

# Molecular Sciences and Simulation

International Master's Program with a Focus on  
Spectroscopy and Simulation

## Master of Science (1-Fach-Studiengang)

Homepage: [www.rub.de/imos/](http://www.rub.de/imos/) <http://www.ruhr-uni-bochum.de/imos/>

Englischsprachiger Studiengang



## Studienbeginn

Nur zum Wintersemester.

## Zulassungsvoraussetzungen

The teaching language is English, in accordance with the program's emphasis on globalized science and interdisciplinary research.

We are continuously looking for students with a B.Sc. or equivalent from a broad variety of disciplines (chemistry, physics, biology, mathematics, and engineering).

Students who apply for the Master of Science programme must have a Bachelor (or comparable) degree in either

Chemistry  
Physics  
Biochemistry  
Mathematic  
a related engineering field.

## Required credits

1. 10 CP in Mathematics
2. 8 CP in Theoretical Chemistry and/or Spectroscopic Techniques and/or Quantum Mechanics and/or equivalent topics

E.g. these requirements serve to ensure similar starting conditions for our future students. A good indicator if you are suited for our Master Course Program is that you understand most of the terms listed below:

**Mathematics:** You are familiar with basic mathematical concepts like real and complex valued vector spaces, matrices and operators, basis set transformations, partial differentiation, integration over arbitrary dimensional spaces, some common types of differential equations and their solutions, and basic statistical entities like distributions, averages, data regression and hypothesis tests.

**Quantum Mechanics:** You are able to explain basic concepts like particle wave dualism, operators, and wave-functions and know the solutions to simple quantum mechanical problems (e.g. particle in the box, harmonic oscillator, hydrogen atom).

**General Physics and Spectroscopy:** You are familiar with basic concepts of classical mechanics, thermodynamics/statistical mechanics (e.g. microcanonical and canonical ensembles) and have some basic knowledge on approximate solutions of the Schrödinger equation such as perturbation theory and the Born-Oppenheimer approximation. You know the difference of spectroscopic concepts like rotational spectroscopy, rovibrational IR spectroscopy of simple molecules, fluorescence and Raman-spectroscopy

Since we expect a variety of applicants, we offer a preparatory course in general mathematics (Module M) right before the start of our core program, as well as a selection of elective courses that serve to strengthen your knowledge in those fields not fully covered by your bachelor studies.

## What is the minimum grade to be accepted into the program?

There is no definitive answer to this question as the required grade mainly depends on where you come from. You are thus requested to send us your application documents when you have completed your first degree (e.g. Bachelor) program, when you are about to complete it, i.e. when you are a few credits shy of your degree. If you do not have the required grades, but believe your additional skills qualify you for the Master of Science course, you are welcome to send us your application. In the selection procedure we will favorably consider your additional qualifications.

Compared to the German rating system (according to which 1.0 is the best and 4.0 is the lowest grade), you should have an average of at least 2.0. All foreign grades will be evaluated according to this system. In order to

## Studienfachberatung

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Sprechzeit: n.V.

give you an idea of what your chances are for admission to the program, the following rules of thumb can be applied:

- in GPA-ratings (maximum grade 4.0, minimum grade to pass 2.0) you need at least an average of 3.0
- in percentage-ratings (100% maximum, minimum grade to pass 40%), you need at least 70%
- if your degree includes ratings like "first division", "first division with distinction" etc., you should have at least earned one of the two best ratings.

### **Language requirements**

The language of instruction is English. You must provide proof that you have sound English language skills. To be accepted to the program, at least one of the following requirements must be fulfilled:

- completion of your first degree program in English (this means that ALL lectures must have been held in English)
- TOEFL: minimum score paper-based 600, computer-based 250, internet-based 100; the TOEFL score must not be older than two years and sent to us directly from the Educational Testing Service (ETS). The Institution Code is 7657.
- IELTS: minimum score 6.0; the score must be sent to us directly from the testing center

### **Do I need to have German language skills?**

All courses are taught in English. Hence, German language skills are not required for admission to the program. However, some pre-knowledge of the German language will be very helpful in everyday life and it will considerably help you to socialize with other RUB students. We thus strongly recommend you to take German classes, ideally before you come to Germany. Ruhr-Universität Bochum offers free German language courses for all levels each semester.

### **Application**

Please read our application information in <http://www.ruhr-uni-bochum.de/imos/admission/application.html.en>

### **Zulassungsverfahren**

#### **Auswahlgespräch**

Übersteigt die Zahl der Bewerberinnen und Bewerber die Gesamtzahl der zur Verfügung stehenden Studienplätze, erfolgt die Auswahl nach Gesamtnote des ersten berufsqualifizierenden Abschlusses und nach Note eines **Auswahlgespräches**.

Die Studienplätze werden in der Reihenfolge von Vergabnoten an Bewerberinnen und Bewerber vergeben, die die Zugangsvoraussetzungen erfüllen. Die Vergabnote setzt sich zu 51 % aus der Gesamtnote des ersten berufsqualifizierenden Abschlusses und zu 49 % aus der Note des Auswahlgespräches zusammen.

Im Auswahlgespräch soll festgestellt werden, ob die Bewerberin oder der Bewerber für den ausgewählten Studiengang besonders geeignet ist. Dabei werden besonders die Motivation, die die Eigenständigkeit sowie die fachliche Eignung bewertet.

Das Auswahlgespräch wird in der Regel spätestens bis zum 15.09. für das Wintersemester an der Universität durchgeführt. Die genauen Termine sowie der Ort des Auswahlgespräches werden in der Regel zwei Wochen vor dem Gesprächstermin durch die Fakultät für Chemie und Biochemie bekannt gegeben. Die Bewerberinnen und Bewerber werden rechtzeitig durch die Fakultät für Chemie und Biochemie eingeladen.

Eine Auswahlkommission führt mit jeder Bewerberin und jedem Bewerber ein Gespräch von circa 30 Minuten.

Dieses Master-Programm ist örtlich zulassungsbeschränkt.

Das Verfahren wird von der Ruhr-Universität durchgeführt. Die Studienplätze werden ausschließlich im Auswahlverfahren der Hochschule vergeben.

Informationen zur Online-Bewerbung unter [www.rub.de/zsb/oertl-master.htm](http://www.rub.de/zsb/oertl-master.htm)

Wichtige Hinweise finden Sie auf der entsprechenden Seite des Studierendensekretariats mit Online-Bewerbung unter

[www.rub.de/studierendensekretariat/studium/bewerbung\\_zulassung/master.html.de](http://www.rub.de/studierendensekretariat/studium/bewerbung_zulassung/master.html.de)

Bitte senden Sie Ihre Unterlagen (Bachelor-Zeugnis, Diploma Supplement, Transcript of Records...) an unsere Zulassungsstelle.

Wichtig: Bitte beachten Sie, dass jederzeit Änderungen im Verfahren möglich sind! Informieren Sie sich darüber unter:

[www.ruhr-uni-bochum.de/zsb/master](http://www.ruhr-uni-bochum.de/zsb/master)

Lesen Sie zur Information auch das zugehörige Bachelor-Info unter <http://studienangebot.rub.de/bachelor>

**Internationale Bewerber/innen:** Bitte beachten Sie, dass Sie sich als internationale/r Bewerber/in immer bewerben müssen, auch wenn Ihr gewünschtes Fach zulassungsfrei ist. Weitere Informationen unter: [www.international.rub.de/bewerbung/](http://www.international.rub.de/bewerbung/)

## **Fächerkombinationen**

Im Masterstudium ist ein Wahlpflichtfach aus einem ingenieurwissenschaftlichen, naturwissenschaftlichen oder medizinischen Studienfach zu wählen.

## **Regelstudienzeit**

4 Semester bis zum Masterabschluss.

## **Durchschnittliche Studiendauer**

4 - 5 Semester.

## **Förderungshöchstdauer nach BAföG**

4 Semester bis zum Masterabschluss.

## **Informationen zum Studium**

### **Curriculum**

#### **Preparatory Courses**

The preparatory course "English for non-native speakers" is optional. It is intended to improve the English skills of the future students of this Master Course Program. For example, all students should be able to properly use the English science terminology, especially in the field of bio-physical-chemical sciences. In addition, non-native English speakers will have the opportunity to refresh their English language skills.

The "Leveling Course in Mathematics" is intended to provide students with differing mathematical backgrounds the mathematical basics that are required to follow the first semester courses right from the start.

We strongly recommend participation in the Preparatory Courses. They will help you to study efficiently and successfully right from the start. In case, you have questions whether your participation is necessary, do not hesitate to contact us after (!) you received your confirmation to join this Master Course Program.

Both preparatory courses will typically start in early October. Details will be announced in the news section. **Mandatory courses**

In the first two semesters, all students have to pass 7 mandatory courses (modules 3-9)

#### **Elective Subjects**

There are three elective courses available: "Concepts of Quantum Mechanics", "Statistical Physics and Thermodynamics," and "Numerical Methods and Scientific Computing" (modules 1, 2 and 10, respectively). In total, 10 credit points from these elective courses are required to obtain the total of 120 credit points necessary for this Master degree. Module 1: "Concepts of Quantum Mechanics" includes an additional contact hour per week. This service is offered to encourage problem solving in small groups. The students will solve the problems independently, but have a supervisor available for advice.

#### **International Course**

The mandatory international practical course opens an excellent opportunity to conduct a research project at one of more than a dozen top universities or research institutions world wide. The students may propose a suitable place where to spend their time abroad. The final decision is made by the selection board based on the

number of available places. This international experience will provide a further step towards high-quality education and research of the students of this Master Course Program. At this stage of the Program, the students have already gained theoretical and practical expertise in their field. This international internship program is a unique opportunity and will enable the students to further develop and improve their scientific, professional and personal skills. The International Course Program will be partly funded by the Master Course Program.

Sem	Nr.	Module	CH			Type	CP
			L	E/S	Pr		
0.	E	<a href="#">English for non-native speakers</a>	3	2		p	0
	M	<a href="#">Leveling Course in Mathematics</a>	3	2		p	0
1.	1 <sup>a)</sup>	<a href="#">Concepts of Quantum Mechanics</a>	2	1	-	e	5
	2 <sup>a)</sup>	<a href="#">Statistical Physics and Thermodynamics</a>	2	1	-	e	5
	3	<a href="#">Dynamics and Simulation</a>	2	1	5	c	9
	4	<a href="#">Concepts of Spectroscopy 1</a>	2	1	5	c	9
	5	<a href="#">Concepts of Molecular Chemistry 1</a>	2	1	-	c	5
	Total	22 or 25 CH	8 (10)	4 (5)	10		28 or 33
2.	6	<a href="#">Electronic and Molecular Structure</a>	2	1	5	c	9
	7	<a href="#">Concepts of Spectroscopy 2</a>	2	1	5	c	9
	8	<a href="#">Concepts of Molecular Chemistry 2</a>	2	2	-	c	5
	9	<a href="#">Theoretical Spectroscopy</a>	2	1	-	c	5
	10 <sup>a)</sup>	<a href="#">Numerical Methods and Scientific Computing</a>	2	1	-	e	5
Total	19 or 22 CH	8 (10)	4 (5)	10		28 or 33	
3.	11	<a href="#">International Course</a>	-	-	14	c	14
	12	<a href="#">Focal Point Practical</a>	-	-	15	c	15
	Total	29 CH	-	-	29		29
4.	13	<a href="#">Masters Thesis</a>				c	30
<b>Total</b>			18	9	49		120

## Internet

### Homepage:

- [www.rub.de/imos/](http://www.rub.de/imos/)

### Allgemeine Informationen

- Allgemeine Informationen zur Master-Bewerbung an der Ruhr-Universität:  
[www.rub.de/zsb/master.htm](http://www.rub.de/zsb/master.htm)
- Master-NC-Werte an der Ruhr-Universität  
(Ergebnisse werden jeweils nach Abschluss des Verfahrens veröffentlicht):  
[http://www.rub.de/studierendensekretariat/studium/bewerbung\\_zulassung/master\\_archiv.html.de](http://www.rub.de/studierendensekretariat/studium/bewerbung_zulassung/master_archiv.html.de)
- Broschüren der Zentralen Studienberatung der Ruhr-Universität rund ums Studieren  
[www.rub.de/zsb/service/download.htm](http://www.rub.de/zsb/service/download.htm)
- Akademisches Förderungswerk (Wohnen, BAföG und mehr)  
[www.akafoe.de/](http://www.akafoe.de/)
- International Office der Ruhr-Universität  
[www.international.rub.de/intoff/](http://www.international.rub.de/intoff/)
- Career-Service der Ruhr-Universität  
[www.rub.de/careerservice](http://www.rub.de/careerservice)
- Hochschulteam der Arbeitsagentur Bochum  
[www.rub.de/zsb/stud-beratung/h-team.htm](http://www.rub.de/zsb/stud-beratung/h-team.htm)

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## Zentrale Studienberatung der Ruhr-Universität

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Unsere Beratungszeiten finden Sie unter  
[www.rub.de/zsb/zeiten](http://www.rub.de/zsb/zeiten)

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