AIMS STRUCTURED MASTER'S IN MATHEMATICAL SCIENCES

SKILLS COURSES 2020-21 - Overview and abstracts

Dates	Course title	Lecturer	Affiliation
16 November to 11 December	Computing & LaTeX	Jan Groenewald	AIMS South Africa
17 Nov - 11 December	Python programming	Paul Taylor Nafissatou Pouye	National Institutes of Health Centre for Humanitarian Data
14-18 December 2020 4- 15 January 2021	Experimental Mathematics with Sage	Yae Gaba Evans Doe Ocansey	African Centre for Advanced Studies Johannes Kepler University
21 December to 15 January 2021	Statistics	Siaka Lougue	Institut de Recherche en Science de la Santé (IRSS)
18 January - 5 February	Mathematical Problem Solving	Eric Andriantiana	Rhodes University
31 May to 18 June 2021	Concepts and Problem Solving in Physics	David Aschman	University of Cape Town
21-25 June 2021	Entrepreneurship	TBA	

ABSTRACT

Introduction to Computing and LaTeX
Jan Groenewald, AIMS South Africa
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.

Python programming
Paul Taylor, National Institutes of Health
Nafissatou Pouye, Centre for Humanitarian Data
The goal of the course is to have the student feel comfortable with the fundamental building blocks of programming, as well as appreciate coding's conceptual ties with the mathematical sciences. We will cover basic functional programming, both in general principles and with specific, Python-based considerations. We frame the course by building on the student's own mathematical background and

on the similarity of notation between math/physics and programming. Major topics include: data types, conditionals; functions; collections (lists, arrays and dictionaries); for and while loops; good programming practice and modular structure; data visualization and plotting; reading from and writing to files; and numerical integration.

Experimental Mathematics with Sage
Yae Gaba, African Centre for Advanced Studies
Evans Doe Ocansey, Johannes Kepler University
The use of a computer algebra system leads the mathematician that we are to a new approach in problem solving, the experiment. This course illustrates how experiments can help mathematicians solve mathematical problems (mainly proving or disproving mathematical claims). These mathematical experiments require computer assistance and in our case, we will use the System for Algebra and Geometry Experimentation (SAGE). We give an overview and an introduction to the SAGE computer algebra system and its features, covering many aspects of maths, including algebra, combinatorics, numerical mathematics, number theory, calculus. We will work mainly with Discrete Mathematics problems: Linear Algebra, Number theory and possibly some Graph theory. We will be learning along some programming concepts, revisit datatypes and play around with plotting functions, curves, geometric figures and interactive plots. By the end of the course, we expect the student to get familiar with the SAGE computer algebra system, acquire the skills to prepare his own sage notebooks for various purposes.

Statistics
Siaka Longue, Institut de Recherche en Science de la Santé (IRSS)
Applied statistics with public health (biostatistics) examples is the main purpose of this course. In this course, students will be exposed to usual experimental designs used in public health we well as common data analysis and impact evaluation techniques. At the end, students should be able to fully understand, explain, implement and interpret common statistics methods in biostatistics and public health using the software R (R studio).

Mathematical Problem Solving
Eric Andriantiana, Rhodes University
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.

Concepts and Problem Solving in Physics
David Aschman, University of 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.

Entrepreneurship
TBA