ITC STUDY GUIDE 2009/2010

Master degree course in Geo-information Science and Earth Observation for

Natural Resources Management

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Natural Resources Management

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Master degree course code: C09-NRM-M-01

Foreword

Dear course participants,

Welcome to ITC.

Having left your family and country, you have come to ITC to further your education. We hope that the course you have selected will fulfil your expectations.

A major change will take place during your studies at ITC. From 1 January 2010 ITC will become a faculty of the University of Twente (UT). Hence, ITC students will receive an UT degree from that date onwards. ITC education, however, will continue to be offered at the present location of our Institute.

Education at ITC is characterised by:

- a modular set-up,
- a mixture of theory and practice, often including participants' own experiences
- a core curriculum for Remote Sensing (RS) and Geo-information Systems (GIS), common to all programmes, and
- choice options according to individual (research) interest and/or the needs of your own organisation.

We are pleased to present you this study guide for the 2009/2010 Master programme offered full-time at ITC Enschede. This study guide gives you information on the courses, an overview of the modules and the detailed content of the course modules. ITC is continuously modifying its courses to the needs of its students and their organisations.

Description of all elements of education at ITC and the descriptions of the modules of other courses are available on the ITC website (http://www.itc.nl/education/courses/modules.aspx).

But there is more to life at ITC than only education. You have arrived at an Institute with more than 400 students from over 70 countries. Furthermore, also ITC staff is originating from more than 25 countries: a truly international environment where you will be able to meet colleagues from all over the world. ITC is organising all sorts of social, cultural and sports activities. Well-known are the International Sports Tournament, the International Food Festival and the International Cultural Event. We would like to encourage you to participate in many if not all of these events and to make new friends in the process.

We will do our best to provide you with the quality of education that you expect from our Institute.

We wish you the best of success during your studies and a pleasant stay at ITC and in the Netherlands.

Prof. Dr. Ir. M. Molenaar, Rector ITC

Introduction to the Master degree programme

1. Introduction to the Master degree programme

1.1 Curriculum

The duration of the Master degree programme in Geo-Information Science and Earth Observation is twelve months. The Master degree programme consists of two courses:

- Geoinformatics, and
- Natural Resources Management

At successful completion of the Master degree programme, the student is able to:

1. Apply conceptual and operational knowledge to design and manage processes to solve problems encountered in professional practice.
2. Apply appropriate methods for collecting, acquiring and verifying spatial data.
3. Use geo-information science and earth observation technology to generate, analyse and display spatial data.
4. Select and apply relevant and appropriate methods and models for data analysis and problem solving.
5. Work in multi-disciplinary teams to contribute to decision making.

These objectives at programme level are worked out into objectives at course and module level. For more information on these, please check the domain specific part of this study guide or the module descriptions.

The Master degree programme is professionally oriented and teaches practical skills. It could be compared to a taught masters in other countries.

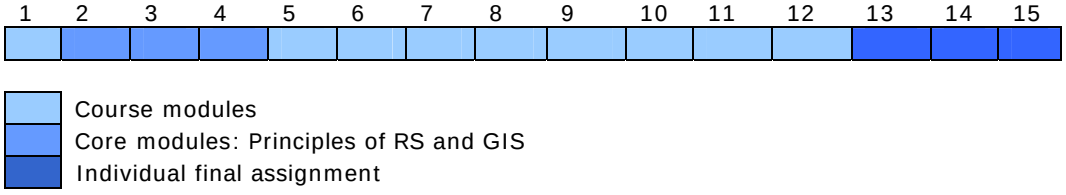
All Master courses lead to a degree with the title:
"Master in Geo-Information Science and Earth Observation".

1.2 Course Structure

All ITC courses are divided into three week periods (modules) or multiples of three weeks (blocks) in which one subject or related subjects are taught. The Master programme is made up of 15 modules, consisting of core modules about GIS and Remote Sensing, course modules, and an Individual Final Assignment (IFA).

ITC's core business is the collection and handling of geo-information and its application in various fields involved in sustainable resource development. ITC has given its core business a prominent place in the courses. The first modules in all degree courses contain ITC's core curriculum: (at least) three weeks of these core modules are spent on Geographic Information Systems (GIS) and (at least) three weeks are spent on Remote Sensing. In addition to these core modules all programmes offer more advanced modules in Geo-Information and Earth Observation techniques that vary per course.

Figure 1
Structure of Master Courses



Course Modules
In the first module, the course domain and principles of databases are introduced. In module 5 and further the core modules are applied within this course domain.

Core Modules
Modules 2 and 3 teach the basic principles of Remote Sensing and GIS, and how these can be applied in various domains. This common core ensures a basic level of GIS and RS for all students, regardless of their background and experience.

Individual Final Assignment
The Master degree programme concludes with an IFA in which the participant can work on a case and topic which is tailored to his or her particular situation and interest. Participants are encouraged to bring data and other material from their home country for this purpose, subject to approval.

1.3 Roles within the Curriculum

Course Director
The course director is authorised by and accountable to the Head Education regarding development and implementation of all courses within a specific domain and their specialisations. The course director is responsible for execution of the courses, including logistic aspects, fieldwork, purchase of all materials, the administration of information regarding students and their study results, diplomas and course records, and course content archiving.

Course Secretary
The course secretary supports the execution of the course and the course director. She is the first point of contact for students requiring information regarding the course.

Module Coordinator
Each module is coordinated by a staff member. He or she is responsible for the organisation and execution of the entire module. The module coordinator can be contacted for information or questions regarding the module he/ she is responsible for.

IFA Assessment Board
The IFA Assessment Board is responsible for assessment of the IFA report and oral examination of the participant on completion of the IFA work.

Academic Board
The Academic Board, consisting of all professors of ITC, is amongst other tasks, responsible for the curriculum and quality assurance of education.

1.4 Study Load

The European Union has developed a European Credit Transfer System (ECTS) to allow easy comparison of study load of courses within Europe. ITC has adopted this system as a means of improving academic recognition for study abroad. In ECTS, 60 EC credits represent the workload of an academic year of study. These include lectures, practical work, seminars, tutorials, fieldwork, and self study. At ITC, each module of three-week duration has a study load of 5 EC. The Master course consists of 15 modules and two weeks of remedial teaching, catch-up activities and graduation ceremonies, totalling 77 EC.

1.5 Opening Hours of ITC Facilities

ITC building	
Monday-Thursday	07:30 - 22:30
Friday	07:30 - 21:00
Saturday	09:00 - 17:00

Bookshop (room 0-006)	
Monday-Friday	08:30 – 12:15
	12:45 – 16:30

Library (room 3-038)	
Monday, Thursday, Friday	08:30 - 17:00
Tuesday, Wednesday	08:30 – 21:00

Audio-Visual centre (room 3-039)	
Monday, Thursday, Friday	08:30 - 17:00
Tuesday, Wednesday	08:30 – 21:00

Students' financial administration desk (room 1-130)	
Monday-Friday	10.30 – 13.30

Computer helpdesk (room 1-004)	
Monday-Friday	08:30 - 12:45
	13:30 – 17:00

Restaurant (ground floor)	
Monday-Friday	
Coffee break	10:15 – 10:45
free coffee/tea	
Lunch	12:00 - 13:30
Tea break	15:15 – 15:45
free coffee/tea	

1.6 Starting dates of modules and holidays

Module number	**2009 / 2010 / 2011**
Registration Master + MSc + PGD	*Monday, September 14, 2009*
Opening Academic Year	*Thursday, September 24, 2009*
Module 1	September 28 through October 16
Module 2	October 19 through November 6
Module 3	November 9 through November 27
Module 4	November 30 through December 18 RS exam: Friday, 6 November 2009 GIS exam: Friday, 27 November 2009 re-sit exam RS: Wednesday, 9 December 2009 re-sit exam GIS: Wednesday, 16 December 2009
Diës Natalis ITC *Christmas break*	*Thursday, December 17, 2009* *December 21, 2009 through January 3, 2010*
Module 5	January 4 through January 22, 2010
Module 6	January 25 through February 12
MSc day	*Wednesday, January 27, 2010*
Module 7	February 15 through March 5
Module 8	March 8 through March 26
MSc research fair	*Wednesday, March 10*
Module 9	March 29 through April 16
Good Friday *Easter Monday*	*April 2, 2010* *April 5, 2010*
Module 10	April 19 through May 7
Queen's day *Liberation day* *Ascension day*	*April 30, 2010* *May 5, 2010* *May 13, 2010 (+ May 14 ITC closed)*
Catch-up week MSc & Master	*May 10 through May 14*
Final Project PGD	May 10 through June 11
Module 11	May 17 through June 4
Whitsun Monday	*May 24, 2010*
Module 12	June 7 through June 25
Closing week PGD *PGD closing ceremony*	*June 14 through June 18, 2010* *Friday, June 18, 2010*
Module 13	June 28 through July 16
Catch-up week MSc	July 19 through July 23
Module 14	July 26 through August 13
Module 15 MSc proposal presentations + Master defences	August 16 through September 3 August 30 through September 3
Closing week Master *Master graduation*	*August 30 through September 3* *Friday, 3 September 2010*
MSc modules 16 through 23	September 6, 2010 through February 25, 2011
MSc mid-term presentations *Diës Natalis ITC* *Christmas break* *MSc thesis submission* *MSc defences*	*November 1 through November 5, 2010* *Friday, 17 December 2010* *December 27, 2010 through January 3, 2011* *Monday, 21 February 2011* *February 28 through March 4, 2011*
Closing week MSc	*March 7 through March 11, 2011*
MSc graduation	*Thursday, March 10 and Friday, March 11, 2011*

Natural Resources Management

2. Natural Resources Management

2.1 Introduction

The world is changing rapidly. Growing population densities lead to scarcity of land and widespread changes in land use. Excessive human activities cause deforestation, overgrazing, depletion of land and water resources and a wide variety of environmental problems. To solve these problems, and to make sure that future generations can enjoy the benefits of the earth's natural resources, better and more careful management of these resources is needed.

Sustainable development requires the implementation of ecologically sound, economically viable and socially acceptable resource management policies. To achieve this, planners, managers and researchers must understand the complexity of factors involved in the management of natural resources. They must collect and interpret the required data and work together with specialists from other disciplines. A large amount of information is needed to make informed decisions about the planning and management of the use of land. The Natural Resources Management Master Course provides knowledge and technical skills needed for the collection, interpretation and management of spatial information, using remote sensing and geographic information systems, to support planning and decision-making processes.

The Master course in Natural Resources Management (NRM) provide participants with the knowledge and technical skills needed for the collection, interpretation and management of spatial information, using remote sensing and geographic information systems, to support planning and decision-making processes.

I hope the course in Natural Resources Management that you have chosen will equip you with all relevant knowledge and skills to enable you to contribute to the important task of caring for our natural environment.

I wish you a successful and enjoyable time as a participant in NRM.

Michael Weir, Course Director

Natural Resources Management Courses, ITC
August 2009

2.2 Objectives and competences

The Master course aims at professionals who, individually or as members of a team within an organization, contribute to information generation for improved planning and decision-making. Graduates typically work as project leaders or as high-level technical support to projects. The course is designed to increase the participant's operational knowledge and technical skills needed to analyse problems and identify and structure relevant information. Participants learn how to manage projects and to work in a multidisciplinary team to solve practical problems in Natural Resources Management (NRM).
On completion of the Master course, participants are able to:

- Apply conceptual and operational knowledge to design and manage processes to solve a problem encountered in professional environmental management practice.
- Apply appropriate methods for spatial data acquisition, verification and quality control
- Use geo-information science and earth observation technology to generate, analyse and display spatial data.
- Select and apply relevant and appropriate methods and models for data analysis and problem solving in environmental management.
- Work in multidisciplinary teams to contribute to decision making in environmental management.

2.3 Curriculum of the Domain

General Outline

The course comprises two blocks of fixed course work, followed by a multi-disciplinary Group Project (including fieldwork) and an Individual Final Assignment. Successful completion of the course leads to the degree of Master in 'Geo-Information Science and Earth Observation'.

The course consists of a number of modules. Each module lasts three weeks and comprises theoretical lectures, workshops and practical assignments. The course is composed of three blocks of modules.

The first four modules, forming block 1, are common to both Master and MSc NRM course participants and to participants who follow these modules as a short course. These four modules prepare participants for a role as natural resource geo-information specialist, working at the interface of natural resources management, natural resource data acquisition & analysis and geo-information technology. Participants master the principles of GIS, remote sensing and information technology applied to NRM.

The next six modules, forming block 2, deal with a number of concepts, approaches, methods, tools and techniques that are specifically applicable to Natural Resources Management. Understanding the present situation as a complex system with feed-back mechanisms and the ability of self-regulation can be achieved in various ways. Modelling techniques and scenario analysis are among them and attempt to capture the effects of changes in land use on the abiotic and biotic environment. Natural ecosystem models describe the development of vegetation and animals in relation to abiotic conditions and management. In agro-ecosystem models the effects of natural and human influences on agricultural and pastoral systems are illustrated.

An important issue is the identification of the problems arising from the interaction of people with their environment and of the diverse interests of different stakeholders in natural resource management. Solutions to these problems that satisfy the varied ecological, social and economic interests of the different parties involved should be sought in order that organizations can implement proper planning and decision-making processes for sustainable NRM.

Although these topics are offered in the form of six modules, much of the content will be treated in the form of project work that may run over several modules. In this way the modules of block 2 form a coherent whole.

The third block of the course comprises the multi-disciplinary Group Project and an Individual Final Assignment.

Group project

The group project demonstrates the role and contribution of different fields of expertise in a real world case of NRM. During a fieldwork period of several weeks, participants practise field techniques and implement strategies for natural resource data acquisition and analysis using remote sensing and GIS. Emphasis is placed on working in teams and on information delivery to planners and decision makers.

Individual Final Assignment

Towards the end of the course, each Master participant undertakes an Individual Final Assignment (IFA), tailored to his or her particular situation and interests. Participants may have data and other material from their home country for this purpose, or they may use data collected during the group project.

Programme Natural Resources Management

	Module	**Module coordinator**
BLOCK 1		
Module 1-2-3 28-09-09 / 27-11-09	Principles and Applications of GIS and Remote Sensing	Drs. E. Westinga
Module 4 30-11-09 /18-12-09	Introduction to Natural Resources Management	Dr. I.C. van Duren
BLOCK 2		
Module 5 04-01-10 / 22-01-10	System and problem analysis	Drs. E.H. Kloosterman
Module 6 25-01-10 /12-02-10	PGIS and mobile GIS	Drs. J.J. Verplanke
Module 7 15-02-10 / 05-03-10	Data Collection and Analysis	To be appointed
Module 8 08-03-10 / 26-03-10	Scenarios and modelling	Drs. E.H. Kloosterman
Module 9 29-03-10 / 16-04-10	EIA, EIS and SIA	Drs. J.M. Looijen
Module 10 19-04-10 / 07-05-10	Evaluating alternatives and decision making	To be appointed
BLOCK 3		
Modules 11+12 17-05-10 / 25-06-09	Group Project	Drs. E.H. Kloosterman
Module 13-15 28-06-10 / 27-08-10	Individual Final Assignment	Supervisor(s) to be appointed

2.4 Staff

Course Director	Dr. Michael Weir
Course Secretary	Ms Ceciel Wolters
Advisor/counselor for MSc students	Dr. Tiejun Wang

Module descriptions

3. Module descriptions

Principles and Applications of GIS and Remote Sensing			
Module: 1-3		Module coordinator: Drs. E. Westinga	
Start:	28-09-2009		
End:	27-11-2009		
ECTS: 15		*Together with MSc and PGD*	U09-NRM-136

Introduction

These modules introduce the principal concepts and techniques of geographical information systems (GIS) and remote sensing (RS). The modules consist of three interrelated parts: a theoretical part which focuses on the concepts, a practical part which aims at developing hands-on skills in using software tools, and, an application oriented part in which participants learn how to design and carry out sequential data processing steps for solving a typical application problem in natural resources management.

The concepts and techniques introduced in these modules will be further elaborated during subsequent modules of the programme.

Objectives

The aim of these modules is to learn how to generate information about the earth from remote sensing and data stored in geographic information systems.

At the end of the core modules participants will be able to:

1. Explain the principles and use the vocabulary of RS and GIS.

- Describe the nature of geographic phenomena and their representation in the context of geo-informatics;
- Outline the principal data models for spatial and non-spatial data used in GIS databases;
- Outline the main components of a GIS and their functions;
- Explain the relationship between spatial data and coordinate systems;
- Outline the main spatial data analysis functions;
- Explain the role of RS in GIS;
- Describe the physical background of remote sensing and compare the main platforms and sensor systems;
- Explain the main digital image processing procedures;
- Describe the common methods of image analysis;
- Outline the principal rules for cartographic visualisation;
- Describe aspects of data quality and how various stages of spatial data handling affect it.

2. Carry out basic RS/GIS operations

- Carry out basic data preparation, geo-referencing and data entry into a GIS;
- Perform basic manipulation, analysis and visualisation operations using a GIS;
- Perform basic image processing techniques;
- Carry out a visual interpretation of an AP stereo pair and a satellite image;
- Apply basic data quality assessment procedures.

3. Apply appropriate RS/GIS methods for problem solving

- Understand the capabilities, uses and limitations of GIS and RS for geo-information production in a NRM context;
- Design and carry out sequential data processing steps for solving a typical application problem;
- Evaluate the results of data processing;
- Be aware of organisational issues of GIS development and implementation.

Contents

The modules cover the following topics:

Introduction to the Natural Resources Management course.

GIS and RS principles

- Geographic information and spatial data types
- Spatial data entry and preparation
- Spatial data analysis
- The electromagnetic spectrum
- RS Sensors and platforms
- Geometric aspects of remotely sensed data
- Image enhancement and visualisation
- Image classification and interpretation
- Spatial data visualisation
- Quality assessment of spatial data.

GIS/RS applications in NRM

- RS data interpretation for land resource inventory
- RS and GIS for land resource change analysis
- GIS tools for landscape analysis.

Prerequisites

Not applicable.

Recommended Knowledge

Basic computer skills.

Compulsory textbook(s)

- O. Huisman and R.A. de By (ed.), 2009: Principles of Geographic Information Systems - An introductory textbook, 4th ed., ITC, ISBN 90-6164-269-5
- K. Tempfli, N. Kerle, L.L.F. Janssen and G.C. Huurneman (eds.), 2009: Principles of Remote Sensing - An introductory textbook, 4th ed., ITC, ISBN 90-6164-270-1

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
60	100	0	30	90	130	10

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Form:

- Two written, closed book, examinations (one on GIS and one on Remote Sensing, each with a weight of 1 module).
- Submitted results of selected exercises and assignments (weight: one module).

Introduction to Natural Resources Management			
Module: 4		Module coordinator: Dr. I.C. van Duren	
Start:	30-11-2009		
End:	18-12-2009		
ECTS: 5		*Together with MSc and PGD*	M09-NRM-115

Introduction

The module has a multi-disciplinary focus which challenges the participants to develop a common basis for the assessment of the multi-actor, multi-purpose and multi-disciplinary nature of NRM, thus recognizing the complexity and conflicts involved in NRM issues. This is achieved through the sharing of the professional background of the participants and their functions in relation to the tasks and processes of NRM. The concepts derived from the individual experiences are then further developed into a more general framework.

Particular care is given to highlighting the importance of geo-spatial data in the NRM processes. Participants are introduced to a selection of concepts, techniques and tools relevant to working with spatial information for natural resource management, both in the office and in the field. This module develops analytical reasoning and critical thinking when working with geographical data and products. This analytical reasoning and critical thinking will be further developed in block 2 (modules 5-10), of the course.

Objectives

Upon completion of the module, participants will be able to:

- define Natural Resource Management and explain their own professional contribution to it.
- outline the complex nature of Natural Resource Management and the major issues involved.
- describe the role of sustainable development and Natural Resource Management
- justify the need for multi-stakeholder approaches in Natural Resource Management.
- outline the principles/approaches of collaborative Natural Resource Management
- apply some relevant planning and management tools for Natural Resource Management
- describe geo-spatial information requirements in Natural Resource Management.

Elements of the educational approach:

The educational approach is based on the principles of experience-based learning and adult education.

This is done through reflecting upon the professional context of the participants` functions in relation to the tasks and processes of Natural Resource Management. In line with the aim of the module, participants practice a multi-disciplinary teamwork approach.

The module is characterised by short presentations, individual and group exercises, "hands-on` learning, games and role play, video presentations, and field exercise. Participants are stimulated to contribute to an interactive learning environment.

Contents

The module covers the following topics:

- Natural resources and natural resource management
- Actors and objectives in natural resources management
- Conflicts and participation in NRM problem situations
- Problem Structuring in NRM
- Case of multi-sector NRM planning in the Netherlands
- Introduction to disciplinary approaches and information requirements in NRM conflict situations
- Skills in Information sourcing and Presentation

Prerequisites

Not applicable.

Recommended Knowledge

Basic computer skills.

Compulsory textbook(s)

Required : Users's guide to the NRM module.
Recommended : Planning and management tools, Groenendijk, E.M.C., Dopheide, E.J.M. 2003.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
14	26	0	36	10	26	8

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Participants will have to satisfactorily complete the various assignments given during the module. Participants will have to demonstrate that they can perform satisfactorily in an inter-disciplinary group work preparation, development of materials, and presentation.

System and Problem Analysis			
Module: 5		Module coordinator: Drs. E.H. Kloosterman	
Start:	04-01-2010		
End:	22-01-2010		
ECTS: 5			M10-NRM-101

Introduction

The aim of the module is to equip participants with a set of concepts, tools, techniques, and skills that enables them to play an active role, within their organization, in the spatial planning components of NRM, while making optimal use of geo-information technology. To achieve this, a standard approach to (spatial) problem solving is followed that comprises four phases:

- Problem identification & formulation
- Analysis & Scoping of problems
- Identification & Design of alternative solutions
- Choice from among alternative solutions, and structural design for implementation.

In this module the first two phases will be emphasised, the other two phases will be addressed in later modules.

Objectives

At the end of the specialisation modules, participants should be able to:

- discuss the basic concepts of planning and environmental management and place these in their organizational context.
- identify environmental factors and processes within an environmental system
- identify, structure and formulate problems in NRM processes
- identify stakeholders and their characteristics and interests
- integrate the spatial dimension in the problem analysis
- select the appropriate analytical tools & methods for analysing spatial problems in NRM
- identify and select relevant indicators for problem description, monitoring and evaluation purposes in NRM
- assume different roles, tasks and responsibilities in group work

Contents

- Before anything else is done the general situation of the area concerned has to be understood by analysing it as a structured system. Dealing with environmental systems implies dealing with dynamic interactions of elements and processes in a spatial context in a systems analysis approach.
- Problem formulation. Planning and decision making processes begin with a proper identification and analysis of the problems. Problem analysis helps to identify the problem, gives it structure and reduces its complexity to a manageable level. The spatial dimension of the problems is emphasized.
- An important aspect of problems is their perception by key stakeholders. Therefore identification of stakeholders and the analysis of their importance and influence needs proper attention.
- Analysis & scoping of problems. Approaches for selecting tools & methods for analysing spatial problems in NRM are reviewed. An essential step is the choice and development of socio-economic and bio-physical indicators as the basis for the appraisal and evaluation of any proposed solutions. The characteristics of good indicators will be examined.
- Once the problems have been identified and structured it is possible to translate them into objectives and these may again be grouped into strategies.

Prerequisites
Completion of the preceding modules.

Recommended Knowledge
The knowledge and skills obtained in the preceding modules.

Compulsory textbook(s)
Groenendijk, L., 2003. Planning and Management tools. A reference book. ITC Special Lecture Notes Series. International Institute for Geo-information and Earth Observation (ITC), Enschede, the Netherlands.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
25	0	0	45	8	40	2

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment
Assessment will take place based on a number of tests and/or individual assignments.

PGIS and Mobile GIS			
Module: 6		Module coordinator: Drs. J.J. Verplanke	
Start:	25-01-2010		
End:	12-02-2010		
ECTS: 5			M10-NRM-102

Introduction

The aim of the module is to equip participants with a set of concepts, tools, techniques, and skills that enables them to collect the relevant data to support the spatial planning process of NRM, while making optimal use of geo-information technology.

Objectives

At the end of the specialisation modules, participants should be able to:

- Translate a NRM problem into data and data-processing and analytical tools required to provide information
- Extract and integrate spatial and non-spatial data from multiple sources and multiple formats
- Explore, analyze and interpret information contained in geographical data
- Utilize descriptive and inferential statistical techniques as an analytical tool
- Decide when to rely on secondary data and when to collect primary data
- Decide which data can be obtained through remote sensing and select appropriate alternative and/or additional approaches when needed
- Practice and apply a number of techniques in socio-economic and environmental data collection
- Collect environmental and/or socio-economic data in the field

Contents

- For the analysis of problems, data need to be collected and organized. Special attention is given to the collection of both environmental and socio-economic information in spatial and organizational settings.
- The identification of which data are needed to analyse the problem at hand and contribute to its solution as well as the choice between using existing (secondary) data and collecting own primary data will be addressed.
- The choice between using RS and GIS techniques for environmental measurements and modelling and other types of data collection will also be addressed, as well as the need for data collection to verify, validate and explain the results of RS.
- The use of questionnaires and interview approaches as well as other field survey techniques will be introduced and practised.
- Approaches to sampling will be discussed.
- Proper analysis of data and presentation of results, using statistics and cartographic visualisation, will be discussed and exercised.

The topics are addressed in a case study approach.

Prerequisites

Completion of the preceding modules.

Recommended Knowledge

The knowledge and skills obtained in the preceding modules. Basic skills in mathematics.

Compulsory textbook(s)

None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
20	10	0	38	8	40	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Assessment will take place based on a number of tests and/or individual assignments.

Data Collection and Analysis			
Module: 7		Module coordinator: To be appointed	
Start:	15-02-2010		
End:	05-03-2010		
ECTS: 5			M10-NRM-103

Introduction
The aim of this module is to equip participants with a set of concepts, tools, techniques, and skills that enables them to carry out a project using a "Participatory GIS" approach and/or using "mobile GIS" in the field of NRM.

Objectives
At the end of the specialisation modules, participants should be able to:
- discuss the basic concepts of PGIS
- identify and describe the relevant tools and techniques of mobile GIS
- identify in which cases PGIS and/or mobile GIS are appropriate
- properly analyse and interpret data obtained through PGIS/mobile GIS

Contents
- Concepts of PGIS. Typical fields of application. Different degrees of participation. Differences and similarities with Rapid Rural Assessment (RRA) and Participatory Rural Assessment (PRA).
- Various tools and techniques used for mobile GIS. Potential applications, advantages and limitations. Practical field exercises with mobile GIS
- Review and discussion of a number of case studies using PGIS and/or mobile GIS.
- Analyse and interpret data obtained through PGIS/mobile GIS

Prerequisites
Completion of the preceding modules.

Recommended Knowledge
The knowledge and skills obtained in the preceding modules.

Compulsory textbook(s)
None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
20	10	0	38	8	40	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Assessment will take place based on a number of tests and/or individual assignments.

Scenarios and Modelling			
Module: 8		Module coordinator(s): Drs. E.H. Kloosterman	
Start:	08-03-2010		
End:	26-03-2010		
ECTS: 5			M10-NRM-104

Introduction

The aim of this module is to equip participants with a set of concepts, tools, techniques, and skills that enables them to design scenarios and create models to represent NRM processes in their spatial and temporal dimensions as a step towards identification and design of alternative solutions to the problems identified in an earlier phase.
There is an increasing need to understand the functioning of ecosystems in order to relate biophysical aspects of ecosystems to socio-economic conditions.

Objectives

At the end of the specialisation modules, participants should be able to:

- Identify key-biophysical and socio-economic drivers that influence the ecosystem dynamics
- Select relevant ecosystem variables and design a conceptual model relating these variables
- Combine relevant data layers in a GIS and model “causal” links
- Carry out simulations to predict the impacts of management interventions on the ecosystem concerned
- Summarize and apply a limited number of techniques for the generation of alternative solutions (scenarios development) in NRM

Contents

- The concepts on Analysis, Modelling and Simulation of ecosystems in a Spatial and Temporal context using GIS which lead to better Understanding of the functioning of an ecosystem.
- Exercises in developing and applying models for analysis of the environmental impact on the ecosystem at the hand of one or two case studies.
- Design of alternative solutions or generation of (spatial) scenarios. An overview of qualitative and quantitative methods for seeking alternative options and generating scenarios is given. Key methods are practiced on one or two case studies.

Prerequisites

Completion of the preceding modules.

Recommended Knowledge

The knowledge and skills obtained in the preceding modules.

Compulsory textbook(s)

None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
16	14	0	36	8	42	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Assessment will take place based on a number of tests and/or individual assignments.

EIA, EIS and SIA			
Module: 9		Module coordinator: Drs. J.M. Looijen	
Start:	29-03-2010		
End:	16-04-2010		
ECTS: 5			M10-NRM-105

Introduction

The aim of this module is to equip participants with a set of concepts, tools, techniques, and skills that enables them to relate the tools and techniques learnt in the previous modules to applications in the field of Environmental Impact Assessment (EIA), Environmental Impact Statements (EIS) and Social Impact Assessment (SIA) in the context of NRM.

Objectives

At the end of the specialisation modules, participants should be able to:

- Discuss the concepts of EIA, EIS and SIA as well as CBA
- Identify and discuss the legal, institutional and organisational setting in which EIA, EIS and SIA take place.
- Map and monitor natural resources
- Develop scenarios for environmental assessment

Contents

- Concepts of EIA, EIS and SIA as well as their legal, institutional and organisational framework. The spatial dimension is emphasized.
- Environmental assessments are used to evaluate what would happen under the "business as usual" conditions versus alternative planning scenarios.
- Concept of Cost-Benefit-Analysis (CBA) and how to apply it to EIA and SIA.

The topics are illustrated by a case study. Other examples and small cases are used to demonstrate the applicability of concepts, tools and techniques in different contexts.

Prerequisites

Completion of the preceding modules.

Recommended Knowledge

The knowledge and skills obtained in the preceding modules.

Compulsory textbook(s)

None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
20	10	0	54	8	24	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Assessment will take place based on a number of tests and/or individual assignments.

Evaluating alternatives and decision making			
Module: 10		Module coordinator: To be appointed	
Start:	19-04-2010		
End:	07-05-2010		
ECTS: 5			M10-NRM-106

Introduction

The aim of this is to equip participants with a set of concepts, tools, techniques and skills that enables them to provide support to decision makers in arriving at a choice from alternative solutions.

Objectives

At the end of the specialisation modules, participants should be able to:

- Apply and compare a number of techniques for evaluation of alternative solutions in NRM
- Evaluate a number of the alternatives that have been designed in the scenario and modelling phase.

Contents

- Introduction to the number of evaluation techniques, varying from purely qualitative to highly quantitative, that are on offer to support the choice from the alternative solutions.
- Spatial Decision Support Systems (SPSS) are tools to assist decision makers to evaluate in a spatially explicit way possible alternative planning options.
- Many of these systems are based on Multi-Criteria Evaluation (MCE) techniques, which allocate weights to assessment criteria in order to rank the alternatives. An important advantage of a GIS based MCE approach is the ease with which evaluation criteria can be changed to visually illustrate the spatial implications of specific decisions.

The topics are illustrated by a case study. Other examples and small cases are used to demonstrate the applicability of tools and techniques in different contexts.

Prerequisites

Completion of the preceding modules.

Recommended Knowledge

The knowledge and skills obtained in the preceding modules.

Compulsory textbook(s)

None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
18	12	0	42	20	24	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

Assessment will take place based on a number of tests and/or individual assignments.

Group Project			
Module: 11-12		Module coordinator: Drs. E.H. Kloosterman	
Start:	17-05-2010		
End:	25-06-2010		
ECTS: 10			U10-NRM-109

Introduction

The group project is an integral part of the Master degree course in all specializations of the NRM programme. It complements the lectures and exercises of all preceding modules and provides the participants with an opportunity to apply the knowledge and skills acquired in those modules under realistic working conditions.

The group project focusses on problems and issues in natural resources management in a real world setting and on the collection, generation and delivery of information that is relevant to planners and decision-makers. Emphasis is thereby on working in a multi / interdisciplinary manner. This does not, however, exclude working on certain tasks with a stronger specialisation focus.

Objectives

Common learning objectives for the group project are described below. Upon completion of the group project students should be able to:

- Identify key NRM problems in an area, formulate working objectives, identify associated data requirements and select appropriate methods & techniques for subsequent data collection, processing and analysis
- Collect and process the required data, and present the information required according to agreed upon Terms of Reference
- Analyse the data collected, and formulate relevant conclusions and recommendations based on this analysis
- Perform project activities as a professional team
- Review the process of working in an multi / interdisciplinary team and the individual contribution to this process

Depending on the specialization additional, more specific, objectives may still be added.

Contents

1) Preparation phase (2 weeks)
- Introduction to the fieldwork area
- Problem analysis (including stakeholder analysis, analysis of the institutional setting, identification of focal areas for specializations)
- Formulation of Terms of Reference (both for the integrative part of the group project as well as the part with a stronger specialization focus)
- Design of a work programme (development of a plan for data acquisition and verification, selection of relevant procedures for data processing and analysis)

2) Fieldwork phase (4 weeks)
- Fieldwork implementation
- Presentation of preliminary results to local authorities

3) Reporting phase (1 week)
- Final (GIS) analysis
- Report writing and compilation

Prerequisites
NRM modules 1-10.

Recommended Knowledge
Not applicable.

Compulsory textbook(s)
None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
2	0	0	230	4	30	4

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment
In the assessment the individual and the group performance will be balanced, taking into consideration both the products delivered and the learning process.

Individual Final Assignment			
Module: 13-15		Module coordinator:	
Start:	28-06-2010		
End:	27-08-2010		
ECTS: 15			U10-NRM-110

Introduction
The Individual Final Assignment (IFA) has to be completed at the end of the Master course. The students have to solve a relatively restricted problem from a real life situation through the application of skills and techniques learnt in the course. In this way the students have to demonstrate that they have achieved the objectives of the Master course. The topic of the assignment must be related to the specialisation.

Objectives
The student must be able to:
- Define, plan and execute a project to solve a real life problem related to the specialisation
- Apply methods and skills learnt in the course
- Prepare a concise technical report
- Orally present and defend the work done

Contents
The choice of an IFA topic is the responsibility of the student in consultation with the staff. For certain topics the material may be provided by ITC. If students prefer to work on a topic of the home country it is their own responsibility to obtain the necessary material.

The co-ordinating staff will provide a general framework for the IFA during module 7. In subsequent modules the student will discuss, write and present a proposal that has to be finalised and accepted before the start of the IFA modules. The IFA proposal should:

- Identify and select a relevant topic.
- Define objectives and methods or techniques to be used.
- Indicate planning of activities and resources required.
- Indicate the form of the final IFA product.

Two-weekly individual progress reports and progress meetings with the supervisors will monitor the progress on the IFA. The final outcome will be a report (hardcopy and/or CD-Rom) as well as an oral presentation and defence.

Prerequisites
Successful completion of module 1 to 13. This implies not more than two failed modules and no mark lower than 50.

Recommended Knowledge
Not applicable.

Compulsory textbook(s)
None.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
0	0	0	0	432	0	0

Time (in # of hours) allocated per major method:
L lecture,
SP supervised practical,
UP unsupervised practical,
GA group assignment (e.g. workshop, project),
IA individual assignment (including Thesis, IFA),
S self study,
O overhead (e.g. QH, exam, opening)

Assessment

A Degree Assessment Board (DAB) will assess the IFA report, a presentation and oral defence.

The assessed aspects are:

- Problem recognition and solving
- Work planning and organisation
- Skills in GI-science and earth observation
- Independent working
- Critical and professional thinking
- Final product
- Presentation and defence

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Assessment Regulations

EA/4332

ITC REGULATIONS FOR COURSES LEADING TO AN ITC MASTER DEGREE

- September 2009 -

These ITC Regulations for the Master degree courses were approved by the Rector and the Academic Board on 17 September 2008. These regulations apply to all Master degree courses commencing September 2009 onwards and replace all former ITC Regulations for the Master degree Courses.

1. Range of application

1.1. These assessment regulations apply to all courses leading to an ITC Master degree, starting from September 2009 onwards and replace all previous ITC Regulations for the Master degree courses.

1.2. The Master course can be an ITC course only (fully taught at ITC) or joint course (fully taught by one or more of ITC's partners or partly by the partner and partly by ITC). The course can be taught fully face-to-face or be a combination of face-to-face and distance components. In all cases, ITC monitors and assures the quality of the whole Master course.

1.3. In most cases where the Master course is taught in conjunction with a partner, the two institutes will agree upon new procedures which may take precedence over these 'ITC regulations for courses leading to an ITC Master degree'. The Course Director of the course concerned will inform the participants which assessment regulations and procedures apply.

1.4. Per 1 January 2010 ITC will be integrated in and will become a Faculty with special status of the University of Twente. This integration might have consequences for the assessment regulations and might lead to changes in these assessment regulations during the course.

1.5. In all cases that are not dealt with in these rules, the Course Director of the course concerned will decide upon an appropriate course of action.
Disputes about the interpretation of these regulations shall be referred to the Rector of ITC, who will determine the interpretation and action that should be taken.

1.6. In exceptional circumstances, the Academic Board, Degree Assessment Board, Head Education and/or Course Director may deviate from these regulations, but only with the approval of the Rector.

2. Management, structure and organization of the Master course

2.1. The Master course is organized into 15 modules[1] and one or two starting weeks for introductory and remedial activities. Some 10 modules consist of coursework including lectures, tutorials, practical work, case studies, project work, assignments and self-study. The remaining modules consist of an extended group project of two modules duration and an Individual Final Assignment (IFA) of three modules duration.

2.2. The duration of the course is 12 months fulltime. Participants may spread the modules over a maximum of three and a half years.

[1] *A module consists of related subjects and has duration of 3 weeks. Courses may contain project-oriented elements of two or more combined modules.*

2.3. The formal curriculum of the Master course has been approved by the Academic Board.
Responsibility for detailed development and implementation of the approved course rests with Head Education, who delegates this responsibility to the Course Director.
Responsibility for quality assurance of the course rests with the Academic Board.
The Degree Assessment Board decides on the eligibility of the Master participant to receive the Master degree.
(See also the appendix 'Bodies and persons involved in management and quality assurance of the Master course').

2.4. During and at the end of the course, a participant's competence in the field of study will be assessed through tests, examinations and/or assignments (in written, oral and/or practical form) and/or based on participation. Assessments will be used to:

- Provide feedback to participants so that they may improve their performance (formative assessment), or,
- Grade participants' work with a mark or quality description on a scale which indicates their competence in the field of study (summative assessment).

Before any assessment, participants shall be told which of the above two functions applies.
These regulations describe the conditions and procedures concerning summative assessments.

2.5. At the beginning of the Master course each participant shall receive a study guide that contains:

- Descriptions of the content of the course and modules
- A copy of these regulations
- The name of the Master degree to be received on successful completion of the course
- The course-specific conditions relating to that Master degree
- Which module assessments will result in a mark and which modules in 'completed/fail'.

2.6. The relationship between mark ranges, 'completed / fail' and grades is as follows:

Mark:	**Grade:**
90 - 100	Excellent
80 - 89	Very good
70 - 79	Good
60 - 69	Pass
00 - 59	Fail
'completed'	Pass or higher
'fail'	Fail

3. Admission to the Master course and exemptions

3.1. Applicants who meet the entry requirements, as stipulated in the current course brochure, may be registered for the Master course at the discretion of the Course Director.

3.2. Participants may be given exemption for a module of the course when they have shown they have already mastered the content of the module. An exemption for a module may lead to direct admission to the next module or to exchange of the module for a module in another course. Exemptions are subject to the approval of the Degree Assessment Board (and in case of exchange for a module in another course, approval of the Course Director of that course).

3.3. Exemption for a module will be given when this module was successfully completed by the participant:
(1) As part of another course in the same ITC domain as the Master course and
(2) No longer ago than three and a half years before the participant is expected to complete the Master course.

At least 50% of the Master course has to be taken to be eligible for the Master degree. Therefore, exemption can be given for a maximum of seven modules.

Requests for exemption that do not meet these conditions will be considered on an individual basis, at the discretion of the Degree Assessment Board. In such cases, exemption can be given for a maximum of five modules.

Exemption can never be given for (part of) the Individual Final Assignment.

3.4. In exceptional cases, a participant may also exchange a module of which the content has not been mastered for a module given in other courses, provided that the Course Director of that course approves. This is up to a maximum of two modules and subject to the approval of the Degree Assessment Board of the own Master course and of the Course Director of the receiving course.

3.5. Rules 3.2, 3.3 and 3.4 concerning exemptions do not apply to joint courses and other cases where ITC has an agreement with a partner institute that students who have successfully completed a specific curriculum in the partner institute can be given direct admission to a later part of the Master course.

4. Assessment of modules (excluding IFA)

4.1. Organization of module assessment

4.1.1. Each module will be assessed by means of a test, examination, assignment and/or based on participation. More than one assessment per module is allowed but must result in a single module mark (0 - 100) or 'completed / fail'. For combined modules (e.g. core modules, Individual Final Assignment), one overall assessment is allowed.

Up to four modules in the course may be assessed by 'completed / fail'. All other module assessments must result in a mark.

4.1.2. One overall assessment for combined modules is allowed. However, for admission to the Individual Final Assignment (see rule 5.2.1) and for the calculation of the average of all modules (see rule 6.2), the result obtained for combined modules will be given to each separate module.

4.1.3. Participants shall be informed of the date, subject, objectives and form of the assessment (practical, written, oral or computer-based, open or closed book), at least one week before an assessment.

4.1.4. The maximum duration of each assessment shall be as follows:

Written theoretical exam	3 hours
Computer-based theoretical exam	2 hours
Practical assignment	determined by the Course Director
Oral theoretical or practical exam	45 minutes

Participants shall be informed at the start of each assessment of:
- the duration of the assessment;
- if there is a choice, the number of questions to be answered;
- the weight of each question;
- whether books and/or notes may be used.

Two staff members must be present at an oral assessment.

4.2. Feedback to participants and re-sits

4.2.1. Participants shall be informed, individually, of the results of an assessment by the staff responsible for the assessment or by the Course Secretary, normally within two weeks of an assessment. The marks awarded for each question or assignment will be made known to each participant.

4.2.2. Marked scripts shall be shown to participants so that they may know the strengths and weaknesses of their answers. Answers to questions and results of assignments shall be reviewed in a class session, through the distribution of answer sheets or through comments on scripts. Staff responsible for the assessment is required to give an explanation of the marks awarded.

Scripts shall be retained for at least one year after the results are officially recorded.

4.2.3. The following rules apply to re-sits:

(1) Only those participants who fail an assessment at the first attempt (i.e. who achieve a mark less than 60 or 'fail') may re-sit that assessment. Only one re-sit per assessment is allowed.

(2) Participants who re-sit an assessment may obtain only a maximum mark of 69 (or PASS grade) or 'completed'.

(3) The previous mark or 'fail' will only be superseded when participants achieve a higher mark or 'completed' in the re-sit.

(4) Only the final grade will be shown on the Course Record or Certificate, without any indication whether the final grade was obtained through a re-sit or not.

(5) Participants who have failed due to serious circumstances (at the discretion of the Course Director) can apply for a new assessment, provided they have reported their circumstances in writing to the module coordinator or staff member responsible for the assessment before the scheduled assessment time.

4.2.4. In the case of practical assignments of long duration (practical exercises, a case study with fieldwork) the possibility of repetition can be considered only in exceptional circumstances and subject to approval by the Course Director.

4.2.5. A participant not attending a scheduled assessment, not completing an assignment or not presenting the required work within the specified time, will be considered as having failed. The participant will be given a 'fail' or a mark of 40 (or the lowest mark, if lower than 40, scored by the other participants on this assessment). If an acceptable reason (at the discretion of the Course Director) can be offered, the participant can apply in writing for a new assessment or extension of the deadline for submission of the assignment.

4.2.6. In case of plagiarism or other types of fraud, the participant(s) concerned will be considered to have failed and a mark 0 (zero) will be given (see also rule 8.5).

4.2.7. The grade sheets managed by the Course Secretary are the official record of the results of assessments. In case of discrepancies between this official record and marks and grades presented to participants in other ways, the marks and grades in the official record apply.

5. Individual Final Assignment (IFA)

5.1. The Individual Final Assignment and report

5.1.1. The IFA period focuses on the application of knowledge, methods and techniques in the subject of the course to the task performed or to the problem investigated. The IFA work requires that the Master participant:

(1) Presents a draft IFA proposal (approx. 2 pages) to the Course Director as required by the course. Proposals (prepared in discussion with members of staff) must be related to geo-information and fall within the domain of the course and the chosen stream (i.a.).
(2) Prepares a final IFA proposal (approximately 5 pages), in consultation with the supervisor(s), to be submitted to the supervisor(s) before the deadline set by the Course Director.
(3) Carries out the IFA plan and reports on progress to the supervisor(s) according to an agreed schedule for the IFA and preparation of the IFA report.
(4) Makes oral presentations to staff and participants on the nature and progress of the IFA, when and as required by the Course Director.
(5) Prepares and submits the IFA report and presents and defends the IFA report when and as required by the Course Director.

5.1.2. The IFA work will be assessed on two occasions:

(1) The final IFA proposal, leading to approval of the proposal or to disapproval and an official warning in writing (see rule 8.1).
(2) The IFA report and oral examination.
(3) In addition to these two formal assessments the participant will receive feedback on his/her performance from the supervisors.

5.1.3. A participant not presenting the (draft) IFA proposal, not submitting the IFA report or not attending the final oral examination within the specified time, will be considered to have failed. Only in exceptional cases, and for reasons beyond the control of the participant (at the discretion of the Course Director), the participant may apply in writing for a new opportunity to meet the above requirements.

5.1.4. The IFA report, approximately 30 pages of text (approximately 350 words per page and presented in the standard ITC format for IFA reports), excluding appendices, shall constitute an ordered and logical description of the IFA. This includes the task performed and/or problem investigated the applied knowledge, methods and techniques, the way they are executed and the evaluation of the results.

5.1.5. The IFA report may describe work done in conjunction with a supervisor or any other person, but the extent of the participant's personal contribution must be certified by the supervisor concerned.

5.1.6. With the explicit approval of the supervisor a participant may be permitted to incorporate in his/her IFA report a limited amount of unpublished work undertaken by the participant prior to the start of the Individual Final Assignment. A participant may not incorporate in his/her IFA report material which has been submitted for achieving the award of a degree from any other educational institution.

5.1.7. The source of any photograph, map, or other illustration shall be indicated, as shall the source, published or unpublished, of any material not resulting from the participant's own work.
If material from other work is incorporated verbatim, without proper acknowledgement of the source (plagiarism), the IFA Assessment Board may decide not to assess the IFA. This means that the Master degree cannot be awarded. (See also rules 8.3 and 8.5.)

5.2. Admission to the IFA period

5.2.1. For admission to the Individual Final Assignment, at least all but two of the previous modules (see rule 6.2 to see which modules are to be included) must have been successfully completed and no mark below 50 is allowed. The Academic Board may set additional requirements, which must be described in the Study Guide.

5.2.2. A participant who is not eligible for admission to the IFA, may however be allowed to continue with an individual special project (assessment will result in 'completed' or 'fail'). At the end of the course, the participant cannot be awarded a Master degree but will receive a Certificate.

5.2.3. The Course Director will assess the eligibility to the IFA period. He/she will also assess the IFA proposal and presentation by the participant or delegate this to an IFA Admission Committee.

5.2.4. When the participant is eligible to the IFA but the Course Director and/or the IFA Admission Committee is of the opinion that the IFA proposal does not have the required level, the participant gets one week to develop and write a better proposal. If still not satisfactory the participant will receive an official warning of the Course Director (see rules 8.1 and 8.2) but may still continue the IFA work and has still access to the IFA examination.

5.3. Supervision of the IFA

5.3.1. Based on the draft IFA proposal and in consultation with members of staff and the Master participant, the Course Director shall recommend a primary and secondary supervisor to the supervisor's department(s). Supervisors are appointed by the management team of the department.

5.3.2. The two supervisors shall divide the supervision tasks and make a supervision plan and meeting schedule with the participant.

5.3.3. Supervisor(s) shall:
(1) Guide the participant in the formulation of the final IFA proposal.
(2) Establish a schedule of supervisory meetings with the Master participant (on an average once per fortnight). Additional meetings may be arranged by agreement.
(3) Provide general advice and guidance on the execution of the IFA
(4) Provide feedback on draft written work, normally within five days of submission.
(5) Forward, where appropriate, any comments on the performance of the participant to the Course Director.
(6) Inform the Course Director when the progress of a participant gives cause for concern so that action can be taken in accordance with these regulations (see rules 8.1 and 8.2).

5.3.4. If a Master participant considers that he/she is not receiving the quality of supervision required in the regulations, the participant should report this to the Course Director.

5.3.5. Replacement of a supervisor may be considered if the subject of the Individual Final Assignment is found to be outside a supervisor's area of expertise, or at the request of the supervisor and/or of the participant.

5.4. Submission of the IFA report

5.4.1. The participant must submit a well-organized copy of all digital files associated with the IFA work on DVD, and a hard-copy of graphic output, at least one week before the examination date or as specified by the Course Director.

5.4.2. ITC will produce sufficient printed copies of the IFA report, including two for the participant. The participant must bring one of his/her copies of the IFA report to the oral examination.

5.4.3. One copy of the IFA report will be sent to each member of the IFA Assessment Board. The Institute will retain two bound copies if a degree is awarded, one of the copies being lodged with the Institute Librarian and the second copy in the course archive.

5.4.4. Where work submitted has been executed in cooperation with others, the supervisor must submit a written statement to the IFA Assessment Board indicating the extent of the participant's share of the work.

5.5. IFA examination

5.5.1. For the examination of the IFA, the Course Director nominates and the Degree Assessment Board approves a separate IFA Assessment Board for each participant. The IFA Assessment Board is accountable to the Course Director.

Each IFA Assessment Board has 2 to 3 members: (one of) the supervisor(s) of the participant, a professor or associate professor in a relevant discipline (chair) and, if needed, one other staff member of the ITC.

5.5.2. The IFA examination consists of the assessment of the IFA report and the oral examination. The oral examination is the defence of the IFA work that may be preceded by the participant presenting the results of his/her Individual Final Assignment. The oral examination has a maximum duration of one hour.

5.5.3. The Course Director assigns a date for an oral examination and informs the participant of this date at least three weeks in advance.

5.5.4. All members of the IFA Assessment Board shall read and assess the quality of the Individual Final Assignment report as an ordered and logical exposition of the application of knowledge, methods and techniques in the subject of the course to the task performed or to the problem investigated. A minimum of two members of the IFA Assessment Board must be present at the oral examination. (In case the ITC (associate) professor can not attend, Head Education will appoint another ITC (associate) professor to replace him or her.) They shall assess the participant's competence in the professional field, problem-solving skills and practical orientation.

5.5.5. The oral examination is open and will be announced as such.
In exceptional cases the Course Director can decide to have the defence of individual participants closed to observers other than ITC staff.

5.5.6. On the basis of the assessment of the participant the IFA Assessment Board shall take one of the following decisions:
(1) That the IFA is satisfactory. One single mark is given.
(2) Subject to minor corrections (that can be implemented within three working days and implemented before the official end of the course) in the IFA report, the IFA is satisfactory. One single mark is given, subject to the corrections in the IFA report being made.
(3) The IFA is not satisfactory and is given the FAIL grade.

5.5.7. No changes may be made in the IFA report after submission for the IFA examination, only an errata list may be added. If the IFA Assessment Board requires minor corrections to the report, these, and only these, corrections must be made and must be checked and approved by one of the supervisors. In all other cases changes can only be made when the report is to be re-examined by the IFA Assessment Board.

5.5.8. In exceptional cases extension to the IFA work may be given, but only before the IFA examination and only when:
(1) Funding for the extension is available, and
(2) The main cause of the unsatisfactory level of the IFA has been beyond the control of the participant (see 5.1.3), at the discretion of the Course Director.
(3) The participant will take the initiative and apply in writing for extension. If the Course Director is of the opinion that condition 2 is met he/she will forward the request to Head Education for decision.

5.5.9. Extensions have a maximum duration of one month. Extensions are only allowed when the participant stays at ITC or, in case of a joint course, at the institute of the partner.

This does not apply to participants who study part-time. They are allowed to work on the IFA in the home organization and since the Master course may be spread over a period of maximum three and a half years (see rule 2.2) they may work on the IFA until about a month before the end of the three-year period. In such cases, no extensions are possible.

5.6. Access to the IFA report

5.6.1. The primary function of the Institute is the development and dissemination of knowledge. IFA reports are lodged with the Institute Librarian and shall be made available for consultation, inter-library loan and photocopying. For reasons of commercial confidentiality, access to digital files may be subject to restriction.

5.6.2. Any staff member who publishes results from an IFA report is obliged to make a proper reference to the Master participant's work.

6. Master degree assessment

6.1. On the basis of the assessment results of the participant, the Degree Assessment Board decides whether the participant will be awarded the Master degree.

6.2. For the award of a Master degree the average of all module marks must be at least 60, no more than 2 modules may have a mark below 60 and no module mark below 50 is allowed. This implies that the Individual Final Assignment must have a mark of at least 60.

Only results of modules that are part of the formal curriculum of the Master course are included in the calculation of the average and counted for the number of marks below 60 and below 50. Therefore results of a module that is taken in addition to the formal curriculum or in exchange for a module of the formal curriculum for which exemption was given will not be included. However, a module that was taken in exchange because of a reason other than exemption (see rule 3.4), is (only for the application of this rule 6.2) considered as part of the formal curriculum.

When a module is assessed with 'completed', this will not be included in the average. When a module is assessed with 'fail', this will be counted as a mark of 50.

If results of modules were obtained more than three and a half years before the end of the course, then the validity of these modules must be confirmed by the Degree Assessment Board (see rule 3.3.).

6.3. To be entitled to receive a Master degree 'with distinction' the average of all module assessments (see rule 6.2 which modules are to be included) must be 80 or above. No marks below 70 or 'fails' are allowed and the Individual Final Assignment must have a mark of 80 or above.

Participants who have taken 11 or fewer modules of the formal curriculum (max. three exemptions or exchanged modules) are not entitled to receive a Master degree 'with distinction'.

6.4. The Degree Assessment Board shall take one of the following decisions:
(1) That the IFA and overall course performance of the participant are satisfactory. The degree of Master shall be awarded.
(2) That the IFA and overall course performance of the participant are such that the Master degree shall be awarded 'with distinction'.
(3) That subject to minor corrections in the IFA report, the IFA and overall course performance are satisfactory. The degree of Master shall be awarded subject to the corrections in the IFA report being made before the official end of the course.
(4) That the IFA and/or overall course performance are not satisfactory. The degree of Master shall not be awarded.

6.5. In case the Degree Assessment Board decides that the Master degree shall not be awarded, the participant will receive a Certificate.

7. Awards and certification

7.1. A **"Master degree"** will be awarded to a participant who has been officially admitted to a Master course (as approved by the Academic Board) and has fulfilled the assessment requirements of that course.

A **"Certificate"** will be awarded to a participant who (1) has been officially admitted to a Master course but has not fulfilled the assessment requirements for that course, and (2) has fulfilled the assessment requirements of at least one summatively assessed module of that Master course.

The Certificate will mention that the participant 'has followed a course in Geo-information Science and Earth Observation' and the study load. Only the modules that have been completed and the modules in which the participant has participated for at least 80%, will be included in the study load.

A **"Certificate of Attendance"** will be given to participants who have been officially admitted to a Master course, but have not fulfilled the assessment requirements of any summatively assessed module.

The Certificate of Attendance will mention that the participant 'has attended a course in Geo-information Science and Earth Observation' and the study load. Only the modules in which the participant has participated for at least 80% will be included in the study load.

No qualification other than 'with distinction' will be indicated on any Master degree.

7.2. Master degrees are issued under the responsibility of the Rector. Certificates and Certificates of Attendance are issued under the responsibility of the Course Director.

7.3. Signatures:
(1) Master degrees are signed by the Rector of the ITC and Head Education.
(2) Certificates and Certificates of Attendance are signed by the Course Director.

7.4. Master degrees are accompanied by a Diploma Supplement. The Diploma Supplement describes the nature, level, context, content and status of the Master degree and the Master course. The Course Record (see 7.5) for the Master degree course is included in the Diploma Supplement.

7.5. Master degrees and Certificates are accompanied by a Course Record, signed by the Course Director. The Course Record will show the period of study, the study load, the titles of and marks or grades obtained for the modules that have been finished successfully or that the participant has participated in for at least 80% but not finished successfully.

The assessments 'completed' or 'fail' will appear as such in the Course Record.

7.6. Only the names and marks and/or grades of the modules that are taken are mentioned on the Course Record.
In case of exemption the number and not the name of the module will be mentioned (e.g. "Modules 1-3: exemption"). In case a new module was taken in exchange for a module for which exemption was given, the name of the new module will be mentioned also (e.g. "Module 3: exemption. Extra module: Database design"). In case of exchange of a module for another reason than exemption only the name of the new module will be mentioned (e.g. "Module 3: Database design").
The names of modules (and the results obtained) that are taken in addition to the formal curriculum of the course are also listed on the Course Record (e.g. "Extra module: Database design").

8. Early termination of the course

8.1. Where a Course Director and/or Head Education are/is of the opinion that a participant's progress gives cause for concern the participant shall be informed of the situation by the Course Director. Where a participant's performance is such that she/he is unlikely to obtain a Master degree without a significant improvement in performance, the participant shall be advised in writing by the Course Director of the situation and the implications. (Oral and/or written advice by the Course Director may not be given when the concern arises after the approval of the Individual Final Assignment proposal.)

8.2. In cases of obvious non-performance, a Course Director and/or Head Education may decide at any time that a participant must discontinue his/her course. Such a decision will not be taken without consulting the Degree Assessment Board and the participant having received one written warning and being given time to improve performance.

8.3. In case of fraud during an exam or in assignments, the participant(s) concerned will be considered to have failed and a mark 0 (zero) will be given.

In case of plagiarism in the submitted Individual Final Assignment, the IFA Assessment Board may decide not to assess the IFA. No extensions are possible then. This will mean that the Master degree cannot be awarded, the participant will get a Certificate.

8.4. In case of other types of misbehaviour, the Course Director will consider expulsion from the course.

8.5. In case of severe or repeated fraud, plagiarism or other types of misbehaviour, the Course Director, in consultation with the Academic board, will decide that the participant is expelled from the course.
Expulsion from the course means that the participant will not receive any certification.

8.6. ITC will use plagiarism detection software or other tools to detect fraud.

In submitting a text, the participant implicitly consents to the text being entered in the database of the detection software concerned.

9. Student appeal procedures

9.1. In case of problems of a general or structural nature in the course, the Student Association Board (SAB) may be consulted.

9.2. In the event that a participant disagrees with decisions taken by a lecturer or IFA Assessment Board, he/she may present this decision for reconsideration to the Course Director.
Where a Master participant finds that he/she is not receiving the quality of IFA supervision required in the regulations, the participant should also seek action from the Course Director.

Only in the event that a Master participant disagrees with decisions taken by the Degree Assessment Board he/she may present this decision for reconsideration to Head Education directly (see rule 9.3).

9.3. If not satisfied with the decision of the Course Director, the participant can seek action from Head Education. If Head Education rejects the complaint of the participant he/she will respond in writing describing the reasons.

9.4. If still not satisfied, participants have a final right of appeal with the Student Appeals Board. An appeal will only be accepted if:

- The formal methods of dealing with complaints (see rules 9.2 and 9.3) have not led to agreement,
- The appeal concerns the implementation of these 'ITC Regulations for the Master degree courses' or the assessment of the Individual Final Assignment and
- The appeal has been made before the official end of the course. Appeals concerning the assessment of the IFA can be made up to a maximum of four weeks after the mark was received.

Appeals should be addressed in writing to the Chairman of the Student Appeals Board, through the Rector, and be accompanied by the argued written response to the appeal by Head Education.

9.5. Where unequal treatment of participants is claimed, copies of all relevant scripts shall be made available for review by those investigating the appeal.

9.6. The Student Appeals Board consists of three staff members to be appointed by the Rector. These staff members should not have been involved in the situation leading to the appeal. For appeals concerning the assessment of the IFA, staff members representing fields related to the subject of research will be invited to sit on the Student Appeals Board.

9.7. The Student Appeals Board will take a final decision on the appeal, after having heard all parties involved (including the Course Director) for relevant information. The decision on an appeal will be passed on to the Rector only if the Appeals Board cannot reach consensus. No further appeal will be possible.

9.8. The Student Appeals Board can reject the appeal or support it. In the latter case, the Appeals Board shall suggest remedial actions, which may include extension of the fellowship.

9.9. The Student Appeals Board should deal with the case within two weeks of receipt of the appeal. If necessary the fellowship will be extended for the duration of the appeal procedure. In case of an appeal concerning the assessment of the IFA, the fellowship may only be extended when the appeal is made before the official end of the course.

9.10. Support to a request for reconsideration or appeal concerning the assessment of the Individual Final Assignment cannot lead to overruling the assessment of the IFA by an IFA Assessment Board that is composed according to these regulations. Acceptable remedial actions do include a re-sit for the oral part of the IFA examination (only when a reason beyond the control of the participant has caused underperformance in the oral part).

Appendix 1

Bodies and persons involved in management and quality assurance of the Master course

The mentioned tasks and responsibilities must be carried out in accordance with these 'ITC Regulations for the Master degree courses'.

Rector

The Rector has the overall responsibility for all tasks of ITC.
The Rector has delegated the academic, quality and policy aspects of the educational programmes and courses to the Academic Board and the implementation of the programmes and courses to Head Education.
The Rector appoints the Head Education, Course Director and Student Appeals Board.

Scientific Council

The Scientific Council advices the Rector and Academic Board on the quality of education and research of the ITC. This responsibility includes:

- Advice on degrees offered by the ITC
- Advice on course curricula, including admission criteria.
- Advice on ITC's quality assurance system
- Advice on degree and assessment regulations, including these 'ITC Regulations for the Master degree courses'

The Scientific Council is a mainly external body; two third of the members are professors of Dutch universities.

Academic Board (AB)

The Academic Board is responsible for the quality of ITC's courses and for development of policy on education. This responsibility includes:

- Advice on the degrees offered by the ITC
- Approval of the curricula of the Master courses
- Approval of ITC's quality assurance system and monitoring of the implementation
- Advice on course-specific elements of the quality assurance system
- Approval of policy on education
- Approval of degree and assessment regulations, including these 'ITC Regulations for the Master degree courses'
- Acting as Degree Assessment Board

The Academic Board consists of the Rector (chair) and all full and visiting professors of ITC.

Head Education

Head Education is responsible for:

- Monitoring of the implementation of the Master course, ITC's quality assurance system and ITC's educational policy as approved by the Academic Board and the Rector. Head Education delegates the actual implementation to the Course Director.
- Coordination and implementation of supra-course aspects.

Course Director (CD)

The Course Director is responsible for:

- Implementation of the Master course, ITC's quality assurance system and ITC's educational policy, as delegated by Head Education
- Implementation of decisions taken by Head Education
- Day-to-day co-ordination and execution of the course.
- Counselling of participants in matters concerning their studies.

Degree Assessment Board

The Degree Assessment Board assures that participants who are awarded the Master degree have the required level.

This responsibility includes:

- Decision on deviation of the formal curriculum by individual participants
- Appointment of the IFA Assessment Boards
- Decision on award of the degree to individual participants

The Academic Board acts as Degree Assessment Board.

IFA Assessment Board

The IFA Assessment Board is responsible for assessment of the IFA report and oral examination of the participant on completion of the IFA work.

Student Appeals Board

The Student Appeals Board is a semi-permanent committee, which will be appointed by the Rector when an appeal from a participant is received.

Appendix 2

Examples
ITC Master Regulations

Structure of the course used in the examples: 10 modules of course work, 2 modules for a group project and 3 modules for the Individual Final Assignment. The assessment of modules 1 and 6 resulted in 'completed / fail'.

Admission to the Individual Final Assignment

5.2.1 For admission to the Individual Final Assignment, at least all but two of the previous modules (see rule 6.2 to see which modules are to be included) must have been successfully completed and no mark below 50 is allowed. The Academic Board may set additional requirements, which must be described in the Study Guide.

4.1.2 One overall assessment for combined modules is allowed. However, for admission to the Individual Final Assignment …… the result obtained for combined modules will be given to each separate module.

6.2 …… Only results of modules that are part of the formal curriculum of the Master course are included in the calculation of the average and counted for the number of marks below 60 and below 50. Therefore results of a module that is taken in addition to the formal curriculum or in exchange for a module of the formal curriculum for which exemption was given will not be included. However, a module that was taken in exchange for a reason other than exemption, is ……. considered as part of the formal curriculum. …….

Examples of 4 participants:

Module	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11+12*	*13+14+15*
participant 1	*c*	*65*	*63*	*71*	*78*	*f*	*51*	*80*	*91*	*70*	*90*	
participant 2	*f*	*63*	*e*	*74*	*70*	*c*	*60*	*60*	*61*	*73*	*58*	
participant 3	*c*	*60*	*63*	*71*	*70*	*f*	*ee 43*	*78*	*90*	*82*	*71*	
participant 4	*c*	*60*	*63*	*71*	*70*	*f*	*ne 43*	*78*	*90*	*82*	*71*	

c = completed *e = exemption*
f = fail *ee = exemption, extra module*
ne = new module, exchange for other reason than exemption

Participant 1: admission to IFA
Participant 2: no admission to IFA
Participant 3: admission to IFA
Participant 4: no admission to IFA

Award of the Master degree

6.2 For the award of a Master degree the average of all module marks must be at least 60, not more than 2 modules may have a mark below 60 and no module mark below 50 is allowed. The Individual Final Assignment must have a mark of at least 60.

Only results of modules that are part of the formal curriculum of the Master course are included in the calculation of the average and counted for the number of marks below 60 and below 50. Therefore results of a module that is taken in addition to the formal curriculum or in exchange for a module of the formal curriculum for which exemption was given will not be included. However, a module that was taken in exchange for a reason other than exemption (see rule 3.4), is (only for the application of this rule 6.2) considered as part of the formal curriculum. When a module is assessed with 'completed', this will not be included in the average. When a module is assessed with 'fail', this will be counted as a mark of 50.

6.3 To be entitled to receive a Master degree 'with distinction' the average of all module assessments must be 80 or above. No marks below 70 or 'fails' are allowed and the Individual Final Assignment must have a mark of 80 or above. Participants who have taken 11 or fewer modules of the formal curriculum (max. three exemptions or exchanged modules) are not entitled to receive a Master degree 'with distinction'.

4.1.2 One overall assessment for combined modules is allowed. However, …… for the calculation of the average of all modules (see rule 6.2) the result obtained for combined modules will be given to each separate module.

Examples of 5 participants:

Module	1	2	3	4	5	6	7	8	9	10	11+12	13+14+15
participant 1	c	65	63	71	78	f	51	80	91	70	90	80
participant 5	c	61	69	71	78	c	62	90	63	81	65	55
participant 6	c	70	87	75	90	c	90	80	95	68	80	90
participant 7	c	82	70	86	77	c	73	81	88	73	78	85
participant 8	e	e	e	ee 81	80	c	83	73	70	70	90	85

c = completed f = fail e = exemption ee = exemption, extra module

Participant 1: Average = $\frac{65+63+71+78+50+51+80+91+70+2*90)+(3*80)}{14} = 74.2$

The Master degree will be awarded.

Participant 5: No Master degree will be awarded, since the IFA has a mark below 60. The participant will receive a Certificate.

Participant 6: Average = $\frac{70+87+75+90+90+80+95+68+(2*80)+(3*90)}{13} = 83.5$

The Master degree will be awarded. The participant will not receive the degree 'with distinction', since the mark of module 10 is below 70.

Participant 7: Average = $\frac{82+70+86+77+73+81+88+73+(2*78)+(3*85)}{13} = 80.1$

The Master degree 'with distinction' will be awarded.

Participant 8: Average = $\frac{80+83+73+70+70+(2*90)+(3*85)}{10} = 81.1$

The Master degree will be awarded. The participant will not receive the degree 'with distinction' since exemption was given for more than three modules.