Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-101	Engineering Mathematics	C	1	Schramm

Subject Area	Duration
MINT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (= 21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
The students understand and are able to apply elements of the advanced mathematical foundations of data analysis
Contents
Elements of advanced engineering mathematics - Complex algebra and its geometrical interpretation, - Multivariate real valued functions and their taylor expansion. - Elements of vector analysis (gradient, jacobian and hesse matrix), - Types of differential equations (deq), system of linear deqs of first order. Matrix exponential, simple solution methods. Fourier Transformation, important theorems (convolution, cross correlation)
Recommended Literature
- Horst Stöcker (Hrsg.), Taschenbuch mathematischer Formeln und moderner Verfahren (mit CD), Harri Deutsch, Frankfurt, 4. Auflage, 2009, (Verlag Europa-Lehrmittel) - I.N. Bronshtein, K.A. Semendyayev, Gerhard Musiol, Heiner Mühlig, Handbook of Mathematics, Springer, Berlin, 2005, SpringerLink - Kenneth A. Stroud, Dexter J. Booth, Engineering Mathematics, Palgrave Macmillan Limited, 01.01.2013 - 1155 Seiten - Schaum's Outline Series: Buchanan, G. R., Schaum's Outline of Fourier Analysis with Applications to Boundary Value Problems, Mcgraw-Hill Professional ,1974 - Scheid, F., Schaum's Outline of Numerical Analysis, 2nd Ed., Mcgraw-Hill Professional, 1989 Spiegel, M. R., Schaum's Outline of Finite Element Analysis, Mcgraw-Hill Professional, 1995 - Spiegel, M. R., Schaum's Outline of Advanced Mathematics for Engineers and Scientists, Mcgraw-Hill Professional; Auflage: 1, 2009
Teaching and Learning Methods
Lecture, (Computer-)Practice, Plenum

Exam(s)

Precondition of Examination	
Type of Examination	**Duration of Examination (if written or oral exam)**
Written or oral examination	Written exam 180 min, partially eAssessment/ 20 min oral Exam
Composition of Module Mark	
Exam grade	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Bachelor Mathematics1,2 (content)

Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		22.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-102	Datenbanken	PF	1	Schramm

Lehrbereich	Dauer
MINT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
2,5	2 (=21 Std.)	54 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden verstehen die Wirkungsweise eines Datenbankmanagementsystems, können Daten im geomatischen Kontext modellieren, Datenbankanfragen formulieren und mit Hilfe einer Programmiersprache durchführen.
Inhalte des Moduls
Datenbankentwurf, Entity-Relationship, Relationale Datenbank Managementsysteme (RDBMS), Datenbankmanagementsysteme für Geodaten (GeoDBMS), SQL, Verwaltung und Abfragen räumlicher Daten, Ereignisbehandlung, gespeicherte Prozeduren, programmgesteuerte Datenbankabfragen
Empfohlene Literatur
Fuchs, Elmar: SQL. Grundlagen und Datenbankdesign. (RRZN-Handbuch). Brinkhoff, Thomas: Geodatenbanksysteme in Theorie und Praxis. (Wichmann).
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Klausur/Mündliche Prüfung (benotet)	90 Min.
Berechnung der Modulnote	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Grundkenntnisse in der Programmierung (inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 16/17		22.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-102	Databases	C	1	Schramm

Subject Area	Duration
MINT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (=21 Std.)	54 Std.

Objectives and Contents

Objective of Qualification (competencies)
The students understand the effectiveness of a database management system, can model data in a geoinformatic context, formulate database queries and carry them out with the help of a programming language.
Contents
Database Design, Entity Relationship, Relational Database Management Systems (RDBMS), Geodata Database Management Systems (GeoDBMS), SQL, Spatial Data Management and Queries, Event Handling, Stored Procedures, Program Driven Database Queries
Recommended Literature
Fuchs, Elmar: SQL. Grundlagen und Datenbankdesign. (RRZN-Handbuch). Brinkhoff, Thomas: Geodatenbanksysteme in Theorie und Praxis. (Wichmann).
Teaching and Learning Methods
Lecture and Exercise, Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
witten or oral exam	90 Min.
Composition of Module Mark	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
basic knowledge of programming (content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		22.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-103	Software and Interface Technology	C	1	Schiewe

Subject Area	Duration
GIT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (=31,5 h)	118,5 h

Objectives and Contents

Objective of Qualification (competencies)
- Students shall gain the ability to solve complex problems by utilising modern software technology. Examples include the processing of geodata. - The students acquire deeper data processing knowledge in the area of hard- and software. They are enabled to solve interfacing problems between data processing instruments and geodetic instruments.
Contents
- Object-oriented software development; object-oriented analysis, design, programming; concepts about complexity, object modelling, classes and objects; methods of software development; development processes; programming using an integrated development environment (IDE). - Interfacing techniques (RS-232/-422/-485, Ethernet). Mechanical, functional, electrical properties. Handshaking. Connecting sensors to a computer. Network topologies. Architecture models. IP addresses and ports. Pro-tocols. Services. Socket Programming.
Recommended Literature
- Python Software Foundation: Python documentation (https://docs.python.org/ - Kenneth Reitz: The Hitchhiker s Guide to Python (http://docs.python-guide.org/en/latest/) - Sweigart: Automate the Boring Stuff with Python (automatetheboringstuff.com) - Axelson, Jan: Serial Port Complete, Second Edition - Erle Robotics: Python networking programming (https://www.gitbook.com/@erlerobotics)
Teaching and Learning Methods
Lecture and exercise, Plenum

Exam(s)

Precondition of Examination	
Successfully completed semester work (S)	
Type of Examination	**Duration of Examination (if written or oral exam)**
Written exam or oral exam	120 min (written) / 20 min (oral)
Composition of Module Mark	
Exam: 100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Recommended for modules Geoinformatik and GIS-Programmierung
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16 /17		22.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-104	Nahbereichsphotogrammetrie	PF	1	Kersten

Lehrbereich	Dauer
GMT	1

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	3 (=31,5 Std.)	118,5 h

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden bearbeiten mehrere Aufgaben im Bereich industrieller optischer 3D-Messtechnik und sammeln Erfahrungen in verschiedenen Projektbearbeitungen. Sie lernen Aufnahmeverfahren (Offline und Online) und Aufnahmekonfigurationen (im Testfeld oder am Objekt) sowie verschiedene Aufnahmesysteme und deren Möglichkeiten zur Kalibrierung kennen. Durch die Auswertung der aufgenommenen Daten lernen die Studierenden die Fehleranalyse und die Bewertung der Ergebnisse durchzuführen und das Automations- und das Genauigkeitspotential der verschiedenen Systeme einzuschätzen.
Inhalte des Moduls
Einführung in photogrammetrische Messsysteme (analoge und digitale Aufnahmekameras, Panoramakameras, Streifenprojektionssysteme), photogrammetrische Aufnahmeverfahren - Aufnahmetechnik und Aufnahmesysteme (Einbildverfahren, Zweibildverfahren, Mehrbildtriangulation, Streifenprojektion), Projekt- und Aufnahmeplanung (Parameter und Anforderungen), Passpunktsignalisierung (kodierte Messmarken und Maßstäbe) und Passpunktbestimmung, verschiedene Verfahren zur Kamerakalibrierung (Testfeld), Bildorientierung und Bündelblockausgleichung inkl. Fehler- und Genauigkeitsanalyse sowie Bewertung der Ergebnisse, Online-Photogrammetrie, Kodierte Messmarken, Photogrammetrische Industriemesssysteme (Anwendungen industrieller Messtechnik), automatische Messverfahren durch pixel-basierte Matching-Verfahren, low-cost Systeme, Einführung in die Streifenprojektion, Distanz-basierte Kameras (TOF-Kamera)
Empfohlene Literatur
Nahbereichsphotogrammetrie. Th. Luhmann, 2010 3. Auflage, Wichmann Verlag Photogrammetry - Geometry from Images and Laser Scans. Karl Kraus 2007, 2nd Edition, De Gruyter Taschenbuch zur Photogrammetrie und Fernerkundung. Albertz / Wiggenhagen 2009, 5. Auflage, Wichmann Verlag Close-Range Photogrammetry and 3D Imaging. Th. Luhmann, S. Robson, S. Kyle, J. Boehm, 2013, de Gruyter Computer Vision - Algorithms and Applications. R.Szeliski. 2011, Springer
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Erfolgreicher Abschluss der Übungsaufgaben (Hausarbeiten; unbenotet)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Klausur bzw. der mündlichen Prüfung (benotet)	90 min/ mündl. Prüfung 20 min
Berechnung der Modulnote	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 17/18		22.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-105	GI-Science	C	1	Schiewe

Subject Area	Duration
GIT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2.5	2 (21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
Students shall gain - knowledge about characteristics and complexity of spatial data (geometrical, thematic, topological, temporal components) and the importance of a proper data modeling stage; - the ability to select a suitable GIS data model for a given application (knowing the advantages and disadvantages of vector and raster as well as methods for the transformations between each other); - the ability to select suitable operations for a given application based on an understanding of the principles of basic geometrical, thematic and topological operations; - knowledge about basic principles for modern cartographical representation of qualitative and quantitative data.
Contents
Terminology; Spatial data modeling (e.g., geometric, thematic, topological modeling, Geodatabases, Spatial Data Infrastructures); Spatial data analysis (e.g., geometric, thematic, topological and combined operations); Visualization of spatio-temporal data.
Recommended Literature
- Lo, C.P. & Yeung, A.K.W. (2002): Concepts and Techniques of Geographic Information Systems. Prentice Hall. - Ehlers, M. & Schiewe, J. (2012): Geoinformatik, WBG.
Teaching and Learning Methods
Lecture, plenum

Exam(s)

Precondition of Examination	
None	
Type of Examination	Duration of Examination (if written or oral exam)
Written exam (marked)	120 min
Composition of Module Mark	
100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated

WS 17/18		22.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-106	Projekt GIT	PF	1	Traub

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
10	4 (= 42Std.)	258 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Projekt GIT: Vertiefung der bisher erworbenen Grundlagenkenntnisse im Bereich Geoinformationssysteme (GIS); Fertigkeit, ein umfangreiches anwendungsbezogenes Fachinformationssystem selbstständig zu konzipieren und einsatzfähig aufzubereiten; kritischer Umgang mit Datengrundlagen, Erzeugung neuer Fachinformation durch GIS-gestützte raumzeitliche Datenanalysen, Visualisierung der erzeugten Fachinformationen
Inhalte des Moduls
Projekt GIT: Konzeption einer kompletten, komplexen Aufgabe mit wechselnden Themen auf Basis einer (kommerziellen) GI-Software zwecks Aufbaus eines Fachinformationssystems. Im Vordergrund stehen dabei Datenanalysen zur Erzeugung fachspezifischer Inhalte sowie die Aufbereitung der Daten in Form digitaler oder analoger Kartenprodukte/Poster
Empfohlene Literatur
Wechselnde Literatur
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Präsentation/Hausarbeit (benotet)	
Berechnung der Modulnote	
PR/H 100%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Grundlagenkenntnisse zur Geoinformatik, insbesondere: Datenmodellierung und Datenanalyse im GIS, Erfahrungen im praktischen Einsatz eines GIS-Produktes (z. B. ArcGIS) (inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 18/19		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-107	Basics of Hydrography	C	1	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2.5	2 (= 21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
Basic understanding of hydrography and hydrographic measurement techniques, supported by practical training in hydrographic surveying.
Contents

- Determination of Positions and Water Depths:
  - Introduction: Definition, tasks and application of hydrography. History. National and international organizations. Single-beam echo sounder (SBES) and Multibeam echo sounder (MBES) system: Principles, components, fre-quencies, beam, parameters, specifications, footprint size. Introduction to other sonars: Basic working princi-ples and measuring techniques of side-scan sonars and sub-bottom profilers and their application. Horizontal and vertical reference systems: Definition and transformation between different vertical reference systems. Chart datum: Definition. Reduction of soundings to a vertical datum (GNSS, tide gauge measurements). Sys-tem configuration: Additional sensors and their accuracies used in echo sounder systems: positioning systems, INS/IMU, tide information, sound velocity profilers, sound velocity probes. Sensor installation, alignment, inte-gration. Vessel reference system. Synchronization. Transformation. MBES: Motion compensation. Calibration. Error budget and estimation of single-beam and multibeam systems. Standards for hydrographic surveys: Sur-vey requirements for different surveys. System set-up. Survey operation: Sonar installation. Planning of sur-veys (SBES, MBES). Execution of a survey. Online data monitoring and real-time quality checks.
- Practical course 1:
  - Planning of a MBES survey. MBES survey of an area showing different properties (e.g., newly dredged area, quay walls, objects like dolphins).

Recommended Literature
- de Jong, C.D, Lachapelle, G., Skone, S., Elema, I.A. (2010): Hydrography. VSSD. - IHO (2011): Manual on Hydrography – Publication C-13. 1st ed., International Hydrographic Bureau, Monaco. - IHO (2008): Standards for Hydrographic Surveys – Publication S-44. 5th ed., International Hydrographic Bureau, Monaco. - Lurton, X. (2010): An Introduction to Underwater Acoustics – Principles and Applications. 2nd ed., Springer. - Urick, R.J. (2013): Principle of Underwater Sound. 3rd ed., Peninsula Publishing. - Wille, P.C. (2005): Sound Images of the Ocean in Research and Monitoring. 1st ed., Springer.
Teaching and Learning Methods
Determination of Positions and Water Depths, 1,5 CP: Lecture and Exercises (1,5 SWS), Plenum Practical course 1, 1 CP: Practical course (0,5 SWS), Plenum

Exam(s)

Precondition of Examination	
Practical course 1: Successful practical training (not graded)	
Type of Examination	**Duration of Examination (if written or oral exam)**
Determination of Positions and Water Depths: written or oral examination (graded)	Written exam of 120 min or oral exam of 20 min
Composition of Module Mark	
100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)

Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 17/18		22.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-108	Hydrographic Data Acquisition and Processing	C	1	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
7,5	4 (= 42 h)	183 h

Objectives and Contents

Objective of Qualification (competencies)

- Basic understanding of underwater acoustics waves and measurement techniques, supported by practical training in hydrographic surveying and introduction to hydrographic data processing.

Contents

- Underwater Acoustics:
  - Fundamental theory of acoustic waves; Pressure, velocity, density, frequency, wavelength, intensity, power, decibel, propagation loss, multiple paths, deformation of acoustics signals, Doppler effect, sound velocity models and measurement in water, acoustics propagation, wave reflection, backscattering, target strength, scattering, underwater acoustic noise, reverberation. Resistance to acoustic waves; Refraction of acoustic waves from one medium to another; reflection coefficient for the reflection at a border surface between different media, acoustic bending. Underwater electro-acoustic transducers and their characteristics. Beamforming. Transmitters, receivers. Array directivity. Time varying gain. Signal-to-noise-ratio. Examples – multichannel and swath sounding systems, possible errors of different systems. Inverse echo sounding from the sea floor to the sea surface.
- Hydrographic Data Processing:
  - Introduction: Common sensors used in hydrography and their errors. Accuracy, precision, uncertainty and standard deviation. Quality checks during data acquisition. Introduction to data cleaning: Data formats (raw sensor format and processed data) including conversion and data structure. Project set-up (vessel configuration, sensor alignment, sensor integration, geodetic settings, etc.). Single-beam echo sounder data processing: Pre-cleaning methods, tide correction including GNSS-tide computation, validation of navigation data. Validation/cleaning of dual-frequency single-beam data. Creation of final product (digital terrain model, contours, soundings, maps). Multibeam echo sounder data processing: Pre-cleaning methods, tide correction including GNSS-tide computation, sound velocity correction, validation of navigation and attitude data and validation/cleaning of multibeam data. Computation of TPU. Computation methods for digital terrain models (IDW, CUBE, etc.) and automatic filter methods. Creation of cross sections, contours, soundings, maps. Lect. 7: Multibeam calibration (Patch test): Sensor alignment and static offsets. Systematic errors in multibeam survey systems, patch test procedure (timing, roll, pitch, yaw, draught), refraction correction procedure, concept of Wobble-test. Side-scan sonar processing: Digitizing of altitude height, layback, slant range correction, beam pattern correction, TVG, despeckle, gain normalisation. Mosaic creation. Seabed classification. Further applications: Airborne LiDAR, water column data/image, shipborne laser scanning.
- Practical course 2:
  - Single-beam echo sounder calibration (bar check) and survey. Multibeam echo sounder calibration (patch test). and survey. Comparison of direct (GNSS) and indirect (tide gauge) reduction of depth measurements to chart datum. Processing, visualisation and evaluation of single-beam echo sounder calibration (patch test) and survey. Processing, visualisation and evaluation of multibeam echo sounder calibration (patch test) and survey.

Recommended Literature

- Blondel, P. (2009): The handbook od Sidescan Sonar. Springer.
- de Jong, C.D, Lachapelle, G., Skone, S., Elema, I.A. (2010): Hydrography. VSSD.
- Grewal, Weill, Andrews (2013): Global Positioning System, Inertial Navigation and Integration. 3rd ed., John Wiley & Sons.
- Lurton, X. (2010): An Introduction to Underwater Acoustics – Principles and Applications. 2nd ed., Springer.
- Urick, R.J. (2013): Principle of Underwater Sound. 3rd ed., Peninsula Publishing.
- Wille, P.C. (2005): Sound Images of the Ocean in Research and Monitoring. 1st ed., Springer.

Teaching and Learning Methods

Underwater Acoustics, 3 CP: Lecture (1,5 SWS), Plenum
Hydrographic Data Processing, 2,5 CP: Lecture and Exercise (2 SWS), Plenum
Practical course 2: Practical course, 2 CP: Exercise (0,5 SWS), Plenum

Exam(s)

Precondition of Examination

Practical course 2: Successful practical training (not graded)	
Type of Examination	Duration of Examination (if written or oral exam)
Underwater Acoustics: written or oral examination (graded) Hydrographic Data Processing: written or oral examination (graded)	Written exam of 120 min or oral exam of 20 min Written exam of 120 min or oral exam of 20 min
Composition of Module Mark	
50/50	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-109	Marine Environment	C	1	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (= 31,5 h)	118.5 h

Objectives and Contents

Objective of Qualification (competencies)

The students become familiarised with qualitative aspects about the marine meteorology and the law of the sea.

Contents

- Marine Meteorology:
  - Introduction: Terminology. Vertical structure of the atmosphere. The sun and the sun radiation. Meteorological elements: Temperature (temperature measurement, instruments, extreme values, layering). Pressure (measure-ment, instruments, extreme values, vertical distribution, lower and upper level weather charts). Humidity (termi-nology, measurement, instruments). Dew-point, frost-point. Meteorological elements: Clouds. Precipitation (rain, snow). Fog (formation,types of fog). Severe weather: Thunderstorm, lightning, hail, tornadoes, hurricanes, waterspouts. Mountain winds: Formation, typical foehn weather effects. Wind: Definitions, measurement, geo-strophic wind, computation of true wind, local wind systems (offshore wind, onshore wind, orographic influences, gusts, local wind systems, El Nino). Weather systems: Large scale atmospheric circulation. Global distribution of pressure, air and sea surface temperatures. Weather systems: Air masses, extra-tropical cyclones, anticyclones. Associated weather. Weather fronts: Development of coldfronts and warmfronts and their movement, sequence of clouds and weather at fronts, occlusions, frontal depression. Trough, secondary low. Weather forecasting: Synoptic charts, extrapolation and steering techniques for on-board short range forecasting. International Marine Meteorological Service Systems: Collection and distribution of meteorological information, use of weather bulletins and facsimile charts.
- Legal Aspects:
  - Introduction: Historical evolution of the law of the sea, participating organisations and mechanisms. International organisations: the work and functions of the IMO and IHO and the relevance of these bodies for the work of a hydrographic surveyor. Maritime boundaries: Baseline, coastal waters (characteristics, features, width), internal waters (bays and bays historical character), contiguous zone. Maritime boundaries: Continental shelf and exclu-sive economic zone (characteristics, extension, rights, duties and responsibilities of the coastal state). Determi-nation of outer limits of the continental shelf. Work of the Commission (submission and recommendations). Regu-lations for underwater cables, pipeline, offshore constructions, scientific research, environmental protection and the impact on surveys. General regulations concerning the deep sea, the peaceful passage and laws concerning islands. International Ocean Floor Authority. Deep seabed regime: the UNCLOS regime and functions of the In-ternational Seabed Authority. -Mining Code- and current status of the exploration areas. Delimitation problems: Geodetic and vertical reference systems. Normal baseline, bay closure lines, middle and equidistant lines, is-lands in the deep ocean, dry-falling rises, river mouths, ports and roads. Delimitation between states with neigh-bouring or opposing coast lines. Marine Law: Study of maritime accidents and court cases. Survey contracts: Tenders, invoices, contractual obligations, insurance, survey work and deliverables.

Recommended Literature

Lackmann, G. (2012): Midlatitude Synoptic Meteorology: Dynamics, Analysis, and Forecasting; American Meteorologi-cal Society
Bader, M. J.; Forbes; Grant; Lilley; Waters (1995): Images in weather forecasting; Cambridge University Press
World Meteorological Organization (1998): Guide to wave analysis and forecasting; WMO, 2nd ed.
World Meteorological Organization (1989): Operational techniques for forecasting tropical cyclone intensity and movement; WMO
Tanaka, Y. (2015): The International Law of the Sea; Cambridge University Press, 2nd ed.
Rothwell, D. (2016): The international Law of the Sea; Bloomsbury Publishing, 2nd ed.
Churchill, R.; V. Lowe (1999): The Law of the Sea; Manchester University Press, 3rd ed.

Teaching and Learning Methods

Marine Meteorology, 3 CP: Lecture (2 SWS), Plenum
Legal Aspects Lecture, 2 CP: Lecture (1 SWS), Plenum

Exam(s)

Precondition of Examination

none

Type of Examination	Duration of Examination (if written or oral exam)
Marine Meteorology: written/oral exam (graded) Legal Aspects written/oral exam (graded)	Written exam of 90 minutes or oral exam of 15 min Written exam of 90 minutes or oral exam of 15 min
Composition of Module Mark	
Marine Meteorology: weight 60% Legal Aspects: weight 40%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
every second year in the winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		03.12.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-110	Industrielle Messtechnik	PF	1	Sternberg

Lehrbereich	Dauer
GMT	

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	3 (= 31,5 Std.)	118,5 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden sollen in die Lage versetzt werden, die Verfahren und Geräte der industriellen Messtechnik einzusetzen und entsprechende Messungen auszuwerten und deren Messunsicherheit angeben zu können
Inhalte des Moduls
Industrielle Messtechnik im dem Maschinen- und Anlagenbau sowie dem Bauwesen: Verfahren der Mess- und Automatisierungstechnik, Sensortechnik, interferometrische und Lasermessverfahren (Lasertracker), 3D-Theodolitmesssysteme, 3-D Koordinatenmessmaschinen, Sensoren moderner Tachymeter, Aufbau eines automatischen Messsystems, Integration verschiedener Messsensoren zur Lösung einer Mess-aufgabe (z.B. Neigungsgeber, Ebenheits-, Alignmentmessungen), Koordinatensysteme, Ausrichtstrategien und Punktdefinitionen Messgenauigkeit, Messunsicherheit, Toleranzen, Toleranzketten und sonstige Begriffe aus dem Anlagenbau, Künstliche Neuronale Netze (KNN) in der Auswertung
Empfohlene Literatur
Möser, Müller, Schlemmer, Werner (Hrsg.): Handbuch Ingenieurgeodäsie, Grundlagen (Wichmann Verlag) Möser, Müller, Schlemmer, Werner (Hrsg.): Handbuch Ingenieurgeodäsie, Maschinen- und Anlagenbau (Wichmann Verlag) Schlemmer, H.: Grundlagen der Sensorik. Eine Instrumentenkunde für Vermessungsingenieure (Wichmann Verlag) Pfeifer, T., Schmitt, R.: Fertigungsmesstechnik (Oldenbourg Wissenschaftsverlag) Keferstein, Claus P.: Fertigungsmesstechnik (Vieweg + Teubner Verlag)
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Erfolgreich absolvierte Übungen (unbenotet)	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
Klausur/mündliche Prüfung (benotet)	Schriftl. Prüfung: 120 min / Mündl. Prüfung: 20 Min.
Berechnung der Modulnote	
Prüfungsleistung	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 17/18		26.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-111	GNSS	C	1	Eicker

Subject Area	Duration
Hydrography, GIT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (= 21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
In this course, students shall gain the competence - to understand the basic concept of GNSS including its system components and to explain the orbit and timing parameters involved in GNSS positioning - to describe the structure of the GNSS signals and to identify the relevant error sources. - to write the observation equations for different GNSS observables including the stochastic models. - to specify and select the appropriate observation techniques for a required survey
Contents
- Basic concept of GNSS, GNSS systems, satellite orbits, reference systems, time systems, - GNSS system architecture, GNSS signals, navigation message - Error sources: atmospheric refraction, clock errors, orbit accuracy, receiver noise, multipath - Observation equations for code and carrier phase observations - Observation procedures: Single point positioning using code measurements, relative GNSS using carrier phase observables: single, double, and triple differences, static, real time kinematic, network RTK, DGNSS: differential and wide area augmentation services, Precise Point Positioning - GNSS applications
Recommended Literature
- B. Hofmann-Wellenhof, H. Lichtenegger and E. Wasle (2008): GNSS - Global Navigation Satellite Systems, Springer Verlag, Wien, Austria, ISBN: 978-3-211-73012-6 - B. Hofmann-Wellenhof, H. Lichtenegger, and J. Collings (2013) Global Positioning System: Theory And Prac-tice, Springer, ISBN: 978-3-7091-6199-9 - P. Misra and P. Enge (2011): Global Positioning System – Signals, Measurements and Performance (2. Edi-tion), Ganga-Jumana Press, Lincoln, Massachusetts, USA, ISBN: 0-9709544-1-7
Teaching and Learning Methods
Lecture, Plenum

Exam(s)

Precondition of Examination	
No preconditions	
Type of Examination	Duration of Examination (if written or oral exam)
written examination or oral examination, respectively (grad-ed)	written: 120 min, oral: 25 min.
Composition of Module Mark	
Grade for oral/written exam	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Practical aspects of GNSS positioning will be covered in Practical Course 3 and in the Supplementary Field Training.
Frequency of Offering
Each winter term
Course Language

English

valid from	valid to	last updated
WS 17/18		26.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-202	Terrestrial Laser Scanning 1	C	2	Kersten

Subject Area	Duration
Hydro, GIT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (=21h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
The students learn about different terrestrial laser scanning systems concerning measuring procedure and principles. They see the potential of the systems through geometrical (accuracy) investigations and the introduction of several applications in topography, archaeology and architecture. The students carry out a field exercise for 3D object acquisition. The subsequent data processing includes registration, geo-referencing, filtering and quality control.
Contents
Introduction into terrestrial laser scanning (TLS), measuring procedures, system criteria of laser scanning systems, data acquisition (scanning), sensor integration & data fusion (digital camera & scanner), registration & geo-referencing of scans, segmentation & filtering, geometric investigations in the precision/accuracy of terrestrial laser scanning systems, modelling & object reconstruction (3D triangulation/meshing and CAD modelling using point clouds) & visualization, applications, kinematic (mobile) TLS
Recommended Literature
- Vosselman, G., & Maas, H. G. (Eds.). (2010). Airborne and terrestrial laser scanning. Whittles Publishing. - Shan, J., & Toth, C. K. (Eds.). (2008). Topographic laser ranging and scanning: principles and processing. CRC press. - Luhmann, T., Robson, S., Kyle, S., & Boehm, J. (2014). Close-range photogrammetry and 3D imaging. Walter de Gruyter. - Kraus, K. (2007). Photogrammetry: geometry from images and laser scans. 2nd Edition, De Gruyter. - Diverse scientific articles from journals and conference proceedings
Teaching and Learning Methods
Lecture and Exercise

Exam(s)

Precondition of Examination	
Successfully completed exercise including report (not graded)	
Type of Examination	Duration of Examination (if written or oral exam)
Written/oral exam (graded)	90 min written exam/15 min.
Composition of Module Mark	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each summer term
Course Language
English

valid from	valid to	last updated
WS 17/18		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-203	Terrestrisches Laserscanning 1+2	PF	2	Kersten

Lehrbereich	Dauer
GMT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
7,5	4 (=42 Std.)	183 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden führen im Rahmen von praktischen Übungen kleine Projekte im Bereich terrestrisches Laserscanning durch und sammeln Erfahrungen in der Projekt- und Aufnahmeplanung. Sie lernen verschiedene Laserscanningsysteme hinsichtlich Messverfahren und Funktionsprinzip und deren damit verbundenen verschiedenen Einsatzmöglichkeiten in den Bereichen Architektur, Topographie und Industrie kennen. Sie führen Objektaufnahmen praktisch durch und werten die erfassten Daten selbständig aus. Durch die Auswertung der aufgenommenen Daten lernen die Studierenden die Fehleranalyse und die Bewertung der Ergebnisse durchzuführen und das Genauigkeitspotential des Systems einzuschätzen. Dies ist eine ergänzende Veranstaltung zum Modul -Terrestrial Laser Scanning 1 -
Inhalte des Moduls
Introduction into terrestrial laser scanning (TLS), measuring procedures, system criteria of laser scanning systems, data acquisition (scanning), sensor integration & data fusion (digital camera & scanner), registration & geo-referencing of scans, segmentation & filtering, geometric investigations in the precision/accuracy of terrestrial laser scanning systems, modelling & object reconstruction (3D triangulation/meshing and CAD modelling using point clouds) & visualization, applications, kinematic (mobile) TLS-Übungen in a) topographischer Aufnahme (z.B. für die Archäologie), b) für Genauigkeitsuntersuchungen im Labor und im Feld, und c) in der 3D-Aufnahme eines Architekturobjektes und dessen Modellierung mit Punktwolken) als praktische Ergänzung zum Modul - Terrestrial Laser Scanning 1 -
Empfohlene Literatur
- Vosselman, G., & Maas, H. G. (Eds.). (2010). Airborne and terrestrial laser scanning. Whittles Publishing. - Shan, J., & Toth, C. K. (Eds.). (2008). Topographic laser ranging and scanning: principles and processing. CRC press. - Luhmann, T., Robson, S., Kyle, S., & Boehm, J. (2014). Close-range photogrammetry and 3D imaging. Walter de Gruyter. - Kraus, K. (2007). Photogrammetry: geometry from images and laser scans. 2nd Edition, De Gruyter. - Diverse Fachartikel aus Fachzeitschriften und Tagungsbänden
Lehr- und Lernform
Vorlesung und Übung

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
zur Klausur: Erfolgreich absolvierte Übungen (unbenotet), zur Präsentation: keine	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
TLS 1: Klausur (benotet), TLS 2: Präsentation(en) (benotet)	90 min Klausur ohne Hilfsmittel
Berechnung der Modulnote	
50/50	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Sommersemester
Unterrichtssprache

TLS 1: Englisch, TLS 2: Deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 17/18		26.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-204	Integrated Navigation	C	2	Sternberg

Subject Area	Duration
GMT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (= 31,5 h)	118 h

Objectives and Contents

Objective of Qualification (competencies)
The students are enabled to assess applications, sensors and systems of navigation as well as their respective potential. They are to learn and apply the required hardware and software foundations for the integration of data. They are to learn hybrid measurement systems and procedures for three-dimensional position and attitude determination, as well as evaluate how complementary system designs can be used in a meaningful way.
Contents
Introduction: Terminology, multi-sensor systems, kinematic positioning methods and their applications. GNSS: Kinematic GNSS positioning, accuracies, comparison of different static and kinematic data GNSS processing methods. Inertial sensors: Principle of inertial sensors. Measurement uncertainties, MEMS inertial measurement unit. Aiding sensors and real-time systems: Odometer, barometer, realtime systems / multi-tasking / requirements for real-time systems. Sensor fusion/filtering: Adjustment, principles of Kalman filter.
Recommended Literature
Hofmann-Wellenhof, B.; Lichtenegger, H.; Collins, J.: GPS – Theory and Practice, 5th edition, Springer, New York, 2001. Linkwitz, K.; Hangleiter, U.: High Precision Navigation 91, Dümmler Verlag, Bonn, 1991. Grewal, M. S.; Andrews, A. P.: Kalman Filtering Theory and Practice using MATLAB, Second edition, Wiley, 2001. Grewal, M. S.; Weill, L. R.; Andrews, A. P.: Global Positioning Systems, Inertial Navigation and Integration, Second edition, Wiley, 2007. De Jong, C. D.; Lachapelle, G.; Skone, S.; Elema, I. A.: Hydrography, First edition, VSSD, 2001. Lawrence, A.: Modern Inertial Technology – Navigation, Guidance and Control, Springer, 1993. Bose, A.; Puri, S.; Banerjee, P.: Modern Inertial Sensors and Systems, Second edition, Phi Learning, 2008.
Teaching and Learning Methods
Lecture and Exercise, Plenum

Exam(s)

Precondition of Examination	
Successfully accomplished exercises (not graded)	
Type of Examination	Duration of Examination (if written or oral exam)
written or oral examination, respectively (graded)	Written exam of 120 min, oral exam 40 minutes (group of three)
Composition of Module Mark	
100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each summer term
Course Language
English

valid from	valid to	last updated
WS 16/17		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-205	Higher Geodesy	C	2	Eicker

Subject Area	Duration
GMT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	4 (= 42h)	108 h

Objectives and Contents

Objective of Qualification (competencies)
The students learn the basic elements of ellipsoidal and three-dimensional geodesy as well as those of geodetic mappings that are common practice today. They are enabled to solve datum problems. The foundations of spherical trigonometry and physical geodesy are imparted.
Contents
Mathematical Geodesy Elements of spherical trigonometry: sphere, small circles, great circles, spherical two-angle, spherical triangle, fundamental laws in the spherical triangle, Delambre s and Napier s equations, first and second Napier s rules, differential equations, application examples. Reference ellipsoid: ellipsoid parameters, latitudes, curvature radii. Three-dimensional geodesy: 3D ellipsoidal coordinates, 3D geocentric Cartesian coordinates, coordinates in the local geodetic and astro-nomical system, coordinate transformations, observation equations in three-dimensional geodesy, differences between natural and ellipsoidal coordinates. Geodesic curve on the rotational ellipsoid: normal section and geodesic curve, mathematical description of the geodesic. Azimuth and angle corrections, distance corrections. Direct and inverse geodetic problems: computations of length and azimuth of a geodesic, computation of ellipsoidal coordinates. Geodetic mapping of the ellipsoid surface onto a plane: general relationships, mappings of major importance (Mercator, Gauss-Krüger or Transverse Mercator, UTM, Lambert, polar stereographic); mapping equations, magnification or point scale factor, meridian convergence, direction and distance correction; other mappings. Geodetic reference systems: comparison of different datums, transformation equations and transformation parameters. Physical Geodesy Gravity and gravity potential, parameters of the normal gravity field, computation of normal gravity. Height systems (dynamic, orthometric, normal), vertical datum. Disturbing quantities in the earths gravity field: gravity disturbance, gravity anomaly, deflection of the vertical. Geoid determination: astrogeodetic method, gravimetric method, combined methods. Earth models, high resolution gravity field representation.
Recommended Literature
Hofmann-Wellenhof, B. & Moritz, H. (2006) Physical Geodesy, Springer, ISBN 978-3-211-33545-1
Teaching and Learning Methods
Lecture and Exercises, Plenum

Exam(s)

Precondition of Examination	
Type of Examination	**Duration of Examination (if written or oral exam)**
written examination or oral examination, respectively (grad-ed)	written: 120 min, oral: 25 min.
Composition of Module Mark	
Grade for oral/written exam	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Bachelor Satellitengeodäsie
Applicability of Module
Frequency of Offering
Each summer term

Course Language
English

valid from	valid to	last updated
WS 17/18		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-206	Seminar GIT	PF	2	Traub

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
2,5	1 (=10,5 Std.)	64,5 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden sollen ein aktuelles Thema aus dem Bereich der Geoinformationstechnologie an Hand von selbst recherchierter (deutsch- und englischsprachiger) Literatur selbstständig erarbeiten und schriftlich sowie mündlich präsentieren können
Inhalte des Moduls
Seminarvorträge
Empfohlene Literatur
Wechselnde Literatur
Lehr- und Lernform
Seminar, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Präsentation/Hausarbeit (benotet)	
Berechnung der Modulnote	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Grundlagenkenntnisse zur Geoinformatik (inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Sommersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS16/17		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-207	Geoinformatik	PF	2	Schiewe

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	3 (= 31,5 Std.)	118,5 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
- Datenmodellierung: - Die Studierenden sollen die unterschiedlichen Anforderungen und Möglichkeiten der (Geo-)Datenmodellierung sowie gängige Standards und deren Anwendung kennenlernen. - Geodatenbanken: - Die Studierenden sollen grundlegende Systemarchitekturen und Implementierungskonzepte für Software-Systeme in der Geoinformatik erlernen.
Inhalte des Moduls
- Datenmodellierung - Einführung (Begrifflichkeiten, Abstraktionsebenen, Eigenschaften von Geodaten); OO-Modell (Basiskonzepte der OO-Analyse, UML); Statische Konzepte der OO-Analysis (UML); Feature-Geometry-Modell, Simple-Feature-Modell (und dessen geometrische/topologische Funktionen). Einführung in gängige (Geo-)Datenformate und ihre Eigenschaften (z.B. XML, GML, ESRI Shapefile, GeoPackage, Geo-/ und TopoJSON, OSM). - Geodatenbanken - Objektorientierte Datenmodellierung, Modellierung von Geodaten, Standardisierung von Geodaten (ISO/OGC), Räumliche Datenbankmodelle, Indexierung von Geodaten, Räumliche Anfragebearbeitung. Exemplarische programmiertechnische Umsetzung der erlernten Konzepte in den Übungen
Empfohlene Literatur
- Brinkhoff, T.: Geodatenbanksysteme in Theorie und Praxis. Wichmann, 2008, 2. Auflage. - van Randen, J.H.: Einführung in UML: Analyse und Entwurf von Software. Springer, 2016.
Lehr- und Lernform
Datenmodellierung, 2,5 CP: Vorlesung und Übung (1 SWS), Plenum Geodatenbanken, 2,5 CP: Vorlesung und Übung (2 SWS), Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Erfolgreicher Abschluss der Übungen Geodatenbanken (unbenotet)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Gemeinsame Prüfung Datenmodellierung/Geodatenbanken: Klausur oder mündliche Prüfung (benotet)	120 min (Klausur) / 20 min (mündlich)
Berechnung der Modulnote	
Klausur oder mündliche Prüfung: 100%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Inhaltlich: Grundkenntnisse in der Programmierung, Grundlagenkenntnisse zur Geoinformatik
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
GIS-Programmierung
Häufigkeit des Angebots

Jedes Sommersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 16/17		04.12.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-208	WebGIS	PF	2	Traub

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
7,5	3 (= 31,5 Std.)	193,5 Std

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
- Verständnis für Besonderheiten webbasierter GIS im Gegensatz zu stand-alone Lösungen; Fähigkeit, für eine gegebene Anwendung eine geeignete Client-Server-Architektur auszuwählen und prototypisch mit einem aktuellen Softwareprodukt umzusetzen; - Kenntnisse über relevante internationale Standardisierungen, Fähigkeit OGC-konforme Implementierungen zu konzipieren bzw. zu bewerten; Kenntnis über aktuelle, größere Geodateninfrastrukturen im nationalen und internationalen Kontext.
Inhalte des Moduls
- Charakteristika von webbasierten Geographischen Informations-Systemen; Client-Server-Architekturen; Map Server; - Implementierung interaktiver Elemente; OGC-Standards (WMS, WFS, etc.); Einsatz im Bereich Geodateninfrastrukturen; Vorstellung von Softwarepaketen; Anbindung von Datenbanken. - Praxis: Erstellung einer webbasierten GIS-Anwendung für ein Kleinprojekt mit Hilfe von HTML, CSS, JavaScript, PHP und eines aktuellen Frameworks, wie bspw. OpenLayers 3, zur Darstellung von Geodaten im Webbrowser.
Empfohlene Literatur
Wird in der Lehrveranstaltung bekanntgegeben.
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Erfolgreich absolvierte Übungen (unbenotet)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Präsentation (benotet)	
Berechnung der Modulnote	
Prüfungsnote	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Empfohlen: Grundlagenkenntnisse zur Geoinformatik, insbesondere: Datenmodellierung und Datenanalyse im GIS, Erfahrungen im praktischen Einsatz eines GIS-Produktes (inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Sommersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert

WS 16/17		26.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-209	Spatial data analysis	C	2	Schiewe

Subject Area	Duration
GIT	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	4 (= 42 h)	108 h

Objectives and Contents

Objective of Qualification (competencies)
- Geostatistics - Ability to calculate and to evaluate geostatistical parameters for huge data volumes with spatial reference - Knowledge about selected methods for and applicability of Exploratory Data Analysis (EDA) - Ability to select and to apply deterministic interpolation methods - Knowledge about models of spatial correlation and their application to interpolation - Ability to select and to apply geostatistical interpolation methods (Kriging). - Digital Elevation Models - Students shall gain the abilities - to apply and to evaluate different uncertainty parameters for describing the quality of DEMs; - to compare advantages and disadvantages of different DEM representation formats; - to describe algorithms of important processing steps; - to select suitable visualization formats for given applications; </i2>
Contents
- Geostatistics: - Basic Statistics - Spatial Statistics (sampling, aggregation, disaggregation, cross tabulation, landscape metrics, spatial auto cor-relation) - Exploratory Data Analysis (selected methods) - Spatial interpolation (deterministic approaches; geostatistical characteristic parameters, Kriging interpolation) - Digital Elevation Models: - Terminology; - Data sources (topographic, bathymetric); - Sampling approaches (raster, TIN); - Selected processing algorithms; - 3D/4D visualization methods. - Exercise: Application of selected DEM housekeeping and analysis operations.
Recommended Literature
- Oyana & Margai (2015): Spatial Analysis: Statistics, Visualization, and Computational Methods. CRC Press. - de Smith, Goodchild & Longley (2007): Geospatial Analysis. A Comprehensive Guide to Principles, Techniques and Software Tools, 2. Auflage, Troubador Publishing
Teaching and Learning Methods
Geostatistics, 2,5 CP: Lecture and Exercises (3 SWS), Plenum Digital Elevation Models, 2,5 CP: Lecture and Execises (1 SWS), Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
written exam	120 min (written)
Composition of Module Mark	
Exam: 100 %	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each summer term
Course Language
English

valid from	valid to	last updated
WS 17/18		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-210	Advanced Hydrography	C	2	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (= 31,5h)	118,5 h

Objectives and Contents

Objective of Qualification (competencies)
Enhancing the knowledge in hydrographic measurement and data processing techniques, particularly with multi beam echo sounding, side scan sonar and magnetometer. Extending measurement experiences in hydrographic projects.
Contents

- Advanced Hydrography:
  - Multibeam echo sounder: Performance. Bottom detection (amplitude and phase detection). Backscatter (recording modes, influences of system parameters, application). Water column data (principles, applications). Side-scan sonar: Components, data acquisition principles (directivity pattern, frequency, range, coverage, sampling rate, resolution), applications, operation, layback calculation. Sources of errors. Image geometry (display of slant ranges, rectification, corrections, mosaicking), image interpretation, survey planning, system configuration. Interferometric sonar systems: Principles, applications, advantages and disadvantages. Synthetic aperture sonar: Principles, applications, advantages and disadvantages. Seabed classification: Classification standards. Relation between acoustic signal backscattering and seafloor characteristics. Sonar image corrections. Absolute and relative backscatter. Angular range analysis. Ground-truthing. Comparison of different sonars for seabed classification. Comparison of acoustic and optical data sets for seabed classification. Sub-bottom profiler: Principles, parametric effect, chirp technique, resolution, applications, operation. Sources of errors (gross, systematic, random). Magnetometer: Types, applications, estimation of ferrous objects from changes in magnetic field intensity, positioning of magnetometers. Survey planning. Unmanned surface and underwater vehicles: ROVs, AUVs, Gliders. Applications, operation. Acoustic underwater positioning systems: Dead-reckoning (velocity log, INS). Position fixing (system components, principles, different methods: LBL, SBL, USBL). Integrated position solution, operation. Accuracies, error sources, calibration, application.
- Practical course 3:
  - Planning and preparation of a survey for wreck investigation using multibeam echo sounder, sub-bottom profiler, side-scan sonar (backscatter), magnetometer. Multibeam echo sounder wreck survey (including backscatter and water column data). Sub-bottom profiler survey. Side-scan sonar (backscatter) survey. Magnetometer survey. Processing, visualisation and evaluation of multibeam echo sounder, sub-bottom profiler, side-scan sonar (backscatter) and magnetometer data.

Recommended Literature
- Ainslie, M.A. (2010): Principles of sonar performance modeling. 1st ed., Springer. - Blondel, P. (2009): The handbook of Sidescan Sonar; Springer - Groves, P.D. (2013): Principles of GNSS, Inertial, and Multisensor Integrated Navigation Systems. 2nd ed., Artech House. - Lurton, X. (2010): An Introduction to Underwater Acoustics – Principles and Applications; Springer, 2nd ed. - Ingham, A.E., Abbott, V.J. (1993): Hydrography for the Surveyor and Engineer. 3rd ed., Oxford. - Medwin, H. (2005): Sounds in the Sea: From Ocean Acoustics to Acoustical Oceanography. 1. ed., Cambridge Uni Press. - Seeber, G. (2003): Satellite Geodesy. 2nd, De Gruyer.
Teaching and Learning Methods
Advanced Hydrography: 3 CP: Lecture and Exercise (2 SWS), Plenum Practical course 3: Practical course, 2 CP: (1 SWS), Plenum

Exam(s)

Precondition of Examination	
Practical course 3: Successful practical training (not graded)	
Type of Examination	**Duration of Examination (if written or oral exam)**
Successful written or oral examination (graded)	Written exam 120 min or oral examination of 20 min
Composition of Module Mark	
Exam grade	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each summer term
Course Language
English

valid from	valid to	last updated
WS16/17		03.12.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-211	Location Based Services	PF	2	Sternberg

Lehrbereich	Dauer
GMT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	3 (= 31,5 Std.)	118,5 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden sollen im Rahmen eines Projektes in die Lage versetzt werden, die vertikale Datenintegration von der Datenerhebung bis zur Anwendung in einem mobilen System mit Ortsbezug theoretisch und praktisch zu bearbeiten
Inhalte des Moduls
- Grundlagen von Ortsbezogenen Systemen und Positionsbestimmungen: - Die Studierenden sollen Möglichkeiten der Datenerhebung von Geobasis- und Fachdaten (analog/digital bzw. primär/sekundär Daten) sowie die Positionsbestimmung in der Bewegung innerhalb und außerhalb von Gebäuden kennen lernen und Daten zur Integration in einem Mobilen Geoinformationssystem aufbereiten. Begriffe und Anwendungen des Mobile Computings, Merkmale mobiler Anwendungen und Dienste, Location Based Services: Begriffsdefinition, Klassifizierung, Akteure, Mobile Geoinformationssysteme: Anwendungsbereiche Mobile standortbezogene Anwendungen und Dienste im Unternehmensumfeld, Technologie mobiler standortbezogener Anwendungen, Drahtlose Kommunikationstechnologie Zellbasierte Funksysteme, Grundlagen von Netzwerken, Drahtlose Kommunikationsnetze, Mobile Informationstechnologie, Mobile Endgeräte, Mobile Betriebssysteme, Datenhaltung auf mobilen Endgeräten, Mobile Clients, Positionsbestimmungsverfahren für LBS und mobile GIS, Alternative Verfahren der Positionsbestimmung, Grundlagen der automatisierten Positionsbestimmung, Anwendung der netzwerkgestütz-ten Positionsbestimmung, Indoor-Positionsbestimmung, Satellitengestützte Positionierung, A-GPS-Assisted GPS, Logische Positionsbestimmung. - Projekt: - Datenerhebung, Positionsbestimmung, Datenintegration, Visualisierung.
Empfohlene Literatur
Blankenbach, Jörg: Handbuch der mobilen Geoinformation (Wichmann Verlag)
Lehr- und Lernform
Grundlagen von Ortsbezogenen Systemen und Positionsbestimmungen, 2 CP: Vorlesung (1 SWS), Plenum Projekt, 3 CP: Projekt (2 SWS), Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
Jedes Sommersemester	
Berechnung der Modulnote	
Aus einer Prüfung	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Sommersemester
Unterrichtssprache

deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 17/18		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-301	Dynamische Messtechnik	PF	3	Sternberg

Lehrbereich	Dauer
GMT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	3 (= 31,5 Std.)	118,5 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Die Studierenden sollen in die Lage versetzt werden, Verfahren, Sensoren und Auswertetechniken bei dynamischen Messungen zu verstehen, einzuschätzen und anzuwenden. Hierbei werden konkret drei Szenarien betrachtet: 1. Bewegtes Objekt, fester Sensor. 2. Festes Objekt, bewegter Sensor. 3. Bewegtes Objekt, bewegter Sensor.
Inhalte des Moduls
- Dynamische Messverfahren in den Bereichen geodätisches Monitoring, Bauwesen und Maschinenbau. - Ein- und mehrdimensionale Messwertaufnehmer (auch low-cost MEMS), Schnittstellen und Datenübertragungstechniken, Echtzeitmesssysteme sowie Sensorfusion. - Zeitabhängige Messungen mit GPS, Tachymetern, Lasertracker, Laserscanner, Dehnungsmesstechnik, Beschleunigungsmesser, Hochgeschwindigkeitskameras. - Auswertung dynamischer Messungen mit Hilfe von Zeitreihenanalyse im Zeit- und Frequenzbereich, Identifikation von dominanten Eigenfrequenzen, mathematisch-statistische Filterverfahren, Autokovarianzfunktionen, Kreuzkovarianzfunktionen, spektrale Analyse langer Perioden, Modellbildung zur Auswertung von Messdaten. - Partikelfilter, einfache Regelungstechnik
Empfohlene Literatur
Wechselnde Literatur
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Erfolgreich absolvierte Übungen (unbenotet)	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
Klausur oder mündliche Prüfung (benotet)	Schriftl. Prüfung: 120 min / mündl. Prüfung: 40 Minu-ten (3er Gruppe)
Berechnung der Modulnote	
Note der Prüfung 100%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache

deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 16/17		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-303	GIS-Programmierung	PF	3	Schiewe

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	2 (= 21 Std.)	129 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Fähigkeit, grundlegende Algorithmen der Geoinformatik zu strukturieren und in einer aktuellen Programmierumgebung zu implementieren.
Inhalte des Moduls
Konzeptioneller Software-Entwurf, räumliche Algorithmen, topologische Beziehungen, objektorientierte Programmierung für GIS (z. B. in Python), Verwendung von Softwarebibliotheken, Plugin-Entwicklung auf Grundlage eines OpenSource-GIS und der zugrundeliegenden (Geometrie-)Bibliotheken.
Empfohlene Literatur
Wechselnde Literatur (Hinweis in Lehrveranstaltung)
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Präsentation/Hausarbeit	
Berechnung der Modulnote	
Gesamtnote	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Empfohlene Inhalte: Grundkenntnisse in der Programmierung, Grundlagenkenntnisse zur Geoinformatik
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 17/18		26.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-304	Visualisierung	PF	3	Schiewe

Lehrbereich	Dauer
GIT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
10	4 (= 42 Std.)	258 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
- Geovisualisierung Fähigkeit, Verfahren zur Bewertung der Gebrauchstauglichkeit (Usability) auszuwählen und zu bewerten; Kenntnis ausgewählter Aspekte der User Experience sowie ihrer Bedeutung in der Kartenerstellung; Fähigkeit, angepasste Darstellungsformen für raumzeitliche Phänomene auszuwählen; Fähigkeit, die Eignung multimedialer Kodierungsformen für gegebene Objektmerkmale zu beurteilen. - 3D-Visualisierung Die Studierenden erhalten theoretische und praktische Kenntnisse und Fähigkeiten in der graphischen und alphanumerischen Modellierung und Visualisierung von Geodaten bzw. Geoinformationen. Im Rahmen einer Projektbearbeitung lernen die Studierende verschiedene Visualisierungsmethoden und die entsprechende Anbindung ins Internet kennen.
Inhalte des Moduls
- Geovisualisierung Definitionen (Kartographie vs. Geovisualisierung, etc.); Usability (u.a. nutzer- und aufgabenorientierte Sichtweisen; Design von empirischen Studien); Multimedia-Kartographie (u.a. Kodierungsformen, Vor- und Nachteile verschiedener Kodierungen, Medienfunktionen); Aktuelle Themen der Forschung und Entwicklung im Bereich (Geo-)Visualisierung. - 3D-Visualisierung Definitionen, Einführung in die Computergraphik, Hardware und Software, Grundlagedaten, Abbildung des Raumes in der Ebene (Koordinatensysteme, 3-D-Transformationen, Farbe, Projektion, Sichtvolumen, Betrachtungs-Transformationen), Modellierung, Rasterung, Entfernen von Flächen, Beleuchtung und Schattierung, Level of Detail, Oberflächengestaltung, Rendering-Methoden, Datenformate, Datenkonvertierung, Methoden der Visualisierung und Animation, Virtual und Augmented Reality, Anwendungsbeispiele, Internetdarstellungen (VRML-Browser), 3D/VR im World Wide Web. Bearbeitung eines praktischen Projektes: Datenaufbereitung, 3D-Objektrekonstruktion, Oberflächengestaltung oder Materialvergabe (Texture Mapping), Kamerapositionen und Beleuchtung, Rendering, Erstellung von Perspektivansichten, Generierung von VRML-Szenen und Videosequenzen (Fly oder Walk Through) sowie Anbindung ans Internet.
Empfohlene Literatur
Wechselnde Literatur (Hinweis erfolgt in Lehrveranstaltung)
Lehr- und Lernform

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
Geovisualisierung: Klausur oder mündliche Prüfung (benotet) 3D-Visualisierung: Semesterarbeit (benotet)	120 min (Klausur) / 20 min (mündlich)
Berechnung der Modulnote	
Geovisualisierung: Gewichtung: 50 % 3D-Visualisierung: Gewichtung: 50 %	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)

Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 16/17		26.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-305	Nautical Charting	C	3	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (= 21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
This course deals with the creation of ENCs. The students get a comprehensive knowledge of the importance of marine databases and the associated IHO standards S-52, S-57, S-58, and S-100. The lectures are accompanied with practical exercises. Students shall gain the abilities - to define the steps and procedures in creation of ENCs - to evaluate survey data storage and transfer strategies - to explain the structure, components, and advantages of marine GIS bases - to explain the importance of Marine Spatial Data Infrastructure and standards
Contents
- Introduction: IHO Standards, storage and transfer formats, survey database, metadata, WMS - Marine Spatial Data Infrastructure - Feature: Digitization and editing of features in respect to the S-57 object catalogue. Feature extraction. Vertical and horizontal datum. Datum transformation. - Filter: Filtering by attribute values, by feature acronym, feature object ID, feature type, unique feature acronym, rule wizard. - Creation of depth information: Contouring in respect to the S-57 standard. Contour smoothing, sounding creation, difference surface, export. - Creation of ENCs: ENC naming convention. Create, update, and customize S-57 base products for export to platform-independent exchange set or stand-alone files (HOB, PRD). Catalogue and data set files. - Validation check: Quality control to ensure compliance with IHO standards.
Recommended Literature
- Hecht, H., Berking, B., Jonas, M., Alexander, L. (2009): The Electronic Chart: Functions, Potential and Limitation of a new marine navigation system. 3rd ed., Geomares. - IHO (2014): Specifications for Chart Content and Display Aspects of ECDIS – Publication S-52. Release 6.1(.1), International Hydrographic Bureau, Monaco. - IHO (2000): IHO Transfer Standard for Digital Hydrographic Data – Publication S-57. Release 3.1, International Hydrographic Bureau, Monaco. - IHO (2014): ENC Validation Checks – Publication S-58. Release 5.0.0, International Hydrographic Bureau, Monaco. - IHO (2015): IHO Universal Hydrographic Data Model – Publication S-100. Release 2.0.0, International Hydrographic Bureau, Monaco.
Teaching and Learning Methods
Lecture and Exercises, Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
written/oral exam (graded)	Written exam of 120 min or oral exam of 20 min
Composition of Module Mark	
written/oral exam: 100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 17/18		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-306	Navigation in Hydrography	C	3	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (= 21 h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
Basic understanding for navigation methods and applications at sea and using of electronic charts.
Contents
Nautical Science: Radar: Radar as navigational aid (principle of radar position, measurement and evaluation, resolution, limitations and display errors). Radar for collision avoidance, target tracking (ARPA). Course sensors: Magnetic compass, gyro compass, electronic sensors, GNSS-based sensors. Errors of magnetic and gyro compass and corrections. Speed sensors: General principles. Hydro-mechanical logs, electro-magnetic logs, Doppler sonar, GNSS-based speed measurements. Accuracies. Positioning sensors: Hyperbolic (e.g. Loran C, eLoran), pseudorange methods (GNSS). Improvement of procedures. Automatic track control. Terrestrial navigation: Principle of terrestrial positioning (measurement, correction, construction and accuracy of lines-of-position (LOPs)). Orientation at sea and near coast using light and direction fires as well as LOPs. Working with nautical charts: Route tracking, other elaborating tasks related to charts. Aids to navigation – Atons (principle of light house and buoy placement and characteristics, lateral and cardinal system, special signs, guidance, direction and cross direction fires). Contents and use of the most important nautical publications: Nautical charts, nautical handbook, collection of light fires, notices to mariners, nautical radio warning. Current navigation. Tides (prediction and application). Law of marine coastal traffic: Regulations for navigation in waterways. Traffic control systems. General rules of behaviour, collision avoidance, light setting, acoustic warning signals, travel in fog. Seamanship: Manoeuvre techniques (steering elements and propulsion systems, properties of manoeuvring, special manoeuvres in narrow and flat waterways, in heavy weather, man-over-board situation, safety technology). **Electronic Chart Display and Information System**: On-board components of ECDIS. Structure and characteristics of ENC data: Format, geo-reference, vector map, objects and attributes. Hydrographic aspects: Datum and quality of hydrographic data. Base cells and updates. Quality assurance by standards, source dependence, and certification. From data to chart display: Selection of information, colours and symbols, forms of display. Access to navigational information. Naviga-tional functions for chart display, route planning, and route monitoring. Proper use of ECDIS: Parameter set-ting, scale-related display aspects, limitations and safety-related alarms. Carriage requirements. Integration with other navigation systems (GNSS, radar, AIS). Chart data management. Differences between EC-DIS/ENCs and ECS, RCDS. Visits to the Federal Maritime and Hydrographic Agency of Germany (BSH) and to companies for ECDIS op-erational exercises.
Recommended Literature
- Blair, C.H. (1977): Seamanship – A handbook for Oceanographers. Cornell Maritime Press. - Bole, A.G., Wall, A.D., Norris, A. (2013): Radar and ARPA Manual: Radar, AIS and Target Tracking for Marine Radar Users. 3rd ed., Butterwoth-Heinemann. - The Nautical Institute (2008): Principles of Navigation - The Admiralty Manual of Navigation; Vol. 1 - Cunliffe, T. (2014): The Complete Yachtmaster; A&C Back, 8th ed. - Burch, D. (2009): Inland and Coastal Navigation – For Power-driven and Sailing Vessels; 2nd ed. - Hecht, H., Berking, B., Jonas, M., Alexander, L. (2011): The Electronic Chart - Fundamentals, Functions, Data and other Essentials – A Textbook for ECDIS use and Training. 3rd ed., Geomares. - Kresse, W., Fadaie, K. (2010): ISO Standards for Geographic Information. 1st ed., Springer. - Weintritt, A. (2009): The Electronic Chart Display Information System (ECDIS): An Operational Handbook.1st ed., CRC Press.
Teaching and Learning Methods
Nautical Science, 1,5 CP: Lecture (1 SWS), Plenum Electronic Chart Display and Information System, 1 CP: Lecture (1 SWS), Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)

combined written/oral exam (graded)	Written exam of 120 min or oral exam of 20 min for both courses of this module together
Composition of Module Mark	
Nautical Science: weight 1/2 Electronical Chart and Display System: weight 1/2	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 18/19		04.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-307	Oceanography	C	3	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (= 31,5 h)	118,5 h

Objectives and Contents

Objective of Qualification (competencies)

To gain basic knowledge and understanding of physical oceanographic questions, methods and results. To identify and relate oceanic phenomena to physical processes in the global ocean and coastal areas.
To describe and explain these processes.

Contents

Physical Oceanography and Tides
Introduction and sea floor geomorphology: Terminology, definitions, overview. Earth's topography, plate tectonics, submarine canyons, banks, coastal islands, seamounts, coastal landscape, estuaries, sea level changes. Properties of water and ice: Physical and chemical properties, temperature, dissolved matter, density, viscosity and surface tension of water, diffusivity, hydro-optics, hydro-acoustics, ice formation. Observations - instruments and methods: Marine observations, platforms (moorings, satellites), measured variables, data analysis, international programmes, coastal observation systems. Global energy and water budget: Heat budget of the ocean, fresh water budget of the ocean (hydrological cycle, residence time, hydrological pathways, climatological sea surface salinity, ice climatology), water masses (water mass concept, globally important water masses, stratification, exchange with marginal seas). Regional oceanography: Oceanographic provinces (equatorial regions, western boundary currents, upwelling regions), ocean basins (e.g. Atlantic Ocean, straits and passages, North Sea). Surface mixed layer dynamics: Air-sea interaction, penetrating solar radiation, vertical mixing static instability, upper ocean profiles, Langmuir circulation cells, SML processes, the seasonal cycle, ice-ocean interactions. Extreme phenomena: Extreme events, tropical cyclones, water sprouts, storm surges, tsunamis, density currents, rogue waves. Ocean circulation: Wind driven ocean circulation (Ekman dynamics, coastal currents).Thermohaline circulation, meridional overturning circulation, gravitational adjustment, oceanic deep convection, global deep circulation, global conveyor belt, three-dimensional circulation, oceanic transport, shelf water drainage, flow over topography. Waves: Wave kinematics. Surface gravity waves (wave diffraction at islands or coast, wave reflection, standing waves in one dimension, co-oscillation). Gravity wave generation (wind waves, capillary waves, sea waves, rogue waves, swell). Effects of earth's rotation: Boundary waves (Kelvin waves, amphidromic systems, topographic waves, basin modes). Effects of stratification, waves in moving media, other nonlinear effects. Tides: The earth-moon system (balance of forces, tidal potential, tidal forces in geographic coordinates), the earth-sun system, combined solar and lunar tides, main partial tides, quilibrium tide, secondary tidal force, dynamic tides, shallow water tides. Tidal phenomena (regional distribution of tides, extreme tidal amplitudes, tidal currents, tidally formed coasts, tidal friction and mixing, tidal datums). Tidal measurements. Tide tables, cotidal charts, non-tidal water level variation.
Oceanographic Data Processing
Introduction: Oceanographic Data Processing, Python: Scientific modules, variables and types, operators and comparisons, compound types, control flow, loops, functions, classes, modules, exceptions. Organizing data in multidimensional numpy arrays: functions for extracting arrays, linear algebra, reshaping, resizing and stacking arrays. Scientific algorithms and their applications: integration, Fourier transformation, optimization, interpolation, statistics. Visualization, plotting and organization of data: Creation, access and sharing of array-oriented scientific data and services (Global Historical Climateology Network (GHCN) Data integration, KNMI Services).

Recommended Literature

- Bearman, G. (Ed.) (2005): Waves, Tides and Shallow-water Processes. 2nd ed., Butterworth-Heinemann.
- LeBlond, P. H.; L. A. Mysak (1978): Waves in the Ocean; Elsevier
- Lin, J. W.-B (2012): A Hands-on Introduction to Using Python in the Atmospheric and Oceanic Sciences; www.johnny-lin.com/pyintro/
- Pedlosky, J. (2003): Waves in the Ocean and Atmosphere; Springer
- Open University Series (1995): Seawater: Its Composition, properties and Behavior; Butterworth-Heinemann, 2nd ed.
- Open University Series (1999): Waves, Tides and Shallow Water Processes; Butterworth-Heinemann
- Open University Series (2001): Ocean Circulation; Butterworth-Heinemann, 2nd ed.
- Scopatz, A., Huff, K.D. (2015): Effective Computation in Physics – Field Guide to Research with Python. 1. ed., O'Reilly and Associates.
- Talley, L.D., Pickard, W.J.E., Swift, J.H. (2011): Descriptive Physical Oceanography. 6th ed., Elsevier Ltd.

Teaching and Learning Methods

Physical Oceanography and Tides, 3 CP: Lecture (2 SWS), Plenum
Oceanographic Data Processing, 2 CP: Lecture (1 SWS), Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
Physical Oceanography and Tides: written/oral exam (graded)	Written exam of 120 min or oral exam of 20 min
Composition of Module Mark	
100 %	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Every two years, winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		03.12.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-308	Marine Geology / Geophysics	C	3	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	3 (= 31,5 h)	118,5 h

Objectives and Contents

Objective of Qualification (competencies)

Developing a comprehensive understanding of geological processes and geomorphology and the relevant measurement methods used in the marine environment.

Contents

- Geology / Geomorphology
  - Marine Geology: Types of rocks and composition of the earth. Plate tectonics. Geological time scale. Geomorphology: Shape of the seafloor, crustal structure. Geomorphology: Geomorphological and sedimentary processes and structures, effects on the seabed topography with special reference to the continental shelf. Seabed sediment types and characteristics. Undersea features: Cartographic terminology, definitions, sym-bology. Paleooceanography: Seabed sampling: grabs, corers, dredges. Proxies, Milanchovich cycles, Stratigraphy – oxygen isotopes, organic petrology.
- Seismics
  - Introduction: Fundamentals and applications. History. Theory of seismic wave propagation: Elastic characteristics of solids, types of seismic waves, signal attenuation, reflection and transmission coefficient, refraction, diffraction phenomena. Marine seismic instrumentation: Principles, seismic sources, detectors, recording instruments (analog, digital), wide-angle seismics (refraction seismics), multi-channel reflection seismics, 3D-seismics. Seismics and marine mammals. Field operation: Equipment configuration, launch and recovery. Seismic processing: Preprocessing (demultiplexing, static correction editing, resampling, gain recovery, deconvolution, filtering, CMP sorting). Processing analysis (velocity analysis, true amplitude recovery, deconvo-lution analysis, filter analysis). Seismic processing: Processing (normal moveout, de-multiple, dip moveout, NMO correction, CDP stack, filtering, equalisation, migration). Final stack.
- Magnetics and Gravimetry
  - Introduction: Terminology. Thematic classification. History. Theory of geomagnetic field: Actual field (representation, variations, magnetic storms). Model geomagnetic fields (international geomagnetic reference fields). Magnetic survey instrumentation: Magnetometers (magnetic field balance, fluxgate, proton, optical pumping magnetometers). Moving platform instrumentation. Magnetic data acquisition and reduction: Consideration for moving platforms, numerical reduction, contour maps. Main error sources of marine magnetic measurements (internal, external). Applications. Marine Gravity: Gravity field and gravity potential. Geoid. Ellipsoidal models. Contributions to the measured gravity. Gravity survey instrumentation: Absolute gravimeters (pendulum, free fall instruments, rise and fall instruments). Relative gravimeters (pendulum, spring gravimeters). Airborne and vessel-based systems. Gravity data: Data acquisition and processing. Applications in geodesy and geophysics.

Recommended Literature

- Hinze, W.J., von Frese, R.R.B., Saad. A.H. (2013): Gravity and Magnetic Exploration: Principles, Practices, and Applications. 1st ed., Cambridge University Press.
- Jones, E.J.W. (1999): Marine Geophysics. 1st ed., John Wiley & Sons.
- Keary, Ph., Klepeis, K. A., Vine, F. J. (2009): Global Tectonics. 3rd ed., John Wiley & Sons.
- Robinson, E. S., Coruh, C. (1988): Basic Exploration Geophysics. John Wiley & Sons.
- Sheriff, R. E., & Geldart, L. P. (1995): Exploration Seismology. 2nd ed., Cambridge University Press.
- Sreepat, J. (2014): Fundamentals of Physical Geology. Springer.
- Torge, W., Mueller, J. (2012): Geodesy. 4th ed., De Gruyter.
- Yilmaz, O. (2001): Seismic Data Analysis: Processing, Inversion and Interpretation of Seismic Data (Vol. 1 & 2). Society of Exploration.
- Wille, P. C. (2005): Sound Images of the Ocean in Research and Monitoring; Springer

Teaching and Learning Methods

Geology / Geomorphology, 1 CP: Lecture (1 SWS), Plenum
Seismics, 2 CP: Lecture (1 SWS), Plenum
Magnetics and Gravimetry, 2 CP: Lecture (1 SWS), Plenum

Exam(s)

Precondition of Examination

Type of Examination	Duration of Examination (if written or oral exam)
combined written/oral exam (graded)	Written exam of 180 min or oral exam of 20 min for all three courses of this module together
Composition of Module Mark	
Weighting like CPs (20% / 40% / 40%)	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		27.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-309	Hydrographic Practice	C	3	Sternberg

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
7,5	6 (= 63 h)	162 h

Objectives and Contents

Objective of Qualification (competencies)
The students are acquainted with modern hydrographic sensors in the context of a practical project. Further, the students are introduced to Quality Management related to hydrographic surveying.
Contents

- Supplementary Field Training / Practical Course:
  - Levelling: Identification of bench marks (governmental and determined by GNSS measurements) and their documentation. Collimation check/2-peg-test. Height determination of a marked point (tide gauge installation point) by levelling using official and GNSS-measured marks. Processing of the levelling. Hydrographic and oceanographic survey: Survey planning including: Definition of areas of investigation, time schedule (including profile planning and calibration and transit time), weather considerations, etc. Survey with hydrographic and oceanographic instrumentation. Processing and visualisation of different data sets. Tide gauge: Tide gauge installation. Determination of local water level variations/tide. Analysis and evaluation of the measured water level height with the official tide gauge data from surrounding tide gauges. Sensor installation: Mounting and integration of sensors. Vessel alignment survey: Execution of a vessel alignment survey to determine the sensors position within a vessel reference frame. Computation and adjustment of a vessel reference frame.
- Quality Management:
  - Introduction: Relevance of quality management; what is quality? Development of the main aspects of quality. Reasons for and the evolution of quality management. Quality assurance, quality control and quality improvement as the quality trilogy. Quality management system and total quality management (TQM). ISO Standards for quality management. Guidelines to improve results in hydrography. Quality tools: introduction and application in hydrography. Development of a quality management system: Example of the BSH. Accreditation, audits and controlling: definitions, procedures, pros and cons.

Recommended Literature

- Supplemtary Field Training
  - Christ, R.D., Wernli Sr, R.L. (2013): The ROV Manual: A User Guide for Observation Class Remotely Operat-ed Vehicles. 2nd ed., Elsevier.
  - Hofmann-Wellenhof, B., Lichtenegger, H., Collins, J. (2013): GPS-Theory and Practice. 5th ed., Springer.
  - Lekkerkerk, H.-J. (2011): Handbook of Offshore Surveying (Volume 1): Projects, Preparation & Processing. 2nd ed., Skillstrade.
  - Lekkerkerk, H.-J. (2012): Handbook of Offshore Surveying (Volume 2): Positioning & Tides. 2nd ed., Skillstrade.
  - Lekkerkerk, H.-J. (2012): Handbook of Offshore Surveying (Volume 3): Acquisition Sensors. 2nd ed., Skill-strade.
  - Torge, W., Mueller, J. (2012): Geodesy. 4th ed., De Gruyter.
- Quality Management:
  - Qualitätsmanagement – QM-Systeme und –Verfahren, DIN-Taschenbuch 226, Beuth-Verlag DIN EN ISO 9001:2015
  - ISO: Quality management principles, ISBN 978-92-67-10573-4, 2012, www.iso.org.
  - ISO: Selection and use of the ISO 9000 familiy of standards, ISBN: 978-92-67-10494-2, 2009, www.iso.org.

Teaching and Learning Methods
Supplementary Field Training / Practical Course, 5 CP: Lecture and Exercise in practical course (5 SWS), Plenum Quality Management, 2,5 CP: Lecture and Exercise (1 SWS), Plenum

Exam(s)

Precondition of Examination	
Successful execution of practical exercise (Supplementary Field Training)	
Type of Examination	**Duration of Examination (if written or oral exam)**
Suppl. Field Training: written/oral examination (graded) Quality Management: written/oral examination in (graded)	Written exam of 120 min or oral exam of 20 min in Supplementary Field Training. 20 minutes oral exam, 90 min written exam
Composition of Module Mark	

Supplementary Field Training: weight 83%
Quality Management: weight 17%

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 16/17		27.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-310	LIDAR and Remote Sensing	C	3	Kersten

Subject Area	Duration
HYD	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
2,5	2 (=21h)	54 h

Objectives and Contents

Objective of Qualification (competencies)
This module consists of lectures, which give the students a comprehensive knowledge of the principles of airborne LiDAR, bathymetric LiDAR, terrestrial and vessel-based LiDAR, bathymetry, satellite altimetry, and aerial photogrammetry for shoreline mapping. Moreover, LiDAR systems and the complete workflow, starting from data acquisition and ending with data processing/visualization, are also addressed. Students shall gain abilities - to evaluate applications of current LiDAR systems and their measurement principles - to specific appropriate LiDAR technology for in use in hydrographic applications - to specify and to analyze the error sources of topographic and bathymetric LiDAR - to evaluate LiDAR data processing the results - to know the use of terrestrial and vessel-based LiDAR for coastal applications and the system calibration - to explain the principles and limitations of satellite altimetry - to analyze image-based methods for hydrographic survey operations and the comparison with LiDAR
Contents
Introduction: History of airborne LiDAR, basic components of airborne LiDAR and its functionality, measurements principles **Error sources**: Interaction of laser beam with target (incl. full waveform analysis), error sources of airborne LiDAR **General workflow**: Filtering and classification, strip adjustment **LiDAR quality**: Strip adjustment, quality control **LiDAR systems**: Overview of commercial airborne LiDAR systems and new developments **Applications**: Overview of airborne LiDAR applications **Bathymetry**: Bathymetric LiDAR – Principles, systems & applications **Kinematic laser scanning**: Terrestrial and vessel-based LiDAR **Aerial and satellite photogrammetry**: Systems, images, image orientation, DEM generation, orthorectification, shoreline mapping, and hydrographic applications **Technology comparison**: Comparison of LiDAR and other remote sensing technologies **Satellite altimetry**: Principles & limitations for measurements of sea surface topography
Recommended Literature
Barale, V.; Gade, M. (eds.): Remote Sensing of the European Seas; Springer. Finkl C.W.; C. Majowski (eds.) (2014): Remote Sensing and Modeling – Advances in coastal and marine recources; Springer. Kraus, K. (2007): Photogrammetry – Geometry from images and laser scans; de Gruyter, 2nd ed. Shan, J.; C. K. Toth (eds.) (2008): Topographic laser ranging and scanning – Principles and processing; CRC press Vosselman, G.; H. G. Maas (eds.) (2010): Airborne and terrestrial laser scanning; Whittles Publishing Up-to-date scientific and technical papers for topics like: LiDAR systems, system calibration, data acquisition and data processing, and LiDAR applications
Teaching and Learning Methods
Lecture, Plenum

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
Written exam	90 min
Composition of Module Mark	
Written exam 100%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each winter term
Course Language
English

valid from	valid to	last updated
WS 18/19		27.11.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-311	Geodätische Erdbeobachtung	PF	3	Eicker

Lehrbereich	Dauer
GMT	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5	2 (=21Std.)	129 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Ziel des Moduls das Verständnis verschiedener geodätischer Satellitenbeobachtungsverfahren wie z.B. Satellitengravimetrie und Satellitenaltimetrie. Die Teilnehmer sollen die Kompetenz erlangen, die aus Satellitendaten abgeleiteten geodätischen Datenprodukte auszuwerten und die Ergebnisse in Anwendungen der Erdsystemforschung zu interpretieren.
Inhalte des Moduls
- Satellitengravimetrie: Satellitenmissionen GRACE/GRACE-FO, CHAMP, GOCE, Messverfahren, Fehlerquel-len, Modellierung des Erdschwerefeldes mit Kugelfunktionen, Berechnung von Massenvariationen aus Ände-rungen des Gravitationspotentials - Satellitenaltimetrie: Beobachtungsprinzip, Fehlerquellen, Bestimmung von Meereshöhen und dynamischer Ozeantopographie - Weitere Beobachtungsverfahren: z.B. InSAR, - Anwendung geodätischer Satellitenverfahren in der Erdsystemforschung: Bestimmung von Eismassenvariationen, Meeresspiegeländerungen und Sea-Level-Gleichung, Variationen im terrestrischen Wasserkreislauf, glazial-isostatische Ausgleichsprozesse, Methoden der Assimilation geodätischer Datenprodukte in numerische Erdsystemmodelle
Empfohlene Literatur
- Hofmann-Wellenhof, B. & Moritz, H. (2006) Physical Geodesy, Springer, ISBN 978-3-211-33545-1 - Torge, W. & Müller, J. (2012) Geodesy, Walter de Gruyter, ISBN 978-3-11-025000-8 - aktuelle wissenschaftliche Publikationen zu Themen wie Satellitengravimetrie, Satellitenaltimetrie, Erdsystemforschung
Lehr- und Lernform
Vorlesung und Übung, Plenum

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Bestehen einer Hausarbeit	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
Klausur/mündliche Prüfung	Klausur 120 Min. / mündliche Prüfung 25 Min.
Berechnung der Modulnote	
Klausur/mündliche Prüfung 100%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Modul Höhere Geodäsie
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Wintersemester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 18/19		03.12.2018

Modulkarte

Master Geodäsie und Geoinformatik
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Geo-M-Mod-401	Master-Thesis	PF	4	Traub

Lehrbereich	Dauer
Thesis	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
30 CP (=900 Std. Workload)		900 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Durch die Masterthesis sollen die Studierenden zeigen, dass sie in der Lage sind, Probleme aus den wissenschaftlichen, anwendungsorientierten und beruflichen Tätigkeitsfeldern der Geomatik selbstständig unter Anwendung wissenschaftlicher Methoden und Erkenntnisse zu bearbeiten, die fächerübergreifenden Zusammenhänge einzuordnen sowie wissenschaftlich und anwendungsorientiert die im Studium erworbenen Erkenntnisse weiterzuentwickeln und zu vertiefen.
Inhalte des Moduls
Verschiedene Inhalte aus dem Gebiet der Geodäsie und Geoinformatik
Empfohlene Literatur
Lehr- und Lernform
Thesis (Abschlussarbeit)

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Prüfungsart/-leistung	Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)
Erfolgreicher Abschluss der Abschlussarbeit, Präsentation, Kolloquium (benotet)	22 Wochen
Berechnung der Modulnote	
Bewertung der Master-Thesis 80%, Präsentation / Kolloquiums 20%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
Jedes Semester
Unterrichtssprache
deutsch

Gültig ab	Gültig bis	zuletzt aktualisiert
WS 16/17		30.11.2018

Mocule Card

Master Geodesy and Geoinformatics
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Geo-M-Mod-401	Master-Thesis	C	4	Traub

Subject Area	Duration
Thesis	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
30CP (= 900h Workload)	-	-

Objectives and Contents

Objective of Qualification (competencies)
By the Master Thesis, students shall demonstrate that they are capable to independently handle problems from the scientific, application-oriented and professional activity fields of geodesy and geoinformatics using scientific methods and knowledge to classify the interdisciplinary relationships as well as scientific and applied research to develop the findings acquired in the study and to deepen them.
Contents
Various topics of the field of geomatics
Recommended Literature
Depends on topic
Teaching and Learning Methods
Thesis Further important information can be found on the leaflet "Zulassung, Anmeldung und Ausgabe von Abschlussarbeiten" on the HCU website (Master > Geomatics > Examination Regulations)

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
Master Thesis, presentation and colloquium (graded) Submission: 2 copies (each copy includes a print version and a digital version (CD/DVD))	Time limit 22 weeks
Composition of Module Mark	
Assessment of the Master's thesis 80% and the result of the presentation/colloquium 20%. The grade is determined by both reviewers equally.	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Applicability of Module
Frequency of Offering
Each semester
Course Language
English

valid from	valid to	last updated
WS 16/17		30.11.2018

Modulkarte

Master FaSt
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
BS-M-Mod-001	BASICS:: Projektmanagement	PF	WiSe	Prof. Dr. Thomas Krüger

Lehrbereich	Dauer
Fachübergreifende Studienangebote (FaSt)	1-2 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5 CP (= 150 Std. Workload)	4 (= 42 Std. Kontaktzeit)	108 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
Kennen der typischen Problemstellungen, Instrumente, Methoden, Akteure und organisatorischen Kontexte von Projektmanagement, dessen theoretischer Bezüge und Praxisformen, auch über die eigene Disziplin hinaus, Anwenden und Reflektieren der Instrumente und Methoden des Projektmanagements im Disziplinen-spezifischen Kontext
Inhalte des Moduls
1) Vorlesung a) Basics: Projektmanagement Vorlesung b) Basics: Project Management Lecture (für alle englischsprachigen Studienprogramme) Instrumente, Akteure und organisatorischer Kontext von Projektmanagement 2) Begleitende Seminare Anwenden und Vertiefen der Vorlesungsinhalte im disziplinären Kontext bzw. nach Studiengängen
Empfohlene Literatur
1) Vorlesung a) Basics: Projektmanagement Vorlesung GPM (2008): ProjektManager. 3. Aufl. Nürnberg: GPM Deutsche Gesellschaft für Projektmanagement. b) Basics: Project Management Lecture Meredith, Jack R.; Mantel, Samuel J.; Shafer, Scott M. (2016): Project management. A managerial approach. 9. ed., internat. student version. Singapore: Wiley. Project Management Institute (2013). A Guide to the Project Management Body of Knowledge (PMBOK Guide) (5th ed.). Newton Square, PA: Project Management Institute, Inc. 2) Begleitende Seminare individuell nach SP
Lehr- und Lernform
1) Vorlesung (2,5 CP) 2) Begleitende Semnare (2,5 CP)

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
1) Vorlesung: keine 2) Begleitende Seminare: 80% Anwesenheitspflicht	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
1) Vorlesung: Klausur / Semesterarbeit 2) individuell nach Studienplan	1) Vorlesung: 90 min. / k.A. 2) individuell nach Studienplan
Berechnung der Modulnote	
1) Vorlesung: 50% 2) Begleitende Seminare: 50%	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
Keine
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)

Empfohlen für Interdisziplinäres Projekt
Häufigkeit des Angebots
1) Vorlesung: jedes WiSe 2) Begleitende Seminare: nach Studienplan
Unterrichtssprache
1) Vorlesung a) Basics: Projektmanagement Vorlesung: Deutsch b) Basics: Project Management Lecture: Englisch 2) Begleitende Seminare: Deutsch bzw. Englisch nach Studienplan

Gültig ab	Gültig bis	zuletzt aktualisiert
WiSe 15/16		25.09.2018

Mocule Card

Master FaSt
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
BS-M-Mod-001	BASICS: Project Management	C	Winter term	Prof. Dr. Thomas Krüger

Subject Area	Duration
Fachübergreifende Studienangebote (cross-curricular Programme)	1-2 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5 CP (= 150 h Workload)	4 (= 42 h contact time)	1-2 Semester

Objectives and Contents

Objective of Qualification (competencies)
• project management competencies including soft skills • ability to survey, apply and critically reflect project management tools
Contents
1) Lecture a) Basics: Projektmanagement Vorlesung b) Basics: Project Management Lecture (English-language Programms) • Tools, Instruments, Parties and organisational Context of project management 2) Seminar (organized by the master programs) • Each cohort deepens an area of project management relevant for the respective discipline in an interactive way that fits to and supports the program students' needs and uses program-related topics as examples.
Recommended Literature
1) Lecture a) Basics: Projektmanagement Vorlesung • GPM (2008): ProjektManager. 3. Aufl. Nürnberg: GPM Deutsche Gesellschaft für Projektmanagement. b) Basics: Project Management Lecture • Meredith, Jack R.; Mantel, Samuel J.; Shafer, Scott M. (2016): Project management. A managerial approach. 9. ed., internat. student version. Singapore: Wiley. • Project Management Institute (2013). A Guide to the Project Management Body of Knowledge (PMBOK Gui-de) (5th ed.). Newton Square, PA: Project Management Institute, Inc. • 2) Seminar • Literature will be announced in the lecture
Teaching and Learning Methods
1) Lecture (2,5 CP; 2 SWS) 2) Seminar (2,5 CP; 2 SWS)

Exam(s)

Precondition of Examination	
1) Lecture: none 2) Seminar: 80% Participation	
Type of Examination	**Duration of Examination (if written or oral exam)**
1) Lecture: Exam / term paper 2) Seminar: form of examination to be defined by each program	1) Lecture: 90 min / - 2) Seminar: to be defined by each program
Composition of Module Mark	
1) Lecture: 50% 2) Seminar: 50%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
none
Applicability of Module

Frequency of Offering
1) each winter term 2) to be defined by each program
Course Language
German and English

valid from	valid to	last updated
WiSe 15/16		25.09.2018

Mocule Card

Master FaSt
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
BS-M-Mod-002	BASICS: Joint Project	C	3	Traub

Subject Area	Duration
Fachübergreifende Studienangebote (cross-curricular Programme)	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5	2 (= 21 h)	129 h

Objectives and Contents

Objective of Qualification (competencies)
Joint project means that it is taught by instructors from different degree programmes and attended by students from different degree programmes. Joint project at the interface of geomatics, urban planning and REAP; Ability, to develop and implement independently an extensive project in a team of students from different degree programmes; planning and management skills, analytical and conceptual competences, to recognize spatial relationships through analysis and presentation of spatial data.
Contents
To design and conduct a complete project, using mainly remote sensing technologies, with different topics from the fields of geomatics. The participants will design their own research project in small working groups, develop a concept (definition of objectives, planning of the project workflow with activities and time frame), and partly implement the project with working methods from the participating disciplines, focusing on satellite image analysis and remote sensing applications. The groups will formulate their research layout in form of short paper presentation at the beginning of the semester. This will be followed by the implementation of the remote sensing applications. At the end, a final presentation of the research results will take place as well as the preparation of a full paper according to scientific standards.
Recommended Literature
varied
Teaching and Learning Methods
Lecture and Project, Plenum (If teachers of more study programmes involved, SWS are teached proportionately.)

Exam(s)

Precondition of Examination	
Type of Examination	Duration of Examination (if written or oral exam)
Depends on project	
Composition of Module Mark	
Grade	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
Recommended: Basic knowledge of Geoinformatics, experience in practical use of GIS
Applicability of Module
Frequency of Offering
Each Winter Semester
Course Language
English

valid from	valid to	last updated
WS 16/17		04.12.2018

Modulkarte

Master FaSt
HCU Hamburg

Modulnummer	Modulname	Modultyp (PF/WP/W)	Studiensemester (empfohlen)	Modulverantwortliche
Q-M-Mod-001	[Q] STUDIES	PF	alle	Prof. Dr. Thomas Schramm

Lehrbereich	Dauer
Fachübergreifende Studienangebote (FaSt)	1 Semester

CP (nach ECTS)	Semesterwochenstunden (SWS)	Selbstudium
5 CP (= 150 Std. Workload)	4 (= 42 Std. Kontaktzeit)	108 Std.

Ziele und Inhalte

Qualifikationsziel des Moduls (Angestrebte Kompetenzen)
• Reflexionskompetenzen: Wissenschaftliches analysieren und reflektieren • Kulturelle Kompetenzen: Transdisziplinäres und interkulturelles Kommunizieren • Wahrnehmungs- und Gestaltungskompetenzen: Kreatives und innovatives Gestalten • Handlungskompetenzen: Proaktives und verantwortliches Handeln
Inhalte des Moduls
) [Q] STUDIES I • Unterschiedliche Veranstaltungsformate mit theoretischem Schwerpunkt • Angebote zur Schulung der Wahrnehmung und Kreativität • praktische Projektarbeit wie z.B. die Konzeption von Veranstaltungen und deren Durchführung b) [Q] STUDIES II • s.o. Lehrbereiche: • Wissenschaft | Technik | Wissen • Medien | Kunst | Kultur • Wirtschaft | Politik | Gesellschaft
Empfohlene Literatur
Wird in der Veranstaltung bekannt gegeben
Lehr- und Lernform
2x Seminar / Ringvorlesung + Übung / Projekt (2x 2,5 CP, 2x 2 SWS)

Prüfung(en)

Voraussetzung zu(r) Prüfung(en)	
Anwesenheitspflicht (80%), aktive Teilnahme (begleitende Aufgaben in Vorlesung und Seminar)	
Prüfungsart/-leistung	**Prüfungsdauer (bei Klausuren/mündlichen Prüfungen)**
wird in der jeweiligen Lehrveranstaltung zu Beginn des Semesters definiert	
Berechnung der Modulnote	
2 x 50 %	

Ergänzende Informationen

Vorkenntnisse/ Voraussetzungen für die Teilnahme (formal und inhaltlich)
keine
Verwendbarkeit des Moduls/ Zugangsvoraussetzung für künftige Module (verbindlich oder empfohlen)
Häufigkeit des Angebots
jedes Semester
Unterrichtssprache

Deutsch und Englisch

Gültig ab	Gültig bis	zuletzt aktualisiert
WiSe 15/16		25.09.2018

Mocule Card

Master FaSt
HCU Hamburg

Module Number	Modul Name	Type (C/CE/E)	Semester (proposed)	Module Coordinator
Q-M-Mod-001	[Q] STUDIES	C	each Semester	Prof. Dr. Thomas Schramm

Subject Area	Duration
Fachübergreifende Studienangebote (FaSt)/cross-curricular Programme	1 Semester

CP (according to ECTS)	Contact Hours/Week (SWS)	Self-study
5 CP (= 150 h Workload)	4 (= 42 h contact time)	108 h

Objectives and Contents

Objective of Qualification (competencies)
- Reflection competencies: scientific analysis and reflection - Cultural competencies: transdisciplinary and intercultural communication - Perception and design competencies: creative and innovative design - The ability to act: proactive and responsible action
Contents
a) [Q] STUDIES I - Different courses with theoretical emphasis - Opportunities to train the perception and creativity through - Practical project work such as the development of course concepts and their implementation b) [Q] STUDIES II - see above Fields of Study: - Science | Technology | Knowledge - Media | Art | Culture - Economy | Politics | Society
Recommended Literature
will be announced in the lecture
Teaching and Learning Methods
2x seminar / lecture + tutorial / project (2x 2,5 CP; 2x 2 SWS)

Exam(s)

Precondition of Examination	
80% participation, active participation, accompanying as-signments	
Type of Examination	**Duration of Examination (if written or oral exam)**
to be defined by each teacher and course	
Composition of Module Mark	
2 x 50%	

Additional Information

Previous Knowledge / Conditions for Participation (in form and content)
none
Applicability of Module
Frequency of Offering
each Semester
Course Language

German and english

valid from	valid to	last updated
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