

Please note that this document is a non-binding convenience translation. Only the German version of the document entitled “Ordnung für die Prüfung im Masterstudiengang „Soft Matter and Materials“ des Fachbereich 09 – Chemie, Pharmazie, Geographie und Geowissenschaften der Johannes Gutenberg-Universität Mainz und des Fachbereichs 05 Physik der Technischen Universität Darmstadt,” dated March 20, 2023, has legal validity.

**Regulations for the Examination in the Master’s Degree Program “Soft Matter and Materials”
of Faculty 09 – Chemistry, Pharmaceutical Sciences, Geography, and
Geosciences of Johannes Gutenberg University Mainz and
Faculty 05 Physics of Technische Universität Darmstadt**

March 20, 2023

Based on sections 22, 50 subsection 1 no. 1 of the Hessian University Act (Hessisches Hochschulgesetz, HHG) from December 14, 2021, Official Gazette of Laws and Ordinances (Gesetzliches Verordnungsblatt, GVBl.) I p. 931 as well as section 7, subsection 2 no. 2 and section 86, subsection 2 sentence 1 no. 3 of the University Act (*Hochschulgesetz*, HochSchG) dated September 23, 2020 (GVBl. p. 461), last amended by law on July 22, 2021 (GVBl. p. 453), BS 223-41, the faculty council of Faculty 05 Physics of Technische Universität Darmstadt and the faculty council of Faculty 09 – Chemistry, Pharmaceutical Sciences, Geography, and Geosciences of Johannes Gutenberg University Mainz agreed upon the following regulations for the “Soft Matter and Materials” master’s degree program on June 10, 2022, and June 8, 2022, respectively. These regulations were approved on February 16, 2023, by the executive board of Technische Universität Darmstadt in accordance with section 7 subsection 4 no. 5 of the TU Darmstadt law of December 5, 2004 (GVBl. I p. 382), last amended by Article 6 of the law dated April 1, 2022 (GVBl. p. 184 (204)), and by the executive university board of Johannes Gutenberg University on February 16, 2023, in the form of a letter from the president in accordance with section 7 subsection 3 sentence 2 HochSchG. They are hereby made public.

I. General Information

Section 1

**Scope, Objective of the Program of Study, Purpose of the Master’s Examination,
Academic Degree**

(1) These regulations govern the examination in the joint master’s degree program “Soft Matter and Materials” of Faculty 09 – Chemistry, Pharmaceutical Sciences, Geography, and Geosciences, referred to as FB 09 in the following, of Johannes Gutenberg University Mainz, referred to as JGU in the following, and Faculty 05 Physics, referred to as FB 05 in the following, of Technische Universität Darmstadt, referred to as TUDa in the following.

(2) If parts of the examination for the master’s degree program are completed at TUDa, the regulations in the General Examination Regulations (*Allgemeine Prüfungsbestimmungen*, APB) of Technische Universität Darmstadt dated April 19, 2004 (*Staatsanzeiger* no. 25 from June 21, 2004, p. 1998), in the 6th amended version dated November 10, 2021 (*Satzungsbeilage* 2022-I p. 3), as amended are applicable with respect to the organization and implementation of these parts of the examination. This applies to regulations on the following: registration dates and implementation details of the registration for modules, courses, and examinations; attendance in courses; coursework; module examinations; the recognition of

coursework and examinations as well as the crediting of qualifications earned outside of the university; and cheating. The master's thesis takes place under the conditions of these examination regulations.

We hereby refer to the collaboration agreement between JGU and TUDa dated February 4, 2023.

(3) The master's degree program is an academic degree program which, building on a primary professionally qualifying university degree, leads to a further professionally qualifying academic degree. Its goal is to convey advanced scientific specialist knowledge in the subject of Soft Matter and Materials.

(4) The master's examination is meant to determine whether students are ready to transition to a career in the field by examining if they have acquired the necessary specialist knowledge in the subject of Soft Matter and Materials, an overview of the interrelations in the field, and the ability to apply scientific methods and skills.

(5) The master's degree program is an English-language degree program; the courses are held in English and the required examinations must be taken in English.

(6) After successful completion of the program of study and the final examination, JGU's FB 09 and TUDa's FB 05 will jointly award the academic degree of Master of Science, shortened to M.Sc. This academic degree may be added to the graduate's name.

Section 2

Admission requirements

(1) Admission requirements for the Soft Matter and Materials master's degree program are:

1. Proof of a bachelor's degree in Chemistry, Chemical Engineering, Physics or Materials Science from a university in Germany, or a degree from another form of higher education institution in Germany or abroad that does not differ significantly from this degree.
2. Proof of practical exercises in a laboratory setting amounting to at least 18 credits, part of which must have been carried out using chemical work techniques.
3. Proof of academic coursework in the molecular sciences amounting to at least 3 credits.
4. Proof of academic coursework in thermodynamics amounting to at least 3 credits.

Coursework and qualifications that were not part of the bachelor's degree program may also be taken into account. This is decided by the examination committee.

(2) Proof of required language proficiency in English at least at the C1 level of the Common European Framework of Reference for Languages. English proficiency at the C1 level is proven by any of the following:

- Cambridge Certificate of Advanced English (C1 Advanced), at least grade C, B, A (180-199)
- Cambridge Certificate of Proficiency in English Level C1
- Exam for the Certificate of Proficiency in English (ECPE)
- International English Language Testing System (IELTS – includes IELTS Indicator) (at least 7 points)
- Michigan English Test (MET) 4 skills, each 64–80
- Oxford Online Placement Test (OOPT) 80–99
- PTE (Pearson Test of English) Academic 76–84

- telc English C1
- telc English B2-C1 University (C1 certificate)
- TOEFL (Test of English as a Foreign Language ITP) 627
- TOEFL (Paper/computer-based test, CBT) 550/213
- TOEFL (internet-based test, IBT includes Special Home Edition) 95–113
- TOEFL essentials 10–11.5
- TOEIC Listening 490, Reading 455, Speaking 200, Writing 200
- Degree earned by completing an English-language degree program pursuant to subsection 1 no. 1.

(3) A further requirement for admission to the Soft Matter and Materials master's degree program is that applicants must retain their eligibility to take the corresponding degree program examination. A corresponding declaration must be submitted for verification.

(4) Applicants who are unable to submit a bachelor's degree certificate as required in subsection 1 by the application deadline can apply if they demonstrate that they have acquired at least 135 credit points in the form of academic coursework and examination results and the relevant certificate must be issued by the corresponding office of their current institution of higher education; alternatively, they may also apply if they have obtained a provisional certificate of recognition issued by JGU for foreign degree certificates. Proof of the total number of credit points acquired must be provided. If admission to the degree program is restricted, the stipulations of the university's selection statutes shall apply as amended. In this case, the final grade of the bachelor's degree will not be taken into account in the selection process. If an applicant is admitted on the basis of the certificate specified in sentence 1, the applicant will be admitted on the condition that they submit by the deadline stipulated in the letter of admission proof that they have successfully completed the preceding bachelor's degree and thus fulfill the general and subject-specific admission requirements. Failure to provide this proof by the deadline will result in annulment of the admission.

(5) Even if all admission requirements are met, admission to the Soft Matter and Materials master's degree program requires successful completion of the admissions process. If admission to the master's degree program is restricted, admission will be granted on the basis of the stipulations of the university's selection statutes.

(6) Admission to the "Soft Matter and Materials" master's degree program must be applied for at JGU.

(7) JGU carries out the admission and enrollment procedures according to the legal basis applicable to JGU. TUDa adopts JGU's decisions regarding admissions and student status (enrolled, leave of absence, exmatriculated) as well as the information required for enrollment provided by JGU. JGU transfers the information required for enrollment to TUDa. Enrollment and re-registration at JGU are prerequisites for enrollment and re-registration at TUDa.

(8) It is possible for new students to start the degree course in both the winter and summer semesters.

Section 3

Scope and Nature of the Master's Examination

(1) The master's examination consists of the following components:

1. the module examinations taken throughout the course of studies
2. the written master's thesis.

(2) Academic adjustments must be made to the examination requirements for students with disabilities or chronic illnesses in order to ensure equal opportunity. If a candidate is unable to fully or partially complete the examinations in the intended form due to long-lasting or permanent disability or chronic illness, the chair of the examination committee must allow the candidate either to complete the examination within an extended time frame or to complete an examination in a different but equivalent form. The presentation of a medical certificate may be requested (*ärztliches* or *amtsärztliches Attest*). The same regulations apply to coursework.

(3) Examinations and coursework may only be completed by students who are enrolled in the Soft Matter and Materials master's degree program at JGU and TUDa and are neither on a leave of absence nor have lost their eligibility to take exams. Section 2 subsection 7 of the Regulations for the Admission and Enrollment of Applicants at Johannes Gutenberg University Mainz (*Ordnung für die Zulassung und Einschreibung von Studienbewerberinnen und Studienbewerbern an der Johannes Gutenberg-Universität Mainz*) remains unaffected.

Section 4

Standard Period of Study, Academic Advising, Deadlines

(1) The standard period of study, including the time needed to complete the master's thesis, is two years (4 semesters).

(2) The program is tightly structured in the interest of keeping to the standard period of study. If a student's academic success seems to be jeopardized, the student can be invited in writing to take part in an academic advising session; this session may not be compulsory. During the academic advising session, the experience with the course of studies up to that point and the reasons for failing to attain the expected academic achievements will be discussed, as will ways to continue successfully with the course of studies. Every student has a legal right to these advisory services.

(3) When determining the length of study required to meet the deadlines recorded in these examination regulations, extensions and interruptions are not counted, as long as they are due to

1. participation in legally or statutorily prescribed committees belonging to a higher education institution, the student body, or the *Studierendenwerk*,
2. disease, disability, chronic illness, or other reasons for which the student is not responsible,
3. pregnancy or raising a child; in these cases, taking advantage of the legally protected maternity leave and the parental leave periods in accordance with the Federal Act on Parental Allowance and Parental Leave (*Bundeselterngehd- und Elternzeitgesetz*) must be made possible,
4. care of a dependent relative,
5. a relevant, recognized study abroad period of one to two semesters; this does not apply to study abroad periods which are to be carried out in accordance with these examination regulations.

It is the student's duty to provide proof that one of the cases in sentence 1 applies.

In general, the time provided to complete an examination carried out at home may not be interrupted by maternity leave and/or parental leave. The examination in question will be considered not to have been assigned. After the period of leave has lapsed, the candidate may apply for a new topic.

Section 5

Modularized Program Structure, Credit System, Active Participation, Coursework, Attendance

(1) The courses and internships of the master's degree program are offered as part of modules. A "module" is a teaching unit that is coordinated in topic and time. In general, each module concludes with a module examination according to section 11. In particularly well-founded individual cases, a module examination may consist of several smaller examinations. In particularly well-founded cases, several modules may be completed with the same examination. For examinations according to sentence 3 and 4, section 11 applies.

(2) Every module is assigned a number of credits that correlates to the estimated amount of time needed for students to complete all of the required courses within the module, the preparation and follow-up work, the acquisition of records of achievement (if applicable), the preparation for examinations, and the completion of the module examination. The same applies to the master's thesis. The credits are earned after successful completion of the module according to subsection 1, including all of the coursework to be completed as part of the module according to subsection 4 or, if applicable, after successful completion of the master's thesis. The criteria for assigning credits correspond to the European Credit Transfer and Accumulation System (ECTS). One credit corresponds to an average expenditure of 30 hours of work.

(3) As a rule, the prerequisite for receiving credits for modules is the successful completion of the module examination according to section 11 following active participation in the module's courses. Proof of active participation is not required for lectures; exceptions are regulated in the appendix. Conditions for active participation are announced at the beginning of the course at latest; active participation may consist of reading or working through assigned reading, holding presentations (25 min.), participating in practice classes and seminars, completing seminar and internship tasks, passing entrance colloquiums and tests at the end of the semester, creating measurement logs, turning in reports and compounds on time, working on exercises, etc. The nature and scope of active participation shall be appropriate to the nature of the course.

(4) The proper completion of a module can be made dependent upon the completion of coursework and active participation in addition to passing the module examination, as long as this is regulated in the appropriate appendix. Coursework mainly serves to keep track of individual achievements; associated grades do not influence the module grade. Coursework counts as completed if, during the assessment, it is awarded at least a "passed" or "sufficient" grade (4.0) according to section 16 subsection 1. These assessments may comprise different parts and mainly consist of written classroom examinations, take-home examinations, oral examinations, reports, portfolios, colloquiums, presentations, practical exercises, and term papers. For more detailed information, see the appendix. If several alternative forms of assessment are included in the appendix, the course teacher will announce the relevant type and duration of assessment by the beginning of the lecture period at the latest. If coursework is graded, it is evaluated according to section 16.

(5) Student attendance may only be made a prerequisite for taking the exam according to section 26 subsection 3 no. 7 HochSchG if it is necessary for achieving the course's learning objective. This applies to practical exercises, internships, and field trips. Further courses in which attendance may be made mandatory are:

- a) courses in which safety knowledge is taught

- b) subject-related didactic courses in which hands-on professional approaches are trained through the simulation of learning and teaching situations
- c) courses with a learning objective primarily related to moderating scientific discussions and/or the presentation of a topic in front of an audience of specialists in the field as well as practicing appropriate and respectful feedback
- d) courses in which students use licensed programs on computers belonging to the working group in order to work on internship-related tasks

Courses with mandatory attendance are marked in the appendix. Attendance in a course must be confirmed if the student misses up to two individual sessions or up to four course hours per semester, or had excused absences due to internships; in well-founded individual cases, exceptions may be permitted. Documented participation in safety training is a prerequisite for taking part in internships.

(6) As a rule, a punctual and binding registration is necessary in order to participate in courses. The chair of the examination committee determines the dates and modes of registration in consultation with the course teachers. If the number of registrations is greater than the number of available spots for a course, the Senate guidelines for admission to courses with a limited number of participants shall apply as amended for the allocation of spots.

(7) Re-taking a course for which coursework was already completed in order to receive further credits or a better grade is not possible.

(8) Failed coursework should be repeated at the earliest possible date. Internships may only be repeated twice. Re-doing coursework in order to receive further credits or a better grade is not possible.

(9) Certification of credits for individual courses may only take place following the receipt of a written application and only for transfer purposes. If, in well-founded individual cases, the certification of individual academic achievements is required, a record of study will be issued. At the very least, the record of study will include the name of the participating student, the exact title of the course and the module, the semester in which the course was taken, the number of credits earned, and, if the record of study pertains to coursework, the type and result of the assessment.

Section 6 Required Coursework and Examinations, Modules

(1) At least 120 credits must be earned as part of the master's degree program.

(2) The program of study is structured as follows:

Phases of Study	Required (R)/Required Elective (RE)	Credits	Place of Study
Basic Modules at JGU			
Module 1: Macromolecular Chemistry	R	6	Mainz
Module 2: Modern and Industrial Aspects of Polymer Materials	R	6	Mainz
Module 3: Colloids and Interfaces	R	6	Mainz
Module 4: Internship – Modern Aspects of Macromolecular Chemistry	R	6	Mainz
Module 5: Higher Statistical Physics	R	6	Mainz

Basic Modules at TUDa			
Module 7: Soft Matter Physics I	R	5	Darmstadt
Module 8: Soft Matter Physics II	R	5	Darmstadt
Module 9: Internship – Physical Experiments & Theory	R	10	Darmstadt
Module 10: Advanced Polymer Chemistry and Polymer Nanotechnology	R	4	Darmstadt
Module 11: Required elective module	R	6	Darmstadt
Advanced Phase			
Module 12: Advanced Soft Matter and Materials	R	6	Darmstadt/Mainz
Module 13: Research Module	R	24	Darmstadt/Mainz
Final Phase			
Final module	R	30	Darmstadt/Mainz
Total		120	

(3) The required and required elective courses for each module are listed in the appendix. The faculties and the cooperating institutions ensure the availability of the courses required for each module.

(4) If courses or modules with identical or mostly identical content were already completed during the bachelor's degree program, they cannot be taken again during the master's degree program. Receiving credits for the same examinations or coursework twice is not possible. Instead, another suitable course or module must be completed. If a required course or module is to be replaced, the examination committee will determine which equivalent replacement course or module is to be completed. Achievements earned in addition to the coursework and examinations required for earning the bachelor's degree are exempt from sentence 2.

Section 7 Examination Committee

(1) The faculty councils of JGU's FB 09 and TUDa's FB 05 compile a collective examination committee for the organization of examinations and the tasks stated in these regulations. Reference is made to section 37 subsection 3 HochSchG.

(2) The examination committee shall include the following members:

- a) four members from among the group of university teachers (professors, junior professors, assistant professors), including at least one representative from TUDa and JGU each,
- b) one student member,
- c) one member from among the group of TUDa or JGU academic staff members
- d) one non-academic TUDa staff member or one employee from JGU's Technics Department or administration.

An appropriate distribution of members from both universities is to be ensured. The committee's chair as well as their deputy must be university teachers. The examination committee makes decisions based on a simple majority vote by the members present; in the case of a tie, the chair has the deciding vote. When determining examinations, section 24 subsection 2 HochSchG is applicable. The student member's term is one year long, while the other members have three-year terms. A committee member can be re-elected. If a committee member ends their term prematurely, a replacement is voted in for the remainder of their term.

(3) Unless determined otherwise, the examination committee is responsible for all decisions to be made on the basis of these regulations; it can delegate tasks to be completed by the chair. The examination committee receives administrative support from the responsible examination office or student advising office. The examination committee ensures compliance with the provisions set forth in these regulations. It regularly reports to the faculties regarding the development of study and examination periods, including the time allotted for working on the master's thesis and the distribution of module grades and overall grades; the report must be disclosed by each university in an appropriate manner. Furthermore, the examination committee gives the faculties and the responsible subject committees for learning and teaching recommendations for reforming the degree plan and the examination regulations.

(4) In collaboration with the faculties, the examination committee is responsible for ensuring that the coursework and examinations can be completed within the time allotted for them within these regulations. To this end, candidates must be informed in a timely manner of the type and amount of coursework and examinations to be completed within a module, as well as the time within which they are to be completed. The candidates are also to be informed of the repeat examination dates for coursework and examinations in a timely manner.

(5) The members of the examination committee have the right to attend all assessments and module examinations. This right does not include advising or disclosure of the grade.

(6) The examination committee's meetings are not public. The examination committee's members are under an obligation of discretion. If they are not public service members, they must be sworn to discretion by the chair.

(7) Students adversely affected by negative decisions made by the examination committee are to be informed thereof in writing as soon as possible. If this concerns the notification that a student has failed an examination with no option to re-sit or has lost their eligibility to take exams within the master's degree program for other reasons, this notification may not be sent out solely electronically. The official notification must include information on rights to appeal the decision. Reference is made to section 24.

(8) The examination committee has the right to use electronic resources to examine academic papers for cheating or attempted cheating. For this purpose, the examination committee may require the author to submit a suitable electronic version within an appropriate period of time. Failure to comply with this request can result in the paper being graded as failed.

Section 8

Examiners and Observers

(1) The master's examination and the module examinations are carried out by examiners. The examination committee appoints the examiners from the pool of authorized examiners. It may assign the task of making appointments to the chair.

(2) Authorized examiners include

- a) university teachers, professors, junior professors, and assistant professors – the participation rights of university teachers who are retired or have emeritus status remain untouched –
- b) retired professors,
- c) interim professors,
- d) visiting professors,
- e) academic staff members with a habilitation,
- f) junior professors whose terms have ended,

- g) adjunct professors,
- h) honorary professors,
- i) academic staff members who have been tasked with independent teaching assignments,
- j) lecturers,
- k) teaching staff for special duties,
- l) persons with practical experience in the subject,
- m) junior research group leaders supported by a university-independent funding program with a process including a call for proposals and a review procedure

who either teach or have taught the subject to be examined within the last four semesters at JGU or TUDa or who possess proven relevant professional experience.

(3) As a rule, when a module examination is part of a course within the module, the course's teaching staff serve as examiners without special appointment by the examination committee. If the examination is not part of a specific course, the chair of the examination committee ensures that the candidates are informed of the examiners' names in a timely manner, usually at least four weeks prior to the examination date. A candidate may propose a specific examiner. The proposal does not establish a claim. If a member of the teaching staff cannot serve as examiner for compelling reasons, the examination committee can appoint a different examiner.

(4) The subject examiners appoint the observers. The observers must at least be in possession of the qualification to be earned through the examination or an equivalent qualification. They record the minutes for oral and practical examinations and may be assigned the preliminary correction of written examinations. They have the right to disqualify candidates from continuing the examination in the case of disruption.

(5) Section 7 subsection 6 sentences 2 and 3 apply to examiners and observers accordingly.

Section 9

Recognition of Coursework and Examinations and Accreditation of Qualifications Earned Outside of the University

The stipulations of the partial general examination regulations of Johannes Gutenberg University Mainz for the recognition of coursework and examinations and the crediting of qualifications earned outside of the university (*Anerkennungssatzung*) applies as amended to the recognition of coursework and examinations and the crediting of qualifications earned outside of the university.

II. Examination

Section 10

Registration and Admission to the Master's Examination

(1) The application for admission to the master's examination is considered submitted when students register for the first module examination or for the first partial module examination by the deadline posted by the examination committee.

(2) If not already submitted in the application for admission to the program of study, the application for admission to the master's examination must include:

1. a declaration concerning whether or not the candidate has already failed a master's examination in the subject of Soft Matter and Materials at a higher education institution in Germany with no option to re-sit, or if the candidate is currently part of an ongoing examination procedure at a higher education institution in Germany or abroad,
2. a declaration concerning whether and, if applicable, how often the candidate has already failed examinations and coursework relevant to the examination in the Soft Matter and Materials master's degree program or in the same subjects or modules of a different degree program at a higher education institution in Germany or abroad.

If the candidate is simultaneously studying in another degree program, the candidate must pledge to inform the examination committee of the commencement and completion of the examination procedure as well as of any examination or assessment failures in the other degree program in writing without delay. The examination committee has the right to demand a certificate of examination eligibility from the issuing university, according to which the eligibility to study and take exams in the same or a comparable degree program has not been definitively lost (*Unbedenklichkeitsbescheinigung*).

(3) Admission to the master's examination will be denied if

1. the application for admission was not submitted on time,
2. the supporting documents are not complete according to subsection 2,
3. the student is not enrolled in the Soft Matter and Materials master's degree program at JGU or TUDa,
4. the student has failed a master's examination in the same degree program at a higher education institution in Germany with no option to re-sit, or
5. the student does not have the option to complete examinations necessary for passing the master's examination due to unsuccessful attempts according to section 17 subsection 5.

If admission to the examination is denied due to no. 4 or 5, the student will be exmatriculated.

(4) If the candidate is not admitted to the master's examination, they are to be informed of this decision and its reasons in writing. The official notification shall include information on rights to appeal.

Section 11 Module Examinations

(1) The module examinations take place over the course of studies; as a rule, they conclude the relevant module. Through the module examination, the candidate must prove their mastery of the content and methods of the module in the essential contexts and that they can apply the acquired knowledge and skills. As a rule, the subject matter of the module examinations is the content of the relevant module's courses. A selection of examination subjects from the module is permissible.

(2) As a rule, a module examination is comprised of one examination. Conditional admission according to subsection 5 remains unaffected by this. The appendix may allow for partial module examinations; these are only permissible in well-founded individual cases. For partial module examinations, the stipulations laid out in subsections 3 to 5 and sections 12 to 14 apply correspondingly. The evaluation of examinations and the calculation of the module grade in

accordance with the modules stipulated in the appendix is carried out according to section 16. Modules concluding with an ungraded assessment are marked as such in the appendix.

(3) The module examinations may take place in oral, written, or practical form according to sections 12 to 14. Types of examinations not named in sections 12 to 14 are permissible in accordance with the appendix; the stipulations in sections 12 to 14 are applicable accordingly. The type and duration of the individual modules' module examinations are regulated in the appendix. If several alternative forms of assessment are included in the appendix, the person responsible for the module will announce the relevant type and duration of assessment by the beginning of the lecture period at the latest.

(4) A timely and binding registration with the chair of the examination committee is required for participation in module examinations. In general, registration for module examinations shall take place during the semester in which the last coursework of the relevant module is completed. Section 10 subsection 3 applies accordingly. The chair of the examination committee determines the examination and registration dates in consultation with the relevant examiners according to section 8. The examination and registration dates are announced at the beginning of the semester. After the registration deadline has passed, withdrawal is only possible in well-founded individual cases, in particular in cases of illness, change of subject, exmatriculation, or transfer between universities, all of which the student must provide proof.

(5) As a rule, a module examination can only be taken if the coursework assigned to the module according to the appendix (section 5 subsection 4) has been completed. If admission to a module examination depends on the completion of coursework and this has not yet been completed in full, conditional admission to the module examination may be granted. In this case, the module examination only counts as passed if all of the coursework has been completed and the module examination has been passed. Exceptions are determined by the examination committee.

(6) If a single examination serves to conclude several modules, subsections 1 through 5 apply accordingly.

Section 12

Oral Module Examinations

(1) Oral examinations are to take place in the presence of at least two examiners (panel examination) or one examiner along with an observer well-versed in the subject according to section 8 subsection 4. Presentations and similar oral examinations with a presentational character are usually carried out in the presence of only one examiner; section 13 subsection 4 sentence 2 must be observed.

(2) The oral examination may be carried out as an individual or group examination (max. four candidates) and shall last for at least 25 and at most 35 minutes per candidate according to more detailed regulations in the appendix. In well-founded cases, other lengths of time may be stated in the appendix. If answering the examination questions requires graphic or mathematical illustrations, these count as part of the oral examination. In the case of a panel examination, the examiner must hear the opinion of the other examiners and observers prior to determining the grade. In the case of a panel examination, the examiners shall attempt to agree on a grade. If they cannot agree, the grade is the arithmetic mean out of the grades awarded by the individual examiners. Section 16 subsection 3 is applicable. The candidate shall be informed of the result immediately following the oral examination. If the candidate has failed, they must be informed of the reasons why.

(3) Minutes must be kept for every oral examination. The minutes must include the names of the examiners, observers, keeper of the minutes, and candidate, as well as the beginning and end time of the oral examination, the main points of the oral examination, the examination performance, and the assigned grades. The minutes shall be sent to the responsible examination office immediately after the examination has concluded.

(4) Students from the relevant faculties may audit oral examinations upon application, as long as none of the candidates oppose this option upon registration for the examination. Applications to audit an oral examination must be submitted to the examination committee three weeks prior to the date of the oral examination and are decided upon by the examiners based on the spots available. Candidates taking the same examination in the same examination period are not eligible to audit. If the examination is at risk of not being carried out properly, students may be expelled during the course of the examination. The public nature of the examination does not include the consultation of the examiners and the announcement of the results.

(5) Upon a candidate's application, the Equality Commissioner of JGU or FB 09, or, if the candidate has a disability or chronic illness, the commissioner for the rights of students with disabilities or chronic illnesses may take part in oral examinations.

(6) In accordance with more detailed stipulations in the appendix, individual oral examinations may be carried out in a foreign language upon the candidate's request if the examiners agree.

Section 13

Written Module Examinations, Portfolio Examinations

(1) A written classroom examination is defined as the written answering of questions posed by the examiner, using the methods commonly used in the subject of study, within a limited period of time, usually with limited resources and under supervision. The allotted amount of time shall be no less than 1 hour and no more than 2 hours and is regulated in detail in the appendix. In well-founded cases, other lengths of time may be stated in the appendix. Written classroom examinations may be carried out with the help of various media, as long as the requirements for it comply with subsection 6.

(2) A written examination in the form of a term paper is defined as the authorship of a paper on a topic assigned by the examiner using methods commonly used in the subject of study and within a limited period of time. The topic shall be chosen in such a manner that the total time required to work on it corresponds to a student workload (according to section 5 subsection 2 sentence 1) of four weeks (full-time); well-founded exceptions may be regulated in the appendix. The examination committee may set deadlines for the submission of the term papers. The term paper may be completed as a group in the form of a group examination if the examiner grants written permission.

(3) A written examination in the form of a portfolio is defined as the independent composition, selection, and compilation of a limited number of written documents on the topic of a module and the products created in the relevant courses. A portfolio is comprised of an introduction, a collection of documents, and a reflection. The portfolio may be submitted in digital form (presentation) with permission from the examiner. The portfolio may be completed as a group in the form of a group examination if the examiner grants written permission.

(4) As a rule, written examinations are evaluated by one examiner. If the examination is the last possible repeat examination for the student, it must be evaluated by a second examiner. If the examination is evaluated by two examiners, the grade is determined by calculating the

arithmetic mean of the two numeric evaluations. Section 16 subsection 3 applies accordingly. The evaluation procedure shall not exceed four weeks. If a repeat examination is to take place within the same examination period as the initial attempt, the candidate must be informed of the examination results at least two weeks prior to the repeat examination date, in some cases four weeks prior.

(5) If the second repetition of a written classroom examination also results in a failed grade, a supplementary oral exam shall take place if so stipulated for the particular module or subject in the appendix. As a rule, the supplementary examination is to be held as an individual examination and should take between 15 and 45 minutes; it shall be carried out in a timely manner. The supplementary oral examination is solely meant to determine whether the candidate will receive a grade of 4.0 or worse. A supplementary oral examination is precluded if the candidate did not take part in the examination or if the examination was graded as "insufficient" based on the provisions of Section 18 subsection 3.

(6) Multimedia examinations ("e-exams") are permissible as long as they are suited for providing the proof stipulated by section 11 subsection 1 sentence 2 or contribute to it; if necessary, they may be supplemented by other types of examinations. As a rule, the elements of multimedia examinations are developed by two examiners. In particular, they consist of essay questions, texts requiring students to fill in the blanks, and matching tasks. Multiple-choice questions are permitted under the conditions set forth in subsection 7. Before carrying out multimedia examinations, examiners must make sure the electronic information can be clearly identified and unambiguously and permanently attributed to the candidates. The examination is to be carried out in the presence of a person well-versed in the subject (keeper of the minutes). The minutes must include at the least the names of the keeper of the minutes and of the candidates as well as the beginning and end time of the examination and, if applicable, unusual or special occurrences. The candidates must be granted access to the multimedia examination as well as to the result they achieved in accordance with the stipulations of section 22. The assignment, a sample solution, the grading rubric, the individual examination results, and the minutes are to be archived in accordance with the legal regulations.

(7) An examination is defined as a multiple-choice examination if the minimum passing score can only be achieved by selecting the appropriate responses. In this case, the examiner sets the minimum passing score between 50 and 60 percent depending on the difficulty of the examination. Multiple-choice examinations are only permissible if they are suitable for providing proof of achieving the objective of the examination according to section 11 subsection 1 sentence 2. Multiple-choice examinations must be prepared by two examiners. The examiners select the material to be examined, formulate the questions, and decide on the choice of responses and how questions are weighted. In doing so, they must ensure that the points to be obtained by correctly answering individual questions are proportionate to the level of difficulty of each question in relation to the total points that can be earned in the examination. The examiners create the grading rubric and apply it once the examination has concluded. The examination questions must be clearly understandable and answerable and be suitable for unambiguously determining the candidates' level of knowledge. The requirements for passing the examination must be determined in advance. Before a multiple-choice examination is held for the first time, the examiners must submit to the examination committee a description of the examination proving its suitability according to sentence 3. Furthermore,

- the selected questions,
- the answer key, and
- the grading rubric

must be deposited with the responsible examination committee. The examination counts as passed if the candidate earns at least the minimum percentage of the total achievable points required in order to pass the examination. This minimum percentage is equal to the minimum passing score, as long as the average examination result (as a percentage) of all of the examination participants is no lower than the minimum passing score. If the average examination result is lower than this score, the necessary minimum percentage is determined to be the sum of the examination-specific bonus and the average examination result (as a percentage) of all of the examination participants multiplied by an examination-specific factor.

The examination-specific bonus is the examination result (in percent) to be statistically expected if the candidate fills out the examination's multiple-choice questions randomly, using optimal strategy. The examination-specific factor equals the difference between 1 and the ratio of the examination-specific bonus to the minimum passing score. If the minimum required points to pass the examination were earned, the grade is

“very good” if at least 75 percent,
“good” if at least 50 but less than 75 percent,
“satisfactory” if at least 25 but less than 50 percent,
“sufficient” if none or fewer than 25 percent

of the points exceeding the minimum score required to pass were earned. It is recommended to only carry out multiple-choice examinations if the number of examination participants and the number of examination questions both exceed 30, and to design the examinations in such a way that the examination-specific bonus does not exceed 20 percent. This also applies to repeat examinations. After the second failed repeat multiple-choice examination, a supplementary oral examination will take place in accordance with the regulations in subsection 5; however, in this case and deviating from subsection 5 sentence 1, it is obligatory. Subsection 5 sentence 4 applies accordingly.

(8) The examiner determines the resources that may be used when completing a written classroom examination. The approved resources must be announced in due time before registration for the examination.

Section 14

Practical Module Examinations

(1) Practical examinations take place as individual or group examinations. In the case of group examinations, section 15 subsection 8 applies accordingly. The type and duration of practical examinations are regulated in the appendix.

(2) Practical examinations are to take place in the presence of at least two examiners (panel examination) or one examiner along with an observer well-versed in the subject according to section 8 subsection 4. In the case of a panel examination, the examiners shall attempt to agree on a grade. If they cannot agree, the grade is the arithmetic mean of the grades awarded by the individual examiners. Section 16 subsection 3 is applicable. Section 12 subsections 3 through 5 apply accordingly. The candidate shall be informed of the result immediately following the practical examination.

(3) If the practical examination includes tasks to be prepared in advance, these must be completed by the candidate. The examiner must submit examination tasks which require advance preparation to the chair of the examination committee in full and in writing. The chair

of the examination committee is responsible for assigning the tasks. The date they are assigned is to be recorded.

Section 15

Master's Thesis

(1) The master's thesis is a written examination intended to demonstrate that the candidate is able to work on a problem from the area studied within the master's degree program with the required methods within the set amount of time. The supervisor for the master's thesis has the duty to provide guidance to the candidate while they are working on the thesis and to track their progress in regular intervals.

(2) The supervisor for the master's thesis must be an authorized examiner according to section 8 subsection 2. Completion of the master's thesis at an institution not belonging to JGU's FB 09, TUDa's FB 05 or the MPI-P requires the approval of the chair of the examination committee.

(3) The preliminary topic of the master's thesis is to be determined in collaboration with the responsible supervisor and must be submitted to the examination committee along with a confirmation from the supervisor when registering for the master's thesis, in accordance with subsection 4. If the candidate cannot find a supervisor, the chair of the examination committee must ensure they find a topic and a supervisor for the master's thesis in due time.

(4) As a rule, registration for the master's thesis takes place in the middle of the third academic semester.

(5) The master's thesis is to be completed within 6 months. In special cases, the examination committee can extend the time allotted for completion of the master's thesis for up to six weeks upon written request from the candidate and if the responsible supervisor agrees. When deciding on the granting of an extension, the standard period of study must be observed.

(6) The topic, assignment, and extent of the master's thesis are to be limited by the supervisor in such a way that the deadline for submitting the master's thesis can be observed. The supervisor assigns the topic of the master's thesis to the candidate by way of the examination committee; section 10 subsection 3 applies accordingly. The date of assignment is to be recorded with the examination committee. The topic can only be refused once and only within the first month of the six months allotted. A new topic must be agreed upon without delay, at the latest within four weeks; sentence 1 and subsection 5 sentence 1 apply accordingly.

(7) The master's thesis must be written in English.

(8) The master's thesis may be completed in a group, as long as the supervisor gives their agreement in writing. Each individual candidate's contribution which is to count for the examination must be clearly delineated from the other contributions by naming sections, page numbers, or other objective criteria, it must be assessable on its own, and it must comply with the requirements stipulated in subsection 1.

(9) The candidate must submit the master's thesis to the examination committee by the deadline and in digital form. Depending on the evaluators' requirements, one bound version per evaluator must additionally be submitted. The candidate must submit a written declaration according to section 17 subsection 5 along with the submission of the master's thesis. The date of submission is to be recorded. If the master's thesis is not submitted by the deadline according to subsection 5, it is graded as "insufficient" (5.0). If the master's thesis is not submitted in accordance with sentence 1 and 2, it may be graded as "insufficient" (5.0).

(10) The examination committee provides the master's thesis to the supervisor in their function as primary evaluator. At the same time, the committee appoints a secondary evaluator from the pool of authorized examiners according to section 8 subsection 2 and provides them with the thesis. At least one of the evaluators must be a university teacher from JGU's FB 09 or TUDa's FB 05.

(11) The submitted master's thesis is to be evaluated by the evaluators in accordance with the stipulations of section 16 and a written evaluation must be prepared. If there is a discrepancy of up to one whole grade point (≤ 1.0) between the two evaluations, the arithmetic mean of the grades awarded by the individual examiners will form the overall grade. If there is a discrepancy of more than one grade point (> 1.0) between the two evaluations, the chair of the examination committee must appoint a third examiner. The chair of the examination committee determines the final grade using the arithmetic mean of the three evaluations. Section 16 subsection 3 applies accordingly. The evaluation procedure shall not exceed six weeks. If an examiner cannot complete their evaluation, the responsible examination committee may appoint a replacement examiner.

(12) The master's thesis counts as passed if it receives the grade "sufficient" (4.0) or better. A master's thesis graded as "insufficient" (5.0) or failed may be repeated once. The examination committee ensures the candidate receives a new topic for the master's thesis within six weeks after receiving the relevant notification. A refusal of the topic by the deadline mentioned in subsection 6 sentence 4 is only permissible if the candidate did not use this option the first time they wrote a master's thesis. A second repetition of the master's thesis is not possible.

Section 16 **Evaluation of Examinations and Coursework,** **Calculation of the Overall Grade**

(1) a) The following grades are to be used for the evaluation of individual examinations and graded coursework:

1.0; 1.3	=	very good	=	an exceptional performance,
1.7; 2.0; 2.3	=	good	=	a performance significantly better than the average requirements,
2.7; 3.0; 3.3	=	satisfactory	=	a performance corresponding to the average requirements,
3.7; 4.0	=	sufficient	=	a performance which still meets the requirements despite its flaws,
5.0	=	insufficient	=	a performance which does not sufficiently fulfill the requirements due to major flaws.

b) Ungraded examinations and coursework are evaluated as passed if they largely fulfill the requirements.

(2) If a module examination consists of a single examination, its grade is simultaneously the grade of the module examination. If the module examination consists of multiple examinations (partial module examinations), the student must pass every examination. The grade of the module examination is calculated as the mean of the grades for the individual examinations,

weighted according to credit points. In order to determine the grade of the module examination in this case, the grades for the individual partial module examinations are multiplied by the credit points allocated to them, added up and then divided by the total sum of the credit points to be earned. The appendix may also stipulate a grade calculated using the arithmetic mean of the individual examinations or, in well-founded cases individual cases, a different method of calculating the module grade.

(3) In the case of an evaluation by multiple examiners or if the module grade is determined according to subsection 2 sentences 2 through 5, the grade of the module examination corresponds to the following:

1.0 up to and including 1.5	=	very good,
1.6 up to and including 2.5	=	good,
2.6 up to and including 3.5	=	satisfactory,
3.6 up to and including 4.0	=	sufficient,
greater than 4.1	=	insufficient.

When calculating the module grade, only the first number after the decimal point is taken into account. All other decimal numbers are discarded without rounding.

(4) In order to determine the overall grade of the master's examination, the grades for the individual module examinations in accordance with subsections 2 and 3 and the grade of the master's thesis are multiplied by the corresponding credit points, added up and then divided by the total sum of the credit points to be earned. Otherwise, subsection 3 applies accordingly. The credit points from ungraded modules are not included in the calculation.

Section 17

Passing and Failing, Repeating Examinations

(1) A module examination counts as passed if the coursework allocated to the module in the appendix has been completed and the concluding module examination has been graded as passed or at least as "sufficient" (4.0). If the module examination consists of multiple examinations (partial module examinations), the student must pass every examination.

(2) The master's examination counts as passed if the module examinations as defined in section 11 for the modules prescribed in section 6 subsection 2 sentence 1 no. 1 and 2 have been successfully completed and the master's thesis was awarded a grade of at least "sufficient" (4.0).

(3) The parts of required modules and required elective modules which were not passed or which do not count as passed may be repeated no more than twice. If the module examination for a required module was not passed, it cannot be replaced by a different examination. In the case of cumulative module examinations (partial module examinations), only the failed partial examinations are to be repeated. Once passed, an examination cannot be repeated.

(4) In the case of a failed examination for a required elective module, students may change their required elective module once during the entire degree program after failing the module for either the first, second, or ultimate time. The student receives another three chances to pass the examination for the new required elective module. Reversing the selection back to the initial module is not permissible. After passing the new required elective module, the previously failed module examination will not appear in the diploma. All further regulations from section 17 concerning passing, failing, and repeating examinations remain unaffected.

(5) Failed examinations or examination-relevant coursework in the same master's degree program at a different higher education institution in Germany are to be counted as unsuccessful attempts when calculating the permissible number of repeat examinations. Furthermore, failed examinations and examination-relevant coursework in modules or examination areas of other degree programs at higher education institutions in Germany which essentially correspond to the master's degree program Soft Matter and Materials are also to be counted as unsuccessful attempts, as long as equal or lesser requirements to pass them were imposed.

(6) Students wishing to repeat a module or partial module examination for the first time must register to do so within six months of failing it; they must register to repeat it a second time within six months of failing the first repeat examination. In well-founded individual cases, longer deadlines may be set; in total they may not add up to more than two years for the first and second repeat examination. If the deadline for registering for the repeat examination is missed, the examination counts as failed. Section 4 subsection 3 is applicable.

(7) For the repetition of the master's thesis, section 15 subsection 12 applies.

(8) If an examination cannot be completed or repeated again, the master's examination counts as failed with no option to re-sit, a continuation of the program of study in the same master's degree program is not possible anymore, and the eligibility to take exams is lost. The examination committee informs the candidate of this in the form of an official written notification. The official notification regarding the failing of the master's examination with no option to re-sit and the corresponding loss of the eligibility to take exams must include information on rights to appeal.

Section 18

Absence, Withdrawal, Cheating, Breach of Regulations

(1) If the candidate fails to appear to an examination which had been properly scheduled and announced without a valid reason or if they withdraw after the examination has begun without a valid reason, the corresponding examination is graded as "insufficient" (5.0). Examinations also count as failed if the candidate did not pass them by the prescribed deadlines. The same applies if a written examination is not submitted within the allotted time.

(2) The reasons given for absence or withdrawal in accordance with subsection 1 must be submitted to the examination committee in writing and proven credible without delay. If the examination committee recognizes the reason as valid, a new date will be scheduled. In this case, already completed examination results are to be counted. If the absence or withdrawal are attributed to a candidate's illness, this must be proven in the form of a medical certificate. The candidate must submit the medical certificate to the responsible examination committee without delay, meaning without culpable hesitation, by the third business day after the examination date or, in the case of a deadline extension for a term paper or master's thesis, by the third business day after the date of the illness's onset as documented in the certificate at the latest. If it is the first time the student is unable to take an examination, a simple medical certificate which confirms their inability to take an examination is sufficient without the addition of further information. In repeat cases, a qualified medical certificate including the time of medical treatment, the type, extent, and duration of the illness as well as its effects on the ability to take an examination, or a medical certificate from a medical officer without this additional information may be demanded. The student must not be obligated to provide the medical diagnosis. Equivalent to the candidate's illness is the illness of a child or relative for

whom they are the primary carer. If the reasons are deemed valid, the examination is to be completed on the next possible examination date once these reasons no longer apply.

(3) If the candidate attempts to affect the result of an examination via cheating or the use of unapproved resources, or if an explanation given in accordance with subsection 5 is proven to be false, the relevant examination is graded as “insufficient” (5.0). Reference is made to section 7 subsection 8. If a candidate disturbs the orderly progression of an examination, he or she may be disqualified from continuing the examination by the responsible examiner or supervising authority, usually after a warning; in this case, the relevant examination is graded as “insufficient” (5.0).

(4) The candidate may demand that the examination committee review the decision according to subsection 3 sentences 1 and 3 within one month. The candidate is to be informed without delay of negative decisions in writing, including the reasoning behind it and information on rights to appeal. The candidate shall be granted the chance to comment on the issue prior to the decision.

(5) In the case of written examinations as defined in section 13 (except written classroom examinations) as well as in the case of the master’s thesis as defined in section 15, the student must include a written declaration certifying that they completed the work on their own and only used the permitted sources and resources, that the work has not already been submitted for another examination in the same or a very similar form, and that the regulations for ensuring good scientific practice in research and teaching and procedures for dealing with research misconduct were followed. If such a declaration proves to be false or in the case of a different attempt to cheat or a breach of regulations when completing the examinations, subsections 3 and 4 apply accordingly.

(6) The provisions made in subsections 1 through 5 apply to coursework accordingly.

Section 19
Diploma, Diploma Certificate, Diploma Supplement

(1) If a candidate passes the master's examination, they must receive the results in form of a diploma without delay, generally within six weeks after they successfully complete the last examination. The diploma includes the grades of the module examinations, the master's thesis, and the overall grade (section 16 subsection 4). The credit points earned are also to be included. Furthermore, the diploma includes the topic of the master's thesis. If module examinations completed at a different higher education institution have been recognized, the name of the higher education institution where the module examinations were completed is also named in the diploma. In addition to the overall grade, grade distribution tables in accordance with the ECTS (European Credit Transfer and Accumulation System) guidelines are also issued, as long as the data necessary for this is available. Additionally completed, non-required coursework and examinations are certified in an appropriate manner; such achievements are not included in the calculation of the overall grade.

(2) The diploma must carry the date on which the last achievement necessary for passing the master's degree program (completion of a module, internship, master's thesis) was completed. The diploma is to be signed by the chair of the examination committee and stamped with the seal of JGU's FB 09 and TUDa's FB 05.

(3) Along with the diploma, the candidate is to receive a diploma certificate which certifies the bestowing of the title Master of Science. The diploma certificate bears the same date as the diploma. It is to be signed by the chair of the examination committee and the dean of JGU's FB 09 and TUDa's FB 05 and stamped with the seal of JGU's FB 09 and TUDa's FB 05.

(4) In addition, the graduate is to receive a diploma supplement in accordance with international specifications; the text agreed upon by the German Rectors' Conference and the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany as amended must be used. It must be signed by the chair of the examination committee.

(5) The diploma, diploma certificate, and diploma supplement are written in German and in English. When signing diplomas, diploma certificates, and diploma supplements, the use of electronic signatures or facsimile stamps is permissible.

(6) Students who leave the university without a degree or continue their studies at the university in a different degree program receive a summary of their completed coursework and examinations (transcript of records) upon request and submission of the necessary documents. The request is to be submitted to the examination committee in writing along with the necessary documents.

III. Final Provisions

Section 20
Annulment of the Master's Examination

(1) If the candidate cheated during the completion of coursework or examinations and this fact only becomes known after the diploma has been handed out, the examination committee may subsequently correct the grade for the coursework or examinations affected by the cheating accordingly and declare the examination or coursework to be failed either in part or as a whole. The examiners are heard beforehand.

(2) If the requirements to be admitted to the examination were not met, the candidate did not willfully disguise this fact, and this fact is revealed only after the candidate has received their diploma, this error is remedied by declaring the examination as passed. If the candidate willfully effected their wrongful admission to the examination, the examination committee decides how to proceed in the case in accordance with the Administrative Procedure Act.

(3) The candidate shall be granted the chance to comment on the issue prior to the decision.

(4) The incorrect examination certificate, the diploma supplement, and the transcript of records, if applicable, are to be revoked and issued anew as applicable. Along with these documents, the master's diploma certificate is to be revoked if the examination is declared as failed due to cheating. A decision according to subsections 1 and 2 is no longer possible after a period of two years after the date of the examination certificate and five years after the date of the master's thesis.

Section 21 Appeal

An appeal against examination decisions can be submitted in writing to the chair of the examination committee by the appropriate deadline after the examination decision has been announced. The appeal is decided upon by the examination committee. If an appeal is filed against the evaluation made by an examiner, a statement from the examiner will be obtained.

Section 22 Candidate's Right to Receive Information

(1) The candidate has the right to find out the results (grades) of their coursework and examinations prior to completing the master's examination.

(2) Upon written request, the candidate is granted access to their examination records, including the master's thesis and the relevant evaluations as well as the examination minutes. This access is permissible even if the master's examination has not yet been completed.

(3) The request must be submitted to the chair of the examination committee within one year of completing an examination. The chair of the examination committee determines the time and place that access is granted.

Section 23 Campus Management System

(1) The examination administration of JGU and TUDa is generally executed via an electronic campus management system. In particular, this includes the registration and deregistration for courses and examinations, the transfer of documents, and the announcement of the results of coursework and examinations.

(2) Students are obligated to make regular use of the integrated course and examination administration system as well as the personal e-mail account made available by JGU and TUDa.

Section 24
Entry Into Force

These regulations enter into force with the commencement of the winter semester of 2023/24. They are published in the *Veröffentlichungsblatt* of Johannes Gutenberg University Mainz and in the *Satzungsbeilage* of TU Darmstadt.

Darmstadt, March 20, 2023

Mainz, March 8, 2023

Prof. Dr. Regine von Klitzing

Prof. Dr. Tanja Schirmeister

Dean of Faculty 05 Physics
of Technische Universität Darmstadt

Dean of Faculty 09 – Faculty of Chemistry,
Pharmaceutical Sciences, Geography and
Geosciences
of Johannes Gutenberg University Mainz

Appendix

Module 1	Macromolecular Chemistry					M.09.032.22_250
Mandatory or elective module	O					
Location	JGU Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
a) Part 1: Synthesis and use of polymers Part 2: Physical chemistry of polymers	L	1 (2)	O	3	103,5 h	4,5
b) Exercises	E	1 (2)	O	1	34,5 h	1,5
In order to complete the module, the following must be completed:						
Attendance						
Active participation	b) according to § 5 para. 3; exercises					
Course achievement(s)						
Module exam	Usually written exam (120 min), otherwise oral exam (30 min)					
Qualification goals/learning outcomes/competencies						
<p>The students acquire the basics of polymer chemistry, polymerization types, chain and step growth. An overview of relevant polymer materials as well as key methods of polymer characterization and basic properties of polymers in solution as well as in the solid state is provided.</p> <p>Students will be able to:</p> <ul style="list-style-type: none"> - Reproduce basic physical properties and material properties of polymers and special features of polymers in comparison to other classes of materials, especially to low molecular weight compounds. - Acquire the basics of polymer chemistry, types of polymerizations, chain and step growth, - to critically evaluate polymerization methods, both about the achievable molecular weights and with regard to the respective limitations concerning polydispersity, - to get to know basic characterization methods and to evaluate them with respect to their suitability for specific problems - to conceptualize and quantitatively discuss the structure and dynamics of macromolecules and to thermodynamically describe macromolecular multicomponent systems. 						
Contents						
<p>Part 1:</p> <p>General principles: tasks of polymer science, polymer structures, nomenclature.</p> <p>Polymer synthesis: polycondensation (step growth), Carothers equation, polymerizations with chain growth, radical and ionic methods of polymer synthesis, kinetics, chain transfer, copolymerization, catalytic polymerization, polyinsertion, catalysts (initiators).</p> <p>Polymerization in heterophase (emulsion, dispersion, suspension).</p> <p>Polymer modification: cellulose, rubber, polymer analogous reactions.</p> <p>Controlled and living polymerization processes, ring opening reactions, solid phase synthesis.</p> <p>Part 2:</p> <p>Polymer structure: block copolymers, conformation of macromolecules, errant statistics, RIS model, ideal and real chain statistics, entropy elasticity, Flory exponent and scale laws.</p> <p>Molecular characterization of polymers in solution: colligative methods, Gelpermeation chromatography, mass spectrometry, static light scattering.</p> <p>Polymer dynamics: Rouse and Zimm model.</p> <p>Polymer thermodynamics: Flory-Huggins theory, phase diagrams</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 6 CP out of 98 graded CP.					

Frequency of the offer	Every semester
Justification of the obligation to be present	
Module officer or person in charge of the module	Prof. Dr. Andreas Walther (JGU – FB 09)
Usability of the module in other study programs	M.Sc. Soft Matter and Materials, B.Sc. und M.Sc. Chemie
Other remarks	<p>Literature:</p> <p>Tieke – Makromolekulare Chemie. Eine Einführung (Wiley).</p> <p>Koltzenburg, Maskos, Nuyken – Polymere: Synthese, Eigenschaften und Anwendungen (Springer)</p> <p>Lechner, Gehrke, Nordmeier – Makromolekulare Chemie (Springer)</p> <p>Seiffert – Physical Chemistry of Polymers: A Conceptual Introduction (DeGruyter)</p>

Module 2	Modern and industrial aspects of polymer materials					M.09.032.22_580
Mandatory or elective module	O					
Location	JGU Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Part 1: Synthesis and use of polymer materials Part 2: Physical chemistry of polymer materials	L	1 (2)	O	3	103,5 h	4,5 CP
Seminar	OS	1 (2)	O	1	34,5 h	1,5 CP
In order to complete the module, the following must be completed:						
Attendance						
Active participation	According to § 5 paragraph 3, successful giving of a lecture in the seminar.					
Course achievement(s)						
Module exam	Usually written exam (120 min) or oral exam (30 min)					
Qualification goals/learning outcomes/competencies						
<p>An in-depth look at custom manufacturing and the multi-layered structure and dynamics of polymer systems and materials is provided. The students are able to</p> <ul style="list-style-type: none"> - Describe key challenges and approaches to modern and industrial polymer synthesis, and understand current research issues of an academic nature: For example, sequence control, thermoplastic elastomers, composite materials, weak interactions in polymer science, self-assembly, responsive materials, and bioinspired materials design, - Describe the rheology of polymers in the melt and solution states methodologically, conceptually, and phenomenologically, both qualitatively and quantitatively. - Reflect the basic characteristics of the structure and dynamics of polymeric solutions, gels, glasses, and crystals. 						
Contents						
<p>Modern methods of polymer synthesis:</p> <ul style="list-style-type: none"> - Advanced composite materials, high-performance materials - Responsive and switchable materials - Biomimetic concepts in polymer science - Phase-segregated polymer systems in application, thermoplastic elastomers - Polymer nanoparticles and self-assembled nanostructures <p>Fundamentals of rheology:</p> <ul style="list-style-type: none"> - viscoelasticity - complex rheological material properties - time-temperature superposition - Rheology of polymer systems: Reptation in melt and solution, rubber elasticity of networks, dynamic glass transition. <p>Building on this: comprehensive and in each case separate treatment of the structure, dynamics and properties of polymers in the state of melts, semi-dilute solutions, gels, crystals and partial crystals glasses</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 6 CP out of 98 graded CP.					
Frequency of the offer	Winter semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Andreas Walther (JGU – FB 09)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials; M.Sc. Chemie; M.Sc. BMC					
Other remarks	Literature:					

	<p>Koltzenburg, Maskos, Nuyken – Polymere: Synthese, Eigenschaften und Anwendungen (Springer) Lechner, Gehrke, Nordmeier – Makromolekulare Chemie (Springer) Rubinstein, Colby – Polymer Physics (Oxford University Press)</p>
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Module 3	Colloids and interfaces					M.09.032.6003
Mandatory or elective module	O					
Location	MPI-P Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
a) Colloid chemistry	L	1 (2)	O	2	69 h	3
b) Physics and chemistry of interfaces	L	1 (2)	O	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	a) Usually written exam (60 min) otherwise oral exam (30 min) b) Usually written exam (60 min) otherwise oral exam (30 min)					
Qualification goals/learning outcomes/competencies						
Based on basic knowledge from macromolecular and physical chemistry, students have acquired knowledge in the field of colloid and interface research. They are able to reproduce these according to scientific standards and can transfer the concepts to analogous problems. The students are able to integrate the knowledge acquired in the lecture into the already existing knowledge and to reproduce and evaluate it in a larger context. Students know the basic concepts of interfacial science, such as interfacial tension and energy. They are aware of how the shape of liquid surfaces is described in equilibrium and the effect of curvature of liquid surfaces on vapor pressure. You know how surface tension changes in the presence of adsorbing substances. They know how to describe basic wetting phenomena quantitatively. They know how surface charges are formed in aqueous medium and know basic electrokinetic phenomena. The important surface forces are known and the students know about the relevance for the stabilization of dispersions. In addition to the theoretical concepts, they know the methods that can be used to measure the important physicochemical quantities. Different methods for the production of nanoparticles and nanocapsules are familiar. The students know possible applications of colloidal systems.						
Contents						
The lecture consists of two parts. (1) Fundamentals of Interfacial Science. Topics include liquid surfaces, thermodynamics of interfaces, charged surfaces and electric bilayers, surface forces, contact angle phenomena, solid surfaces and adsorption, modification of surfaces. (2) Colloids and nanoparticles. Topics include surfactants, emulsions, liposomes, polymersomes, foams, emulsion methods, various heterophase polymerization processes, nanoparticles and nanocapsules, and applications of nanoparticles.						
Entry requirement(s)						
Recommended prerequisite(s) for the module or for individual courses of the module	Basic knowledge of physical and macromolecular chemistry.					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 6 CP out of 98 graded CP.					
Frequency of the offer	Winter semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Hans-Jürgen Butt (MPI-P)					
Usability of the module in other study programs						
Other remarks						

Module 4	Practical course - Macromolecular Chemistry		[Module-ID]			
Mandatory or elective module	O					
Location	JGU Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Lab course Macromolecular Chemistry 2	LC	1 (2)	O	6	117 h	6
In order to complete the module, the following must be completed:						
Attendance	Lab course only					
Active participation	According to § 5 para. 3 esp. preliminary interview, test protocols					
Course achievement(s)						
Module exam						
Qualification goals/learning outcomes/competencies						
According to the previous knowledge of the students, practical experiments are selected from the following areas: Polymer synthesis experiments (step growth, chain growth): Radical polymerization, polycondensation, living/controlled polymerization, copolymerization, polymerization in heterophase, networks. Furthermore, practical experiments on typical physical properties of polymers (solubility, molecular weights, conformation in solution), determination of thermal and mechanical properties of polymers and crystallinity, supramolecular polymerization, DNA nanoscience systems, advanced analytics.						
Contents						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	ungraded					
Frequency of the offer	Every semester					
Justification of the obligation to be present	Lab course					
Module officer or person in charge of the module	Prof. Dr. Andreas Walther (JGU – FB 09)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials, M.Sc. Chemistry					
Other remarks						

Module 5	Advanced Statistical Physics					[Module-ID]
Mandatory or elective module	O					
Location	JGU Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Lecture „Advanced Statistical Physics“	L	1 (2)	O	4	138 h	6
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Oral exam (30 Min.)					
Qualification goals/learning outcomes/competencies						
Learning advanced concepts and applications of statistical physics. To learn central concepts of the physics of systems and materials whose behavior is dominated by large fluctuations, such as E.g. all fluids, many plastics, membranes, and most biomaterials, but also systems outside the natural sciences (E.g. stock exchange). The focus will be on general principles that have overarching importance, such as symmetries, cooperative processes and phase transitions, scales and scale-free, and the concept of coarsening. The concrete material examples are oriented towards the research in Mainz and come for the most part from the field of "soft matter".						
Contents						
<p>- Fundamentals of a statistical description of complex systems in equilibrium and nonequilibrium: Linear response and transport, stochastic processes, structure, correlations and scattering.</p> <p>- Model building: symmetries and conservation laws, concepts of coarsening (reduction of degrees of degrees of freedom).</p> <p>- Phase transitions, mean-field approaches, Landau theory, fluctuations and critical exponents, Scale invariance and renormalization, possibly basic concepts of statistical field theory.</p> <p>Other topics will be based on instructor preferences. Possibilities are: An in-depth treatment of nonequilibrium thermodynamics, stochastic thermodynamics. Disordered systems and glasses. Basic concepts of hydrodynamics at small Reynolds numbers. Statistical physics of complex soft materials (E.g. polymers, self-assembling systems, membranes, liquid crystals, colloidal systems, charged systems, entangled systems, biomolecules, biomaterials). Interdisciplinary applications of statistical physics (E.g. financial physics).</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 6 CP out of 98 graded CP.					
Frequency of the offer	Winter semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Friederike Schmid (JGU - FB08)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials, M. Sc. Physics					
Other remarks	<p>Literature:</p> <ul style="list-style-type: none"> • Chaikin/Lubensky: Principles of Condensed Matter Physics. • Plischke/Bergersen: Equilibrium Statistical Physics. • Landau-Lifshitz: Theoretische Physik Band I und IX. • Goldenfeld: Lectures on phase transitions and the renormalization group. • Paul/Baschnagel: Stochastic processes. From physics to finance. • Risken: The Fokker-Planck equation. • Guyon, Hulin, Petit, Mitsu: Physical Hydrodynamics. • de Gennes: Scaling Concepts in Polymer Physics. • Doi/Edwards: The Theory of Polymer Dynamics. 					

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| | <ul style="list-style-type: none">• Grosberg/Khokhlov: Statistical Mechanics of Macromolecules.• Rubinstein/Colby: Polymer Physics. |
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Module 6	Exchange Pool	[Module-ID]
<p>If the competences of module 1 have already been acquired in the previous bachelor's degree program, Module 1 is to be replaced by a module from the following pool:</p> <ul style="list-style-type: none"><li data-bbox="204 376 715 409">6.1 Physical Chemistry: Condensed Matter.<li data-bbox="204 409 587 443">6.2 Biochemistry (Biochemistry)		

Module 6.1	Condensed Matter						M.09.032.22_640
Location	JGU Mainz						
Mandatory or elective module	EM						
Creditpoints (CP) and workload	6 CP = 180 h						
Duration of module (according to study plan)	1 Semester						
Courses/ Forms of learning	Type	Regelsemester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self- study	Creditpoints	
a. Lecture	L	1 (2)	W	2 SWH	69 h	3 CP	
b. Seminar	S	1 (2)	W	2 SWH	69 h	3 CP	
In order to complete the module, the following must be completed:							
Attendance	None						
Active participation	None						
Course achievement(s)	None						
Module exam	Usually written exam (120 min.), otherwise oral exam (30 min.)						
Qualification goals/learning outcomes/competencies							
<ul style="list-style-type: none"> Students will be introduced to the physicochemical principles of condensed matter leading to an understanding of the material nature and properties of functional materials, especially at the nanometer scale. The range of suitable topics includes E.g. structure and properties of amorphous and crystalline condensed matter, structure and properties of polymers and colloids, intermolecular interactions and molecular assemblies, nanomaterials. One or more specific topics will be used to develop an in-depth understanding of a research-related condensed matter specialty that will provide a foundation for successfully completing a master's thesis in this or a related field. 							
Contents							
<ul style="list-style-type: none"> a) Lecture: Fundamentals of hard and soft condensed matter; intermolecular interactions; structure, dynamics and related characteristic properties of crystalline-hard as well as amorphous-soft matter; scattering from complex matter; electronic and magnetic ordering; relaxation dynamics; energy storage capacity and dissipation, viscoelasticity. The lecture will be offered in digital form via an e-learning platform. b) Seminar: in the accompanying seminar the contents of the digital lecture will be deepened in group work, using interactive teaching and forms of learning (here: inverted classroom and just-in-time teaching). 							
Entry requirement(s)	None						
Recommended prerequisite(s) for the module or for individual courses of the module	None						
Language(s) of instruction and language(s) of examination	English						
Weight of the module grade in the overall grade	Graded 6 out of 98 graded CP.						
Frequency of the offer	Winter semester						
Justification of the obligation to be present							
Module officer or person in charge of the module	Prof. Dr. Seiffert (JGU - FB09)						
Usability of the module in other study programs	M.Sc. Soft Matter and Materials, M. Sc, Chemie, M. Sc. Physik						
Other remarks	The module consists of two sections, one on hard matter and one on soft matter. The first is taught by Prof. M. Kläui (FB08), the second is taught by Prof. S. Seiffert (FB09).						

Module 6.2	Biochemistry					[Module-ID]
Location	JGU Mainz					
Mandatory or elective module	EM					
Creditpoints (CP) und Arbeitsaufwand (Workload)	6 = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
a) Lecture: Methods of Biochemistry	L	1 (2)	EM	2	69 h	3
b) Seminar to a)	S	1 (2)	EM	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation	according to § 5 para.3 b) The student elaborates and presents a given, current biochemical topic and engages in discussion on the topic.					
Course achievement(s)						
Module exam	Usually written examination (120 min.), otherwise oral examination (30 min.) on a) and b)					
Qualification goals/learning outcomes/competencies						
<p>The students are able to,</p> <ul style="list-style-type: none"> - to assign suitable methods to problems from the fields of protein and membrane biochemistry. - to analyze typical data of these methods. - to evaluate the results of bioanalytical experiments. - to understand the limitations of the respective methods based on their physical principles. - to assess the applicability of the methods to new problems. - to critically evaluate the significance of the respective experiments in publications in international journals. - to acquire independently an in-depth knowledge of current topics in biochemical analysis and related fields. - to analyze and evaluate scientific literature from a scientific point of view. <p>independently prepare, present and defend a scientific paper on a (given) current biochemical-analytical topic.</p>						
Contents						
<ul style="list-style-type: none"> - Methods of protein expression - Principles and methods of protein isolation and identification - Immune techniques in biochemistry - Spectroscopic methods in biochemistry - Methods of protein structure analysis - protein stability - Protein dynamics - Chemical modification of proteins - Biochemistry and biophysics of lipid membranes - Membrane proteins - In vivo and in vitro studies of protein-protein and protein-lipid interactions - Microscopic techniques <p>Expression and protein characterization in vivo</p>						
Entry requirement(s)	Basic lecture "Biochemistry" or comparable performance.					
Recommended prerequisite(s) for the module or for individual courses of the module	Events with cell biological and physiological content					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 6 out of 98 graded CP.					
Frequency of the offer	1x yearly, in Winter semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Dirk Schneider (JGU - FB09)					

Usability of the module in other study programs	M.Sc. Soft Matter and Materials, B. Sc. Molecular Biotechnology, M. Sc. Chemistry
Other remarks	A basic understanding of chemical and biological principles, in particular the structure and function of proteins and membranes, is required.

Module 7	Physics of soft matter I					[Module-ID]05-61-3101
Mandatory or elective module	O					
Location	TU Darmstadt					
Creditpoints (CP) and workload	5 CP = 150 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
a) Physics of Soft Matter I	L	2 (1)	O	3	88,5 h	4
b) Exercises	E	2 (1)	O	1	19,5 h	1
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Usually oral exam (30 min), otherwise written exam (120 min)					
Qualification goals/learning outcomes/competencies						
<p>The students</p> <ul style="list-style-type: none"> - have basic and advanced knowledge of the above topics - have skills in model building and in the formulation of mathematical-physical approaches and are able to apply and communicate these to tasks in the above-mentioned areas, - are competent in working independently on problems in the above-mentioned areas and are able to estimate accuracies of observation and analysis, - are able to embed the technical content in the social context, to critically assess the consequences and to act ethically and responsibly accordingly. 						
Contents						
<p>Phase transitions Interaction and structure in colloids and polymers Brownian motion, dynamic scattering experiments Dynamics in colloids and polymer melts Self-organization of complex phases</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 5 out of 98 graded CP.					
Frequency of the offer	In Summer semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Michael Vogel (TUDa - Fachbereich Physik)					
Usability of the module in other study programs	MSc. Soft Matter and Materials (compulsory course)					
Other remarks	Literature: Will be specified by lecturer Examples: Strobl: The Physics of Polymers Jones: Soft Condensed Matter Hamley: Introduction to Soft Matter Evans und Wennerstroem: Colloidal Domain					

Module 8	Physik der weichen Materie II <i>Physics of soft matter II</i>					[Module-ID] 05-61-3102
Mandatory or elective module	O					
Location	TU Darmstadt					
Creditpoints (CP) and workload	5 CP = 150 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
a) Physics of Soft Matter II	L	2 (1)	O	3	88,5 h	4
b) Exercises	E	2 (1)	O	1	19,5 h	1
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Usually oral exam (30 min), otherwise written exam (120 min)					
Qualification goals/learning outcomes/competencies						
The students - have basic and advanced knowledge of the above topics - have skills in model building and in the formulation of mathematical-physical approaches and are able to apply and communicate these to tasks in the above-mentioned areas, - are competent in working independently on problems in the above-mentioned areas and are able to estimate accuracies of observation and analysis, - are able to embed the technical content in the social context, to critically assess the consequences and to act ethically and responsibly accordingly.						
Contents						
Liquid crystals, wetting, adsorption of amphiphiles and polymers at interfaces, biological membranes, protein folding and stabilization, Kirkwood-Buff theory, confinement effects, current topics in soft matter physics.						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 5 out of 98 graded CP.					
Frequency of the offer	In summer semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Emanuel Schneck (TUDa - Department of Physics)					
Usability of the module in other study programs	MSc. Soft Matter and Materials (compulsory course)					
Other remarks	Literature: Will be given by lecturer Examples: Strobl: The Physics of Polymers Jones: Soft Condensed Matter Hamley: Introduction to Soft Matter Evans und Wennerstroem: Colloidal Domain					

Module 9	Practical Work: Physics Experiments & Theory					[Module-ID] 05-61-3103
Mandatory or elective module	O					
Location	TU Darmstadt					
Creditpoints (CP) and workload	10 CP = 300 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Practical Work Physics: Experiments & Theory	LC	2 (1)	O	7	226,5 h	10
In order to complete the module, the following must be completed:						
Attendance	Lab course only					
Active participation	According to § 5 para. 3 esp. preliminary interview, test protocols					
Course achievement(s)						
Module exam						
Qualification goals/learning outcomes/competencies						
<p>The students</p> <ul style="list-style-type: none"> -know and know in-depth techniques in experimentation or simulation, scientific protocol management and are familiar with more complex procedures of data analysis; they acquire in-depth knowledge and measurement and simulation applications in the field of soft matter -possess skills in the execution of experiments and their analysis, including the critical assessment of experimental uncertainties, as well as basic methodological knowledge for writing a scientific paper, -are competent to work independently in a limited subject area with selected literature, to critically evaluate the extracted results and to present their knowledge both in the oral preliminary discussion and in the written elaboration; the students are proficient in elementary forms of scientific discussion. 						
Contents						
6 Elective experiments on soft matter experiments and simulations using modern techniques: Liquids, polymers and amphiphiles, and glasses in bulk phase and at interfaces.						
Entry requirement(s)			None			
Recommended prerequisite(s) for the module or for individual courses of the module			None			
Language(s) of instruction and language(s) of examination			English			
Weight of the module grade in the overall grade			ungraded			
Frequency of the offer			Every semester			
Justification of the obligation to be present						
Module officer or person in charge of the module			Prof. Dr. Regine von Klitzing (TUDa - Department of Physics)			
Usability of the module in other study programs			M.Sc. Soft Matter and Materials			
Other remarks			Literature: Will be specified by instructor(s) Examples: Strobl: The Physics of Polymers Jones: Soft Condensed Matter Hamley: Introduction to Soft Matter			

Module 10	Advanced Polymer Chemistry and Polymer Nanotechnology					[Module-ID]
Location	TU Darmstadt					
Mandatory or elective module	O					
Creditpoints (CP) and workload	4 CP = 120 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Advanced Polymer Chemistry and Polymer Nanotechnology	L	2 (1)	O	2	60 h	3
Exercise	E	2 (1)	O	1	15 h	1
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Written exam (120 min)					
Qualification goals/learning outcomes/competencies						
<p>Students will develop an in-depth understanding of the advanced synthetic capabilities of polymer chemistry and the methods used to experimentally demonstrate the architecture and structure of polymers. Students will also be able to correlate important molecular parameters of chain molecules with their properties and the nanostructures they form. In addition, students will learn how to tailor, tune, and utilize polymer self-assembly for applications such as polymer-based drug delivery, nanoscale reaction compartments, and the formation of nanostructured materials.</p> <p>As part of the tutorial, students will practice their scientific and presentation skills by researching a topic related to the lecture and presenting it in the form of a poster presentation.</p>						
Contents						
<p>The aim of this lecture is to provide in-depth knowledge in modern synthesis, molecular characterization and nanotechnological applications of macromolecular substances. First, the chain and step growth reactions presented in the Organic Polymer Chemistry lecture will be discussed in mechanistic and kinetic detail. This includes advanced polymerization techniques such as enzyme-catalyzed polymerization. Based on this, current research and development trends in the various polymerization processes are presented and discussed mechanistically and kinetically. The third part of the lecture is devoted to more complex polymer architectures, their targeted preparation, their self-assembly into nanostructured materials, and their application as building blocks for nanotechnology - ranging from block copolymers, through defined branched homopolymers, to hyperbranched polymers and dendrimers.</p> <p>In the associated tutorial, students conduct a literature review on a current topic in advanced polymer chemistry and polymer nanotechnology, prepare a poster, and present it to their peers.</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 4 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Nico Bruns (TUDa - Department of Chemistry)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks						

Module 11	Compulsory modules	[Module-ID]
<p>Two of the following modules must be chosen:</p> <ol style="list-style-type: none"> 1. polymers on surfaces 2. chemical technology of pulp and paper 3. sustainable polymer chemistry 4. technical aspects of macromolecular chemistry 		
<p>In order to complete the module, the following must be completed:</p>		
Attendance		
Active participation		
Course achievement(s)		
Module exam	Written exam (120 min), consisting of two partial exams, otherwise oral exam (60 min)	
<p>Qualification goals/learning outcomes/competencies</p>		

Module 11.1	Polymers at Interfaces					[Module-ID]
Location	TU Darmstadt					
Mandatory or elective module	EM					
Creditpoints (CP) and workload	3 CP = 90 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Polymers at Interfaces	L	2 (1)	O	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	See main modules11					
Qualification goals/learning outcomes/competencies						
Polymers at interfaces play an important role in many applications, from functional surfaces, drug delivery systems, particle stabilization, and membranes, to name a few. In this lecture, students will gain insight into various ways to design the chemistry and physics of surfaces in such systems using thin polymer films. In a second part, students will gain insight into modern methods for characterizing such interfaces, which is often a challenge in itself, E.g. due to small amounts of material. With this knowledge you will be able to address research questions and problems in the application of interfaces in the field of medicine, separation or sensing.						
Contents						
The lecture gives an introduction to the functionalization of interfaces with polymers, the interfacial specific behavior and their characterization. This is E.g. relevant for the design of functional water repellent surfaces or in the field of membranes to enable more efficient separation or sensing. Specifically, the following topics will be addressed: Polymer functionalization: synthesis of thin polymer layers by grafting from, grafting onto, grafting by different polymerization processes; adsorption of polymers on surfaces; self-assembly of molecules on surfaces; chemical bonding of thin polymer films; polymer brushes; layer-by-layer assembly; polymer networks on surfaces; lithography at interfaces. Polymer behavior on surfaces: swelling of thin polymer films; switchable surfaces by external stimuli; Characterization of polymers at surfaces: Introduction to forces at interfaces, electrical double layer; structural characterization (XRR, AFM, SEM); chemical characterization (IR, UV-VIS, wetting, XPS); optical characterization (ellipsometry, plasmon, waveguide-mode spectroscopy, STED); electrochemical characterization (cyclic voltammetry.)						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 3 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. A. Andrieu-Brunsen (TUDa - Department of Chemistry)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks						

Module 11.2	Chemical Technology of Pulp and Paper		[Module-ID]			
Location	TU Darmstadt					
Mandatory or elective module	EM					
Creditpoints (CP) and workload	3 CP = 90 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Chemical Technology of Pulp and Paper	L	2 (1)	O	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	See main module 11					
Qualification goals/learning outcomes/competencies						
The paper industry is a special key industry that uses a special technology in which colloid chemical and macromolecular processes play the dominant role. In this lecture, students will learn about papermaking from a chemical perspective. On the way from the diluted pulp suspension to the finished paper, the necessities, and modes of action of various chemical auxiliaries are discussed. Students gain comprehensive knowledge in the industrially important area of polymer additives for the paper industry.						
Contents						
Chapters in this lecture include: - Polymers as process and functional auxiliaries in papermaking, - Polymers flocculants, dewatering agents, and fixatives, - Types and functions of fillers, - Polymers as dry and wet strength additives in paper, - Dyes and biocides, - Chemistry of paper coating and other finishes of paper, - Treatment of pollutants and effluents, - Chemical and physicochemical analysis of paper						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	The winter semester lecture "Chemical Technology of Paper and Bio-based Fibers" is recommended but not mandatory.					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 3 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Markus Biesalski					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks						

Module 11.3	Sustainable Polymer Chemistry					[Module-ID]
Mandatory or elective module	EM					
Location	TU Darmstadt					
Creditpoints (CP) and workload	3 CP = 90 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Sustainable Polymer Chemistry	L	2 (1)	0	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	See main module 11					
Qualification goals/learning outcomes/competencies						
Students develop an in-depth understanding of the environmental concerns of plastics and the potential of polymers for a sustainable future. The course is firmly rooted in the chemistry and technology of polymers. This provides students with the theoretical expertise to develop new concepts for sustainable polymer chemistry and to engage as experts in the societal discourse around polymers and sustainability.						
Contents						
The aim of this lecture is, on the one hand, to provide in-depth knowledge of the environmental problems associated with plastics and polymers, such as microplastic pollution and marine litter. On the other hand, the lecture will cover the many contributions and opportunities that polymer chemistry offers to solve environmental problems. For example, polymers contribute significantly to the reduction of CO ₂ emissions in the form of lightweight materials for the automotive and aerospace industries or in the form of high performance insulation materials. In addition, the lecture will detail the synthesis and manufacturing routes for sustainable polymers, including enzymatic polymerizations, as well as bio-based and biodegradable polymers. Finally, the end-of-life cycle of polymers is discussed, including mechanical and chemical recycling strategies, biodegradability, and circular economy.						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 3 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. Nico Bruns (TUDa - Department of Chemistry)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks						

Module 11.4	Engineering Aspects in Macromolecular Chemistry					[Module-ID]
Mandatory or elective module	EM					
Location	TU Darmstadt					
Creditpoints (CP) and workload	3 CP = 90 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Engineering Aspects in Macromolecular Chemistry	L	2 (1)	O	2	69 h	3
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	See main module 11					
Qualification goals/learning outcomes/competencies						
Students will gain an overview of fundamentals and current work in the field of polymer reaction engineering. This includes methods of kinetic investigations, modeling techniques for describing polymerizations on a laboratory and industrial scale, and the application of modeling polymerization reactions in technical practice. As a result, they have the prerequisites for successful employment in companies involved in the design or operation of commercial polymer plants. The often international context in which these companies operate and the fact that in the Anglo-Saxon world these fields of work are taught with the independent subject Polymer Reaction Engineering must be taken into account. Students will be able to describe polymerization processes in models. This includes both laboratory-scale experiments, which focus on the control of the polymer microstructure by the reaction conditions, and the description of technical reactors. Here, students have learned the basic tools, modeling techniques and methodology of application and are able to apply them.						
Contents						
Polymerization kinetics, methods for determining kinetic coefficients, modeling of polymerization at laboratory and pilot plant scale. Application of modeling in technical practice.						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 3 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Prof. Dr. M. Busch (TUDa - Department of Chemistry)					
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks						

Module 12	Advanced Soft Matter and Materials		[Module-ID]			
Mandatory or elective module	O					
Location	TU Darmstadt und/oder JGU Mainz					
Creditpoints (CP) and workload	6 CP = 180 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
- one module(à 6 CP) - several modules - one module(à 5 CP) and lectures		3	O	4	138 h	6
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	according to the selected events					
Qualification goals/learning outcomes/competencies						
<p>The students</p> <ul style="list-style-type: none"> - have basic and advanced knowledge of the above topics - have skills in model building and in the formulation of mathematical-physical approaches and are able to apply and communicate these to tasks in the above-mentioned areas, - are competent in working independently on problems in the above-mentioned areas and are able to estimate accuracies of observation and analysis, - are able to embed the technical content in the social context, to critically assess the consequences and to act ethically and responsibly accordingly. <p>If colloquium lectures have been attended, students are</p> <ul style="list-style-type: none"> - are able to present technical contexts and to summarize current research results in a trenchant way in writing - able to embed the professional contents in the social context, to critically assess the consequences and to act ethically and responsibly accordingly. 						
Contents						
<p>Students choose modules with a total of at least 6 credit points on in-depth topics on Soft Matter and Materials from the catalog of events of the participating institutions. The courses available for selection are updated and announced every year.</p> <p>Instead of a module, the attendance of colloquium lectures can be credited. The lecture series from which lectures may be selected will be updated and announced each semester. Lecture series, can be E.g. institute colloquia or lectures in ongoing GRKs or SFBs. The list of lectures to be heard must be agreed upon in advance with one of the course coordinators in Mainz or Darmstadt. Each lecture must be summarized briefly (approx. 1 page). If 10 summaries are submitted, 1 credit point will be credited.</p>						
Entry requirement(s)	None					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	ungraded					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module						
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks	Literature: is specified by lecturer					

Module 13	Research Module	
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The research module consists of

either

a) two research modules of 12 CP each

or

b) one research module à 24 CP

Module 13 a.1	Research Module 1					[Module-ID] 05-21-2780
Location	TU Darmstadt oder JGU Mainz oder MPI-P Mainz					
Mandatory or elective module	EM					
Creditpoints (CP) and workload	12 CP = 360 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Research Module 1	LC	3	0	8	276 h	12
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Presentation (15 min.) and written report					
Qualification goals/learning outcomes/competencies						
The students know the scientific methodology in research in the subject area of the working group. They are able to deal with problems of the current state of research in a scientifically appropriate manner and to present and discuss their research results orally and in writing according to recognized standards of the subject. They fit into the research group, which is usually composed of staff members with distinctly different cultural backgrounds. They are able to work constructively in an internationally staffed team, taking gender and diversity aspects into account.						
Contents						
Under the supervision of members of the working group, the students work on a current project from the research topics of the supervising working group. This includes the research of the scientific background, the practical implementation of the project, the presentation and critical discussion of the results in the research seminar of the working group, usually in English, and the written documentation of the project.						
Entry requirement(s)	45 CP from the basic phase must have been achieved. Research Module 1 must take place in a different working group than Research Module 2.					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 12 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module						
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks	Literature: Will be specified by supervisor(s) Comment: Research module 1 and 2 together replace Research module 3.					

Module 13 a.2	Research Module 2					[Module-ID] 05-21-2780
Location	TU Darmstadt oder JGU Mainz oder MPI-P Mainz					
Mandatory or elective module	EM					
Creditpoints (CP) and workload	12 CP = 360 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Research Module 2	LC	3	O	8	276 h	12
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Presentation (15 min.) and written report					
Qualification goals/learning outcomes/competencies						
The students know the scientific methodology in research in the subject area of the working group. They are able to deal with problems of the current state of research in a scientifically appropriate manner and to present and discuss their research results orally and in writing according to recognized standards of the subject. They fit into the research group, which is usually composed of staff members with distinctly different cultural backgrounds. They are able to work constructively in an internationally staffed team, taking gender and diversity aspects into account.						
Contents						
Under the supervision of members of the working group, the students work on a current project from the research topics of the supervising working group. This includes the research of the scientific background, the practical implementation of the project, the presentation and critical discussion of the results in the research seminar of the working group, usually in English, and the written documentation of the project.						
Entry requirement(s)	45 CP from the basic phase must have been achieved. Research Module 2 must take place in a different working group than Research Module 1.					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 12 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module						
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks	Literature: Will be specified by supervisor(s) Comment: Research module1 and 2 together replace Research module 3.					

Module 13 b	Research Module 3					[Module-ID] 05-21-2780
Location	TU Darmstadt oder JGU Mainz oder MPI-P (Mainz)					
Mandatory or elective module	EM					
Creditpoints (CP) and workload	24 CP = 720 h					
Duration of module (according to study plan)	1 Semester					
Courses/ Forms of learning	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Creditpoints
Research Module 1	LC	3	O	16	552 h	24
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)						
Module exam	Interim written report and interim presentation (10 min.) (30% of the final grade) and final written report and final presentation (20 min.) (70% of the final grade).					
Qualification goals/learning outcomes/competencies						
The students know the scientific methodology in research in the subject area of the working group. They are able to deal with problems of the current state of research in a scientifically appropriate manner and to present and discuss their research results orally and in writing according to recognized standards of the subject. They fit into the research group, which is usually composed of staff members with distinctly different cultural backgrounds. They are able to work constructively in an internationally staffed team, taking gender and diversity aspects into account.						
Contents						
Under the supervision of members of the working group, the students work on a current project from the research topics of the supervising working group. This includes the research of the scientific background, the practical implementation of the project, the presentation and critical discussion of the results in the research seminar of the working group, usually in English, and the written documentation of the project.						
Entry requirement(s)	45 CP from the basic phase must have been achieved.					
Recommended prerequisite(s) for the module or for individual courses of the module	None					
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 24 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module						
Usability of the module in other study programs	M.Sc. Soft Matter and Materials					
Other remarks	Literature: Will be specified by supervisor(s) Comment: Research module1 and 2 together replace Research module 3.					

Finale module	Master Thesis					A.09.032.6014
Location	JGU Mainz oder MPI-P Mainz oder TU Darmstadt					
Mandatory or elective module	O					
Creditpoints (CP) and workload	30 CP = 900 h					
Duration of module (according to study plan)	1 Semester					
	Type	Regular semester at beginning of study WS (SS)	Degree of obligation	Contact hours (SWH)	Self-study	Leistungs-punkte
Master Thesis		4	O			30
In order to complete the module, the following must be completed:						
Attendance						
Active participation						
Course achievement(s)	Talk (30 min)					
Final exams	Master Thesis					
Qualification goals/learning outcomes/competencies						
The students are able to work scientifically on a topic in the special field of "Soft Matter and Materials". They are able to introduce this topic in the form of a scientific paper (master thesis), to describe and document their results and to interpret and discuss them in the light of the relevant literature. They are also able to present and defend their master's thesis as a scientific paper, answering questions on the topic as well as on peripheral topics.						
Contents						
Master thesis: writing of a scientific paper on the topic, consisting of the following parts: Abstract (max. 1 page), introduction including objectives, material & methods as well as results, discussion, bibliography; an appendix may be added to document further primary data. Oral examination: Presentation of the results as a lecture (30 min) and discussion.						
Entry requirement(s)	According to examination regulations					
Recommended prerequisite(s) for the module or for individual courses of the module						
Language(s) of instruction and language(s) of examination	English					
Weight of the module grade in the overall grade	Graded 30 out of 98 graded CP.					
Frequency of the offer	Every semester					
Justification of the obligation to be present						
Module officer or person in charge of the module	Working group leaders involved in the study program					
Usability of the module in other study programs						
Other remarks						