr>
</tbody>
</table>

#### B5.6.5 Bachelor’s Research Project on Chemistry

Students work on their Bachelor’s research project in one of the research groups. In principle, they choose a research group that is appropriate for their chosen specialization. Once a year, an information session is organized so that students can find out about the different research groups and the procedures relating to research. Students who are still uncertain about which research group to choose when there are only a few weeks to go before they are due to begin the project should make an appointment as soon as possible with the leaders of the research groups they are considering, so that they can discuss possible projects.

Obviously, the Bachelor’s Research Project must meet certain requirements. These are set out in the Bachelor’s Protocol on the Student Portal page for the Bachelor’s Research Project. The research project concludes with a presentation in their research group.

Prior knowledge: students must have passed the propaedeutic phase. In addition, they must have earned 150 ECTS of the Bachelor’s degree programme.

On the university website you can find more information on the various Chemistry-oriented research groups:

- [http://www.rug.nl/research/fmns/group/chemistry-oriented](http://www.rug.nl/research/fmns/group/chemistry-oriented)
**B5.7 BACHELOR’S DEGREE PROGRAMME IN CHEMICAL ENGINEERING**

The programme is shown in the table below. Descriptions of the course units can be found at:

<table>
<thead>
<tr>
<th>Year 1 (Propaedeutic phase)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester</strong></td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>1b</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester</strong></td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>1b</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semester</strong></td>
</tr>
<tr>
<td>1a</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td>1b</td>
</tr>
<tr>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>
B5.7.1 Options within the degree programme in Chemical Engineering

Choice in Chemistry and Chemical Engineering
In all cases students can continue with the Chemistry programme or the Chemical Engineering programme without incurring study delay. This is even possible after Year 1!

Choice in Year 3
In Year 3, 20 ECTS is reserved for electives. These can be:
- Course units under the Minor ‘Science for Scientists’ for Chemical Engineers (see Ocasys).
- A package of course units approved on an individual basis by the Board of Examiners (e.g. for a period of study abroad, or if you want to do a course that isn’t in the ‘Science for Scientists’ Minor.)
- A small research project of 10 – 15 ECTS in Chemical Engineering under the supervision of prof. dr. F. Picchioni.

More information about electives can be found via Ocasys or by asking your academic advisor.

B5.7.2 Bachelor’s project on Chemical Engineering
The Bachelor’s project for Chemical Engineering is a design-process assignment comprising the following parts:
1) An individual assignment consisting of
   a) a literature survey
   b) a process description
   c) PFDs (process flow diagrams) and P&IDs (piping and instrumentation diagrams)
   d) BOD (Basis of Design)
   e) a mass and energy balance
   f) a list of equipment
   g) a cost estimate with investments and variable consumption key numbers.
   - all as part of the overall process
2) An assignment in pairs consisting of
   a) a literature survey (overall process)
   b) an overall process description
   c) a PSA (process safety analysis)
   d) a Hazard and Operability (HAZOP) study
3) A report (hardware version and digital version), a general – mass – Aspen model of the overall process and a specific (mass and energy) model of the personal assignment component of the process.
4) Various lectures on the use of Aspen modeling, PFD, P&ID, BOD, PSA, HAZOP, etc. are given to support part of the assignment. Attendance at these lectures is compulsory.
5) An oral presentation

Prior knowledge: the student must have passed the propaedeutic phase. In addition, they must have earned 150 ECTS of the Bachelor’s degree programme.

B5.7.3 CHANGES IN THE CURRICULUM
As of the 5th of September 2016, the curriculum of Chemistry and Chemical Engineering will have changed.
In the first year there is a new course General Chemistry. This course is a substitute for three electives in the first year in the past: From bacteria to plastic, Physics lab and Introduction to mathematics.
For most courses, nothing has changed, and for some courses only their place in the schedule has changed.
C

Rules, Regulations and Addresses
C1
RULES AND REGULATIONS
Many things treated in this Study Guide are based on formal documents approved on the basis of the Higher Education Act by the Board of the University, the board of the faculty, the faculty counsel or by the Board of Examiners. In case of doubt or in case of conflicts it is advisable the refer to these formal documents. Of importance are the following.

C1.1 STUDENT CHARTER
The Student Charter
The Student Charter provides an overview of the rights and obligations of both students and the University. It is based on national legislation, particularly the Higher Education and Research Act (WHW), supplemented by regulations that are specific to the University of Groningen. These latter regulations are set out in the appendices to the Student Charter.

The Act stipulates that the Student Charter comprises two sections: a university-wide section and a programme-specific section.

- The university-wide section describes the rights and obligations that apply to the University as a whole, such as registration and protection of rights. You can find this section on the Student Portal. The university-wide section of the Student Charter does not literally quote the articles from acts and regulations but describes them as clearly as possible. The various topics are accompanied by links to the relevant articles of the act or regulation in question.
- The programme-specific sections describe the rights and obligations that apply to specific degree programmes. These sections include the Teaching and Examination Regulations (OER), Rules and Regulations for examinations and final assessment and other regulations and provisions set by the various degree programmes and faculties. You can consult your programme-specific section at the faculty Education Offices and in the Study Guides.

Applicability
The Student Charter applies to academic year 2015-2016. The university-wide section of the Student Charter is approved annually by the Board of the University and endorsed by the University Council. In the event that the Charter challenges or contradicts any legal regulations, these legal regulations will take priority.

Publication
At the start of the academic year all students will be sent an e-mail by the Board of the University informing them where they can find the Student Charter on the internet and where they can consult a hardcopy of the Student Charter.

Using the Student Charter
All students are expected to be familiar with the contents of the Student Charter. Not complying with the rules in the Charter may affect your rights, for example the right to financial support from the Graduation Fund.

Some of these regulations may not be as hard and fast as they sound. Rules and regulations are by definition general in character, and this Student Charter is no exception. This means that the applicability of these regulations in concrete situations and individual instances is not always a predictable and straightforward matter. Students who have registered for the first time this year may find that the regulations that apply to them are different to those for students who have reregistered. Make sure you are provided with the right information by your faculty and/or University Student Desk and read the Student Charter and the associated regulations carefully.
**Items in the Student Charter**
The university-wide section of the Student Charter contains information on the rights and obligations of students regarding the following items:
- Admission;
- Registration and deregistration;
- Tuition fees;
- Teaching, including the binding study advice;
- Examinations and final assessments;
- Financial assistance;
- Consultative participation;
- Rules of behaviour;
- Legal rights.

**C1.2 TEACHING AND EXAMINATION REGULATIONS (OER)**
The Teaching and Examination Regulations is established by board and council of the faculty. It contains a number of regulations with respect to structure and content of the degree programmes, form and frequency of examinations, admission regulations, tutoring, cum laude, etc.

The OER can be found at the Student Portal.

**C1.3 RULES AND REGULATIONS OF THE BOARD OF EXAMINERS**
The Rules and Regulations of the Board of Examiners contain a number of additional regulations concerning examinations: e.g. registration for examinations, procedures for exemptions, assessment, fraud, cum laude, etc.

The Rules and Regulations of the Boards of Examiners of the degree programmes of the Faculty of Mathematics and Natural Sciences can be found at the Student Portal.
C2

ADDRESSES CENTRAL BODIES UNIVERSITY OF GRONINGEN

C2.1 GENERAL ADDRESSES

Board of the University (CvB)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5285

University Council (U-raad)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8535
E-mail: uraad@rug.nl
Website: www.rug.nl/uraad

Legal Affairs Office (ABJZ)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 5440

Donald Smits Center for Information Technology (CIT)
Visiting address: Zernikeborg, Nettelbosje 1
Postal address: P.O. Box 11044, 9700 CA Groningen, the Netherlands
Telephone: (050) 363 9200
E-mail: secretariaat-cit@rug.nl
Website: www.rug.nl/cit

CIT Helpdesk
Telephone: (050) 363 3232
E-mail: servicedesk.cit@rug.nl

Health, Safety and Environment Service (AMD)
Visiting and postal address: Visserstraat 49, 9712 CT Groningen, the Netherlands
Telephone: (050) 363 5551
E-mail: amd@rug.nl
Website: www.rug.nl/amd

Office of the Confidential Advisor
Marijke Dam, Confidential Advisor

Visiting and postal address: Visserstraat 47, 9712 CT Groningen, the Netherlands
Telephone: (050) 363 5435
E-mail: j.m.dam@rug.nl
Website: www.rug.nl/vertrouwenspersoon

Complaints Committee for harassment, sexual harassment and aggressive, violent or discriminatory behavior (SIAGD)
Postal address: Antwoordnummer 172, 9700 AB Groningen, the Netherlands
C2.2 ADDRESSES FOR STUDENTS

University Student Desk (USD)
Visiting address: Broerstraat 5
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8004
Website: www.rug.nl/insandouts
www.rug.nl/usd
Or myuniversity > frequently asked questions

International Service Desk (ISD)
Visiting address: Broerstraat 5
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8181
E-mail: isd@rug.nl
Website: www.rug.nl/isd

Student Service Centre
Visiting address: Uurwerkersgang 10
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Telephone: (050) 363 8066
E-mail: ssc-secretariaat@rug.nl
Website: www.rug.nl/ssc

NEXT Career Services
Visiting address: Uurwerkersgang 10
Postal address: Postbus 72, 9700 AB Groningen
E-mail: next@rug.nl
Website: www.rug.nl/next

Central Portal for the Legal Protection of Student Rights (CLRS)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
Website: www.rug.nl/clrs

University Funds Committee (UFC)
Postal address: P.O. Box 72, 9700 AB Groningen, the Netherlands
E-mail: ufc@rug.nl
C3
FACULTY ADDRESSES

C3.1 BUILDINGS
- Kapteynborg (building J, 5419): Astronomy, Landleven 12, 9747 AD Groningen; telephone secretary (050) 3634074 Open during office hours, ring the bell to enter the building
- ADL1 (buildings 3211–3217/3219): ESD, Medical Sciences, Dentistry and Pharmacy, Antonius Deusinglaan 1, 9713 AV Groningen; telephone reception (050) 363 8000. Open: Mon–Thurs: 8:00 – 20:30; Fri: 8:00 – 17:30.

For a map, route description and more information about the buildings, see:
  • www.rug.nl/fwn/organization/locaties

See Chapter C4 for maps of the buildings of the faculty.

C3.2 LIBRARY
Central Medical Library
Location: Hanzeplein 1, 9713 GZ Groningen
Winkelstraat 1 or Poortweg 12, 4th floor, Y 4.202
Telephone: (050) 363 3048 and/or (050) 361 2596
E-mail: cmb@umcg.nl

University Library Zernike
Location: Nettelbosje 2, 9747 EA Groningen
2nd floor of the Duisenberg building
Telephone: (050) 363 3708
E-mail: zernike-bibliotheek@rug.nl

C3.3 EXCHANGE OFFICE
Henriëtte Mulder
Location: Bernoulliborg, Nijenborgh 9, room 5161.0050,
E-mail: exchange.science@rug.nl

Margriet Hulshof
Location: Antonius Deusinglaan 1, room 3213.0017
E-mail: m.a.hulshof@rug.nl

See:
  • myuniversity.rug.nl/infonet/studenten/fwn/studeren-buitenland/algemeneinformatie/contactexchange
C3.4 EDUCATION SUPPORT DESK
ESD Zernike
Location: Bernoulliborg, Nijenborgh 9, building 5161, first floor
Opening hours: 10:30 – 12:00 (all week days)
13:00 – 15:00 (not on Wednesday and Friday)
Phone: (050) 363 4422 (9.00 – 12:00 and 13:00 – 16.00)

ESD ADL
Location: UMCG, Antonius Deusinglaan 1, building 3214, ground floor
Opening hours: 12:00 – 14:00
Telephone: (050) 363 3315 or (050) 363 3343
(9.00 – 12:00 and 13:00 – 16.00)
E-mail: esc.fwn@rug.nl
C4
LOCATIONS

C4.1 ZERNIKE

Translation:
- Ingang = Entrance
- Chemie-Fysica-Milieukunde = Chemistry – Physics – Environmental Sciences – Industrial Engineering and Management – Nanoscience
- Tentamenhal = Examination building, Aletta Jacobs
C4.2 ADL

ADL2
Ant. Deusinglaan 2
9713 AW Groningen
phone 050 363 3270 / 8000

Medical Sciences,
Dentistry and
Pharmacy (ADL1)
Ant. Deusinglaan 1
9713 AV Groningen
phone 050 363 8000

University Medical Center
Groningen (UMCG)