

MSc in Geospatial & Mapping Sciences

Geospatial information, acquisition and management

Programme Structure

The programme is modular and organised with formal classes on 3 days of the week. Additional time is required for completion of practical work, background reading, report writing, revision, etc. It is designed to be flexible and accommodate both full time and various patterns of part-time study leading to the PG Certificate, PG Diploma, or MSc and for individual courses to contribute to continuing professional development (CPD). Part-time students will attend classes 1 or 2 days per week, or in 5 week blocks; CPD participants will normally attend 1 day per week for 5 weeks.

The teaching year starts in mid September (week beginning 14th September in 2009). The academic session is divided into two 13 week semester with courses taught in 5 week blocks. The additional weeks are used for private study, revision and assessment. The MSc project is normally commenced in late April and completed towards the end of August.

	Day 1	Day 2	Day 3
Week 0	Intro to programme	Intro to programme	Intro to programme
Semester 1A Weeks 1-5	Fundamentals of Geomatics I (10 credits)	Principles of Land Survey (10 credits)	Principles of GIS (10 credits)
Week 6	Private study	Private study	Private study
Semester 1B Weeks 7-11	Fundamentals of Geomatics II (10 credits)	Land Survey Instrumentation & Methods (10 credits)	Principles of Photogrammetry & Remote Sensing I (10 credits)
Week 12	Private study	Private study	Private study
Week 13	Exam	Exam	Exam
Semester 2A Weeks 14-18	Geodesy & GNSS (10 credits)	Hydrographic Survey I* (10 credits)	Land Registration/Cadastral and LIS I (10 credits)
Week 19	Private study	Private study	Private study
Semester 2B Weeks 20-24	Topics in Geomatics* (10 credits) Choose 2 from: Hydrographic Survey II; Land Administration; Photogrammetry II; NSDI; etc.	Engineering Survey I* (10 credits)	Research & Professional Issues* (10 credits)
Week E1	Field Course (6 days)		
Week 25	Private study	Private study	Private study
Week 26	Exam	Exam	Exam
Weeks 27-42	MSc Project (60 credits)		

* courses with significant input from industrial guest lecturers

Brief description of courses

Each of the taught courses is 10 credits (approx. 5 ECTS), representing about 100 hours of student effort. Formal teaching, including lectures, scheduled practicals, tutorial and seminars typically constitute about 15-25 hours (3-5 hours per week) in each course with the additional time being devoted to private study. Some courses combine two 5 credit teaching units, available separately as CPD.

Fundamentals of Geomatics I

This course covers key underlying principles of geospatial data and its processing, including geodesy and essential mathematics & statistics and an introduction to IT applications in Geomatics

- The size and shape of the Earth
- Plane Geometry & 2D coordinates; 2D coordinate transformations
- Datums and 3D coordinate systems
- Plane and Spherical Trigonometry
- Basic statistics and their application to geospatial data
- Introduction to IT systems and general purpose software
- Information coding systems, data storage and backup procedures
- Data communications and interfacing survey instrumentation
- Data formats used in surveying & mapping
- IT standards and metadata for Geospatial Information

Fundamentals of Geomatics II

Further mathematical principles and applications and an introduction to Digital Terrain Modelling

- Map projection systems and their use
- VBA Programming (for coordinate and projection transformations)
- Vectors; Matrices; Solution of Equations
- Calculus; Principles and use of Least Squares
- Data quality
- Areas, volumes & conic sections
- Surface sampling strategies and data sources
- Spatial interpolation methods
- Terrain representation and visualisation
- Applications of terrain models
- 3D GIS and solid modelling

Principles of Land Survey

This course aims to introduce the basic principles, instrumentation and methods of land surveying.

- Basic survey concepts
- Horizontal and vertical control for surveying, including GPS networks & control
- Methods of detail survey
- Basic survey instrumentation – the total station; levels; GPS.
- Observation methods, booking methods, electronic recording, survey abstracts, data reduction
- Survey computations – bearing & distance, intersection, resection.

Land Survey Instrumentation & Measurement

This course builds on the introduction in Survey Principles, covering the design & use of survey instrumentation, advanced computations and survey operations

- Total station design, calibration and user testing
- Traverse observation, computation and adjustment
- Design and use of scanning devices and other instrumentation
- Survey network adjustment
- Planning survey operations, including survey specifications
- Reporting on survey operations
- Products of survey operations

Principles of Geospatial Information Systems

This course introduces the nature and use of GIS.

- The nature & classification of geospatial phenomena and data
- Geospatial data models and data structures
- GIS operations and basic spatial analysis
- Designing and building geospatial databases
- Basic map design & visualisation
- GIS applications

Photogrammetry & Remote Sensing (I)

The first part of this course examines the processes involved in the capture of geospatial data from aerial and space born platforms; the second part focuses on the use of these techniques in survey and mapping applications.

- Photogrammetric cameras and imaging platforms, recording media
- Air photo distortion and displacement
- Terrain height determination; Parallax equation
- Photo orientation; Collinearity equations
- Space resection and photo control, camera calibration
- Photogrammetric mapping project planning, aerotriangulation
- Digital photogrammetry and orthophoto production
- Engineering applications of photogrammetry;
- Convergence of photogrammetry, satellite remote sensing and LIDAR.
- Remote sensing imaging systems, data, sources
- Image enhancement, image analysis

Geodesy & GNSS

A more advanced level course in Geodesy & Satellite positioning systems, including mathematical & computational issues.

- Sphere, Spheroid & Ellipsoid
- Astronomical & Geodetic co-ordinate systems
- Terrestrial Reference Systems & Frames
- Geodetic transformations
- GNSS
- Geodetics & GNSS Networks
- Quality issues in GNSS
- Basic Geophysics

Hydrographic Surveying

This course introduces the particular issues, equipment and methods involved in surveying at sea and supporting offshore engineering projects.

- The sea as a working environment, tides, currents, etc.
- Hydrographic charts
- Navigation and positioning techniques and accuracies
- Acoustic theory
- Hydrographic survey instrumentation
- Hydrographic data processing
- Applications

Engineering Surveying

This course covers the specific requirement and techniques involved in engineering site survey.

- Engineering survey geometry
- Setting out engineering projects
- Deformation monitoring
- Engineering applications and survey output requirements

Land Registration/Cadastre and LIS

In many parts of the World the determination and management of property boundaries and land registration is a key role for surveyors. This course covers the nature of boundaries and the development and use of Land Information Systems.

- The nature of land and boundaries
- Adjudication, delimitation and demarcation of boundaries
- International (land, maritime, riverine) and property boundaries
- Land Registration & Cadastre; Scotland and international comparisons
- Survey and Mapping for Cadastre
- Land&Survey Law
- Land Information Systems; design and implementation
- VBA programming for Customising GIS/LIS
- Data quality and error propagation in GIS/LIS

Research and Professional Issues in Geomatics

The research component focuses on the preparation of proposal for the MSc project. The nature of the profession and issues related to working in the profession are covered in the other component which will take the form of a series of talks from senior individuals from industry, including participation in the CPD programmes of the professional institutions.

Research methods

- Key research areas in Geomatics
- Library skills for researchers
- Assessing published information
- Preparing a research/project proposal
- Presentation skills

Professional Issues

- The nature of the Geomatics industry, professional qualifications and career paths
- The business of Geomatics
- Topical issues in Geomatics
- Attendance at RICS/ICES CPD meetings (this will be spread throughout the year)

Topics in Geomatics

The course gives students a chance to choose two topics of particular interest to them and to investigate these in greater depth. The range of topics may vary from year to year. These topics may will involve significant contribution from invited experts.

Example topics (available in 2008-9):

Hydrographic Survey Applications; Terrestrial Laser Scanning;
Land Administration; National Geospatial Data Infrastructures;
Photogrammetry II; Space Geodesy & deformation mapping; GIS Virtual Placement;

MSc Project

The MSc project is an extended piece of work carried out largely independently over a period of 3-4 months. Students are encouraged to carry out projects in collaboration with industry, or in support of research projects within the Department of Geographical & Earth Science

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