

ITC Study guide
2008

Geoinformatics

**Principles of Spatial Data Handling: Databases, GIS
and Remote Sensing**

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Contents

	Page
Foreword	3
ITC Introduction	5
Geoinformatics modules 1 to 4	11
Appendix: ITC Assessment regulations	25

Course code: C08-GFM-SC-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.

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 2008/2009 courses 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. The structure of the MSc courses was adjusted last year in order to strengthen the links between the courses and the research projects, implemented by ITC.

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 the ITC staff is originating from more than 30 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 ITC

One of humanity's greatest challenges is to achieve an appropriate balance between the development of natural resources and the maintenance of an optimal natural environment. To meet this challenge we need information on the earth's surface and sub-surface: spatially referenced information or *geo-information*.

Many different types of *earth observation* provide efficient ways of gathering geo-information. These types include conventional photographic and non-photographic imaging techniques, electro-optical sensing of the wider spectrum by multi-spectral, thermal infrared and radar scanning as well as geophysical and geochemical data-acquisition techniques. All these methods are used in mapping the earth's topography, monitoring the natural environment and exploring for natural resources and all are applied by specialist groups within the Institute.

ITC specializes in the collection, management and visualisation of geo-information and its integrated interpretation in support of resource management and policy development. In this way, scientific earth observation supports decision-making for sustainable development and the alleviation of poverty in the developing world.

The International Institute for Geo-Information Science and Earth Observation was established in 1950, and is usually referred to as ITC because of its original name: International Training Centre for Aerial Survey. It is the largest institute for international higher education in the Netherlands.

ITC is an autonomous organisation operating under the aegis of the University of Twente, and is funded by the Ministry of Education, Cultural Affairs and Science of the Netherlands. ITC is subject to the national quality assurance procedure for universities in the Netherlands. It is based in Enschede. ITC's main activities are education, research and advisory services. These activities are carried out by six scientific Departments:

- Department of Earth Observation Science (EOS)
- Department of Earth Systems Analysis (ESA)
- Department of Geo-information Processing (GIP)
- Department of Urban and Regional Planning and Geo-information Management (PGM)
- Department of Natural Resources (NRS)
- Department of Water Resources (WRS)

They are supported by the education, research, consultancy and general support departments.

Education

ITC has a scientific staff of some 150 professionals of 31 nationalities. More than 19,000 students from over 150 countries have graduated from courses at the institute since 1952. ITC offers courses at different levels: PhD degree (conducted in collaboration with Netherlands universities), Master of Science degree, Master degree, postgraduate and undergraduate Diploma and Certificate courses.

The ITC degree programmes are nationally accredited and registered in the Central Register of Higher Education (CROHO) of The Netherlands.

Recently ITC embarked on a programme of decentralizing its education, through joint education programmes with partners in various countries throughout the world. ITC also offers a growing number of distance education courses.

Updating the knowledge and skills of ITC alumni is an important task, in addition to the institute's regular courses. Therefore, ITC organises refresher courses at ITC and abroad.

The language of instruction is English.

Research

ITC carries out multidisciplinary and problem-oriented research that focuses on strengthening organisations involved in survey, management and planning for sustainable development. To this end, a strategic multidisciplinary research programme with the following themes is established:

- Biodiversity in fragmenting landscape
- Carbon-cycle and climate change
- Stochastic methods for image mining and data quality
- Disaster management
- Earth systems science
- Food security and environmental sustainability
- Governance and Integrated Spatial Assessment
- Spatial data infrastructure technology
- Spatio-temporal data integration and visualization
- Informed multilevel governance of urban regions
- Land administration for informed governance
- Managing water scarcity
- Sustainable urban-regional dynamics
- Utilisation of sensor developments for efficient topographic mapping
- Water cycle climate

Advisory services

ITC's transfer of knowledge also encompasses advisory services, mainly in developing countries. Advisory services of ITC often act as a follow-up service to alumni and their organisations and institutes.

Approximately 1000 projects have now been completed and ITC is presently committed to a wide variety of assignments around the world. The majority of these are based in developing countries and are education-oriented.

Introduction to ITC's educational programmes

At degree level ITC offers PhD, MSc and Master degree courses. Also Diploma courses, and short courses (some through distance education) are offered as part of the regular education.

The MSc degree programme in Geo-Information Science and Earth Observation (lasting 18 months) consists of seven courses, each with a specific orientation:

- Applied Earth Sciences
- Geoinformatics
- Governance and Spatial Information Management
- Land Administration
- Natural Resources Management
- Urban Planning and Management
- Water Resources and Environmental Management

The Master degree programme (lasting 12 months) consists of two courses:

- Geoinformatics
- Natural Resources Management

Postgraduate Diploma courses (lasting 9 months) are offered in:

- Applied Earth Sciences
- Geoinformatics
- Land Administration
- Natural Resources Management
- Urban Planning and Management
- Water Resources and Environmental Management

Programmes in cooperation with other institutes

ITC cooperates with Universities in The Netherlands, Europe and throughout the world in full-time and part-time joint education programmes, leading to MSc and Master degrees and to Diplomas:

- In The Netherlands ITC cooperates with the universities of Utrecht, Delft and Wageningen in an MSc course, focusing on Geographic Information Management and Applications (GIMA). The course is offered through distance learning, with four periods of classroom learning.
- In Europe, ITC cooperates with the universities of Southampton, Lund and Warsaw in an MSc course on Geo-information Science and Earth Observation for Environmental Modelling (GEM). The course is taught in four countries: UK, Sweden, Poland and The Netherlands.
- ITC has entered into partnership with reputable education institutes for the purpose of providing joint courses in several countries throughout the world. At present, MSc and Master courses are or will be conducted in Bolivia, China, Ghana, India, Indonesia, Iran, Kenya, Mexico, Nigeria and Tanzania.

For more information on our joint courses, please consult the ITC website (<http://www.itc.nl/education/jointcourses.aspx>).

Opening hours of various 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 - 16:00

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 <i>free coffee/tea</i>	10:15 - 10:45
Lunch	12:00 - 13:30
Tea break <i>free coffee/tea</i>	15:15 - 15:45

Starting dates modules and holidays

Module number	2008
<i>Registration</i>	<i>Monday, September 25, 2008</i>
<i>Opening Academic year</i>	<i>Thursday, September 25, 2008</i>
Module 1	September 29 through October 17
Module 2	October 20 through November 7 <i>RS core exam: November 7</i>
Module 3	November 10 through November 28 <i>GIS core exam: November 28</i>
Module 4	December 1 through December 19 <i>RS core re-sit exam: December 10</i>
<i>DIES celebration</i>	<i>GIS core re-sit exam: December 17: morning</i> <i>Wednesday, December 17: afternoon no classes</i>
<i>Closing</i>	<i>December 22 to 24</i>

Geoinformatics

Geographic and earth sciences rely increasingly on digital spatial data acquired from remotely sensed images, analysed through geographical information systems and visualised on the computer screen or on paper. The technologies supporting the processes of acquisition, analysis, visualisation and dissemination of 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 technology, 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 the management of and access to the data. Organisations must be able to keep pace with development in electronic data dissemination.

Objectives

The objective of the Principles of Spatial Data Handling: Databases, GIS and Remote Sensing course is to provide the participants with a deepened understanding of the workings of spatial data and geo-information. The course takes the perspective of the process of producing geo-information from air- and space-borne devices, using various tools and techniques, arriving at geo-information sources for consumption by the human decision-maker. We do so by emphasizing those geo-production environments that are not ad hoc, but rather need to operate in a systematic way for reasons of production continuity, scale, or quality. The course's focal points lies in the understanding of fundamental principles, and the methods and tools that have been developed from them, leading to best-practice methodology. An important characteristic of the course is the extensive amount of practical exercises that have been set up in support of understanding the principles. Thus, the course leads to conceptual understanding and practical skills.

Target groups

This course is designed for: Professionals from organizations which are dealing with geo-spatial information such as national mapping organizations, national surveys, bureaus of statistics, national cadastres, and other providers for the national geo-information infrastructure, to name but a few.

What will be achieved?

The tools we use are satellite and airborne imagery, image processing packages, and database and GIS systems. Course attendants can expect to become relative advanced users of this technology, with a generic understanding of how other similar tools operate.

Main subjects

The course has four modules, in which different aspects of geo-information are paid attention to. The modules address:

- fundamentals of spatial data acquisition from air- and spaceborne sensors (remote sensing);
- fundamentals of relational and spatial databases;
- fundamentals of geographic information systems;
- a final project.

These modules provide a complete theory of databases, geographic information systems (GIS) and remote sensing.

Organisation and staff of the Geoinformatics courses

Course Director and Course co-ordinators		
	Room	Phone
G.C. Huurneman MSc; GFM Course Director	2-009	216
Ms Dr.Ir. W. Bijker; Course co-ordinator of the Master of Science Degree course	2-040	203
Dr. Ir. R.L.G. Lemmens; Course co-ordinator of the Master Degree course	1-064	529
A.M. Mank; Course co-ordinator of the Diploma course	1-043	459

Course secretariat GFM/LA/UPM		
	Room	Phone
Ms J.M. Mol; course secretary Land Administration (LA) courses	2-105	480
Ms D.E. Scholten; course secretary GFM MSc, PG and Diploma courses	2-105	334
Ms L.J.C. Windig; course secretary GFM Master course and UPM courses	2-105	464

Principles of Spatial Data Handling: Databases, GIS and Remote Sensing course

Duration of the module	Module	Co-ordinating staff member	
MSc, PG and Master modules			Modules 1-4: Programming Skills Part 1 Coordinator: Dr. O. Huisman
Module 1:	29-09-08/17-10-08 Introduction and Principles of Databases	Dr. Ir. R.A. de By	
Module 2:	20-10-08/07-11-08 Principles of Remote Sensing	J.P.G. Bakx MSc	
Module 3:	10-11-08/28-11-08 Principles of Geographic Information Systems	Dr. C.P.J.M. van Elzakker	
Short course module			
Module 4:	01-12-08/19-12-08 Final project	J.P.G. Bakx MSc	

Introduction and Principles of Databases		
Module: 1	Co-ordinating staff:	
Start: 29-09-2008	Dr.Ir. R. A. de By	
End: 17-10-2008		
Level: M, MSc, PG		M08-GFM-160

Introduction

This module introduces the notion of database and data manipulation. We focus here on thematic (also known as attribute) databases, the relational data model, and queries in the query language SQL. Database engineering is an important tool for any type of information management. The techniques learnt in this module will be useful throughout the course, and indeed later in professional life.

Contents

The module covers the following topics:

- What purposes do databases serve?
- Database Management Systems.
- The relational data model.
- Set theory and mathematical logic as a foundation for database querying.
- Database querying using SQL.
- Database maintenance.
- Introduction to database design.

Objectives

Main objective: To learn how a database management system works, what stored tables and queries are, and how to define queries in the standard language SQL. Applying all that knowledge to improve an existing database, allowing us to extract information that was originally impossible to extract. Also, the first aspects of database design.

Upon completion of this module student should be able to:

- Explain the fundamentals of the relational data model,
- Formulate simple queries in mathematics,
- Define, execute and verify SQL queries against an existing relational database,
- Improve a badly designed database, and
- Database design: UML class diagrams.

Prerequisites

Basic computer handling skills, some familiarity with Windows software, secondary school discrete mathematics, ability to explore new software and new data sets, group collaboration.

Recommended Knowledge

Basic computer skills, basic mathematics.

Hardware and Software Requirements

Computer cluster. MS Access, MS Excel, MS Word.

Teaching Materials

Principles of Databases, LA/GFM Course Reader, Reader Exercises Databases. Various.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
36	38	0	30	0	16	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

In the third week, students will carry out an assignment in groups of three to five students. The work consists of re-organizing a database through queries, and preparing the answers to a number of given data analysis problems. The work is concluded with a small report and a finalizing discussion with the supervisors. The group effort is given a mark between 10 and 100; it will be the first full module mark for each student. In exceptional cases, students may be taken apart for a separate, individual assessment.

Principles of Remote Sensing		
Module: 2	Co-ordinating staff: J.P.G. Bakx M.Sc.	
Start: 20-10-2008		
End: 07-11-2008		
Level: M, MSc, PG		M08-GFM-161

Introduction

This module introduces the principal concepts and techniques remote sensing. The module consist of lectures explaining the theory and focusing on the concepts, and practical's aiming at illustrating the lectures and developing hands-on skills in using (mostly software) tools, carrying out sequential data processing steps for solving typical application problems. The concepts and techniques introduced in the module will be further used and developed during subsequent modules.

Contents

The module covers the following topics:

- The electromagnetic spectrum.
- Sensors and platforms.
- Radiometric aspects of remotely sensed data.
- Geometric aspects of remotely sensed data.
- Aerial photography.
- Image enhancement and visualization.
- Image interpretation and classification.

The module contains the following GFM specific topics:

- Radar;
- Laser scanning.

Objectives

Main objective. To learn how to generate information about the Earth from remote sensing data. At the end of the core modules participants must be able to:

- Explain the principles and use the vocabulary of RS;
- 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;
- Perform basic image processing techniques;
- Carry out a visual interpretation of an AP stereo pair and a satellite image;
- Apply appropriate RS methods for problem solving;
- Understand the capabilities, uses and limitations of RS in their field of application;
- Design and carry out sequential data processing steps for solving a typical application problem;
- Evaluate the results of data processing.

Prerequisites

Not applicable.

Recommended Knowledge

Basic computer skills, basic mathematics, stereo vision.

Hardware and Software Requirements

PC; Image Processing Software (ERDAS Imagine) and GIS software (ArcGIS).

Teaching Materials

- Principles of Remote Sensing, ITC Educational Textbook.
- Reader Exercises RS.
- Handouts of lectures.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
34	36	4	8	0	28	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

Written closed book exam on (parts of) the ITC RS textbook.

Note:

Examination on this core module contents is based upon the generic topics and will have ITC wide coordination. A precise list of compulsory topics and Textbook paragraphs will be distributed.

Principles of Geographic Information Systems		
Module: 3	Co-ordinating staff: Dr. C.P.J.M. van Elzakker	
Start: 10-11-2008		
End: 28-11-2008		
Level: M, MSc, PG		M08-GFM-162

Introduction

This module introduces the principal concepts and techniques of geographic information systems (GIS). The module consists of two interrelated parts: a theoretical one that focuses on the concepts and a practical one that aims at developing hands-on skills in using (mostly software) tools. The concepts and techniques introduced in these modules will be further enhanced during subsequent modules of the course.

Contents

The module covers the following topics:

- Introduction to GIS.
- Geographic information and spatial data types.
- Data processing systems.
- Determining and mapping position.
- Spatial data entry and preparation.
- Spatial data analysis.
- Spatial data visualization.

Objectives

Main objective: To learn how to generate information about the Earth from data stored in Geographic Information Systems. At the end of this core module, participants must be able to:

Explain the principles and use the vocabulary of 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;
- Outline the principal rules for cartographic visualisation;
- Describe aspects of data quality and how various stages of spatial data handling affect it.

Carry out basic 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;
- Apply basic data quality assessment procedures.

Apply appropriate GIS methods for problem solving:

- Understand the capabilities, uses and limitations of GIS in their field of application;
- 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.

Prerequisites

Not applicable.

Recommended Knowledge

Basic computer skills, basic mathematics.

Hardware and Software Requirements

ITC cluster PC with standard software and ArcGIS9.3.

Teaching Materials

Principles of Geographic Information Systems, 4th Edition, 2008. ITC Educational Textbook Series.

Principles of Geographic Information Systems, Exercises. Version 7.0, 2008.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
30	34	0	0	0	62	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

Written closed book exam on the ITC GIS textbook referred to above.

Final project						
Module: 4		Co-ordinating staff:				
Start:	01-12-2008	J.P.G. Bakx MSc				
End:	19-12-2008					
Level: SC						M08-GFM-164

Introduction

Within the field of their interest, the Final Project allows the course participants to work individual, or in small groups, on a short GeoInformation production oriented project. The Final Project aims to prepare the participant to prospective production tasks within their organisation.

Contents

New topics will not be taught in this concluding module. The participant should be confident to apply the accumulated expertise throughout the entire course in a project.

Objectives

Upon completion of this module students should be able to:

- Describe and apply the skills and techniques previously learnt in a piece of production work.

Prerequisites

Successfully completed all the modules taught previously.

Recommended Knowledge

Not applicable.

Hardware and Software Requirements

Cluster with multimedia PC's, with Visio, ArcGIS, FreeHand, Ilwis, Visual Basic, MapObjects, Flash, Leica Photogrammetric Suite (LPS), ERDAS Imagine, MS Office, colour and b/w printer.

Teaching Materials

All books, lecture-notes, handouts, slides, exercise/assignment instructions, etc. used throughout the programme as well as ITC book- and maps library.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
4	0	0	0	110		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

The assessment (completed/fail) will be done by the allocated supervisor on the basis of the output data and a presentation to the other module participants.

Programming skills 1		
Module: 1-4	Co-ordinating staff: Dr. O. Huisman	
Start: 29-09-2008		
End: 19-12-2008		
Level: M, MSc, PG		U08-GFM-159

Introduction

The main objective of this course component is to provide a working knowledge of programming in the Python programming language. Python is a General-purpose open-source computer programming language used by hundreds of thousands of developers around the world, in areas as diverse as spatial modelling, internet scripting, user interfaces, product customization, and more. Using a variety of theoretical and applied examples from each of the modules, students will learn how to think in a structured, logical way. "Programming Skills" will be taught and exercised in the first and second week of each module, but not in the exam week of any module. It will be assessed through regular exercises and project-based work.

Contents

- What is a program?
- The difference between interpreted scripts and compiled code.
- Variables, Expressions and Conditions.
- Functions.
- Recursive tasks.
- Working with Strings and Lists.

Objectives

After completing this course component students should be able to:

- Think analytically about a computational problem, i.e. be able to decompose and structure a problem,
- Formulate algorithms, which solve a given (simple) problem, and
- Implement these using Python.

Prerequisites

Not applicable.

Recommended Knowledge

Not applicable.

Hardware and Software Requirements

The Python programming environment, plus additional modules.

Teaching Materials

- The book How to Think Like a (Python) Programmer, Allen Downey, Green Tea Press, 2007.
- Lecture notes and slides available via Blackboard.
- Exercises and puzzles, distributed via Blackboard.

Allocated Time per Teaching Learning Method

L	SP	UP	GA	IA	S	O
12	24	0	0	0	12	12

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

Students are required to submit completed exercises at the end of each module.

Appendix: ITC Assessment regulations

**ITC REGULATIONS FOR COURSES LEADING TO AN
ITC MASTER OF SCIENCE (M.Sc.) DEGREE
OR
ITC POSTGRADUATE DIPLOMA**

– September 2008 –

- 1. Range of application**
- 2. Management, structure and organization of the M.Sc. and Postgraduate Diploma courses**
- 3. Admission to the course and exemptions**
- 4. Assessment of modules (excluding research period and final assignment)**
 - 4.1 Organization of module assessment**
 - 4.2 Feedback to participants and re-sits**
- 5. Research orientation and research period (M.Sc. course)**
 - 5.1 Research work and thesis**
 - 5.2 Admission to the research period**
 - 5.3 Supervision of the research work**
 - 5.4 Submission of the thesis**
 - 5.5 Thesis examination**
 - 5.6 Access to the thesis**
- 6. Final Assignment (Postgraduate Diploma course)**
 - 6.1 Final Assignment and result**
 - 6.2 Admission to the Final Assignment period**
 - 6.3 Supervision of the Final Assignment**
 - 6.4 Submission of the Final Assignment result**
 - 6.5 Assessment of the Final Assignment**
- 7. M.Sc. degree and Postgraduate Diploma assessment**
- 8. Awards and certification**
- 9. Early termination of the course**
- 10. Student appeal procedures**

Appendix:

Bodies and persons involved in management and quality of the course

These ITC Regulations for the Master of Science (M.Sc.) degree and Postgraduate Diploma courses were approved by the Rector and the Academic Board on 17 September 2008. These regulations apply to all courses commencing September 2008 onwards and replace all former ITC Regulations for Master of Science Degree Courses and Regulations for Postgraduate Diploma courses.

1. Range of application

- 1.1 These assessment regulations apply to all courses leading to an ITC Master of Science (M.Sc.) degree or a Postgraduate Diploma (PGD) starting from September 2008 onwards and replace all previous ITC Regulations for Master of Science Degree Courses and ITC Regulations for Postgraduate Diploma courses.
- 1.2 The M.Sc. and Postgraduate Diploma course can be an ITC course only (fully taught at ITC) or a joint course (partly taught by one or more of ITC's partners 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 course.
- 1.3 In most cases where the M.Sc. / Postgraduate Diploma 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 of Science degree or ITC Postgraduate Diploma'. The Course Director of the course concerned will inform the participants which assessment regulations and procedures apply.
- 1.4 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.
- 1.5 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 M.Sc. and Postgraduate Diploma course

- 2.1 The M.Sc. course is organized into four blocks with a total of 23 modules¹ and one or two starting weeks for introductory and remedial activities.

Block 1: modules 1-4
Block 2: modules 5-10
Block 3: modules 11-15
Block 4: modules 16-23

The first year of three blocks and 15 modules consists of coursework. The last 6 months (block 4; 8 modules) focus on individual research.

The Postgraduate Diploma course consists of the first two blocks (10 modules) of the M.Sc. course, one or two starting weeks and a Final Assignment of four weeks duration.

- 2.2 The duration of the M.Sc. course is 18 months fulltime. The duration of the Postgraduate Diploma course is nine months fulltime. Participants in both courses 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 M.Sc. course and the Postgraduate Diploma 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 M.Sc. participant to receive the M.Sc. degree. The Academic Board decides on whether the participant in the Postgraduate Diploma course will receive the Postgraduate Diploma. (See also the appendix 'Bodies and persons involved in management and quality assurance of the M.Sc. course and the Postgraduate Diploma 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 M.Sc. and Postgraduate Diploma 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 M.Sc. degree / Postgraduate Diploma to be received on successful completion of the course
- The course-specific conditions relating to that M.Sc. degree / Postgraduate Diploma
- 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 course and exemptions

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

3.2 Participants in the Postgraduate Diploma course who wish to take the whole M.Sc. course have to re-apply for the (second part of the) M.Sc. course. In such cases the maximum time between the starting date of the Postgraduate Diploma course and the graduation date of the M.Sc. course is three and a half years (see rule 3.4).

3.3 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 (M.Sc. course) or the Academic Board (PGD course) and, in case of exchange for a module in another course, approval of the Course Director of that course.

3.4 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 M.Sc. / Postgraduate Diploma course and

(2) No longer ago than three and a half years before the participant is expected to complete the M.Sc. / Postgraduate Diploma course.

At least 50% of the M.Sc. / Postgraduate Diploma course has to be taken to be eligible for the M.Sc. degree / Postgraduate Diploma. Therefore, exemption can be given for a maximum of 11 modules of the M.Sc. course and for a maximum of five modules of the Postgraduate Diploma course.

Requests for exemption that do not meet these conditions will be considered on an individual basis, at the discretion of the Degree Assessment Board (M.Sc. course) or the Academic Board (PGD course). In such cases, exemption can be given for a maximum of eight modules in the M.Sc. course and four modules in the Postgraduate Diploma course.

Exemption can never be given for (part of) the research work or Final Assignment.

3.5 In exceptional cases, a participant may also exchange a module of which the content has not been mastered for a module given in another course, provided that the Course Director of that course approves. Such an exchange is up to a maximum of two modules and subject to the approval of the Degree Assessment Board (M.Sc. course) or Academic Board (PGD course).

3.6 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 participants who have successfully completed a specific curriculum in the partner institute can be given direct admission to a later part of the M.Sc. or Postgraduate Diploma course.

4. Assessment of modules (excluding research period and final assignment)

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, thesis), one overall assessment is allowed.

Up to three of the first 11 modules in the M.Sc. course may be assessed by 'completed / fail'. The other module assessments must result in a mark.

The assessment of modules 12 and 13 may not be based on participation only and must result in a mark.

4.1.2 For admission to the research part (see rule 5.3.1) and for the calculation of the average of all modules (see rule 7.2), 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 shall 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 will 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 9.5).
- 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. Research orientation and research period (M.Sc. course)

5.1 Research orientation (block 3)

5.1.1 At a specified date before the start of Module 11 participants must submit:

- (1) A motivated choice of modules 12 and 13,
- (2) The research theme they will join, and
- (3) The preliminary title of the individual M.Sc. research topic and its main thrust.

The choices will be assessed by the Course Director and the research theme leader concerned (or delegate).

Approval of these choices leads to admission to the research theme and two M.Sc. supervisors will be appointed (see rule 5.4.1).

5.1.2 The final M.Sc. research proposal (approximately 8 pages) must be presented in module 15.

5.1.3 Participants have freedom to choose from the advanced subjects on offer in modules 12 and 13, with the limitation that modules will only be given when sufficient participants will participate.

5.2 The individual research period and thesis (block 4)

5.2.1 The M.Sc. research period focuses on individual research. The research requires that the M.Sc. participant carries out the research and reports on progress to the supervisors according to an agreed schedule for the research and preparation of the thesis.

5.2.2 The research work will be assessed on three occasions:

- (1) The detailed research proposal and presentation, leading to admission / no admission to the research period (end of module 15).
- (2) The mid-term presentation. No mark is given. The participant receives feedback from the supervisors. In the case of weak performance, the participant will receive a written warning from the Course Director (see rule 9.1).
- (3) The assessment and oral examination of the thesis.

In addition to these formal assessments, the participant will receive feedback on his/her performance from the supervisors throughout the research period.

- 5.2.3 A participant not presenting the (draft) research proposal, not making the mid-term presentation, not submitting the thesis 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.
- 5.2.4 The thesis, approximately 50 pages of text (approximately 350 words per page and presented in the standard ITC format for theses), excluding appendices, shall constitute an ordered, logical and critical description of the research and should afford evidence of reasoning power, critical attitude, competence in the scientific discipline (application and/or development of knowledge and skills), and knowledge of relevant literature.
- 5.2.5 The thesis 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.
- 5.2.6 With the explicit approval of the supervisor, a participant may be permitted to incorporate in his/her thesis a limited amount of unpublished work undertaken by the participant prior to the start of the research. A participant may not incorporate in his/her thesis material which has been submitted for achieving the award of a degree from any other educational institution.
- 5.2.7 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 Thesis Assessment Board will decide not to assess the thesis. This means that the M.Sc. degree cannot be awarded (see also rule 9.3 and 9.5).

5.3 Admission to the research period

- 5.3.1 For admission to the research part of the course, at least all but two of the previous modules (see rule 7.2 to see which modules are to be included) must have been successfully completed and no mark below 50 is allowed.
The second requirement for admission to the research part, which is as important as the marks obtained in previous modules, is the ability to undertake independent research. This ability will be developed and assessed during the first 15 modules and finally assessed on the basis of the detailed, written and orally presented, research proposal (end of module 15).
- 5.3.2 The Course Director will nominate, and the Degree Assessment Board will approve, a Thesis Admission Committee. This Committee will assess the proposal and the presentation by the participant. The Thesis Admission Committee is accountable to the Course Director.
- 5.3.3 Each Thesis Admission Committee has 3 to 4 members: the research theme leader or delegate (chair), the first supervisor and the second supervisor (or delegate). The Course Director and involved PhD students or AiO's (see 5.4.1) may be present as advisors.
- 5.3.4 The oral defence of the research proposal is open and will be announced as such.
In exceptional cases the Course Director can decide to have the oral defence of individual participants closed to observers other than ITC staff.

- 5.3.5 When the Thesis Admission Committee is of the opinion that the research proposal is not of a level required for the start of the individual research period, the participant will receive feedback and will have a second opportunity to defend a revised proposal within two weeks. In case the second proposal presentation is not satisfactory, the candidate will not be admitted to the individual research period.
- 5.3.6 A participant who is not eligible for admission to the individual research period of the course but has completed modules 1 to 14 of the M.Sc. course successfully (see rule 8.1) will receive a Postgraduate Diploma.
- 5.4 Supervision of the proposal phase and the research work
- 5.4.1 In module 11, based on the research pre-proposal, in consultation with the research theme leader and the M.Sc. participant, the Course Director shall recommend a primary and secondary supervisor to the supervisor's department(s). PhD students and AiO's may be involved in the supervision as advisor and support the work of the supervisors. Supervisors and advisors are appointed by the management team of the department.
- 5.4.2 The two supervisors and, if applicable, the advisor shall divide the supervision tasks and make a supervision plan and meeting schedule with the participant.
- 5.4.3 Supervisor(s) shall:
- (1) Guide the M.Sc. participant in the formulation of a detailed research proposal.
 - (2) Establish a schedule of regular supervisory meetings with the M.Sc. 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 research.
 - (4) Provide feedback on draft written work, normally within 10 days of receipt.
 - (5) Where appropriate, forward 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 9.1 and 9.2).
- 5.4.4 If a M.Sc. 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.
- 5.4.5 Replacement of a supervisor may be considered if the research is found to be outside a supervisor's area of expertise, or at the request of the supervisor and/or of the participant.
- 5.5 Submission of the thesis
- 5.5.1 The participant must submit a well-organized copy of all digital files associated with the research work on DVD, and a hard-copy of graphic output, at least two weeks before the examination date or as specified by the Course Director.
- 5.5.2 ITC will produce sufficient printed copies of the thesis, including two for the participant. The participant must bring one of his/her copies of the thesis to the oral examination.
- 5.5.3 One copy of the thesis will be sent to each member of the Thesis 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.

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

5.6 Thesis examination

- 5.6.1 For the thesis examination, the Course Director nominates and the Degree Assessment Board approves a separate Thesis Assessment Board for each participant. The Thesis Assessment Board is accountable to the Course Director.

Each Thesis Assessment Board has 3 to 5 members: one or both supervisor(s), an ITC professor or associate professor in a relevant discipline, an external examiner and, if necessary, other staff members of the ITC. The involved AiO or PhD student (see 5.4.1) and the Course Director may advise. In many cases, the external member comes from outside ITC, preferably being an academic staff member of a university. In the remaining cases, the external member comes from an ITC department that does not play a major role in the course and research theme.

The Thesis Assessment Board is chaired by the ITC (associate) professor. In exceptional cases one of the other members, but not the first supervisor, can be the chair.

- 5.6.2 The thesis examination consists of the assessment of the thesis and the oral examination that includes a presentation and defence. The oral examination has a maximum duration of one and a half hours.
- 5.6.3 The Course Director assigns a date for an oral examination and informs the participant at least one month in advance of this date.
- 5.6.4 All members of the Thesis Assessment Board shall read and assess the quality of the thesis as an ordered, logical and critical exposition of research work in the approved field.
A minimum of three members of the Thesis Assessment Board must be present at the oral examination. (In case the ITC (associate) professor cannot attend, Head Education will appoint another ITC (associate) professor to replace him or her.) These members of the Thesis Assessment Board will assess the participant's reasoning power, critical attitude, competence in the scientific discipline, and knowledge of the relevant literature, will raise questions concerning the thesis and will decide on the mark.
- 5.6.5 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.
- 5.6.6 On the basis of the assessment of the participant the Thesis Assessment Board shall take one of the following decisions:
- (1) The thesis 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 thesis, the thesis is satisfactory. One single mark is given, subject to the corrections in the thesis being made.
 - (3) The thesis is not satisfactory and is given the FAIL grade.

5.6.7 No changes may be made in the thesis after submission for the thesis examination, only an errata list may be added. If the Thesis Assessment Board requires minor corrections to the thesis, 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 thesis is to be re-examined by the Thesis Assessment Board.

5.6.8 Extensions to the research period can be given before the thesis is submitted and/or as result of the thesis examination. In case the participant does the research work at a distance, extension can only be given before the thesis is submitted.

Extensions will be given only when:

- (1) Funding for the extension is available,
- (2) The main cause of the unsatisfactory level of the thesis has been beyond the control of the participant (at the discretion of the Course Director),
- (3) The extension could lead to an acceptable thesis and re-examination (at the discretion of the Thesis Assessment Board)

The participant will take the initiative and apply in writing for extension. If the Course Director is of the opinion that the second and third conditions are met, he/she will forward the request to Head Education for decision.

5.6.9 The maximum total duration of extensions to the research period is three months. Extensions are allowed only when the participant stays at ITC or, in the 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 thesis in the home organization and since the M.Sc. course may be spread over a period of maximum three and a half years (see rule 2.2) they may work on the thesis until about a month before the end of the three and a half year period. In such cases, no extensions are possible.

5.7 Access to the thesis

5.7.1 The primary function of the Institute is the development and dissemination of knowledge. Theses are lodged with the Institute Librarian and shall be made available for consultation, inter-library loan and photocopying.

Theses that meet the following criteria will also be made available in digital format at the ITC website:

- (1) Have been awarded a mark of 75 or more
- (2) Contain no material of which the copyright rests with third parties
- (3) Contain no confidential data or information.

5.7.2 Any staff member who publishes results from M.Sc. research work or the related thesis is obliged to make a proper reference to the M.Sc. participant's work.

6. Final Assignment (Postgraduate Diploma course)

6.1 The Final Assignment and result

6.1.1 The Final Assignment period focuses on the application of knowledge, methods and techniques in the subject of the course to the task performed or to the topic investigated. Depending on the course, the Final Assignment will be done individually or in small groups.

- (1) At the start of the Final Assignment period, participants will receive terms of reference from supervising and coordinating staff.
- (2) Subsequently, participants will have to plan and carry out the assignment according to the terms of reference.

- (3) Part of the output of the assignment will be a final report and a documented database.
- (4) The output of the assignment will be presented and discussed in public.

6.1.2 A participant or group not completing the Final Assignment within the specified time, will be considered to have failed. Only in exceptional cases and for reasons beyond the control of the participant/group (at the discretion of the Course Director), the participant/group may apply in writing for a new opportunity to meet the above requirements.

6.1.3 A participant or group may not incorporate material that has been submitted for achieving certification from any other educational institution, in the Final Assignment result.

6.1.4 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/group's own work.
If material from other work is incorporated verbatim, without proper acknowledgement of the source (plagiarism), the Course Director may decide that the Final Assignment will not be assessed. This means that the Diploma cannot be awarded.

6.2 Supervision of the Final Assignment

6.2.1 The coordinator of the Final Assignment period, in consultation with the Course Director, will set up a scheme indicating which staff is available for consultation and supervision throughout the Final Assignment period. The supervising staff have to be appointed by the management team of their department.

6.2.2 The supervising staff shall:

- (1) Provide the participant/group with clear terms of reference.
- (2) Establish a schedule of supervisory meetings with the participant/group.
- (3) Provide general advice and guidance on the execution of the Final Assignment.
- (4) Provide feedback on work, normally within three days of submission.
- (5) Forward, where appropriate, any comments on the performance of the participant(s) to the Course Director.
- (6) Advise 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 9.1 and 9.2).

6.2.3 If a participant/group considers that he/she is not receiving the quality of supervision required in the regulations, the participant/group should seek action from the Course Director.

6.3 Submission of the Final Assignment result

6.3.1 The participant/group must submit a well-organized copy of all digital files associated with the Final Assignment work on DVD, and copies of hard-copy graphic output, to the supervising staff on the date of the Final Assignment assessment or as specified by the coordinator of the Final Assignment period in consultation with the Course Director.

6.3.2 Where the Final Assignment has been executed in groups or where individual Final Assignment work submitted has been executed in cooperation with others, the supervisor(s) must provide a written statement, indicating the extent of the share of the work that each participant has done.

6.4 Assessment of the Final Assignment

6.4.1 Participants will be assessed individually based on the output of and the presentation of the Final Assignment.

6.4.2 The Course Director assigns a date for the Final Assignment assessment and informs the participant/group of this date at least two weeks in advance.

6.4.3 Criteria for the assessment of the Final Assignment will be provided at the start of the Final Assignment period, i.e. at the time of providing the participants with the terms of reference for the final assignment.

6.4.4 The Final Assignment result will be assessed by two or three staff members: at least one (associate) professor in a relevant discipline and at least one staff member who has been involved in the supervision during the execution of the Final Assignment.

6.4.5 The presentation of the Final Assignment is open and will be announced as such. In exceptional cases the Course Director can decide to have the presentation of individual participants closed to observers other than ITC staff.

6.4.6 On the basis of the assessment of the participant(s) the assessing staff shall take one of the following decisions:

- (1) That the Final Assignment is satisfactory. One single mark is given.
- (2) That subject to minor corrections (that can be implemented within three working days and implemented before the official end of the course) in the Final Assignment result, the Final Assignment is satisfactory. One single mark is given, subject to the corrections in the Final Assignment result being made.
- (3) The Final Assignment is not satisfactory and is given the FAIL grade.

6.4.7 In exceptional cases extension may be given for the Final Assignment work, but only before the Final Assignment assessment and only when:

- (1) Funding for the extension is available, and
- (2) The main cause of the unsatisfactory level of the Final Assignment has been beyond the control of the participant/group, at the discretion of the Course Director.

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.

6.4.8 Extensions have a maximum duration of 50% of the standard duration of the Final Assignment. Extensions are only allowed when the participant/group stays at ITC.

This rule does not apply to participants who study part-time. They are allowed

to work on the Final Assignment in the home organization until the end of the period of three and a half years counting from the official starting date of the course (see rule 2.2). In such cases, no extensions are possible.

7. M.Sc. degree and Postgraduate Diploma assessment

- 7.1 On the basis of the assessment results of the participant, the Degree Assessment Board decides whether the participant will be awarded the M.Sc. degree.

On the basis of the assessment results of the participant, the Academic Board decides whether the participant will be awarded the Postgraduate Diploma.

In case the Degree Assessment Board (M.Sc. course) or Academic Board (PGD course) decides that the M.Sc. degree or Postgraduate Diploma will not be awarded, the Course Director will decide whether the participant will be awarded a Certificate or Certificate of Attendance.

- 7.2 For the award of a M.Sc. degree the average of all module marks (including the thesis that counts for 8 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 thesis must have a mark of at least 60.

The criteria for the award of a Postgraduate Diploma are:

- (1) The average of all final module marks must be at least 60. When a module is assessed with 'completed' or 'fail': a 'completed' will not be included in the average, a 'fail' will be counted as a mark of 50. In case of one overall assessment for combined modules, the overall mark will be given to each separate module, before calculation of the average.
- (2) No more than two of the modules may have a mark below 60. No final module mark below 50 is allowed.
- (3) The final assignment must have a mark of at least 60.

Only results of modules that are part of the formal curriculum of the M.Sc. or Postgraduate Diploma 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 7.2) 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 (M.Sc. course) or Academic Board (PGD course). (See rule 3.4.)

- 7.3 To be entitled to receive a M.Sc. degree or Postgraduate Diploma with distinction the average of all module assessments (see rule 7.2 which modules are to be included) must be 80 or above. The thesis or Final assignment must have a mark of 80 or above. No marks below 70 or 'fails' are allowed.

Participants who have made changes in the formal curriculum of their M.Sc. or Postgraduate Diploma course (exemptions or exchanged modules) that affect more than four (M.Sc. course) or two (PGD course) modules are not entitled to receive a M.Sc. degree or Postgraduate Diploma 'with distinction'.

- 7.4 The Degree Assessment Board (M.Sc. course) / Academic Board (PGD course) shall take one of the following decisions:
- (1) That the thesis / final assignment and overall course performance of the participant are satisfactory. The degree of M.Sc. / Postgraduate Diploma shall be awarded.
 - (2) That the thesis / final assignment and overall course performance of the participant are such that the M.Sc. degree / Postgraduate Diploma shall be awarded "with distinction".
 - (3) That subject to minor corrections in the thesis / final assignment, the thesis/ final assignment and overall course performance are satisfactory. The degree of M.Sc. / Postgraduate Diploma shall be awarded subject to the corrections in the thesis / Final Assignment result being made before the official end of the course.
 - (4) For M.Sc. candidates: That the research work / final assignment and/or overall course performance are not satisfactory. The degree of M.Sc. shall not be awarded. The participant will receive a Postgraduate Diploma.
For Postgraduate Diploma course participants: That the final assignment and/or overall course performance are not satisfactory. The Postgraduate Diploma shall not be awarded. The participant will receive a Certificate.

8. Awards and certification

- 8.1 A “**Master of Science Degree**” will be awarded to a participant who has been officially admitted to a M.Sc. course (as approved by the Academic Board) and has fulfilled the assessment requirements of that course.

A “**Postgraduate Diploma**” will be awarded to a participant who has been officially admitted to a PGD course (as approved by the Academic Board) and has fulfilled the assessment requirements of that course.

A “Postgraduate Diploma” (‘with distinction’ will not be possible in this case) will also be awarded to a participant who (1) has been officially admitted to a M.Sc. course, (2) has not been admitted to the research period or has failed the thesis, and (3) has completed modules 1 to 14 of the M.Sc. course successfully (average of all module marks is at least 60, not more than two marks between 50 and 60 and no marks below 50).

A “**Certificate**” will be awarded to a participant who (1) has been officially admitted to a M.Sc. course or Postgraduate Diploma course but has not fulfilled all assessment requirements for that course, and (2) who has fulfilled the assessment requirements of at least one summatively assessed module of that M.Sc. or Postgraduate Diploma 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 M.Sc. course or Postgraduate Diploma 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 M.Sc. degree or Postgraduate Diploma.

- 8.2 M.Sc. degrees and Postgraduate Diplomas are issued under the responsibility of the Rector. Certificates and Certificates of Attendance are issued under the responsibility of the Course Director.

- 8.3 M.Sc. degrees and Postgraduate Diplomas are signed by the Rector of the ITC and Head Education.
Certificates and Certificates of Attendance are signed by the Course Director.
- 8.4 M.Sc. degrees, Postgraduate Diplomas 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.

- 8.5 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 of 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").

9. Early termination of the course

- 9.1 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 M.Sc. Degree / Postgraduate Diploma without a significant improvement in performance, the participant shall be advised in writing by the Course Director of the situation and the implications.
(Oral or written advice by the Course Director may not be given when the concern arises after the mid-term presentation of the thesis or after the approval of the Final Assignment plan.)

- 9.2 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 (M.Sc. course) or Academic Board (PGD course) and the participant having received one written warning and being given time to improve performance.

- 9.3 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 thesis, the Thesis Assessment Board will decide not to assess the thesis. Extensions of the thesis period are then not possible. This means that the M.Sc. degree cannot be awarded. The participant will get a Postgraduate Diploma.

In case of plagiarism in the submitted final assignment of the Postgraduate Diploma course, the Course Director may decide that the final assignment will not be assessed. This will mean that the Diploma cannot be awarded, the participant will get a Certificate.

- 9.4 In case of other types of misbehaviour, the Course Director will consider expulsion from the course.
- 9.5 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.

9.6 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.

10. Student appeal procedures

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

10.2 In the event that a participant disagrees with decisions taken by a staff member or Thesis Assessment Board, he/she may present this decision for reconsideration to the Course Director.

Where a participant finds that he/she is not receiving the quality of thesis / final assignment supervision required in the regulations, the participant should also seek action from the Course Director.

Only in the event that a M.Sc. participant disagrees with decisions taken by the Degree Assessment Board he/she may present this decision for reconsideration to Head Education directly (see rule 10.3)

10.3 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.

10.4 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 10.2 and 10.3) have not led to agreement;
- The appeal concerns the implementation of these 'ITC Regulations for Master of Science (M.Sc.) degree and Postgraduate Diploma courses' or the assessment of the thesis / Final assignment and
- The appeal has been made before the official end of the course. Appeals concerning the assessment of the thesis can be made later 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.

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

10.6 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 thesis, staff members representing fields related to the subject of research will be invited to sit on the Student Appeals Board.

10.7 After having heard all parties involved (including the Course Director) for relevant information, the Student Appeals Board will take a final decision on the appeal. 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.

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

- 10.9 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 thesis, the fellowship may only be extended when the appeal is made before the official end of the course.
- 10.10 Support to a request for reconsideration or appeal concerning the assessment of the thesis cannot lead to overruling the assessment of the thesis by a Thesis Assessment Board that is composed according to these regulations. Acceptable remedial actions do include a re-sit for the oral part of the thesis examination (only when a reason beyond the control of the participant has caused underperformance in the oral part) or an extension to the research period (only when the main cause of unsatisfactory level of the thesis has been beyond the control of the participant) in combination with a full re-examination.

Support to a request for reconsideration or appeal concerning the assessment of the final assignment in the Postgraduate Diploma course cannot lead to overruling the assessment of the final assignment, carried by (a) supervisor(s) according to these regulations. Acceptable remedial actions do include a re-examination (only when a reason beyond the control of the participant has caused underperformance in the oral part) by the supervisor(s) or two other ITC staff members with sufficient expertise in the subject of the Final Assignment.

Bodies and persons involved in management and quality assurance of the M.Sc. course and the Postgraduate Diploma course

The mentioned tasks and responsibilities must be carried out in accordance with these 'ITC Regulations for the Master of Science (M.Sc.) degree and Postgraduate Diploma 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, Director Graduate Programme and Student Appeals Board.

Scientific Council

The Scientific Council advises 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 and thesis examination criteria.
- Advice on ITC's quality assurance system
- Advice on degree and assessment regulations, including these 'ITC Regulations for the Master of Science (M.Sc.) degree and Postgraduate Diploma 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 M.Sc. and Postgraduate Diploma 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 of Science (M.Sc.) degree and Postgraduate Diploma courses'
- Acting as Degree Assessment Board
- Decision on deviation of the formal curriculum by individual participants in the Postgraduate Diploma course.
- Decision on award of the Diploma to individual participants in the Postgraduate Diploma course.

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

Research theme leader

The Research Theme leader is responsible for all research carried out by the scientific staff and participants connected to that theme. This responsibility includes:

- Approval of the research pre-proposal; admission of the participant to the research theme
- Monitoring of the quality of the research supervision given to M.Sc. participants under the theme

Research theme leaders are ITC professors.

Head Education

Head Education is responsible for:

- Monitoring of the implementation of the M.Sc. course and Postgraduate Diploma 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. Head Education delegates the coordination of supra-course aspects of block 3 and block 4 of all M.Sc. courses to the Director Graduate Programme

Course Director (CD)

The Course Director is responsible for:

- Implementation of the M.Sc. course and Postgraduate Diploma 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

Director Graduate Programme

The Director Graduate Programme is responsible for:

- Coordination of the development and implementation of supra-course aspects of block 3 (research orientation) and block 4 (individual research period) of the M.Sc. course

Degree Assessment Board

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

This responsibility includes:

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

The Academic Board acts as Degree Assessment Board.

Thesis Admission Committee

The thesis Admission Committee is responsible for assessment of the thesis proposal and admission to the research part of the M.Sc. course.

Thesis Assessment Board

Responsible for assessment of the thesis and oral examination of the participant on completion of the research.

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.

Additional rules for short courses and individual study programmes leading to an ITC CERTIFICATE ¹

- September 2008 -

Short courses and individual study programmes consist of modules of an ITC (Postgraduate) Diploma, Master and/or Master of Science (M.Sc.) course. The regulations that apply to the latter courses apply to the parts as well. Only the rules described below take precedence over the Diploma, Master and M.Sc. regulations.

1. Range of application

These additional rules apply to all courses and individual study programmes leading to an ITC Certificate starting from September 2008 onwards. These courses consist of one or more modules of a Diploma, Master and/or Master of Science course.

Short courses have specific course objectives. These courses may start and/or finish with a few days for introductory respectively rounding-off activities. The individual study programmes consist of one or more separate modules chosen by the participant.

2. Management of the course

The curriculum of short courses has been approved by the Academic Board. Individually chosen combinations of separate modules need the approval of the Course Director. In case the individual study programme consists of modules of block 3 of the M.Sc. course only or of a combination of modules from more than one domain, approval of Head Education is needed. Individual changes made in the course curriculum of the short course lead to the course being seen as an individual study programme.

Responsibility for implementation of the approved short course or individual study programme rests with Head Education, who delegates this responsibility to the Course Director(s) or, in the case of elective modules, to Module Coordinators.

Responsibility for quality assurance rests with the Academic Board.

3. Assessment

Courses leading to a Certificate are summatively assessed. The right to re-sit for an examination exists only when the date of the re-sit falls within the official study period of the participant.

4. Certification

A "Certificate", mentioning that the participant has followed the course, will be awarded to a participant in a short course who has fulfilled all assessment requirements for that course.

¹ These rules were approved by the Rector and by the Academic Board on 17 September 2008; they apply to all courses commencing September 2008 onwards.

A "Certificate", mentioning that the participant 'has followed an individual study programme in Geo-information Science and Earth Observation', will be awarded to

- A participant in a short course who has fulfilled the assessment requirements of one, but not all, modules of the short course and to
- A participant in an individual study programme who has fulfilled the assessment requirements of at least one module.

A "Certificate of Attendance", mentioning that the participant 'has attended an individual study programme in Geo-information Science and Earth Observation', will be awarded to all other participants who have participated for at least 80% in one or more modules. The titles of these modules will be mentioned on the Certificate of Attendance.

Certificates and Certificates of Attendance mention the study load. Only the study load of the modules that have been completed and the study load of the modules that the participant has participated in for at least 80%, are included in the study load.

Certificates are accompanied by a Course Record mentioning the period of study, the study load and the titles of the modules that the participant has completed or participated in for at least 80%.

Certificates, Certificates of Attendance and accompanying Course Records are signed by the Course Director or, in case the short course or individual study programme consists of modules 14 and 15 of the M.Sc. course only or of a combination of modules from more than one domain, by Head Education.

Certificates and Certificates of Attendance of distance courses are signed by the Course Coordinator and by the Course Director or, in case of new distance courses, by Head Education.

5. Building blocks for Diploma or Degree

Successfully completed modules of short courses and individual study programmes can be used as building blocks for obtaining an ITC (Postgraduate) Diploma, Master degree or M.Sc. degree, provided the participant has been formally admitted to the (Postgraduate) Diploma, Master or Master of Science course.

Participants have three and a half years to meet all requirements of the (Postgraduate) Diploma, Master or M.Sc. course. 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 (M.Sc. and Master courses) or Academic Board (Diploma courses).

Appendix: ITC Regulations for courses leading to an ITC Master of Science (M.Sc.) degree or ITC Postgraduate Diploma,
ITC Regulations for courses leading to an ITC Master degree or
ITC Regulations for courses leading to an ITC Diploma.