STUDY GUIDE 2011-2012

CHEMISTRY and CHEMICAL ENGINEERING

Master Programmes

UNIVERSITY OF GRONINGEN
Faculty of Mathematics and Natural Sciences
School of Science and Technology
Department of Chemistry and Chemical Engineering

The information in this study guide can also be found on the Internet:

www.rug.nl/scheikunde

More detailed information, such as timetables of classes and examinations, can also be found through this Internet address.

Composition:
F.J. van Steenwijk

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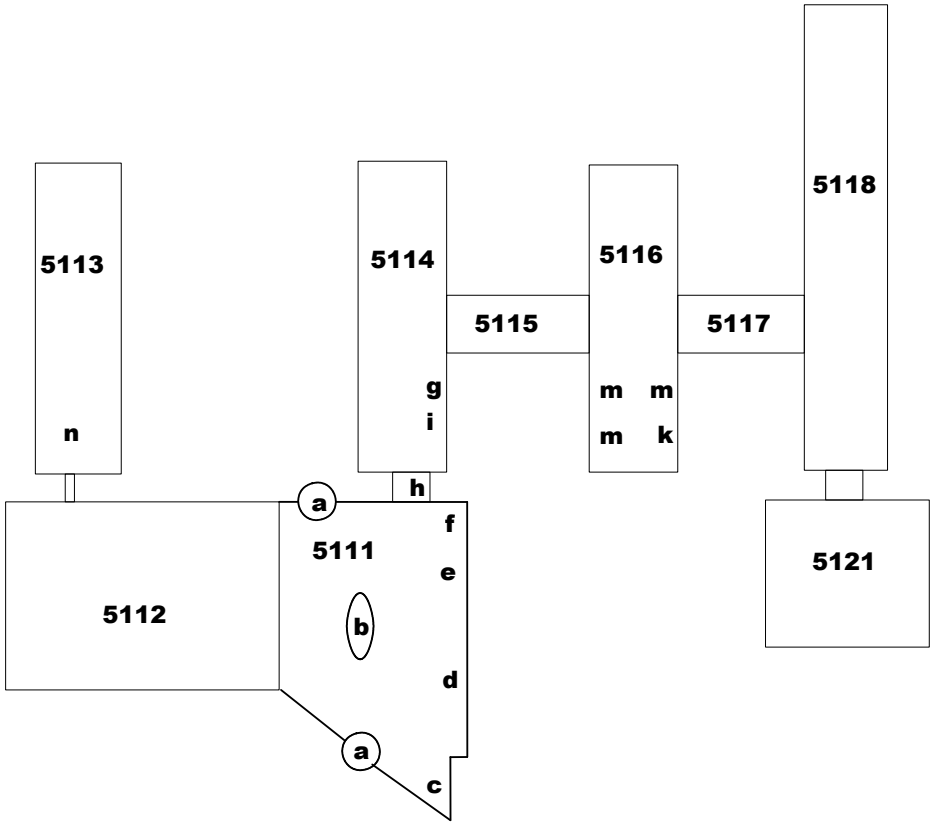
Physics and Chemistry Building
Nijenborgh 4
9747 AG Groningen
tel.: 050 – 363 4133



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a) entrances
b) the 'Ei'
c) cafeteria
d) lecture hall 5111.0022
e) lecture hall 5111.0080
f) Bureau Onderwijs en Examens, room 5111.0077
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k) helpdesk ICT, room 5116.0308
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1 General Information

1.1 Introduction

This study guide contains information on programmes, facilities, important university offices, financial matters, rules and regulations etc. for master students in Chemistry and Chemical Engineering, who start their master studies in the academic year 2011-2012.

Data liable to change during the academic year, such as schedules for classes and examinations, and detailed information about the contents of the courses can be found on the website of the Department of Chemistry:

www.rug.nl/scheikunde

In case of individual situations or circumstances for which this study guide does not provide sufficient information, it is advised to consult the study advisor.

1.2 Degrees in Chemistry and Chemical Engineering

The University of Groningen offers the opportunity to study Chemistry as well as Chemical Engineering. Graduates of these Master's programmes are awarded the degree Master of Science (M.Sc.). The equivalent Dutch degrees are "Doctorandus (Drs.)", in case the master programme in Chemistry is completed, or "Ingenieur (Ir.)", in case the Master's programme in Chemical Engineering is completed.

1.3 Faculty of Mathematics and Natural Sciences

The Faculty of Mathematics and Natural Sciences comprises three schools and 10 research institutes.
The schools are

- the School of Science and Technology
- the School of Life Sciences
- the School of Information Sciences

In the field of Chemistry the following centres of research are important

- Zernike Institute for Advanced Materials (ZIAM): materials research
- Stratingh Institute: organic chemistry, inorganic chemistry, and chemical technology
- Groningen Biomolecular Sciences and Biotechnology Institute (GBB): biomolecular research

The greater part of the scientific staff in the field of chemistry is active in one of these research institutes, while taking part in teaching activities of the School of Science and Technology.

1.4 School of Science and Technology

The master's degree courses in Chemistry and Chemical Engineering are part of the School of Science and Technology. Other master's programmes the School of Science and Technology offers include Physics, Applied Physics, Astronomy, Mathematics, and Industrial Engineering and Management.

The board of the School of Science and Technology is constituted as follows:

- dr. H. Hanson, chair and director
- vacancy (Chemistry)
- prof. dr. ir. E. van der Giessen (Physics)
- prof. dr. M. Mendez (Astronomy)
- prof. dr.ir. B.J. Kooi (Industrial Engineering and Management)
- prof. dr. G. Vegter (Mathematics)
- A.E. Boerma (student)

1.5 Department of Chemistry and Chemical Engineering

Department chair

- vacancy

Staff

- Drs. G.J. Zondervan (student study advisor)
- (vacancy) undergraduate coordinator)
- Ms. P.J. Kruizinga-Huisman (coordination support)
- Ms. A. Nanning (secretary)
- Ms. G. Alberts (Bureau of Education and Exams)
- Ms. J.E.G. van Leeuwen (Bureau of Education and Exams)
- Ms. F. de Haan (Bureau of Education and Exams)
- Ms. W.G. Hof ing. (practicals coordinator)
- R. Kloosterman (practicals)
- J. van Dijken (practicals)
- R.M. Liewes (practicals)

Course Committee (opleidingscommissie, OC)

Matters related to the course curriculum are discussed in the Course Committee. The Course 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 Course Committee also reviews the Teaching and Examination Regulations (OER) annually. The committee advises to the Board of the School of Science and Technology, to the Board of the Faculty or to individual professors.
The course committee consists of six staff members and six student members, but also the department chairman, thestudy advisor and the undergraduate coordinator generally attend the meetings of the committee. Student members of the OC are elected annually; staff members hold office for rwo years.

- Dr. J.G. Roelfes (Molecular Chemistry, chairman)
- Drs. G.J. Zondervan (secretary)

Board of Examiners

The Board of Examiners is responsible for examinations and checks whether individual student have met the requirements for graduation. Also the admission of foreign students and the individual adaptations of the degree programme are the responsibility of the Board of Examiners.

- Prof. dr. B.W. Dijkstra (chairman)
- Drs. G.J. Zondervan (secretary)

1.6 Student Organizations

De Chemische Binding
De Chemische Binding (CB, "The Chemical Bond") is a student's association for all students of Chemistry and Chemical Engineering. The current number of members is about 220, of which some 60 members are actively involved in organizing several events.
The CB organizes study-related events: an annual symposium and many excursions to companies during the academic year. Every year an almanac is published by the CB. Senior students can visit the yearly "β-bedrijvendagen" ("β-company-days"), where students and representatives of companies have the opportunity to meet.

Less serious matters are also handled by the CB. At the end of the week, on Friday, there is a drink (borrel). Parties and more sportingly activities like the nocturnal volleyball tournament and the "Batavierenrace" are participated in by the CB. And for the parents of the third-year students, there is a special day to visit the lab (ouderdag). Pictures are taken at all events and can be reordered.
Many more activities are organized by the CB. The website www.chemische-binding.nl and the periodical "Het Chemisch Bindmiddel" will offer you all information about the activities and events. Members will receive it five times a year. Moreover all activities will be announced in the University paper (UK) and on posters scattered all in the building.

At the beginning of your study you can join the CB. The membership fee is only € 5,- per annum.
If you want to know more about our association or if you are interested in helping organize events, just drop in at our den (CB-hok, 5111.0047), tel. 050 363 4117. Every day someone will be present between 12.30 and 13.30 to inform you about our vivid society. Finally our den is perfect for small talk, because the CB is more than just your studies!

Excursions
The CB organizes excursions for all its members. The students visit enterprises in trade and industry and are informed about the importance of chemistry for them. In this way you can get and impression of how your future job could be, about working conditions and about the role of a chemist in the production process. The excursions are an instructive and valuable addition to your study and the insight in the business is an unexpected bonus.
Besides the above mentioned excursions the CB also organizes the biannual European study tour and, during the other years, the SBE (allied to the CB) organizes a biannual study tour outside Europe for students in Chemistry and Chemical Engineering.

CB-Stem
The CB-Stem is the 'political' branch of the CB and is made up of a group of students trying to promote the student's interests. The activities of the CB-Stem mostly concern educational fields. Evaluations are organized and discussed in the Department Committee in order to prevent problems with exams, bad lectures and scholarships. Representatives of the CB-Stem are also seated in the board and in the faculty council (faculteitsraad). They see that justice is done to the interests of all the students.
If you are interested, you can enter the CB-Stem during the introductory days of first-year students, and you could also join the weekly meetings on Fridays, 12.30 in room 5116.0136

Society for Chemical Engineers: Gronings Technology Dispute 'Bernoulli'
G.T.D. Bernoulli is the student's association for students Chemical Engineering and others interested in product- and process engineering. Bernoulli organizes the sale of textbooks and notes.
Bernoulli exists since 1985 and at this moment is a very vivid society of 200 members. Every year there are several excursions to chemical companies in the Netherlands. Bernoulli also has a journey abroad every several year and exists since 1989. The last years the journey went to: Italy, Portugal, Czech Republic, East-Germany and the next journey will go to Spain, Gibraltar and South-Portugal.

The biggest annually event is the Engineers Symposium. It is a new concept that is growing since 2004, with now over 250 people from different studies joining it.
The main goal of Bernoulli is to make the student familiar with the companies after your graduation. Therefore we offer besides activities also vacancies, internship-offers and lectures from companies on the university.
Last but not least; we have the greatest and nicest fun activities among all associations in Groningen. You can see the pictures on our website or here the stories from our members. Membership at GTD Bernoulli will make your study time the best of your life.
All activities are done by students. If you are interested and/or would like to become a member; just drop in at the Bernoulli-lounge. You will be kept in touch via the mailing, poster and our periodical; 'Groningenieur'.
Info: I: www.gtdbernoulli.nl
E: board@gtdbernoulli.nl
T: 050 353 4399
Room 5118.0238

Society of polymer chemists "Netwerk"
On the 24th of October 1991 an association was established in the group of Polymer Science: "Netwerk" (Network). This society is meant for the entire group, viz. science staff, general staff and, of course, for students. At the moment "Netwerk" has around 50 members.
The goal of the society is maintaining contact between organizations in the field of polymer chemistry, in particular in trade and industry. Several activities are organized in the light of this contact, such as excursions, lectures and symposia. Furthermore, "V.v.P Netwerk" sets up activities within the group to encourage mutual contact between the members. For example, the General Polymer Colloquia (GPCs) and drinks, but also an annual sports tournament in which the participants compete for the "Netwerk" cup. With these activities "V.v.P. Netwerk" sees to the members of the polymer chemistry group getting to know each other in a rather different manner than during the work in the lab.
If you would like to become a member of "V.v.P Netwerk", or if you would like more information, contact Lieuwe Jan Eilander on Lieuwejan@gmail.com or visit the website http://www.vvpnetwerk.com

1.7 House rules, regulations

Every student receives safety regulations for the labs of Nijenborgh 4 in the form of the 'Information Guide Nijenborgh 4'. Students are expected to live up to it.

Opening hours building
The main entrance of the building is open from Monday up to and including Friday between 07.00 and 18.00 hour. Other entrances are only available using an entrance card. At weekends and holidays the building can be entered and left using a valid entrance card. Such an entrance card can be handed out to students during the research period of their studies. The application procedure is described in the 'Information Guide Nijenborgh 4'

Fire and accidents
In case of fire and accidents: call 8050 and clearly explain the situation and location.

Equipment in operation
Equipment and experiments are only allowed to be in operation outside duty hours in urgent cases. One is required to take care of optimal safeguarding to prevent calamities caused by external malfunctioning.
Furthermore, when leaving equipment running, one is required to fill out a special form (aanlaatformulier) in duplicate. One copy should be present and visible at the specific equipment; the other copy should be handed over to the porter. In case the special form is not filled out at the right location, the porter is compelled to report this and take necessary measures.

The forms for leaving equipment running (aanlaatformulier) are available at the porter's. The forms are valid for a maximum of four weeks. Hereafter, possibly a new form has to be filled out.

Insurance
All students are insured via the university. This insurance consists of a collective accident insurance in combination with a collective third-party insurance during presence on grounds and in buildings (including labs) of the Rijksuniversiteit Groningen.

Food and drinks
Food and drinks are strictly forbidden in the labs, as is drinking from laboratory glassware. Storage and handling of food in or with laboratory equipment, such as e.g. refrigerators, ovens, etc., are also forbidden.

Canteen rules
The canteen is opened from 08.45 till 15.45. Used plates, cups, saucers and cutlery should be handed in at the window of the scullery. Plastic cups and such should be discarded in the litter bins. Smoking is prohibited in the canteen. Furthermore, no studying is allowed in the canteen.

1.8 Computer screens and RSI

Many students spend a lot of time in front of computers and are at risk of developing RSI-troubles. RSI is the abbreviation for Repetitive Strain Injury and is a generic term for all troubles involving neck, shoulders, arms, wrists and hands. These troubles can become chronic and lead to incapacitation for work and serious limitations in everyday life.

Symptoms
RSI symptoms can vary from stiffness, pain and tingling sensations to loss of strength in the above mentioned body parts. Initially the symptoms occur only during work in front of screens, but at a later stage they occur also when at rest. Eventually the troubles might occur continuously, causing pain at even the simplest of actions or making them completely impossible.

How to prevent RSI?
- Do not work at a computer for more than 6 hours a day
- Regularly relax your shoulders
- Sit up straight, use the arm rests
- Hold the upper arms vertically along the upper body
- Place the monitor, keyboard and document holder right in front of you
- Keep your wrists straight, if necessary by means of a wrist support or ergonomic keyboard

When using a mouse:
- Make the movements from your elbow rather than from your wrist
- Operate the mouse with your other hand every now and then
- Place the mouse close to you.

2 Facilities

2.1 Libraries

2.1.1 University Library (UB)

The UB functions as facility centre for the entire university community; for both the faculty- and institutional libraries and the library users.
The UB offers students many services. It contains more than 2.4 million books and articles. There are around 1600 places for study. Furthermore, the library holds vast collections of references and educational material. About 30% of these are available at the study rooms. The remaining material is kept at closed depots. The material can be accessed via the loan facility. For further information and services of the UB one may refer to the website.

University library
9712 CP Groningen
www.rug.nl/bibliotheek
tel.: + 050 363 5020

2.1.2 Library FWN

The library of the Faculty of Mathematics and Natural Sciences (Library FWN) serves research and education of staff and students of FWN. Furthermore, the Library FWN is open to all staff of the Rijksuniversiteit Groningen, to all students associated with the university and all guests of the library.

Library card
Staff can apply for a library card at the library. Students can use their student card as a library card.

Borrowing
Books and bound journal volumes can be borrowed for a period of four weeks. Bibliographies, reference books (like encyclopaedias, manuals and dictionaries) and current issues will not be lent out as a rule.

Practical information Library FWN

Address:	Nijenborgh 9, 9747 AG Groningen
Telephone:	050 – 363 4126 (loan- and information counter)
Opening hours:	Monday-Friday, 9.00 - 17.00 hours
E-mail:	bibliotheekfwn@rug.nl
Website:	http://www.rug.nl/bibliotheek/locaties/bibFWN
Facilities:	Photocopiers are present at the 1st and ground floor. Printer and scanner are present at the 1st floor. Copy/print cards are available at the library counter. 6 Carrels, 1 study group workroom, 1 instructionroom, 120 study places (63 are provided with computers) and 6 reference pc's.

2.2 Computer facilities provided by the university

Account
With your enrolment as a student of the university you will receive a letter with a student number and a preliminary password to access a computer account called the UWP (Universitaire WerkPlek). A student-account basically provides a number of common services all accessible with one username and password:

- access to the central servers for use of MS-Windows based applications
- access to the Internet and remote storage facilities

- an e-mail account
- access to Nestor (the electronic learning environment of the Rijksuniversiteit Groningen); and access to ProgRESS WWW where you can register for courses or monitor your study progress.

E-Mail
Your login name is your student number prefixed by an 's'. This login name is used in your mail address (e.g. s123456@student.rug.nl), but for mail addresses an alias with a real name is also provided.
At https://salsa.service.rug.nl/wachtwoord.html you can change your password. Students usually access their mail with a web browser but mail can also be read using mail protocol IMAP.
The details will be sent in a letter but can also be found on the internet.

ProgRESS WWW
ProgRESS WWW is a web application designed for students who want to access their course results or want to register for courses and exams. The course results are refreshed several times a week; a few days after a final grade has been registered by the administrations office, the grade will also appear on ProgRESS WWW. If you need an official transcript (grade report), you can print the course results and ask a secretary in the administration office for a stamp and signature.

Nestor
Nestor is the electronic learning environment (ELO) of the University of Groningen.
Nestor, contains information like study guides, lecture notes, assignments and other relevant documents. It has a *Discussion Board*, a forum used by students to exchange information and a *Drop Box* to share files with fellow students such as a group assignment that has to be reviewed by students in your group.

Ocasys
Ocasys is the university course catalogue. It contains short descriptions of course contents, necessary literature, etc. The web address is: www.rug.nl/ocasys

Student PCs
Nijenborgh 4 has six computer rooms (5116.0310, 5116.0303 and 5116.0315, 5113.0303, 5113.0306, 5111.0010) with around 90 computers for all students. Using these PCs you can log onto the university 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 the rooms are available for self study. Two printers are accessible for students (in 5116.0308 and 5113.0303). Students can buy print quota at the reprodesk in the main entrance hall of Nijenborgh 9 (Bernouilliborg)

More information and conditions
For more information about network, security, available applications, helpdesk etc., have a look at: www.rug.nl/studenten/ictvoorzieningen/index
Finally there are conditions on the use of these facilities. You can read these at: http://www.rug.nl/cit/security/aup/index
All students are expected to know these conditions and to live up to them. Abuse will be punished with exclusion for a certain time.

2.3 Beta Science Shop

Non-commercial groups and institutions can profit from all the knowledge and experience of the Faculty via the Beta Science Shop.
The Science Shop acts as a mediator between the questioners on the one side and the researchers (both students and staff) on the other. Eligible groups are, for example: environmentalist groups, labour unions, patient groups, community organizations, schools and

authorities. Questions can cover any topic of expertise within ONT, from mathematics to engineering, as well as expertise within Life Sciences.
Co-ordinators of the Science Shop are C.M. Ree, MSc and H.A.J. Mulder, PhD, tel. 363 4132 and 363 4436, room 5118.0139. More information can be found on http://www.rug.nl/wewi.

What does the Science Shop do?
Environmental movements, labour unions and other non-commercial groups can present their questions to the Science Shop. When these questions are suitable for research projects or educational projects, the Science Shop will find researchers or students to do research on the question. Students can carry out a project within their study programme. This usually concerns a literature/patent study, expert interviews, making calculations and/or doing some modelling, design (of part of a process, of software, or of information sheets), and sometimes it also concerns experiments. The length and the level of the project can be tailored to the student's options; it can well be the subject for your BSc or MSc thesis.

What do you learn from it?
Research into a client's question has several aspects you ordinarily do not encounter during your studies. This can be very instructive. You can play a role in a social issue. You will discuss the question together with the client, discuss the (im)possibilities of scientific research and its role in the client's strategy. It can bring you in frequent contact with authorities and with research institutions during your research. As a result you can write a report that shows scientific quality, but that is understandable for laymen too. Your report could eventually lead to an external publication of the Science Shop and/or an article in a popular magazine.

How does it fit into your studies?
There are several possibilities to fit projects of the Science Shop into your studies. For example:

- as optional credits at the Science Shop, in co-operation with a supervisor within the Faculty; the length and the level of the project can be discussed freely.
- as research project or graduation thesis (BSc or MSc) in any discipline of the Faculty, provided that there is prior agreement with the responsible member of staff within that discipline
- as integrative project, working visit or internship in Industrial Engineering and Management / Chemical Engineering
- as project at the Centre of Energy and Environmental Sciences (IVEM)
- as traineeship in the Master M-variant Management and Industry
- as assignment in the Master Education & Communication

Projects may be carried out individually or in groups of two or three students.
Supervision/advice will be sought at research schools, if required also outside the Faculty, depending on the subject of the project. The projects can be planned at any time during the studies. The offer of projects changes frequently; an overview is available. It is recommended to apply for a project in good time, because of the choice and preparation of the project.
When you plan to do a Science Shop project, or if you would like to see if there are interesting projects available, just drop in. Students from all disciplines in the Faculty can apply. You are very welcome.

Some recent examples
Mathematics: Mussels and sediment transport
The wetland area of the Wadden Sea has an unique morphology, shaped by biobuilders like mussels and sea grass. However, the mussel bed area is decimated by extensive fishery and the relief of the Wadden Sea is probably decreasing. The processes of transport and consolidation of fine sediments can be described in physical parameters and mathematical models. On request of the Wadden Sea Society, a student of Physics made a comprehensible description of the Deltares model, including the active role of mussel beds in sedimentation and the shaping of the Wadden Sea floor and with relevance for the conditions of restoration of mussel beds.

Physics/Marine Biology: Marine animals and wind farm noise

Offshore wind farms offer a good opportunity for renewable energy supply, avoiding horizon disruption and noise hindrance on land. However, the effects of noise on marine life are seriously underestimated. Especially the sound levels emitted during pile driving for the foundation of the wind turbines are reason for concern. A student of Biology discussed this topic in his colloquium for the Wadden Sea Society. He found a great lack of research, standardization and correct interpretation of both the sound levels, the sound prolongation processes and the effects on marine animals. A field study in the North Sea indicates that harbour seals and some kinds of fish try to avoid the pile driving noise up to 50 to 80 kilometres from the source. So intensive research and technological adaptations are needed to prevent the risk of ecological damage.

Chemistry: Cleaner PUR production
Polyurethane is a widely used polymer with an increasing amount of applications and good market perspectives. A Chinese company is active in the production of the isocyanate MDI, a major polyurethane feedstock, and has showed some interest in Delfzijl as a location for a new MDI plant. However, MDI has a bad reputation in occupational health as an inductor of respiratory diseases; moreover, the MDI production process includes hazardous substances like phosgene and aromatic chlorinated solvents. So a student in Chemistry conducted a literature survey to cleaner production processes for MDI and polyurethane, on request of the regional Environmental Federation. There are some interesting perspectives for cleaner processes; however, they’re still in a research stage.

Environmental Health: Fragrances and sensitivity
The effects of environmental pollution on human health is a matter of concern to the Platform of Health and Environment. An investigation of environmental factors related to health complaints (as experienced by the complainers) showed a high score for fragrances as a cause of sensitivity in the respiratory system. Fragrances are widely used in cosmetics, food and several household products and their application is emerging rapidly. A student in Chemistry reviewed the chemistry of fragrances and the technology to provide long-lasting odours, for instance in laundry. However, literature on their respiratory effects is scarce and no valid explanation could be found for the phenomena of multiple chemical sensitivity.

3 Study Affairs

3.1 Academic calendar

The academic year 2011/2012 starts on September 5, 2011 and concludes on July 13 2012. The academic year consists of two semesters each consisting of two quarters of ten or eleven weeks. Vacations are from the second week of July until the last week of August and the two weeks including Christmas and New Year. In August there is some opportunity to take examinations that were not passed in the preceding quarter (resits). Information on timetables can be found on the website: http://www.rug.nl/fwn/onderwijs/roosters/index

3.2 Information channels

Website of the department
The website http://www.rug.nl/scheikunde contains a fount of information about education and research. The information behind the button 'Education' (Onderwijs) does not only give you information from this catalogue, but also the latest detailed information on (examination) timetables.

Mail/Notice
In some cases messages of importance to students or groups of students, like requests to sign up for certain courses or alterations in the timetables, are sent to the electronic mailbox of the students concerned. The students are for this reason expected to check their mailbox on a regularly base (at least once a week!)

Notice board
Examination results, division of groups for practicals, etc., are announced on the notice board opposite to the office Bureau of Education and Exams (Bureau Onderwijs & Examens) room 5111.0077).

Student counsellor
See section 3.8.1.

University paper (Universiteitskrant, UK)
The Executive Board (College van Bestuur) frequently publishes the central rules and regulations in this paper. This mainly concerns tuition fees, scholarships and the graduation fund. Furthermore, the UK contains columns with announcements of departments of the faculty of Mathematics and Natural Sciences among those of other faculties. The weekly issue of the UK can be found in the entrance hall of the Physics and Chemistry Building.

3.3 Study and finances

Tuition fees
You can only participate in the Master programme as a full-time student.
For EU students the annual tuition fee amounts to € 1703,- .
For non-EU students the annual tuition fee amounts to € 9600,-.
These fees pertain to the academic year 2011-2012.
Fees do not include travel, accommodation, living and incidental costs (about € 8000,- per year). The Housing Office assists foreign students in finding accommodation.

Deadline for applications
Applications for admission to the MSc-programme in Astronomy by foreign students should be completed as early as possible, but should have reached the university admissions office (Mrs. G.A. Sanders, admissions@rug.nl) before April 15.

Study expenses
Costs of textbooks and educational tools are relatively low. For the master programme € 1000,- will cover most of the compulsory textbooks, manuals, practical materials, excursions, etc. The University of Groningen has a policy regarding study expenses. The purpose of this policy is to regulate study expenses in a way that they do not exceed the component 'study expenses' in the Dutch student's budget, as determined by the Ministrer of Education. For 2011-2012 these study expenses are set to € 680,-. It is sometimes inevitable to exceed this maximum sum. Half of the extra expenses can then be reclaimed from the Faculty Board (Faculteitsbestuur), or an arrangement will be made. Contact the study counsellor and Student Service Desk for a brochure about study expenses, the university's policy regarding prices and further information. The directs study costs for the master programme in Physics are estimated well below the maximum (appr. € 500,- per year).

3.4 Study advisor

The main task of the study advisor is to provide assistance to students experiencing personal and academic problems. In practice, issues such as choice of courses, study methods, choice of (future) specialization, optional courses and career perspectives are most discussed. A study advisor can also provide assistance or help in financial matters (for instance in case of delay) or personal issues. Study advisor for Chemistry and Chemical Engineering is drs. G.J. Zondervan (room: 5114.0010, tel.: 3634130, email: G.J.Zondervan@rug.nl)

3.5 Teaching Assistantship

Dutch speaking senior students have the opportunity to gain valuable experience as a teaching assistant. Teaching assistants mainly teach exercise classes or assist during computer sessions or practicals. Also, grading homework or exams may be a task of teaching assistants. Of course the teaching assistant is paid for his services.
Students interested in a teaching assistantship can gain more information from the study advisor or wait for an e-mail call from the undergraduate coordinator.

3.6 Examinations (tentamens)

Timetable
The examination timetables give the dates for written examinations of the individual course units: http://www.rug.nl/scheikunde/onderwijs/roosters/index
Usually an examination is scheduled at the end of the quarter in which the course unit has been offered. Students are allowed to take the examination of a particular course unit two times per year.
The timetables of examinations are liable to change, so students should check the website regularly.

Enrolment for exams
Students should enrol for written exams through ProgressWWW (http://progresswww.nl/rug/) at least one week before the examination date. If you cannot take part after all, you can cancel the enrolment until one day before the examination date.

Procedures during exams
Students are required to show their student card at written exams.

Graphing calculators are not permitted unless such is explicitly allowed by the lecturer of the course.
Electronic pocket calculators without graphic display are allowed.
Students are obliged to follow the directions of the vigilance personnel.

Fraud
Any act of a student to mislead the examiner in such a way that a correct evaluation of the students knowledge, insight or competences is prevented, is considered as fraud.
Examples of fraud are:

- the use of crib notes (on paper or digital);
- plagiarism (also the use of internet files without proper reference is considered as fraud);
- 'free riding' on the work of fellow students in group assignments;
- copying (laboratory) reports from fellow students;
- falsifying experimental data;

In case of fraud the Board of Examiners can exclude a student from participating in the particular exam for a period of one year.

Registration of Examination results.
Examination results are processed by the *Bureau Onderwijs en Examens* (room number 5111.0077) will be published on the bulletin board in building 5111, opposite to room 5111.0077. Students can look at their achieved results through ProgressWWW. (www.progresswww.nl/rug/).
Appr. twice a year all students receive a certified printout of their results.
In case an official list of results is needed in between, a certified list of results can be obtained from the 'Bureau Onderwijs and Examens' (5111.0077).

3.7 Graduation

Enrolment procedure for graduation

1. Approval by the Board of Examiners
   Prior to a request for graduation the Board of Examiners considers the list of results on the course units that are part of the degree programme. The student should complete a form with the results obtained on the registration form for graduation. The form can be downloaded from:
   http://www.rug.nl/scheikunde/onderwijs/bureauoe/aanmeldingsformulieren
   First after written approval by the Board of Examiners a request for graduation can be filed.
2. Request for graduation
   At least one month before the graduation date (= the date on the graduation certificate), the student has to submit a request for graduation. The appropriate form can be obtained from the Bureau Onderwijs en Examens (room 5111.0077). The completed and undersigned form should be handed in, preferably personally, at the Bureau Onderwijs en Examens, together with the written approval of the Board of Examiners. This procedure should be completed three weeks before the graduation ceremony.
3. Research thesis
   Together with the request for graduation a hard copy of the final version of the master's thesis should be handed in at the Bureau Onderwijs and Examens. An electronic copy should uploaded into the repository of the library (see www.rug.nl/scheikunde/onderwijs/examens/repository for the upload instructions).

Graduation is only possible for enrolled students. It is strongly advised that the student files a request for graduation as soon as (or even some weeks before) all requirements of the curriculum have been met in order to prevent unnecessary tuition costs.

Graduation ceremony
The graduation ceremony usually takes place in the Academiegebouw, Broerstraat 5. After proper registration the student will receive a schedule with time and place of the ceremony. At the graduation ceremony the graduate receives a graduation certificate together with a diploma supplement stating the grades on the separate course units.

Usually the graduation date coincides with the date of the graduation ceremony. In some cases (usually around September 1) the graduation ceremony may be postponed to September. This may be the case when the last examination results are obtained in the last weeks of August and the administrative procedures for graduation cannot be timely fulfilled before August 31 (i.e. before the end of the academic year). When the examination results do so permit, the graduation date can be set at August 31, whereas the graduation ceremony takes place in September.

For the timetable of the graduation ceremonies one should refer to the website:
http://www.rug.nl/scheikunde/onderwijs/examens/examenrooster

3.8 Rules and Regulations

Many things treated in this study are based on formal documents approved on the basis of the Higher Education Act by the 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:

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 internet (www.rug.nl/studenten/ > Legal position > Students' Charter).
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 2011-2012. 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 fixed 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 the Student Service Centre (SSC) 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,
- teaching, including the binding study advice,
- examinations and final assessments,
- financial assistance,
- consultative participation,
- rules of behaviour,
- legal rights.

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 educational programmes, form and frequency of examinations, admission regulations, tutoring etc.
The OER can be found at: http://www.rug.nl/fwn/informatievoor/studenten/reglementen/oer-en/index

Rules and Guidelines of the Board of Examiners

The Rules and Regulations of the board of Examiners contain a number additional regulations concerning examinations: e.g. registration for examinations, procedures for exemptions, assessment, fraud, etc.
The Rules and Guidelines of the Board of Examiners for the MSc in Physics programme can be found at: http://www.rug.nl/fwn/informatieVoor/studenten/Reglementen/RenR

3.9 Objection and appeal procedures

Mistakes are, unfortunately, sometimes made when applying rules and regulations. This is why the Students' Charter (Studentenstatuut) covers provisions to ensure lawful protection of the student. If students feel unjustly treated, they can object and lodge an appeal.
The two agencies a student can contact are mentioned in the Students' Charter:

- Higher Education Appeals Tribunal (College van Beroep voor het Hoger Onderwijs). For most matters concerning the central part of the Students' Charter (see chapter 9).
- Board of Appeal for the Examinations (College van Beroep voor de Examens). Mostly for matters concerning the decentral part of the Students' Charter (OER). An overview of all objects and appeal procedures can be acquired from the "Dienst Algemeen Bestuurlijke en Juridische Zaken" of RuG, tel. 363 5440.

Complaints

There are many situations possible where regulations of the Students' Charter (Studentenstatuut) are not directly violated, but that make the student still feel improperly or unjustly treated. In such a case he/she can file a complaint to the following agencies:

Decentral

Each of the faculties and departments has its own (specific) complaint procedure. The study advisor can offer direct assistance, but he/she could also forward the case to, for example, the head of the Course Committee (Opleidingscommissie) or to the director of the School of Science and Technology.

Student Service Desk

If one cannot or wishes not to contact the faculty or department, the complaint could be discussed with a student dean at Student Service Desk. He/she will act as ombudsman and mediate, and, if requested, demand inspection of dossiers or contact professionals.

4 Master of Chemistry

4.1 Introduction

To be admitted to the master programme in Chemistry, the student must have obtained the prerequisite bachelor degree in Chemistry. In case a student does not meet this requirement, but does hold a bachelor degree in a related field, the student can in some cases still be admitted. In this case the student must consult thestudy advisor to set up an individual programme to eliminate deficiencies.

4.2 General information on the Master of Chemistry

The programmes presented in this catalogue pertain to all students who start with their master studies in the academic year 2010-2011.

Goals of the Chemistry Master programmes

- To enable students to participate in scientific research in the area of chemistry
- To prepare students for a career in chemistry trade and industry
- To train students in the presentation of scientific results
- To train students in the teaching of chemical principles

P-variant and M-variant

P-variant: to graduate as a scientific researcher
M-variant: to graduate for a position in the field of policy and management functions in trade and industry and public authorities, for which scientific knowledge and skills are desirable.

The studies are mostly attended on an individual basis in research projects and/or traineeships at companies/administrative bodies. Furthermore, specific courses have to be taken for each variant.
The P-variant is primarily concentrated on the profession of a researcher. This study concentrates on a continuing research in preparation for a dissertation (PhD). Obviously, students graduating the M-variant have also the opportunity to prepare for a doctor's degree.

Lectures

Theoretical parts of the studies are given in the form of lectures in which one or more lecturers give insight into the discussed subjects. Caput lectures can exist in the form of a series of lectures, followed by interim examinations or assignments.

Research projects

Research projects are a part of the study in which experimental and/or theoretical and/or descriptive scientific research is carried out in a chemical subject at the university, a company or a government organization. Each research project should be concluded by a written report and a talk in the Department of Chemistry.
A research project comprises at least 30 ECTS (including report, talk, discussion, etc.) and should be carried out under daily supervision of a tutor joined with the Department of Chemistry. Depending on the chosen variant or profile, a second research or traineeship, of a minimum of 30 EC, can be part of the programme. The second research project or traineeship should preferably treat a different subject and should be guided by a different lecturer.

Traineeships
A traineeship is an essential part of the M- and C/E variants. The goal of the traineeship is to learn the organization and methods of a company or public authority, where results of chemically oriented researches are put into practice. An assignment will be done in such an organization and is always accompanied by an external guide. The final responsibility lies by a lecturer of the Department of Chemistry. Every traineeship is finished with a written report and talk at the Department of Chemistry.

Goals of the traineeship:
- familiarizing with the organization
- familiarizing with a job's situation
- carrying out the project assignment of the party offering the traineeship

Colloquium and essay
The Master's degree programme is concluded with a colloquium and a graduation essay. A relative short time (six weeks) is available to study a chemical subject on the basis of literature research, in which a certain aspect of a field is treated thoroughly. The results of this study are written down in an essay and presented in a talk. It is important that the subject does not have overlap with the research or with a traineeship of the Master's degree programme. The essay will be edited under supervision of a teacher of the Department of Chemistry who also works in the field of the chosen profile of the student.

4.3 Research profile Molecular Chemistry

The understanding of molecular aspects of chemistry is further developed and applied in the field of synthetic chemistry, catalysis, supramolecular chemistry, functional molecules and in the chemistry of life. Insight on molecular level is essential to understand reactive and organizational chemical processes in both artificial and natural systems. This insight is developed by means of a research project, (caput) lectures and workshops.

The following sections are part of Molecular Chemistry:

- Synthetic Organic Chemistry — Prof. dr. B.L. Feringa, Dr. J.G. Roelfes, Dr. S. Otto, Dr. W.R. Browne, Prof dr. J.G. de Vries
- (Bio)Organic Materials — Prof. dr. J.C. Hummelen, Dr. R.C. Chiechi
- Bioorganic Chemistry — Prof. dr. ir. A.J. Minnaard
- Molecular Inorganic Chemistry — Prof. dr. S. Harder, Dr. M.W. Bouwkamp

The profile is offered for Chemistry students and students in Life Sciences with sufficient knowledge of molecular chemistry. Admission requires successful completion of courses of the Molecular Chemistry profile in the third year of the bachelor programme of Chemistry. Students with different background should refer to thestudy advisor to consider individual adaptation of their programme.

Chemistry, profile: Molecular Chemistry master's programme (P-variant)	ECTS
Research Project in Molecular Chemistry	45
Second research project or traineeship	15
Colloquium	10
Workshops in Molecular Chemistry	5
Structure Determination with Spectroscopic Methods	5
Organic Synthesis: Methods and Strategy 1	5
Final examination in molecular chemistry	5
Optional courses in Molecular Chemistry	30
totaal	**120**

In case any of the course units mentioned in this programme has been taken before as a part of the bachelor programme, the credits of this such a course unit will be added to the credits reserved for *Optional courses in Molecular Chemistry*.

Optional courses in Molecular Chemistry	ECTS
Coordination Chemistry	5
Organometallic Chemistry	10
Organic Synthesis: Methods and Strategy 2	5
Reaction Mechanisms	5
Supramolecular Chemistry	5
Organic Materials	5
Homogeneous Catalysis	5
Stereochemistry	5
Biomolecular Chemistry	5

Further Information
Further information on the course units, including prerequisites, can be found in OCASYS.

4.4 Research profile Chemical Physics

This profile studies physical and chemical characteristics of atoms, molecules and condensed matter, by means of several experimental techniques and theoretical methods.
The following sections are part of Chemical Physics:

- Solid State Chemistry — Prof. dr. T.T.M. Palstra, dr. G.R. Blake
- Nanostructures of Functional Oxides — Porf. dr. B. Noheda
- Theoretical Chemistry — Prof. dr. R. Broer

The profile is offered for chemistry students with sufficient knowledge of physical and theoretical aspects of chemistry. Admission requires successful completion of courses of the Chemical Physics profile in the third year of the bachelor programme of Chemistry. Students with different background should refer to thestudy advisor to consider individual adaptation of their programme.

Chemistry, profile: Chemical Physics master's programme (P-variant)	ECTS
Research Project in Chemical Physics	45
Second Research Project or Traineeship	15
Colloquium	10
Electromagnetism of Solids	5
X-ray diffraction	5
Optional courses in Chemical Physics	40
totaal	**120**

Optional courses in Chemical Physics	ECTS
Caput Theoretical Chemistry	5
Computational Methods in Quantum Chemistry	5
Computational Physics	5
Lasers in Nanoscience	5
Magnetism and Conductivity	5
Mesoscopic Physics	5
Molecular Dynamics	5
Molecular Quantum Mechanics	5
Non linear Optics	5
Device Physics	5
Physics of Lasers	5
Solid State Phase transitions	5
Solid State Physics 1	5
Surfaces and Interfaces	5

Further Information
Further information on the course units, including prerequisites, can be found in OCASYS.

4.5 Research profile Polymer Science

The goal of this profile is to provide understanding of structure and properties of macromolecules.

The following sections are part of Polymer Science:

▪ Polymer Chemistry and Bio-engineering	Prof. dr. A. Herrmann
▪ Physical Chemistry of Polymers	Prof. dr. G. ten Brinke
▪ Polymer Thin Films and Surface Science	Prof. dr. A.J. Schouten, prof. dr. T. Loontjens, dr. K.U. Loos

The profile is offered for chemistry students with sufficient knowledge of polymer chemistry. theoretical aspects of chemistry. Admission requires successful completion of courses of the Polymer Science profile in the third year of the bachelor programme of Chemistry. Students with different background should refer to the study advisor to consider individual adaptation of their programme.

Chemistry, profile: Polymer Science master's programme (P-variant)	ECTS
Research project	30
Second Research Project	30
Colloquium	10
Polymer Science Lab Course 3	5
Thermodynamics of Polymer Systems	5
Nanochemistry	5
Advanced Polymer Science	5
Biomaterials 2	5
Colloid Chemistry	5
Polymer Physics	5
Polymer Surfaces and Interfaces	5
Structure and Properties of Polymers	5
Optional Courses in Polymer Chemistry	5
totaal	**120**

Optional Courses in Polymer Science	ECTS
Supramolecular Chemistry	5
Homogeneous Catalysis	5
Polymer Products	5
Surfaces and Interfaces	5
Surface Characterization	5

Further Information
Further information on the course units, including prerequisites, can be found in OCASYS.

4.6 M-variant Science, Business and Policy

Within the framework of the MSc-degree programme in Chemistry students who are capable of the Dutch language may opt for the M-variant 'Beta, Bedrijf en Beleid' (Beta, Business and Policy). The goal of this variant is to combine your specific scientific knowledge with insights in other disciplines, for example business and administrative management. The M-variant is meant for students who would like to work at a chemically oriented company or for students who like to be involved in policy making by public authorities.

The M-variant is a variant in the Master programme. The programme consists of two parts. The first part (60 ECTS) concentrates on a research profile in chemistry (cf. chapters 4.3, 4.4 and 4.5). The courses should tie up with the research profile and should be taken after consultation with the study advisor, ms. drs. G.J. Zondervan.
The second part (also 60 ECTS) focusses on the interaction with business and policy. This second part consists of the course 'Beta in Business and Policy', and a traineeship Business and Policy.

Table 6.1 The study programme of the M-variant 'Science, Business and Policy'

courses in the chosen research profile *)	30 EC
research project	30 EC
'Beta in business en policy' (Cursus Beta in Bedrijf en Beleid)	20 EC
Traineeship Business and Policy (Stage Bedrijf en Beleid)	40 EC
	---
total	120 EC

The course Beta in Business en Policy introduces new disciplines: business and administrative management. So-called 'intensive courses' will acquaint you with the main scientific frameworks and concepts in a relatively short time. You will apply this knowledge to project assignments of companies and public authorities in multidisciplinary projects. Students of master programmes in Chemistry, Molecular Biology and Biotechnology could take part in projects in their own field of interest.
After the course you will follow the graduation-traineeship route 'Business and Policy', which is made up of a traineeship of six months in a company or a government organization. An in-house traineeship at the university is also possible. The traineeship will continue where the course Beta in Business and Policy has ended and will offer acquaintance with and exercise in project management. The traineeship is complemented with lectures, training, sharing experiences and reports in the two preparative weeks, a return week and a concluding week. The traineeship project gives an opportunity to orient on future profession and working conditions. During this traineeship the student works on solving a certain problem, either in business or government, with a relation to chemistry.

Take into account the following:

- The traineeship coordinator has to be consulted at least six months in advance of the traineeship
- Students can only do a traineeship after completing the course Beta in Business and Policy and the specific scientific programme of the section.

You can find more information about the course Beta in Business and Policy and the graduation-traineeship route below. For more information about the specialization Science, Business and Policy contact:

- Drs. A.J. Abma (lecturer and traineeship coordinator)
  tel. 050 – 363 2263
  email: a.j.abma@biol.rug.nl
- Dr. M.P. Gerkema
  tel. 050 – 363 2027
  email: m.p.gerkema@biol.rug.nl

See also: http://www.rug.nl/fwn/mvariant

4.7 Biochemistry

Students interested in Biochemistry are advised to opt for the degree programme Molecular Biology and Biochemistry.
The master Molecular Biology and Biotechnology is meant for students with an interest for research in the area of:

- The structure and function of proteins and other macromolecules (DNA, RNA)
- The molecular basis of prokaryotic and eukaryotic cells functioning in their environment
- Functional genomics, proteomics, metabolomics
- The role of the various cellular compartments (organelles) and the molecular mechanism of regulatory processes
- The development, storage, processing and analysis of complex datasets (bioinformatics).

After completing this Master's degree programme students may find research positions, as well as management and pr-positions, at universities, hospitals, industries and research institutes (KNAW, TNO, RIVM, DLO). A lot of them will also find jobs as a teacher (life sciences, physical sciences, health and technology), both at secondary schools and at universities.
The Master programme Molecular Biology and Biotechnology is carried out by staff members from both the Biology and the Chemistry Departments of the Faculty of Mathematics and Natural Sciences, organized in the Groningen Biomolecular Sciences and Biotechnology Research Institute (GBB).

Students who are interested should refer to the website
http://www.rug.nl/biologie/onderwijs/masters/MasterMoleculair
For more information:

- Prof. dr. P.J. van Haastert (tel. 050 - 3634172, email: p.j.m.van.haastert@rug.nl) or
- Prof. dr. M.W. Fraaije (tel.: 050 -3634345, email: m.w.fraaije@rug.nl), coordinator for Biochemistry in the Chemistry Department.

4.8 Education and communication

Students interested in becoming a teacher in a secondary school as well as students who are interested in communication of science to the general public are advised to opt for

- the master's programme Educatie en Communicatie in Wiskunde en Natuurwetenschappen, which is a two year programme, or for
- the post-master programme for secondary school teacher, which is a one year programme.

It should be noted that these programmes are only offered to students who are capable of the Dutch language.
For more information one should refer to the study guides of these programmes.
or to the website: http://www.rug.nl/ec/index

5 Master of Chemical Engineering

5.1 Introduction

To be admitted to the master programme in Chemical Engineering, the student must have obtained the prerequisite bachelor degree in Chemical Engineering. In case a student does not meet this requirement, but does hold a bachelor degree in a related field, the student can in some cases still be admitted. In this case the student must consult the study advisor to set up an individual programme to eliminate deficiencies.
Graduates will obtain a Master's degree (MSc). There also entitled to the Dutch title *ingenieur* (Ir.).
Within the master programme two specializations can be distinguished:

- Chemical Product Engineering
- Water Technology

Chemical Product Engineering is based in Groningen, Nijenborgh 4
Watertechnology is based in Leeuwarden as a part of the Wetsus Academy
www.

5.2 Objectives of the programme

General objectives
The goals of the Master's degree programme

- To acquire knowledge of and participate in scientific research in the field of chemical engineering
- To prepare for a career in chemical engineering with the profile Chemical Product Engineering or with the profile Water Technology.
- To develop the ability to follow the latest development in chemical engineering
- To develop the ability to pass on the acquired knowledge and skills to others
- To gain communicative and management skills

Specialization Chemical Product Engineering
The specialization in Chemical Product Engineering concentrates on future professions in process technology in industry which handle fine chemistry, foodstuffs and structured products. The programme aims to develop the following:

Knowledge and skills of graduates:

- Knowledge and understanding of the way scientific research is carried out in the field of chemical engineering, and know-how of available systems of information.
- Understanding of developmental trajectories for products and processes.
- Understanding of physical and chemical backgrounds of production processes and characteristics of products.
- Ability to approach process and product technological problems structurally, analytically and by use of models.
- Ability to acquire new knowledge via research, and the subsequent application of it in the development of products and processes.
- Insight into the social and scientific role of Chemical Engineering.
- Ability to acquire available knowledge.
- Ability to pass on the acquired knowledge and skills to others and communicate practically.
- Ability to take up the practical part of a certain process after a certain period of one's job.
- Ability to design a process or product (with others).
- Insight into personal capabilities, limitations and preferences, and the ability to criticize own actions.

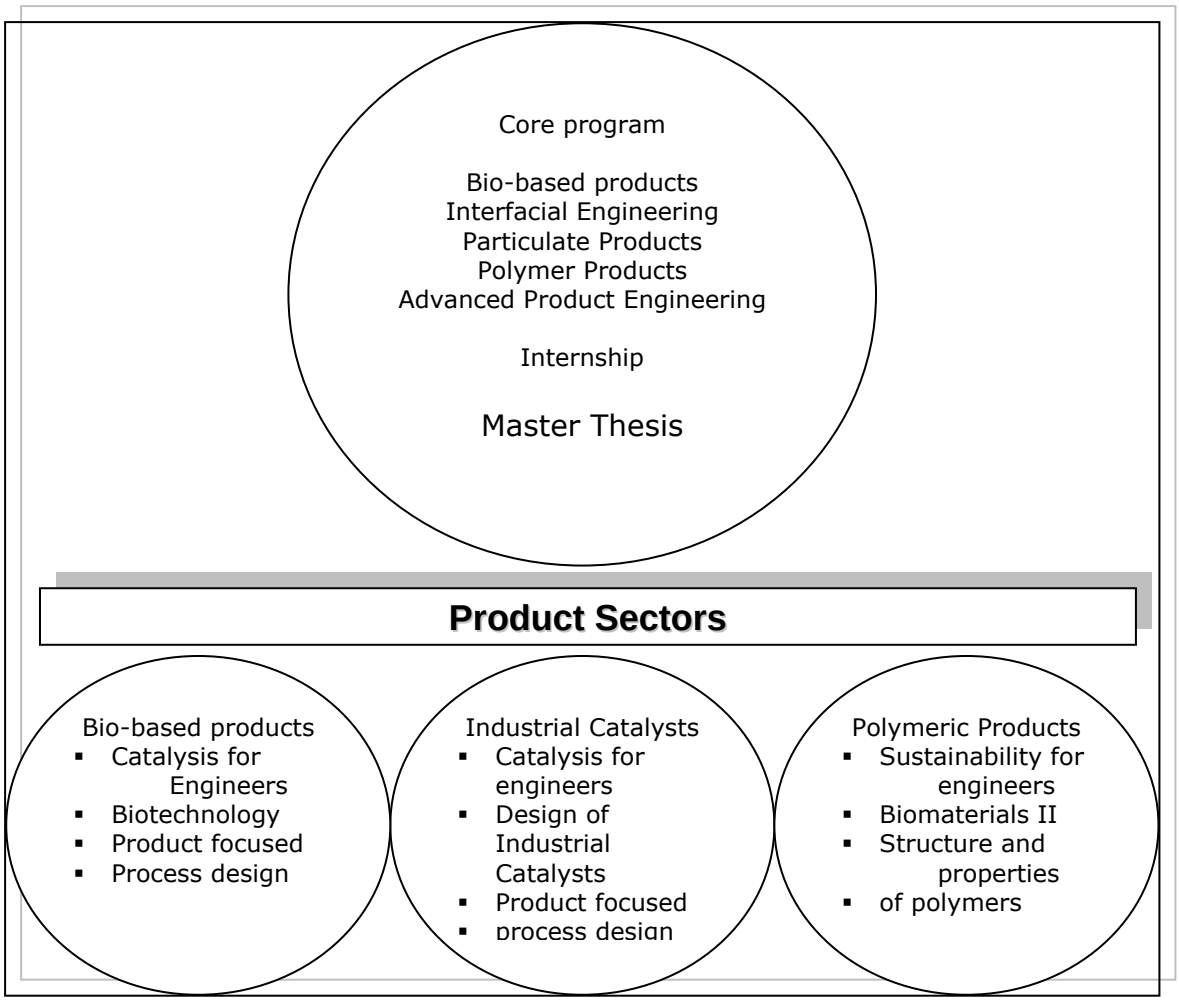
Specialization Water Technology
The specialization Water Technology focuses on design and development of water treatment and linked production processes and on engineering strategies for improvement and control of fermentation, conversion and separation processes. Engineering is fully integrated with the disciplines physical and organic chemistry, biochemistry and biology to achieve product quality- and process requirements from interested party/customer. Students with this specialization are well trained to work in a multi- and interdisciplinary team in a (bio)technological research and development environment as researcher, water technologist, advisor or manager.

Domain-specific and profession-specific competences:
In addition to the above-mentioned general profession-specific and academic competences for MBT graduates, graduates with specialization Water Technology should

- have basic knowledge and understanding of molecular biology and microbiology as tools in water technology;
- have an advanced level of knowledge and understanding of water technology principles and control engineering,
- have an advanced level of knowledge and understanding of fermentative, organic chemical, bio-electrochemical and biochemical conversion reactions and of separations and physical chemical phenomena in water technology;
- have a set of advanced skills to design, model and control a water technological process;
- define the objectives and to formulate a hypothesis for innovative research on water technological design or on design, model and control of a (bio)technological production system in water technology;
- test the hypothesis and contribute to the scientific knowledge domain of physical and colloid chemistry, (bio)organic chemistry, water process engineering or process control.

5.3 Requirements for the specialization Chemical Product Engineering

The current master program is organized in such a way that it gives attention to recent trends in academic and industrial research and anticipates developments in the short to medium term business prospects for the conversion industry. Conversion industry may be defined as the industry that converts natural resources into chemicals-based consumer products. As such, industries that produce petrochemicals, industrial catalysts, fuels, electricity, metals, ceramics, pharmaceuticals, food products, personal care and hygiene products, paper, plastics, adhesives, foams, coatings, and the like, can be considered as sectors of the conversion industry. Following several decades of cost reduction, technology optimization and business restructuring, this industry now focuses on product diversification and production of added-value specialty products. This requires that future chemical engineering graduates should be prepared for this new environment, and that former master programs needed to be restructured.
From the academic year 2010-2011 the Chemical Engineering Master program at the University of Groningen is organized according to a new structure that prepares students for this new environment. The overall program is focused on Product Technology (PT) and is conceptually split (Figure 1) into a "core program" (compulsory for every student and containing general PT courses) and subprograms according to the corresponding "product sector".



The Master programme requires 120 ECTS in total, that are composed as indicated in the table below:
The programme as given below holds for all students who start with the master programme in the academic year 2010-2011.

Block 1		Block 2	Block 3	Block 4
Bio-based Products	sem.	**Polymer Products**	**Internship**	**Advanced Product Engineering**
Interfacial Engineering		Choice		Choice
Particulate Products		Choice		Choice

Table 1. Core program in the 1st year of the Master.

In the core program most general elements for Product Technology are treated in the corresponding courses. At the end of the 1st block (sem. in Table 1) a short seminar will be held by the Chemical Engineering staff members. In the seminar relevant examples of research projects will be discussed in order to give students a kaleidoscopic view of the different product sectors. As of the second block, students are expected to fill their optional space (6 courses in total) according to the product sector(s) of their choice. For every specialization (product sector) three courses are considered compulsory (in bold in Table 2) and five are suggested as possible choices (in italics in Table 2).

Polymeric products			
Block 1	Block 2	Block 3	Block 4
Biomaterials II	**Sustainability for engineers**	Advanced Polymer Science	Product focused process design
Management & Accounting	**Structure and properties of polymers**		
Organic Materials	Solar cells		
Industrial catalysts			
Block 1	Block 2	Block 3	Block 4
Organic Materials	Sustainability for engineers	Biotechnology	**Catalysis for engineers**
Management & Accounting			**Product focused process design**
Design of Industrial Catalysts			Product Innovation
Bio-based products			
Block 1	Block 2	Block 3	Block 4
Organic Materials		**Biotechnology**	Product Innovation
Management & Accounting	Sustainability for engineers		Product focused process design
Biomaterials II			**Catalysis for engineers**

Table 2. Optional and compulsory courses for the different specialization (product sectors). in the first year of the master

Ideally a student should choose the product sector specialization in order to perform her/his Master Thesis research in the same application field. However, individual choices (thus not according to the structure given in Figure 1) are possible if a clear learning iter is detected and upon approval of the exams commission. The Master Thesis (50 ECTS) is on the 2nd year program together with the remaining optional courses (10 ECTS in total). A student is allowed to start with his master Thesis research with a maximum of 25 ECTS to be still booked from the compulsory (core) and optional program.

Further Information
Further information on the course units, including prerequisites, can be found in OCASYS.

Courses: lectures, tutorials and projectwork
The theoretical parts of the programme are given in the form of interactive lectures, tutorials and projects. The acquired knowledge will be assayed by means of an examination and/or assignments.
Chemical Engineering expects students to be very self-reliant. Smaller groups provide direct interaction between lecturers and students. This is also encouraged by the large part of tutorials and projects in the study programme.
Tutorials require active participation of students, with understanding of the lecture material. Questions and assignments regarding the material will be treated here.
Projects are an important part of the Master programme of Chemical Engineering. Students study and solve problems in groups. The results are reported, both verbally and written. This requires an active and independent attitude of students.

Traineeship
The purpose of the traineeship (15 ECTS) is to get acquainted with a business or government organization, where results of research in the field of chemical engineering are put into practice. In such an organization an assignment has to be done always supervised by an

external supervisor. The final responsibility is in the hands of a lecturer of the Department of Chemistry. Every traineeship is finished with a written report which is assessed by the lecturer.
Goals of the traineeship:

- Gain experience in carrying out duties in business or government
- Learn how to function in an organization
- Familiarize with the chemical engineer's profession
- Practice and improve social and communicative skills
- Carry out a project assignment in chemical engineering for the party offering the traineeship.

Furthermore, the student gains experience in:

- Analyzing and formulating a research problem and inventing a research strategy
- Carrying out research under supervision
- Critically analyzing and explaining results.

Research assignment

The graduation research project (50 ECTS) is a part of the study programme in which experimental, theoretical and descriptive scientific research is carried out. This research refers to a chemically technologically oriented subject. It takes place at the university, in a company or public authority and can be carried out both individually and in a multidisciplinary project group. Each subject is completed by a written report and a presentation in the Department of Chemistry.
A research subject is worth 50 ECTS including the report and presentation and has to be done under supervision and responsibility of a lecturer of the cluster Chemical Engineering. The day-to-day supervision could be done by a lecturer, a PhD student in association with a lecturer or by an approved supervisor from a company or public authority, in case the project takes place there. The student should be able to take part in scientific communication within the concerned cluster.
The goal of the graduation research is to prove that the student

- can analyse and formulate a research problem and find a research strategy
- can carry out research under supervision
- can critically analyse and explain its results
- can draft a model on the basis of theory and experiments
- can report and defend a research both verbally and in writing
- is able to function in a (multidisciplinary) research environment.

Planning of study

In the first year of the master's programme students should take 25 ECTS of coursework. The traineeship of 20 EC is planned for the first half of the second semester of first year. The research project is started after the traineeship, in parallel with the remaining coursework.

5.4 Requirements for the specialization Watertechnology

Water Technology master's programme	**ECTS**
Global Water Cycle	5
Mathematical principles in water technology	6
Colloid chemistry	5
Water microbiology	5
Transport phenomena in water technology	6
Advanced water treatment processes	5
Reactor design	6
Biological water treatment and recovery technology	5
Process dynamics and control	5
Process design	12
Internship	20
Master thesis	40

Further information
The specialization Watertechnology is a joint programme of the University of Groningen, Twente University and Wageningen University. It is based at Wetsus Academy in Leeuwarden. All educational activities of the specialization Watertechnology take place in Leeuwarden. Students from each of the universities may take the specialization Watertechnology remaining a student of one of the above mentioned universities. Groningen students will, after completion of the programme, obtain a degree in Chemical Engineering at the University of Groningen.

Information on the scheduling of the programme can be found through the home page of Wetsus Academy:
http://www.wetsusacademy.nl > educational programmes > water technology master track

Information on the individual courses modules can be found through the course catalogue OCASYS: www.rug.nl/ocasys or, more directly, from the course information page of the website of Wetsus Academy:
http://www.wetsusacademy.nl > educational programmes > water technology master track > course descriptions

Further information can also be obtained from the Leeuwarden based coordinator of the specialisation Water Technology:

Ms. N. van Dorenmalen,
email: Nelleke.vanDorenmalen@wetsus.nl

or through the contact data of Wetsus academy:

Wetsus
P.O. Box 1113
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t +31 (0)58 - 284 62 00
f +31 (0)58 - 284 62 02
wetsusacademy@wetsus.nl

Other interesting related information can be found through the homepage of WETSUS:

www.wetsus.nl

6 Contact data

6.1 University contact data

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

University Council (U-raad)
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Telephone: (050) 363 8535
E-mail: uraad@rug.nl
Internet: www.rug.nl/uraad

Legal Affairs Office (ABJZ)
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Internet: www.rug.nl/bureau/expertisecentra/abjz

Donald Smits Center for Information Technology (CIT)
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Telephone: (050) 363 9200
E-mail: secretariaat-cit@rug.nl
Internet: www.rug.nl/cit
CIT Helpdesk:
Telephone: (050) 363 3232
E-mail: servicedesk-centraal@rug.nl

Health, Safety and Environment Service (AMD)
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Internet: www.rug.nl/amd

Office of the Confidential Advisor
Marijke Dam, Confidential Advisor
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Complaints Committee for harassment, sexual harassment and aggressive, violent or discriminatory behaviour
Postal address: Antwoordnummer 172, 9700 AB Groningen

Student Service Desk
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Internet: www.rug.nl/isd

Student Counsellors, a department of the Student Service Center
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Psychological Counselling Service, a department of the Student Service Center
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Centre for Study Support and Academic Skills (SO), a department of the Student Service Center
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Talent and Career Center (T&CC)
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Postal address: P.O. Box 7117, 9701 JC Groningen, the Netherlands
Telephone: (050) 311 1589
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Board of Appeal for Examinations (CBE)
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6.2 Department of Chemistry and Chemical Engineering

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Study coordinator:	Tiesinga dr. G.		
Study counsellor:	Zondervan, drs. G.J.	4130	5114.0010
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Haan, F. de		4422	5111.0073
Leeuwen, J.E.G. van		4140	5111.0073
Chemistry practical			
Dijken, J. van		4290	5116.0316
Kloosterman, R		4366 / 95138	5114.0312
Liewes, R.M.		4290	5116.0316
Hof, W.G. ing. (coordinator)		4292	5115.0301
Teaching methodology			
Apotheker, drs. J.H.		4365	5114.0332
Science Shop			
Mulder, dr. H.A.J.		4132	5118.0139
Ree, drs. C.M.		4132	5118.0139
Student organizations			
De Chemische Binding		4117	5111.0070
G.T.D. Bernoulli		4399	5118.0238
V.V.P. Netwerk		4511	5117.0322
Facilities			
Bibliotheek		4127	Bernoulliborg
Reception		4133	5111.0004
Repro Service		4107	5111.0004
IT-management (IT beheer)		4341	5116.0341
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Biochemistry (BC)			
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Poolman, prof.dr. B.		4190	5116.0143
Slotboom, dr. D.J.		4187	5116.0145
Biophysical Chemistry (BFC)			
Secretariat (EM & Xray), ms. H.T. Riemens		4378	5118.0047
Dijkstra, prof.dr. B.W.		4381	5118.0053
Boekema, prof.dr. E.J.		4225/4220	5119.0010
Broos, dr. J.		4277	5118.0063
Croce, dr. R.		4214	5119.0006
Thunnissen, dr. A.M.W.H.		4380	5118.0051

Secretariat (Mol. Dynamica), ms. H.T. Riemens	4323	5117.0015
Marrink, prof.dr. S.J.	4457	5117.0013
Scheek, dr.R.M.	4328	5116.0043
Vries, dr. A.H.	4336	5117.0006

Chemical Physics (CF)

Secretariat, ms. H. van Mil-Boddeveld	4440	5117.0002
Blake, dr. G.R.	4414	5118.-145
Broer, prof. dr. R.	4374	5118.0039
Filatov, prof. dr. M.	4377	5118.0045
Noheda, prof. dr. B.	4565	5117.0016
Palstra, prof.dr.T.T.M.	4419	5117.0018

Molecular Chemistry (OMAC)

Secretariat, ms. H.H. Biemold	4235	5115.0209
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Feringa, prof.dr.B.L.	4278	5115.0205
Harder, prof. dr. S.	4322	5118.0151
Bouwkamp, dr. M.W.	4443	5118.0138A
Hummelen, prof.dr.J.C.	5553	5118.0115
Minnaard, dr. A.J.	4258	5172.0836
Otto, dr. S.	8639	5115.0221
Roelfes, prof .dr. J.G.	7745	5115.0217
Vries, prof.dr.J.G. de	4243	5116.0237

Polymer Science (PC)

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Loontjes, prof. dr. J.A.	4510	5118.0355
Loos, prof. dr. K.U.	6867	5118.0357
Schouten, prof.dr.A.J.	4513	5118.0341

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Broekhuis, prof.dr. A.A.	4918	5118.0255
Harmsen, prof.dr. G.J.	7888	5117.0320
Heeres, prof.dr.ir. H.J.	4174	5118.0235
Levinsky, prof.dr. H.B.	4544	5117.0318
Melian Cabrera, dr.I.V.	4267	5118.0241
Mokhov, dr. A.V.	4481	5117.0318
Picchioni, dr. F.	4333	5118.0237
Roffel, prof.dr.ir.B.	8366	5118.0207
Versteeg, prof. dr. G.F.	7888	5117.0320