

# Geoinformatics

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Geographical and earth sciences rely increasingly on digital spatial data acquired from remotely sensed images, analysed by geographical information systems (GIS) and visualised on the computer screen or on paper. The technologies supporting the processes of acquiring, analysing and visualising spatial data form the core of geoinformatics. Technological skills alone, however, are not sufficient for organisations involved in the production and management of geo-information. To optimise the use of technologies, additional capabilities must be available, such as a thorough understanding of efficient data collection, the structuring of spatial databases, and data output by visualisation techniques, as well as a sound organisational infrastructure for managing and accessing the data. Organisations must be able to keep pace with developments in electronic data dissemination.

## What will be achieved?

Two types of degree course, the Professional Master (PM) course and the Master of Science (MSc) course, are offered in the Geoinformatics programme. The PM course addresses the needs of professional staff who wish to improve their skills in the use of integrated geo-information production technology. An integral part of the course is the operational management of geo-information production systems, including design, planning, execution and quality control. The goals of the MSc course are a critical understanding of, and competence in, developing systems and tools for the acquisition, processing, transformation, analysis, storage, presentation and use of geo-information. In addition skills are developed to enable participants to design and undertake research and development projects in various fields of geoinformatics, as well as participate in multidisciplinary research and development projects.

## Course content and structure

The courses are composed of a series of three-week modules. There are four types of module: core modules, programme modules, specialisation modules and elective modules.

### Core modules

The core modules, followed by all participants, deal with the theory, tools and techniques of GIS and remote sensing that are common to all ITC programmes. Knowledge of the principal concepts of spatial data acquisition through remote sensing and spatial data handling with GIS is supplemented by developing the practical skills required to apply these tools. Throughout other modules GIS and remote sensing tools are applied regularly. This provides the opportunity to develop a full understanding of their relevance to geoinformatics, and the ability to extract maximum utility from their use.

### Programme modules

The programme modules followed by participants of both courses first introduce participants to common concepts and the theory of geoinformatics technology and production. Further modules deal with framework data generation, the

visualisation and dissemination of geospatial data, and the design and operation of integrated geo-information production and dissemination systems. The two courses then diverge.

### Specialisation modules

Specialisation modules are offered in three directions, but within the PM course only. The MSc course, however, integrates aspects of all three specialisations.

#### *Digital Photogrammetry and Remote Sensing*

The quality of decision making on matters of urban growth, environmental protection, exploration for natural resources, sustainable development, and communication largely depends on the timely availability of adequate spatial data. Zealous research efforts and rapid technological developments continually extend the possibilities for efficient data acquisition. Advances in airborne and spaceborne sensor systems, digital photogrammetry, image understanding and computer vision favour integrative acquisition techniques.

This specialisation addresses the systems, techniques and commercial services of primary data acquisition. It deals with concepts, systems and methods of image transformation and information extraction from primary data. The quality and performance of processes related to topographic (framework) and thematic data are an important aspect. With a strong emphasis on data integration and digital database updating, participants are prepared for the operational management of spatial data production.

#### *Geographical Information Systems*

Technology for geo-information management changes so rapidly that it is difficult to keep pace. Yet concealed behind the constantly evolving user interfaces of these systems is a fairly stable type of technology based on storage techniques and manipulation requirements. A good understanding of the latter is the best guarantee for becoming a technologically up-to-date scientist/developer of geo-information applications.



The core business of this specialisation consists of thematic, spatial and spatio-temporal data manipulation and the design of systems that accommodate this manipulation. The tools used are those of thematic/spatial database design, GIS application development for spatial analysis, and general computer programming. Special topics include higher-dimensional topology, fuzzy logic, temporal and spatial data, object-oriented application development, spatial database design, and Internet programming techniques.

### ***Cartography and Geo-information Visualisation***

Modern cartography is much more than the presentation of geographical information in map form. It is seen as geo-visualisation, involving the visual exploration of the data by individual scientists and the final presentation to a more general public. Furthermore, increasing use of the Internet and multimedia to disseminate geographical information places specific demands on display techniques.

The presentation of topographic and framework data at various scales forms an important part of this specialisation, involving generalisation and in some cases a combination of digital data with remotely sensed images. Selecting the best projection and display design for maps of different types of attribute data for different user groups is also dealt with in detail.

The specialisation includes practical exercises in all of these aspects of modern cartography, and aims to give a thorough grounding in the basic principles of map design, and in the use and management of the techniques required to produce maps on a computer display screen or on paper.

### **Elective modules**

All ITC participants may choose from a variety of elective modules offered simultaneously by all ITC's scientific departments. For the PM course, two such electives are scheduled; for the MSc course three. Examples of modules on offer include Environmental Impact Assessment, Network Information Systems, Decision Support Systems and Multicriteria Evaluation, Advanced GIS and Remote Sensing.



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