



# AIMS

African Institute for  
Mathematical Sciences  
SOUTH AFRICA

## **AIMS MSc in Mathematical Sciences - August 2016 intake**

### **Skills courses abstracts**

**22 August – 25 November**

#### **Computing and LaTeX Jan Groenewald (AIMS)**

This course introduces students to the AIMS computing facilities and packages. The course covers an introduction to LaTeX using texmaker, followed by working through the book: <http://en.wikibooks.org/wiki/LaTeX>, and associated documents such as those from the American Mathematical Society.

#### **English and Communication Skills Noluvuyo Hobana (AIMS)**

This course introduces students to the essentials of English communication, writing and presentation in a scientific environment.

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**26 August – 16 September**

#### **Mathematical Problem Solving Florian Breuer and Dimbinaina Ralaivaosoana (Stellenbosch)**

In this course we shall consider a variety of elementary, but challenging, problems in different branches of pure mathematics. Investigations, comparisons of different methods of attack, literature searches, solutions and generalizations of the problems will arise in discussions in class. The objective is for students to learn, by example, different approaches to problem solving and research.

#### **Programming in Python Jeff Sanders and colleagues (AIMS)**

The purpose of this course is to teach students how to program, using the language Python as a vehicle. Programming is difficult, and one of the reasons is that programmers are offered no “space” in which to develop their ideas. Instead they are forced to write code, then test and modify it, iteratively, in the hope that a more accurate program results. Inevitably, it seldom does. In this course, we introduce “design space” for the specification and development of programmes. The result is that students are able to use discrete mathematics in formulating algorithms and analysing their efficiency before having to downcode to Python. Also covered: version control; unix; and shell script.

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**19 September - 7 October**

**Experimental Mathematics with Sage  
Evans Ocansey (Johannes Kepler)**

This course introduces an approach to doing mathematics that is founded on experiment and inquiry. It does so in the medium of Sage, a Python-based tool for computation and experiment. Some of the problems studied come from Number Theory and some from Graph Theory. Skill with Sage will be important for many subsequent courses.

**Statistics using R  
Kaja Jasinska (Yale)**

A course in statistical concepts and methods, with specific focus on practical applications of the statistical software package "R". The course emphasizes foundational topics in statistics such as: exploratory data analysis for univariate and bivariate data, sampling and experimental designs, basic probability models, hypothesis testing in one-sample and comparative two-sample studies, analysis of variance (ANOVA) for one factor and multiple factor designs, analysis of covariance (ANCOVA), and regression models. The course also covers more advanced and multivariate statistics such as: multiple analysis of variance, multilevel linear modeling and growth curve modeling. Students without prior statistical knowledge will be introduced to a wide range of methods, and students with formal statistical knowledge will be exposed to advanced topics, with the option to complete an independent project under the lecturer's supervision.

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**10-21 October**

**Entrepreneurial Skills  
Jonathan Marks (Gordon Institute of Business Science)**

**10-28 October**

**Concepts and Problem Solving in Physics  
David Aschman (Cape Town)**

This course shows that physics describes the real world using the language of mathematics. Problem solving techniques such as changing the point of view, using different reference frames, estimating orders of magnitude, dimensional analysis, and numerical approaches will be used. Examples will be taken from physics of moving objects, electrodynamics, gravity, movement of molecules in gases, and elementary particle physics.

Students are required to read, think, discuss, engage, interact, argue, present their ideas verbally, do homework, compute and present their ideas verbally and in writing. Details of the topics covered will be available on the course page.

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**29 August – 25 November**

**The Scientific Environment  
AIMS Staff and invited lecturers**

Various meta-mathematical topics are important for a scientific professional including: avoiding plagiarism, professional ethics, gender issues, scientific writing, managing your research, presentation skills, online collaboration.

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