Module Description

MSc Geoinformatics

(Institute for Geoinformatics, University of Muenster)

MSc Geoinformatics	Credit Points	Term	Weight for the final grade
1 Fundamentals of Geographic Information Science	5	1 or 2	5/120
2A Interoperability A	10	1+2	10/120
2B Interoperability B	10	1+2	10/120
3 Analysis of Spatio-temporal Data	5	1 or 2	5/120
4 Location Based Services	5	1 or 2	5/120
5 Geoinformation in Society	5	1 or 2	5/120
6 Advanced Topics in Geographic Information Science	10	1+2	10/120
7 Computer Science	10	1+2	10/120
8 Interdisciplinary Aspects of Geographic Information Science	10	1+2	10/120
9 External Studies	30	3	24/120
10 External Project in Industry or Government	30	3	24/120
11 Master Thesis	30	4	36/120
Contents	**Credit Points**	**Percentage**	
Geoinformatics	40	33,3%	
Computer Science	10	8,3%	
Interdisciplinary Aspects of Geographic Information Science	10	8,3%	
External Semester	30	25%	
Master Thesis	30	25%	
Total	**120**	**100%**	

- 2A Interoperability A: This module is compulsory unless students have completed equivalent courses during their BSc studies.

- 2B Interoperability B: This module is compulsory if students have passed courses equivalent to those in module „2A Interoperability A" during their BSc studies.

- Either module „External Studies" or „External Project in Industry or Government" is to be completed.

Website: www.master-geoinformatics.info/

Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Fundamentals of Geographic Information Science
Program of studies:	*Master of Science Geoinformatics*

1	**Module no.:** 1	**Status:** [x] Compulsory [ ] Optional

2	**Rotation:** [ ] each term [ ] WS [x] SS	**Duration:** [x] 1 sem. [ ] 2 sem.	**Term:** 2. when starting in WS; 1. when starting in SS	**CP:** 5	**Workload (h):** 150h

3

Module structure

No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
1.	S	Introduction to Geographic Information Science	[x] P [ ] WP	2	30h (2 SWS)	30h
2.	S	Advanced Research Methods and Skills	[x] P [ ] WP	3	30h (2 SWS)	60h

4

Contents:

The module provides an overview of the areas covered by Geoinformatics, and the scientific methodological basis of Geoinformatics as an information science. The course "Introduction to Geographic Information Science" gives an introduction to the scientific grounds of and interdisciplinarity of Geoinformatics. "Advanced Research Methods and Skills" provides methods for advanced scientific activity, including literature research, presentation techniques, writing, reviewing and criticizing scientific publications and texts.

5

Qualifications:

Students are aware of the theoretical concepts and scientific questions behind the technologies of Geoinformatics. They have an overview of the most important methods in Geoinformatics, current research topics and results, and they can relate this to other, nearby disciplines. Their scientific skills include the formulation of research questions, the efficient handling of scientific literature, writing proposals and planning scientific activity, reviewing, as well as presentation and communication skills in a scientific setting.

6

Optional courses within the module:
None

7

Type of module examination:

[x] Final module exam   [ ] Module exam   [ ] Partial module exams

8

Examination relevant performances:

Type	Scope	Weight for the module grade %
Written exam	60 minutes	100%

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9	**Academic activities:**	
	Type, course	Scope
	Course 2: „Advanced Research Methods and Skills": Written essay with prior oral presentation	3-6 pages, 15 minutes

10	**Approval of credit points:**
	The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:**
	5/120

12	**Module specific requirements:**
	None

13	**Attendance:**
	Students may be absent at a maximum of two sessions of seminars; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other and since they are also aimed at improving soft skills such as communication competence; such skills cannot be acquired if students are not present.

14	**Application to other programs of studies:**
	None

15	**Module responsible:**	**Faculty:**
	Prof. Dr. Edzer Pebesma	Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Interoperability A
Program of studies:	*Master of Science Geoinformatics*

1	**Module no.:** 2 A	**Status:**	[ ] Compulsory [x] Optional

2	**Rotation:** [x] each [ ] WS [ ] SS	**Duration:**	[ ] 1 Sem. [x] 2 Sem.	**Term:** 1. and 2.	**CP:** 10	**Workload (h):** 300h

Module structure

3	No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
	1.	L+E	Reference Systems for Geoinformation	[x] P [ ] WP	5	60h (4 SWS)	90h
	2.	L+E	Spatial Information Infrastructures	[x] P [ ] WP	5	60h (4 SWS)	90h

4	**Contents:** The module provides the theories and concepts underlying modern distributed architectures of geoinformatics, including their methodological and technical requirements. The course on "Reference Systems for Geoinformation" introduces theoretically and practically the foundations of referencing geo-referenced information: geodetic datum, projection systems, coordinate transformations, geoid, height systems, time systems, ontologies, semantic translation. The course on "Spatial Information Infrastructures" conveys a comprehensive understanding of the goals, concepts, technologies, and processes in the development and use of modern, socio-technical infrastructures for the distributed provision and use of geo-referenced information. It covers classical approaches for regional and transnational geodata infrastructures as well as current trends and developments in Geoinformatics and IT markets. The exercises practice the contents of the lecture through implementations of components and applications of geoinformation infrastructures. They involve tasks that also need to be solved outside the contact hours for the groups.

5	**Qualifications:** Students can describe geoinformation using analytical and logical methods, in order to integrate data and services from heterogeneous sources. They are able to assess the current status and trends in the development of spatial information infrastructures. They know the relevant standards and are able to design interoperable services and applications using database and web technologies and deploy them as components of information infrastructures.

6	**Optional courses within the module:** None

7	**Type of module examination:** [ ] Final module exam [ ] Module exam [x] Partial module exams

Examination relevant performances:

8	Type, course	Scope	Weight for module grade %
	Course no.1 „Reference Systems for Geoinformation": Written exam	30 minutes	50%

	Course no. 2 „Spatial Information Infrastructures": Written exam	90 minutes	50%

9	**Academic activities:**	
	Type, course	Scope
	Course no. 1 „Reference Systems for Geoinformation": Regular exercises	2-5 pages each
	Course no. 2 „Spatial Information Infrastructures": Regular exercises	2-5 pages each

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 10/120

12	**Module specific requirements:** None

13	**Attendance:** Students may be absent at a maximum of two sessions of exercise courses; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other, and deepen the knowledge presented in the lecture. Furthermore, students discuss and cooperatively evaluate solutions to problems in interoperability.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Werner Kuhn	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:** Module 2A is compulsory unless students have completed equivalent courses during their BSc studies.

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Interoperability B
Program of studies:	*Master of Science Geoinformatics*

1	Module no.: 2 B	Status: [ ] Compulsory [x] Optional

2	Rotation: [x] each [ ] WS [ ] SS	Duration: [ ] 1 sem. [x] 2 sem.	Term: 1. and 2.	CP: 10	Workload (h): 300h

Module structure:

No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
1.	L/E/S	Selected Topics in Geographic Information Science	[ ] P [x] WP	5	60h (4 SWS)	90h
2.	P	Project Selected Topics in Geographic Information Science	[ ] P [x] WP	5	30h (2 SWS)	120h
3.	P	Project in Interoperability	[x] P [ ] WP	5	30h (2 SWS)	120h

(Row 3 of table labelled section **3**)

4

Contents:
The module deepens the formal and mathematical concepts to describe and solve integration and interoperability problems in modern distributed geoinformation architectures. Courses chosen as selected topics and projects must have significant mathematical, formal, and/or technical components. The project involves teamwork to solve specific interoperability and integration problems analytically, conceptually, and through technical implementation.

5

Qualifications:
Students know the approaches from mathematics, logic, and computer science to formally specify data, services, and concepts, as far as they are applied in geoinformatics (ontologies, API's, data and service catalogues, etc.). They are able to describe geoinformation using analytical and logical methods, in order to solve integration and interoperability problems in geoinformation infrastructures. They can discover, use, and offer geoinformation in the internet and they can combine such information from multiple sources into new information products.

6

Optional courses within the module:
Possible combinations within the module:
    either a) course no. 1 and no. 3
    or b) courses no. 2 and no. 3

7

Type of module examination:
[ ] Final module exam   [ ] Module exam   [x] Partial module exams

8

Examination relevant performances:

Type, course	Scope	Weight for the module grade %
Course no. 1 „Selected Topics Interoperability in Geographic Information Science": Written exam, report or presentation. The teacher defines the type of examination at the start of the course.	60 minutes, 8-12 pages, 20 minutes	50%

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| | Course no. 2 „Project Selected Topics in Geographic Information Science": Project report including software demonstration | 5-10 pages 15 minutes | 50% |
| | Course no. 3 „Project in Interoperability": Project report including software demonstration | 5-10 pages 15 minutes | 50% |

	Academic activities:	
9	Type, course	Scope
	Courses no. 1 and 2: Depending on the course contents and type, the activities per course can, for example, consist of presentations or reports. The teacher defines the type of activity at the start oft he course.	

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 10/120

12	**Module specific requirements:** None

13	**Attendance:** In seminars, projects, and exercise courses, students can miss a maximum oft two classes to still be admitted to the exam. The presence is necessary, as seminars build on previous classes and serve to build presentation and discourse skills that cannot be learned independently. In exercises, groups jointly work on interoperability problems and discuss them. In the Interoperability Project, students learn how to analyse requirements and implement solutions in a team.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Werner Kuhn	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:** Taking module 2B is mandatory for students who have taken courses equivalent to those in module 2A during their Bachelor studies.

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Analysis of Spatio-temporal Data
Program of studies:	*Master of Science Geoinformatics*

1	**Module no.:** 3	**Status:**	[x] Compulsory	[ ] Optional

2	**Rotation:** [ ] each [x] WS [ ] SS	**Duration:** [x] 1 sem. [ ] 2 sem.	**Term:** 1. when starting in SS 2. when starting in WS	**CP:** 5	**Workload (h):** 150h

3	**Module structure:**					

No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
1.	S	Seminar Analysis of Spatio-temporal Data	[x] P [ ] WP	3	30h (2 SWS)	60h
2.	E	Exercise Course Analysis of Spatio-temporal Data	[x] P [ ] WP	2	30h (2 SWS)	30h

4	**Contents:** The seminar „Analysis of Spatio-temporal Data" teaches advanced analysis methods for spatio-temporal data such as tracking data, time series of satellite images, and/or data from monitoring networks with fixed or mobile sensors. The advanced analysis methods include selected stochastic, deterministic and combined modeling approaches, as well as methods for visualizing spatio-temporal data. Special emphasis lies on the identification of error sources and the quantification of uncertainties in analysis processes (knowledge, data, model, visualization). Further, in the seminar formal and technical aspects of implementation will be included, such as the efficiency of algorithms, dealing with large data sizes and/or numerical stability. In the exercises, participants deal with example data sets and compare different analysis methods. They use state-of-the-art software libraries, in order to implement reproducible procedures. In addition, the participants evaluate each other's implementations from a technical perspective. Seminar and exercises are coordinated, and thematic emphasis is adopted according to recent developments. Both need to be accomplished in the same semester.

5	**Qualifications:** Students are able to analyze spatio-temporal data such as satellite images or sensor data. From problems they can formulate research questions, select appropriate analysis methods and evaluate research results. They know how to handle uncertainties in the analysis of spatio-temporal data, and can evaluate and communicate various sources of uncertainties in a quantitative way. By implementing analysis procedures, participants can apply scientific computation to analyze spatio-temporal data. They improve their competence to reproduce scientific results in a transparent way.

6	**Optional courses within the module:** None

7	**Type of module examination:** [x] Final module exam [ ] Module exam [ ] Partial module exams

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8	**Examination relevant performances:**		
	Type	Scope	Weight for the module grade %
	Written essay with prior presentation	8-12 pages, 15 minutes	100%

9	**Academic activities:**	
	Type, course	Scope
	Course no. 2 „Exercise Course Analysis of Spatio-temporal Data": regular exercises	2 to 5 pages each
10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.	

11	**Weight of the module grade for the final grade:** 5/120

12	**Module specific requirements:** None

13	**Attendance:** Students may be absent at a maximum of two sessions of the seminar or the exercise course; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other and since they are also aimed at improving soft skills such as communication competence; such skills cannot be acquired if students are not present. In the context of the exercises, students work in groups to cooperatively solve problems in spatio-temporal data analysis.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Edzer Pebesma	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Location Based Services
Program of studies:	*Master of Science Geoinformatics*

1	**Number:** 4		**Status:**	[x] Compulsory	[ ] Optional

2	**Rotation:**	[ ] each [ ] WS [x] SS	**Duration:**	[x] 1 sem. [ ] 2 sem.	**Term:** 1. when starting in SS; 2. when starting in WS	**CP:** 5	**Workload (h):** 150h

Module structure:

3	No.	Type	Course	Status		CP	Presence (h + SWS)	Self-studies (h)
	1.	L	Lecture Location Based Services	[x] P	[ ] WP	2	30h (2 SWS)	30h
	2.	E	Exercise Course Location Based Services	[x] P	[ ] WP	3	30h (2 SWS)	60h

4	**Contents:** Location-based services are a fast moving area of research in mobile systems. Information about the location of a person and their environment facilitate the provision of new types of services, which adapt to the context of use. The lecture "Location Based Services" introduces students to several key topics in this area of research, e.g. techniques for determining the position of a user, application areas, contextual factors and implications for the interaction between users and between a user and the service. The practical part "Exercise Course Location Based Services" complements the lecture, and enables students to delve deeper into the topics covered in the lecture by conducting independent research of academic sources and by participating in discussions and group work. Lecture and practical are synchronised on a methodological and topical level, and are updated every year to reflect new developments. Consequently, both courses have to be taken in the same semester.

5	**Qualifications:** Students are familiar with key theoretical concepts of location-based services and relevant technical methods (positioning, algorithms for selecting relevant information based on location). They independently extend this knowledge using academic sources and apply it to design and develop mobile applications that adapt to the location and context of their users. Participants are familiar with current research in location based systems and with the basic concepts of user studies aimed at improving usability.

6	**Optional courses within the module:** None

7	**Type of module examination:** [x] Final module exam (MAP) [ ] Module exam (MP) [ ] Partial module exam (MTP)

8	**Examination relevant performances:** Type, course	Scope	Weight for module grade %

	Written essay	8-12 pages	100%

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9	**Academic activities:**	
	Type, course	Scope
	Course no. 2 „Exercise Course Location Based Services": Preparation and active participation in discussions and group work	60h
10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.	

11	**Weight of the module grade for the final grade:** 5/120

12	**Module specific requirements:** None

13	**Attendance:** Participation in the lecture is strongly recommended. Presence during the exercise course (no. 2) is compulsory. If students miss more than two exercise classes they will not be admitted for examination. Presence is compulsory because the courses build upon each other, and deepen knowledge in further topics in a self-organized way. Students may be absent at a maximum of two sessions of the exercise course; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other. In the context of the exercises, students work in groups to cooperatively solve problems for location based services.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Christian Kray	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**

Website: www.master-geoinformatics.info/

Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Geoinformation in Society
Program of studies:	*Master of Science Geoinformatics*

1	**Number:** 5	**Status:** [x] Compulsory	[ ] Optional

2	**Rotation:**	[ ] each [x] WS [ ] SS	**Duration:**	[x] 1 Sem. [ ] 2 Sem.	**Term:** 1. when starting in WS; 2. when starting in SS	**CP:** 5	**Workload (h):** 150h

3	**Module structure:**						
	No.	**Type**	**Course**	**Status**	**CP**	**Presence (h + SWS)**	**Self-studies (h)**
	1.	S	Seminar Geoinformation in Society	[x] P [ ] WP	3	30 (2 SWS)	60h
	2.	E	Exercise Course Geoinformation in Society	[x] P [ ] WP	2	30 (2 SWS)	30h

4	**Contents:** Spatial and spatiotemporal information, primarily geoinformation, have a rapidly growing importance in society. The use of geoinformation is not limited anymore to the production of maps, but occurs in all sciences, government agencies, and large parts of our private lives. Thus, students need a comprehensive understanding of the societal roles of geoinformation and its potential as well as challenges. In the seminar, they learn about the basic theories and models of geoinformation in society. In the exercises, they develop technological solutions taking these theories and models into account and evaluate them in realistic settings. In particular, they learn to apply methods of information design for spatially referenced contents. Seminar and exercises are topically coordinated, with an annually changing topical focus. Thus, they have to be taken at once in the same semester.

5	**Qualifications:** Competencies are acquired in a problem-driven form. The students work in small groups of 2 to 4, solving an actual problem. They learn to design information products for specific members or groups (decision makers) in society. They get to know and apply the entire design cycle from idea collection through requirements analysis to implementation and maintenance of information products. They acquire a clear awareness for socially responsible geospatial technology development and deployment.

6	**Optional courses within the module:** Keine

7	**Type of module examination:** [x] Final module exam [ ] Module exam [ ] Partial module exams

8	**Examination relevant performances:**		
	Type	Scope	Weight for the module grade %
	Presentation and discussion of problem solution	20 minutes	100%

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9	**Academic activities:**	
	Type, course	Scope
	Course no. 1: „Seminar Geoinformation in Society": Presentation, short report	7 minutes, 1 page

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of module grade for the final grade:** 5/120

12	**Module specific requirements:** None

13	**Attendance:** In both courses, students can miss a maximum of 2 classes each to still be admitted to the exam. Presence is required because the classes build on previous classes and provide discourse and design skills that cannot be acquired individually. Also, students work together in small groups and problem-driven to design information products.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Werner Kuhn	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**

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Module title:	Advanced Topics in Geographic Information Science
Program of studies:	*Master of Science Geoinformatics*

1	**Number:** 6	**Status:** [x] Compulsory [ ] Optional

2	**Rotation:** [x] each [ ] WS [ ] SS	**Duration:** [ ] 1 sem. [x] 2 sem.	**Term:** 1. und 2.	**CP:** 10	**Workload (h):** 300h

3	**Module structure:**					
	No.	**Type**	**Course**	**Status**	**CP**	**Presence (h + SWS)**	**Self-studies (h)**
	1.	L/S/E	Advanced Topics in Geographic Information Science Course, Institute for Geoinformatics (ifgi)	[X] P [ ] WP	5	60h (ca. 4 SWS)	90h
	2.	P	Study Project Advanced Topics in Geographic Information Science	[X] P [ ] WP	5	30h (2 SWS)	120h

4	**Contents:** The module improves thematic knowledge in one or more of the areas of Geoinformatics. In "Advanced Topics in Geographic Information Science", students gain theoretic-methodological compentences, in "Study Project Advanced Topics in Geographic Information Science" students work in a problem-oriented project. The content of "Advanced Topics in Geographic Information Science" is offered in 5 CP courses dedicated to specialized areas in Geoinformatics, which have a theoretical and methodological content. The methodological part depends on the area considered, and requires an active contribution from the student. This can be in the form of a design of prototypical GIS software, user studies of GIS software, presentation of current research projects, or autonomously led scientific discussion rounds. In "Project Advanced Topics in Geographic Information Science" a complex, students work on a practical exercise in Geoinformatics. The project is 5 CP and is carried out in small groups with clear individual tasks. As a rule, software development (design, implementation, evaluation) with emphasis on spatial data is part of the activity. During the project, students document and communicate all steps, and when needed adapt the project goals in agreement with the teachers.

5	**Qualifications:** In the theme considered under „Advanced Topics in Geographic Information Science", such as „Time in GIS", „Geospatial Ontology", „Cognitive Aspects in GIScience", „Ubiquitous Computing", „Mobile Navigation Services", „Advanced and Space-Time Geostatistics", „Linked Open Data", „Geosensor Networks", „Geospatial Databases", „Situated Computing", „Disaster Management" or other themes from the research labs of the Institute for Geoinformatics, the students obtain theoretical and methodological knowledge at the expert level, and can apply, reflect and develop this further to reach solutions autonomously. In the project work, students obtain professional qualities such as teamwork, communication skills, and other competences required for GIS software engineering, including designing mobile and/or distributed GIS, modeling geospatial data, managing geospatial data, and GIS user studies.

6	**Optional courses within the module:**

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	Students can choose courses from the „Advanced Topics in Geographic Information Science" course offer at the Institute for Geoinformatics.

7	**Type of module examination:** [ ] Final module exam [ ] Module exam [x] Partial module exams

	Examination relevant performances:		
	Type, course	Scope	Weight for module grade %
8	Course no. 1 „Advanced Topics Geographic Information Science Courses Institute for Geoinformatics": Written essay with prior presentation or Presentation or Written exam Type and scope of the examination relevant performance will be announced by the lecturer at the beginning of each course.	8-12 pages, 15 minutes 45 minutes 90 minutes	50%
	Course no. 2 „Study Project Advanced Topics in Geographic Information Science": Project report including software demonstration	8-12 pages, 15 minutes	50%

	Academic activities:	
9	Type, course	Scope

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 10/120

12	**Module specific requirements:** None

13	**Attendance:** Students may be absent at a maximum of two sessions of seminars or projects; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other and since they are also aimed at improving soft skills such as communication competence; such skills cannot be acquired if students are not present. In the context of the project, students work in groups to cooperatively solve complex problems in Geographic Information Science.

14	**Application to other programs of studies:** None

	Module responsible:	**Faculty:**
15	Prof. Dr. Edzer Pebesma	Faculty 14, Institute for Geoinformatics

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16	**Miscellaneous:**

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Module title:	Computer Science
Program of studies:	*Master of Science Geoinformatics*

1	Module no.: 7	Status:	[x] Compulsory	[ ] Optional

2	Rotation:	[x] each [ ] WS [ ] SS	Duration:	[ ] 1 Sem. [x] 2 Sem.	Term: 1. and 2.	CP: 10	Workload (h): 300

Module structure:

3	No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
	1.	L/E/S	Selected Topics Computer Science	[X] P [ ] WP	5	60h (4 SWS)	90h
	2.	P	Project Computer Science	[X] P [ ] WP	5	30h (2 SWS)	120h

4	**Contents:** This module provides students with the opportunity to deepen their understanding in one or more specific areas of Computer Science. Students acquire advanced theoretical or methodological knowledge in courses under the heading „Selected Topics Computer Science", whereas they take a more practical, problem-driven approach in the „Project Computer Science". The topics covered by courses in „Selected Topics Computer Science" are structured according to specific sub-areas in Computer Science, and each course consists of a theoretical part (lecture or seminar) and a methodological part (e.g. a practical). The exact type and structure of the latter part depends on the nature of the topic, and includes a student-driven portion, for example, a programming exercise, efficiency analyses, user studies, presentations on current research projects or initiatives, or student-led discussion circles on relevant research topics. In the context of the „Project Computer Science", students have to complete a complex practical task in the field of Computer Science. Students work in small teams with clearly defined individual sub-tasks. Part of the project work usually consists of developing a piece of software (including conceptualisation, implementation and testing). This software usually requires specialised and advanced knowledge in areas such as mobile computing, distributed and parallel systems, or graphics cards. During the project, students document their progress, systematically communicate amongst themselves and with teaching staff, and adapt projects goals if needed.

5	**Qualifications:** After successfully completing this module, students possess theoretical and methodological skills in the topic areas covered by the courses (e.g. „Human Computer Interaction", „Distributed and Parallel Systems", „Computer Vision", „Situated Computing", „Information Management", „Formal Specification", „Physical Computing", „Scientific Computing" etc.). They are capable of applying these skills independently to solve complex problems in these areas, reflect on their solutions and to continuously improve and adapt them. Through the project work they further improve their soft skills such as teamwork and communication, and they also extend their experience base in areas such as software engineering, realising hardware-specific architectures, data modelling, efficiency analysis and user studies.

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6	**Optional courses within the module:** For „Selected Topics Computer Science" students can select from courses in Computer Science offered by the Institute for Geoinformatics, by the Institute for Information Systems, and – where applicable – by other faculties. For the „Project Computer Science" students can choose amongst study projects in Computer Science offered by the Institute for Geoinformatics and – where applicable – by other faculties (after consultation with the module responsible).

7	**Type of module examination:** [ ] Final module exam [ ] Module exam [x] Partial module exams

8	**Examination relevant performances:**		
	Type, course	Scope	Weight for the module grade %
	Course No. 1 „Selected Topics Course Computer Science": Written report with prior oral presentation or Written exam Type and scope of the examination relevant performance will be announced by the lecturer at the beginning of each course.	8-12 pages, 15 minutes 90 minutes	50%
	Course No. 2 „Project Computer Science": Project report with prior software demonstration	8-12 pages, 15 minutes	50%

9	**Academic activities:**	
	Type, course	Scope
	None	

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 10/120

12	**Module specific requirements:** None

13	**Attendance:** Students may be absent at a maximum of two sessions of seminars or projects; otherwise, they will not be admitted to the exam/assignment. Attendance is required as the courses build upon each other and since they are also aimed at improving soft skills such as communication competence; such skills cannot be acquired if students are not present. In the context of the project, students work in groups to cooperatively solve problems for Computer Science.

14	**Application to other programs of studies:** None

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15	**Module responsible:**	**Faculty:**
	Prof. Dr. Christian Kray	Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**
	If courses are chosen from other faculties, students are responsible to find out about the rules governing enrolment and dropping out of these courses. Permission to count such courses towards this module is granted by the module responsible.

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Module title:	Interdisciplinary Aspects of Geographic Information Science
Program of studies:	*Master of Science Geoinformatics*

1	Number: 8	Status:	[x] Compulsory	[ ] Optional

2	Rotation:	[x] each [ ] WS [ ] SS	Duration:	[ ] 1 sem. [x] 2 sem.	Term: 1. and 2.	CP: 10	Workload (h): 300h

3	Module structure:						
	No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
	1.	S	Spatial Intelligence	[x] P [ ] WP	3	30h (2 SWS)	60h
	2.	L/S/E	Course Interdisciplinary Aspects Geographic Information Science 1	[ ] P [x] WP	6	ca. 60h (4 SWS)	120h
	3.	L/S/E	Course Interdisciplinary Aspects Geographic Information Science 2	[ ] P [x] WP	3	30h (2 SWS)	60h
	4.	L/S/E	Course Interdisciplinary Aspects Geographic Information Science 3	[ ] P [x] WP	3	30h (2 SWS)	60h
	5.	C	Geoinformatics Forum Colloquium Series	[x] P [ ] WP	1	30h (1 SWS)	0

4	**Contents:** This module deepens the knowledge in interdisciplinary aspects of geoinformatics. The seminar „Spatial Intelligence" relates geoinformatics to research from psychology and cognitive science. The course discusses concepts for intelligent representation and processing of spatial information and introduces human strategies to acquire and organize knowledge about spatial environments from a theoretical and experimental point of view. Furthermore, student have the choice between a single 6 CP or two 3 CP courses on interdisciplinary aspects of geographic information science. These courses can be selected from the course offerings of the Institute for Geoinformatics and Institute for Information Systems. The Institute for Information Systems offers courses on interdisciplinary aspects of information processing such as "Costs and Value of Information", "Information Management", „Business Process Modeling and Workflow Management", "Data Privacy Law", „E-Commerce Law". Students can choose courses of the department of geosciences which deal with computer science methods to solve spatio-temporal problems to solve geo-spatial problems. The „Geoinformatics Forum" offers presentations on current research questions in the various topic areas of geoinformatics, for which guest speakers from university, industry, and government are invited to talk about research and praxis. Students need to participate in 15 lectures spread over 2 semesters.

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5	**Qualifications:** In this module, students gained the competencies to analyze spatial problems in an interdisciplinary manner. They know the interface between Geoinformatics and related disciplines and are able to formulate interdisciplinary research questions. Thus, the students can actively support the communication between Geoinformatics and its related sciences. They are able to choose suitable methods from other disciplines to answer Geoinformatics research questions, as well as apply Geoinformatics methods to answer research questions of other disciplines. Moreover, students gained the ability to define interdisciplinary objects of research and solve them in cooperation with experts of relevant related disciplines.

6	**Optional courses within the module:**
	Possible course combinations within the module:
	      either a) course no. 1, 2, 5
	      or b) course no. 1, 3, 4, 5
	
	See paragraph 4 for more details on alternative choice.

7	**Type of module examination:** [ ] Final module exam [ ] Module exam [x] Partial module exams

	Examination relevant performances:		
	Type, course	Dauer bzw. Umfang	Gewichtung für die Modulnote in %
8	Course no. 1 „Spatial Intelligence": Presentation	45 minutes	40%
	Course no. 2 „Course Interdisciplinary Aspects Geographic Information Science 1": Written exam, written essay or presentation Type and scope of the examination relevant performance will be announced by the lecturer at the beginning of each course.	60 minutes, 8-12 pages, 20 minutes	60%
	Course no. 3 „Course Interdisciplinary Aspects Geographic Information Science 2": Written exam, written essay or presentation Type and scope of the examination relevant performance will be announced by the lecturer at the beginning of each course.	60 minutes, 8-12 pages, 20 minutes	30%
	Course no. 4„Course Interdisciplinary Aspects Geographic Information Science 3": Written exam, written essay or presentation Type and scope of the examination relevant performance will be announced by the lecturer at the beginning of each course.	60 minutes, 8-12 pages, 20 minutes	30%

	Academic activities:	
	Type, course	Scope
9	Veranstaltungen Nr. 2, 3 und 4: Presentation, report or test, depending on the course. Type and scope of the academic activities will be announced by the lecturer at the beginning of each course.	
10	**Approval of credit points:**	

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	The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 10/120

12	**Module specific requirements:** None

13	**Attendance:** Students can miss up to 2 sessions of a seminar or the colloquium. If they are absent in more sessions, they are not admitted to the exams. Attendance is necessary because lectures are based on each other and serve the acquisition of communication competencies which cannot be acquired in self-studies.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Angela Schwering	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:** In case students want to take courses from other fields of studies, they need to check the requirements and enrolment modalities in the applicable examination regulations. Agreement of the module responsible is required.

Website: www.master-geoinformatics.info/

Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	External Industry or Government Project
Program of studies:	*Master of Science Geoinformatics*

1	Module no.: 9	Status:	[ ] Compulsory	[x] Optional

2	Rotation:	[x] each [ ] WS [ ] SS	Duration:	[x] 1 sem. [ ] 2 sem.	Term: 3. term recommended	CP: 30	Workload (h): 900h

3	**Module structure:**					
	No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
	1.	P	Guided Project Work in External Industry or Government	[x] P [ ] WP	29		870h
	2.	S	Wrap-Up Seminar External Industry or Government Project	[x] P [ ] WP	1	15	15h

4	**Contents:** Depending on their goals and personal interests, students carry out a practical semester in industry or other institutes in the public sector. Goals and contents of the practical semester are established in a written agreement in accordance with the supervisor and the module responsible. During the five month stay in or outside Germany, students gain professional experience and report the content of the work and results and professional qualities obtained in a project report.

5	**Qualifications:** Students are able to analyse GIS-related problems in technical as well as in their scientific complexity, and work on strategies to solve them together with co-workers from industry or the public sector. The gain experience with political-legal, scientific, social and psychological boundary conditions of professional practice, and have developed the necessary qualities such as communication capabilities, planning capability, cooperation with non-experts, and the ability to recognize relevant aspects in complex situations. Besides scientific and professional qualities, students extend communication skills, social and intercultural competences. In a final meeting with students, the experience gained will be presented, discussed and reflected.

6	**Optional courses within the module:** Course no. 1: Free choice in agreement with the module responsible.

7	**Type of module examination:** [x] Final module exam [ ] Module exam [ ] Partial module exams

8	**Examination relevant performances:**		
	Type, course	Scope	Weight for module grade %
	Project report including self-evaluation according to learning agreement	~20 pages	100%

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

9	Academic activities:	
	Type, course	Scope
	Course no. 2: „Wrap-Up Seminar External Industry or Government Project": Presentation	15 minutes

10	Approval of credit points: The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	Weight of the module grade for the final grade: 24/120

12	Module specific requirements: None

13	Attendance: Course no. 1: During the internship, students are bound to the working time regulations of the institution. Course no. 2: Attendance during the wrap-up seminar is compulsory because students share their experiences. If a student is absent the wrap-up seminar must be repeated.

14	Application to other programs of studies: None

15	Module responsible:	Faculty:
	Prof. Dr. Edzer Pebesma	Faculty 14, Institute for Geoinformatics

16	Miscellaneous: In case of valid reasons, students may complete this module in the second term. Either module 9 or 10 have to be completed.

Website: www.master-geoinformatics.info/

Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	External Studies
Program of studies:	*Master of Science Geoinformatics*

1	**Module no.:** 10	**Status:** [ ] Compulsory [x] Optional

2	**Rotation:** [x] each [ ] WS [ ] SS	**Duration:** [x] 1 Sem. [ ] 2 Sem.	**Term:** 3. term recommended	**CP:** 30	**Workload (h):** 900h

Module structure:

3	No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
	1.	L/S/EP	Courses from an agreed course program („learning agreement") (V/Ü/S) and/or Research Project (P)	[x] P [ ] WP	29		870h
	2.	S	Wrap-Up Seminar External Studies	[x] P [ ] WP	1	15	15h

4	**Contents:** Depending on previous experience and professional goals, students can program their external study semester individually. It is typically an exchange semester at a university abroad, involving an individualized study program and/or research project work in a local team. A learning agreement defines the goals and contents as well as the relative work load of course and project work.

5	**Qualifications:** Students learn to work with their Geoinformatics competencies in larger projects and in teams. They acquire a sharpened professional qualification profile, including soft skills like independent and self-organized work, multi-cultural awareness and competencies, communication skills, networking, career planning and preparation of scientific (thesis) work. Additional skills and competencies depend on the individual program design.

6	**Optional courses within the module:** Course 1: free choice in agreement with the advisor of the external semester and the module responsible; goals and details of courses defined in the learning agreement.

7	**Type of module examination:** [ ] Final module exam [ ] Module exam [x] Partial module exams

8	**Examination relevant performances:**		
	Type	Scope	Weight for the module grade %

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Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

	Examination relevant performances are documented in the learning agreement and can include oral and written parts.	According to learning agreement.	100% (weighting according to learning agreement)

9	**Academic activities:**	
	Type, course	Scope
	Course no. 1: according to „learning agreement"	
	Course no. 2: „Wrap-Up Seminar External Studies": Presentation	15 minutes
10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.	

11	**Weight of the module grade for the final grade:** 24/120

12	**Module specific requirements:** None

13	**Attendance:** Course 1: Presence requirements are defined in the learning agreement or by the local rules. Course 2: Mandatory presence in the wrap-up seminar, as it is intended to exchange and reflect on experiences.

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Werner Kuhn	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:** Students who have acquired their Bachelors degree abroad and are subject to constraining visa or other residence requirements in Münster can take this module at the University of Münster. In case of valid reasons, students may complete this module in the second term. Either module 9 or 10 have to be completed.

Website: www.master-geoinformatics.info/

Responsible: Prof. Dr. Edzer Pebesma, email: edzer.pebesma@uni-muenster.de

Module title:	Master Thesis
Program of studies:	*Master of Science Geoinformatics*

1	**Module no.:** 11	**Status:**	[x] Compulsory	[ ] Optional

2	**Rotation:**	[x] each [ ] WS [ ] SS	**Duration:**	[x] 1 sem. [ ] 2 sem.	**Term:** 4.	**CP:** 30	**Workload (h):** 900h

3 Module structure:

No.	Type	Course	Status	CP	Presence (h + SWS)	Self-studies (h)
1.		Master Thesis including disputation	[x] P [ ] WP	30		900h

4 Contents:

Through their Master thesis, students demonstrate that they can actively participate and contribute to scientific progress in their discipline(s). They formulate and solve a specific scientific problem within a the specified time and document their work following the requirements of scientific work and writing. Contents and methods of the thesis depend on the chosen topic. The module includes the written thesis and an oral defence. The defence is scheduled before the final submission of the thesis, so that the discussions can still be taken into account.

5 Qualifications:

With the completion of the Master Thesis, students are capable to
- formulate scientific problems as concrete research goals and questions;
- develop research goals and questions independently;
- apply and further develop Geoinformatics methods to (help) solve domain problems;
- author scientific publications in English;
- plan their research, coordinate it with others, and reflect critically on it;
- communicate in teams and with advisors.

6 Optional courses within the module:

The candidate can propose a topic and advisor.

7 Type of module examination:

[x] Final module exam   [ ] Module exam   [ ] Partial module exams

8	**Examination relevant performances:**		
	Type	Scope	Weight for module grade %
	Master Thesis including disputation (Weighting scheme: 80% Master Thesis, 20% disputation)	A number of 60 pages of text should not be exceeded, 20 minutes	100%

9	**Academic activities:**	
	Type, course	Scope
	None	

10	**Approval of credit points:** The credit points for this module are awarded when the entire module has been successfully completed, i.e. when all assessed and non-assessed assignments have been passed.

11	**Weight of the module grade for the final grade:** 36/120

12	**Module specific requirements:** 60 CP are required before starting the thesis.

13	**Attendance:**

14	**Application to other programs of studies:** None

15	**Module responsible:** Prof. Dr. Werner Kuhn	**Faculty:** Faculty 14, Institute for Geoinformatics

16	**Miscellaneous:**