# **DEPARTMENT OF MATHEMATICS**

Professor Alexandra Rodkina, MPhil, PhD, Kiev, DSc Moscow – Head of Department

### HIGHLIGHTS

S at July 2011, the teaching staff of the Department of Mathematics comprises of 1 Professor, three senior lecturers, six lecturers, and three assistant lecturers. Among them there are six members of staff with PhD (one, in addition to PhD, has a Higher Doctorate degree), one person is a Fellow of the Canadian Institute of Actuaries, and a Fellow of the Society of Actuaries, and one person is a Fellow of the Institute of Actuaries (UK).



This year (2011/2012), for the first time, mathematics major students at the Level 1 have been required to read 3-credit courses, MATH1141, MATH1142, MATH1151 and MATH1152, as stipulated by the Faculty in its curriculum reform. In addition to these courses, the Department has offered the first year course, MATH1185, tailored to the needs of the Departments of Physics and Chemistry. To further service the Faculty of Pure and Applied Sciences, we have been offered a first year statistics course, STAT1001. This year we will start teaching new 3-credits second year courses: MATH2401, MATH2403, MATH2410, MATH2421.

The department continued to offer 2 special 3-credit courses for the Engineering students: MATH1180 and MATH2230. It also taught a newly created course by the Department of Computing mathematical course COMP1110.

This summer the department started the Internship programme for the Actuarial students.

The Department obtained approval at the Faculty level of all its third level 3-credit courses (pending approval of AQUAC), which are expected to be offered in September 2013.

Four new revised programmes were approved by AQUAC to be taught starting from September 2012.

As long as the staff-complement remains unchanged the student numbers continue to increase, the department will remain in a less than desirable position with higher than acceptable students/staff ratios. Recently, the Department tried to address this problem at level one by introducing a new (third) stream. The current average ratios for Semester I from level zero to level three are 1:164, 1:159: 1: 82 and 1:38 respectively. For Semester II the current average ratios from level zero to three are 1:84, 1:108, 1:75 and 1:27 respectively.

## **Research Output**

During the years 2006-2011, a high level of research activity was sustained within the Department of Mathematics at the University of West Indies, Mona Campus.

There were three well developed areas of research in the department: Stochastic Analysis, Physiological Fluid Dynamics and Mathematical Physics. In addition, some work has been done in Linear Algebra, Statistics and Actuarial Science.

The research of the Department was recognized by substantial support from the UWI New Initiative Programme and Research and Publication and Graduate Awards grant. Additional external research support came from the State of Upper Austria Excellence Grant EUR 4,000.

#### Attended Conferences

- **Richard Plummer,** 4th Annual R/Finance Conference, University of Illinois, Chicago, May 11-12, 2012.
- Whyte, W. St. Elmo, 19th Annual International Association of Black Actuaries (IABA) Conference, Atlanta, USA, August 3-4, 2012.

- A. Rodkina, International Biannual Statistical Conference, RCAC, UWI Mona, November 2011.
- S. McDaniel, International Biannual Statistical Conference, RCAC, UWI Mona, November 2011.

#### PAPERS PRESENTED

- Nagarani. P and Binil Sebastian: Mathematical Model of dispersion of a solute in oscillatory flow in an annulus, TWAS-ROLAC, 10th Young Scientist Conference, Trinidad & Tobago, W.I., Dec 7-9, 2011.
- Binil Sebastian and **Nagarani. P.:** Dispersion of a Solute in a Catheterized Artery-A Mathematical Model, FPAS conference, Mona, UWI, Jamaica, W.I, April 2012.
- Binil Sebastian and **Nagarani. P.:** A Study on Longitudinal Dispersion of a Solute, FOSS conference, Jamaica, W.I, June 2011.
- Binil Sebastian and Nagarani. P.: Effect of Non-Newtonian Pulsatile Flow on Convective Diffusion in Annulus, SIAM Conference on Analysis of Partial Differential Equations, San Diego, California, USA, November 14-15, 2011.
- Peter Palmer, **Conall Kelly, Alexandra Rodkina.:** Almost Sure Asymptotic Stability Analysis of the Theta-Milstein Method for a Scalar Linear Stochastic Differential Equation with M Independent Perturbations. FPAS conference, Mona, UWI, Jamaica, W.I, April 2012.
- A.Rodkina, L.Braverman.: Stochastic perturbations can stabilize chaotic models, 18<sup>th</sup> International Conference on Difference Equations and Application, Barcelona, Spain, July 2012.
- Dr. D. Batic: Scattering Matrices via Monodromy Matrices, ETH Zuerich, Switzerland, June 20, 2012.

### PUBLICATIONS

#### **Refereed Journals**

- \* **D. Batic,** N. Kelkar and M. Nowakowski, On Born approximation in black hole scattering, *Eur. Phys. J.* C 71, 1831 (2011)
- \* Evelyn Buckwar and **Conall Kelly**, Non-normal drift structures and linear stability analysis of numerical methods for systems of stochastic differential equations. *Computers & Mathematics with Applications* (2012).
- \* Gregory Berkolaiko, Evelyn Buckwar, **Conall Kelly, and Alexandra Rodkina**, Almost sure asymptotic stability analysis of the theta-Maruyama method applied to a test system with stabilising and destabilising perturbations. *LMS Journal of Computation and Mathematics*, 15:71-83, 2012.
- \* J. A. D. Appleby, J. Cheng and A. Rodkina, Characterization of the Asymptotic Behaviour of Scalar Linear Differential Equations with Respect to a Fading Stochastic Perturbation, *Discrete and Continuous Dynamical Systems*, Supplements Volume 2011, Issue Special, 79-90.
- \* Braverman, E **Rodkina, A.** On difference equations with asymptotically stable 2-cycles perturbed by a decaying noise, to appear in *"Computers and Mathematics with Applications."*
- \* Ramana, B., Sarojamma, G., Vishali, B. and **Nagarani, P.**: Dispersion of a solute in a Herschel-Bulkley fluid flowing in a conduit, *Journal of Experimental Sciences* 3(2), 2012, 14-23.
- \* Nagarani. P. and Lewis. A. : Peristaltic flow of a Casson fluid in an annulus. *Korea – Australia Rheology Journal* 24(1), 2012, 1-9.
- \* Arunaye. F. I, Bhatt. B. S. And Nagarani. P.: On the solution of the convective-diffusion equation, *Int. Jour. of Pure and Applied Mathematics*, 68(1), 2011, 37-53.

### **Refereed Conference Proceedings**

\* Nagarani, P. and Sebastian, B.: Effect of Flow Oscillation on Dispersion of a Solute in a Tube, AIP Conf. Proc. 1368, pp. 29-32.

### Organization of workshops and conference

Workshop on Stochastic and Deterministic PDEs, was organized by the Department of Mathematics, organizing committee: Dr. D. Batic, Dr. Kelly and Prof. A. Rodkina and held on December 12, 2011 at UWI Mona, Kingston, Jamaica.

Several lectures were given by four (4) visiting mathematicians from Austria and Columbia.

The Department's graduate students participated as well. This was the first workshop held by the department for the last 20 years.

Dr. Kelly and Dr. N. Ponakala were members of the organizing committee of the Faculty Conference "9th Faculty Conference of the Faculty of Pure and Applied Sciences. Science: A Bridge to the Future" in April 2012.

The Department took a very active part in the Faculty Conference: there were 2 talks presented by our research students (in collaboration with the staff members) and also 4 posters presented by staff and students.

An invited lecture was given by Prof. Elena Braverman mathematician, from the Department of Mathematics, University of Calgary, Canada. Her lecture was entitled "Modelling the future: discrete dynamics approach". This was the first time a Mathematician was an invited speaker at a Faculty Conference.

## **INCOME GENERATION**

The UWI New Initiative Grant of J\$1,153,989.00 for project titled *"Mathematical aspects of quantized spacetimes"* was given to **Dr. Batic**. The project started September 1, 2011 and ends August 31, 2012.

An External grant "Exzellenzstipendium des Landes Oberosterreich (State of Upper Austria Excellence Grant)" of (approx. 4,000 EURO) was given to **Dr. Kelly** to fund his visit to the Institute for Stochastics, Johannes Kepler University, Linz, Austria over the period May 28-June 29 to deliver a special-topic graduate lecture course on Stochastic Difference Equations.

# OUTREACH

This year the Department participated in a workshop held in May 2012 put on by the Faculty Office to host fifth form students from Kingston College. Requests were made by the Spanish Town High School for a visit to the Department; however that was cancelled by them at short notice.

## PUBLIC SERVICE

Several members of staff of the Department are members of Editorial Boards of International Journals and also are involved in referee activity, preparing reviews of the papers submitted to wide range of the international journals. They also write reports on the dissertations of MPhil and PhD levels.

### **STUDENTS**

The Department has graduated an average of 58 B.Sc. students per year with a major or minor in mathematics, completing the Actuarial Science Option, completing the Mathematics with Education Option.

In 2010, a significant number of students were admitted to the Mathematics Department due to extensive outreach activities conducted by the Dean's Office.

From 2008 to 2011, a total of 292 students graduated from the department (excluding those with the Mathematics with Education option). This is broken down as follows:

2007	2008	2009	2010	2011
69	55	48	52	68

This year a total of nine students graduated with First Class Honours degree.

### Information on Students

The number of students graduating in each programme over the last five years is shown below:

Year	Math	Actuarial Sci	Math/Edu	Math/Econ	Total
2007/08	28	29	2	10	69
2008/09	18	29	2	6	55
2009/10	20	21	_	7	48
2010/11	7	35	1	9	52
2011/12	18	33	2	15	68

Mathematics Undergraduate Graduates (last Five Years)

### Summer School

The Department offered twelve courses for summer of 2012 some of which were to facilitate students who needed to graduate as well as to facilitate curriculum reform. Overall, we had a successful summer school.

## Mathematics Bridging Programme

The Mathematics Bridging Programme has been set up to improve the mathematical skills of students entering the Faculty. It is structured to give students a self-paced non-traditional experience in a small group setting.

This year 28 students participated in the programme facilitated by five tutors. The programme was expanded this year to run for 10 weeks instead of 8. Response to this change was positive as 95% improvements were seeing amongst the students. Plans are being made to expand this programme to include Social Sciences' students.

# Mathematical Olympiad

This year the Mathematical Olympiad programme was transferred to the Department of Educational Studies upon the request of the Principal. It was his wish to use this project to impact mathematics within schools in Jamaica. Staff members from the Mathematics Department were actively involved in the activities of the Olympiad and facilitated its workshops despite its relocation. Four persons were selected to represent Jamaica at the International Competition held in El Salvador in July 2012. They were accompanied by Drs. Raymond McEachin and Samuel McDaniel. Improvement was seen in their performances this year as they moved up 2 places in rank competitively.

## **Actuarial Society**

In February 2012, The Department and the Actuarial Society were graced with a visit from Mike McLaughlin, a past president of the Society of Actuaries, and a thought leader in enterprise risk management. During his visit he met with the Vice Chancellor, Principal, members of staff as well as Actuarial Sciences students. He gave a talk entitled "The Risk Intelligent Enterprise—Principles, Players, Processes" which was held at the Undercroft to the public.

## MSc Programme

The Mona School of Business in conjunction with the Department of Mathematics has launched a new MSc. Enterprise Risk Management progamme to begin in September 2012. This degree programme will address the demand in the financial and risk management services.

The MSc Mathematics was restarted as a part-time 2-year programme in Semester 2 of 2009/10. The new intake was in a semester 1, 2011/2012, after which it is anticipated that the programme will be offered again in Semester 1, 2013.

Six students have already completed the requirements for the award of their degrees and are expected to graduate in November 2012.

### **Research students**

The Department has 2 MPhil students and two PhD students, one of whom was recently upgraded from the MPhil level. Both PhD students: Mr. Peter Palmer and Mrs. Benil Thomas-Sebastian gave talks at the PAS Faculty Conference in April 2012. "Almost Sure Asymptotic Stability Analysis of the Theta-Milstein Method for a Scalar Linear Stochastic Differential Equation with M Independent Perturbations" and "Dispersion of a Solute in a Catheterized Artery – A Mathematical Model."

MPhil students Dujon Dunn and Runako Williams, MSc students Carlton Henderson, Dwight Dunn, Ajani Ausaru and Ricardo Buccas presented posters at that conference.

The MPhil students Mr. Runako Williams and Mr. Dujon Dunn visited Universidad de los Andes (Bogota', Colombia) three times during the last year to conduct research, thanks the UWI's New Initiative Grant received by Dr. Davide Batic for his research entitled "Mathematical aspects of quantized spacetimes". While there they worked with Prof. Marek Nowakowski (Department of Physics) and Prof. Monika Winklmeier (Department of Mathematics). Moreover, during their last visit in June 2012 they participated in the workshop entitled Quantum Integrable Systems held at Universidad de los Andes from May 28 to June 1.