AIMS | African Institute for Mathematical Sciences SOUTH AFRICA

TRAINING AFRICA'S TOP MATHEMATICAL SCIENTISTS

Innovative Training, Research & Home-grown
Solutions for a Prosperous Continent

FIVE FACTS **ABOUT AIMS SOUTH AFRICA**

AIMS South Africa was established in 2003 as a partnership project of the following six universities:

Since 2003, AIMS South Africa has graduated 967 students (35% women) from 41 countries;

AIMS South Africa has hosted over 500 world-class lecturers from more than 40 countries around the world;

AIMS South Africa offers two intakes each year in August & January;

Qualified students benefit from full scholarships.

2020/2021 Student Groups

AIMS – ACCELERATING KNOWLEDGE-LED DEVELOPMENT IN AFRICA

The African Institute for Mathematical Sciences (AIMS) is a pan-African network of centres of excellence for post-graduate training in mathematical sciences and research and public engagement in science, technology, engineering and mathematics (STEM). Founded in 2003, AIMS is leading Africa's socio-economic transformation through:

1. *Innovative scientific training (the development of human capital);*
2. *Facilitating technological advances and cutting-edge scientific discoveries;*
3. *Scientific foresight, policy design and*
4. *Public engagement for the continent's scientific emergence.*

Founded in 2003 in South Africa and later replicated in Senegal, Ghana, Cameroon, Tanzania and Rwanda under the framework of the Next Einstein Initiative, AIMS is feeding the STEM pipeline by training African students for a Master's in mathematical sciences, including a co-operative option with a direct link to industry.

The network also offers research programmes, with 90 researchers currently conducting studies under the tutelage of prestigious Research Chairs across the network. In addition to a gender responsive Teacher Training Program currently implemented in Cameroon, Rwanda and South Africa (through the AIMS Schools Enrichment Centre in South Africa), AIMS has equally created two critical initiatives: Quantum Leap Africa to prepare the continent for the coming quantum revolution and the Next Einstein Forum to propel Africa on to the global scientific stage.

To implement this vision, AIMS targets the brightest young African students who are shaped as independent thinkers, capable of solving problems, innovating and propelling Africa to economic prosperity. Africa's youth are at the heart of the innovation and transformation ecosystem, which consists of a set of academic and non-academic programmes expertly tailored to provide AIMS learners with a unique post-graduate training experience on the continent.

OUR PROGRAMS

ACADEMIC PROGRAMS

AIMS Master's in Mathematical Sciences

AIMS South Africa offers an intensive one-year graduate-level course leading to a taught Master's Degree in Mathematical Sciences formally accredited by the Universities of Cape Town, Stellenbosch and the Western Cape. The course provides both a broad overview of cutting-edge science and strong mathematical and computer research skills. A new Master's stream, AI for Science, will be introduced in August 2023.

The course is unique, offering students' exposure to a range of topics, thereby allowing them to make an informed choice as to their future specialisation. The goal is to develop well-rounded scientists, with excellent problem-solving skills, capable of creative thinking and genuine innovation.

There is a strong grounding in end-to-end skills, from problem formulation, estimation, prioritization, and generally applicable mathematical and computing methods, to clear and concise scientific report writing. The aim is to equip students with the necessary tools and confidence for decision-making and policy analysis.

Faculties from African universities have been intimately involved in developing the AIMS curriculum, ensuring it is integrated with local undergraduate and Master's courses, and with local post-graduate research opportunities.

World-leading scientists & educators have volunteered to teach at AIMS centres. Their participation ensures an education of the highest international quality. Tutors (often including AIMS alumni) provide teaching and administrative support, assistance to foreign language speakers, and continuity across the visiting lecturers.

Academic Programme Features

First semester: Skills courses are compulsory and designed to:

- provide introductory & foundational material to the students;
- train students in problem solving using a wide range of mathematical & computing methods;
- provide a working knowledge of mathematics, physics and selected topics.

They are structured to achieve pre-defined outcomes, with little flexibility in their content.

Second semester: Review courses are elective and are fundamentally different. Each is flexibly designed and together they provide a wide range of topics. Students are required to complete 11 courses selected from the 18 review courses offered (with at most two chosen from any three-week block). Choices offered are balanced as far as possible with respect to focus on mathematics, physics, computer science and interdisciplinary topics, such as bio-mathematics, financial mathematics, and more. Students can select from the list of courses in consultation with the Academic Director who ensures coherance.

The AIMS understanding is that each Review Course provides an overview and indepth study of some topic from a major field of modern scientific work in the mathematical sciences and its applications. These are often relevant to African development.

Third semester: Research project: During the three-month long research project phase students work on a research topic with a supervisor. Students are not expected to do original work to achieve a passing grade, but the criterion for an outstanding research project is broadly that it could constitute the early part of a Research Master's thesis. For example, it could be publishable in a journal, or form an outstanding introduction to the field that could be used by other students entering the area. During this phase targeted communication skills and computing classes may continue, at the supervisor's discretion.

The purpose of the research project is: *(1)* to give students the opportunity to work with an expert supervisor on a non-trivial project; *(2)* to go through the process of independently reviewing, understanding and explaining scientific or mathematical material; *(3)* to optionally do experiments - on a computer or otherwise – and report the results; *(4)* to write a scientific report, and to defend it in an oral exam.

Assessment & Evaluation: The academic assessment of students for the AIMS Master's Mathematical Sciences is accomplished through: *(1)* Continuous assessment through written assignments, tutorials, short tests and student presentations set by the lecturers. *(2)* A written research project which the student is required to present (orally) to a panel of examiners. This panel includes the AIMS Director, the Academic Director, the supervisor, a teaching assistant and at least one external examiner. *(3)* In order to complete the AIMS Master's degree successfully, a pass is required for each of the phases. *(4)* Integrated assessment - a portfolio for each student is compiled, containing the grades achieved for each of the courses attended as well as observations on their presentations, all their assignments, completed exercises and their final research project.

Each student is registered, and graduates, from one of Cape Town's three universities. External evaluation of each student's performance and all aspects of the programme is conducted by six senior academics representing the different mathematical sciences disciplines (including Physics). The outcome of the integrated assessment is reported to the university at which each student is registered.

Mastercard Foundation Scholars Program

Since 2014, the Mastercard Foundation, together with AIMS, is leveraging the AIMS model to develop Africa's next generation of leaders through education. In a bid to propel socio-economic change, the Mastercard Foundation Scholars Programme at AIMS focuses on driving transformative leadership by encouraging scholars to engage in the development of their communities and the continent at large. The programme targets socioeconomically disadvantaged students with brilliant academic records and leadership potential.

Features of the Mastercard Foundation Scholars Program at AIMS

Selected Mastercard Foundation Scholars each year;

Transformative leadership and give-back activities;

BSc (Hons) in Mathematics with a focus in Biomathematics

This is an annual course run in conjunction with Stellenbosch University & commences in January each year. The course aims to train mathematicians to formulate & analyse precise models for experimental data arising from real-life research problems within the fields of biology and medicine - from predicting the influence of HIV/AID, malaria & tuberculosis to the effects of climate change on South Africa.

AIMS-ESMT Industry Immersion Program

The program provides an opportunity for AIMS alumni and students who have an interest in pursuing a career in industry to participate in a 20-week structured program which includes a 12-week internship with an industry partner, as well as courses tailored to work in industry. The program is done in partnership with the European School of Management and Technology (ESMT Berlin) and is supported by the German Federal Ministry for Economic Cooperation (BMZ) through the German Academic Exchange Service (DAAD.)

RESEARCH CENTRE

AIMS is contributing to Africa's transformation by supporting outstanding research in the mathematical sciences with emphasis on those areas that promote development and prosperity in Africa. The AIMS research environment encourages research freedom, with researchers conducting research that will impact humanity; support local and global strategic-driven initiatives; and forecast and respond to emerging challenges and opportunities.

The mission of the AIMS South Africa Research Centre is to conduct and foster outstanding research and learning in the mathematical sciences, thus contributing to the next generation of pan-African leaders in many spheres and the advancement of African science and academia within a multicultural environment.

The overarching theme of the Research Centre is "Mathematical Modelling in a Multi-disciplinary context", with a special focus on data analysis and computation. Two important themes, Mathematics for Development and AIMS as a Doctoral Training Centres, cut across each of the research focus areas.

The Research Centre offers Doctoral and Master's bursaries for research study under the supervision of our researchers. There are also fellowships available to a variety of visiting researchers. The Research Centre hosts research chairs, resident researchers, postdoctoral fellows, PhD and Research Master's students.

Research Centre Features

Focus areas:

- Cosmology & Astrophysics
- Mathematical & Physical Biosciences
- Mathematical Finance
- Mathematical Foundations & Scientific Computing
- Data Science & Information Systems

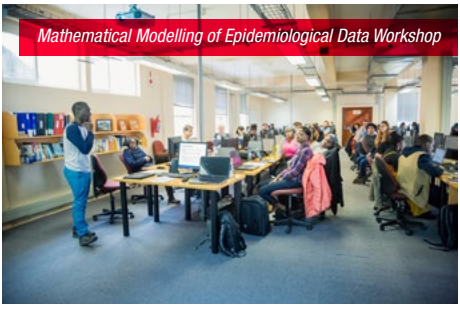
9 researchers

5 postdoctoral fellows, 14 PhD students and 16 Research Master's students

Workshops and conferences in areas related to research foci hosted throughout the year.

Over 600 publications since 2008

Mathematics in Industry Study Group



Mathematical Modelling of Epidemiological Data Workshop

ALUMNI SPOTLIGHT

Dr. Nantsoina Cynthia | Madagascar

2012 AIMS South Africa

After graduating from AIMS in 2012, Cynthia completed her Research Master's at Stellenbosch University (SU) in 2013. She was then awarded a DAAD scholarship to complete her PhD at SU in close collaboration with Tel Aviv University. She obtained her PhD in December 2016 following which she as a postdoctoral fellow in the AIMS South Africa Research Centre from January 2017 to August 2018 after which she joined Clemson University, South Carolina, USA, as Assistant Professor. Her research is mainly on Field Arithmetic and Algebraic Number Theory.

David Niyukuri | Burundi

2015 AIMS South Africa

David was awarded an NRF-TWAS African Renaissance Doctoral Fellowship in 2016 and is currently completing his PhD under the supervision of Prof. Wim Delva at the South African Centre for Epidemiological Modelling and Analysis (SACEMA), based at Stellenbosch University. His research focuses on developing new methodologies for HIV prevention studies based on understanding HIV transmission dynamics using bio-behavioural data and phylodynamics. He a member of the Infection Control Africa Network which is affiliated with the Global Outbreak Alert and Response Network.

Dr. Omowunmi Isafiade | Nigeria

2010 AIMS South Africa

Omowunmi is currently a postdoctoral researcher in the Department of Computer Science at the University of the Western Cape (UWC), under the DST-NRF Innovation Fellowship. She holds a BSc (Hons) in Computer Science from the Federal University of Agriculture, Abeokuta, Nigeria, and a graduated from AIMS South Africa in 2010. She successfully completed her Research Master's and PhD at UCT in December 2012, and July 2017respectively. She has had the privilege to lecture computer science courses both at UWC and UCT. She is also involved in students' research supervision at post-graduate level.

Munira Howaheer | Mauritius

2018 AIMS South Africa

Munira studied Physics at the University of Mauritius, with a focus on Astrophysics, and her thesis was on higher-dimensional black holes. She graduated from AIMS South Africa in 2018 and was awarded the Ben and Mary Turok Scholarship for Excellent Achievement. During her time at AIMS she also completed the AIMS-ESMT Industry Immersion Programme as well being selected as one of 13 participants to take part in the 8-week Data Science Intensive Programme organised by AIMS South Africa and funded through the UK's Science and Technology Facilities Council-funded 'Data Intensive Science Centre in SEPnet' (DISCnet). She is currently working as a data science consultant on machine vision projects.

PUBLIC ENGAGEMENT

Global research has demonstrated the potential of mathematics and science to fuel economic growth. AIMS public engagement programs spread the word about the ways math and science can build a better future for all.

AIMS South Africa is committed to increasing the pipeline of students progressing into secondary and tertiary mathematics education, and to decreasing the failure or drop-out rate of mathematics students at all levels.

AIMS Schools Enrichment Programme (AIMSSEC)

Through new approaches, the use of technology and updated curricula, AIMS South Africa is focusing on strengthening teacher capacity and reaching as many students as possible through the AIMS Schools Enrichment Programme. The programme offers free learning resources for learners of ages from 5 to 18+ years together with professional development courses for teachers. For more information please visit http://aimssec.aims.ac.za.

AIMSSEC teacher training

School learners visit AIMS

The AIMS House of Science

The AIMS House of Science is the coordination hub of AIMS South Africa's public engagement activities. Delivering public engagement and advancing leadership, knowledge and skills for scientific outreach and science communication for AIMS students and researchers. House of Science also provides mentoring and capacity building to enhance and up-scale AIMS students and researchers in research dissemination and community outreach.

AIMS South Africa exhibition at the launch of the 2022 South Africa National Science Week

Africa Scientifique Workshop 2022

AIMS Women in Stem Mentoring Session

Objectives

- To build capacity and train AIMS students, researchers, academics and alumni so that they are better enabled, skilled and confident in undertaking public engagement activities, initiatives and community outreach.
- To promote mathematics and science engagement with the broader community in Africa, showcasing mathematical sciences and its research applications conducted at AIMS.
- To stimulate young people's interest to pursue careers in science, technology, engineering and mathematics (STEM) and become the next generation of scientists, leaders and problem solvers.
- To improve the participation, progression and retention rates of women and girls in STEM-related fields.
- To conduct research studies on various topical issues on science/maths communication and gender in STEM in Africa.

For more information about this programme please visit https://aims.ac.za/house-of-science/

MEET THE AIMS SOUTH AFRICA TEAM

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Academic Director

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Become a student at AIMS, apply from December 1 to March 31 annually: https://www.nexteinstein.org/apply/.

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