

# MAKERERE UNIVERSITY

## 63<sup>rd</sup> GRADUATION BOOKLET

**The Principal, College of Natural Sciences to present the following  
Conferment of the Degree of Doctor of Philosophy (Mathematics)**

MIRUMBE Geoffrey Ismail

**"Distribution solutions to ordinary differential equations with polynomial coefficients on the real line"**

Mr. Mirumbe "lifted" ordinary differential equations with polynomial coefficients on the real line to the complex plane and used the vast classical results in complex analysis, sheaf theory, homological algebra, distribution theory and analytic D-module theory to prove that for a class of locally Fuchsian differential equations, the dimension of the distribution solution space is the order of the ordinary differential equation plus the sum of all multiplicities of the zeros of the leading polynomial coefficient of the differential equation. He further proved an existence Theorem for fundamental solutions to a class of locally Fuchsian differential equations using the "flag" lemma and theories from linear algebra. This work was funded partly by staff development (fees waivers) and also the International Science Program (ISP) through its arm the East African universities Mathematics program (EAUMP). The supervisors were Dr. V.A. Ssembatya (Director, Quality Assurance Directorate, Makerere University), Prof. Rikard Bogvad and Prof Jan Erik Bjork both of Stockholm University.

**The Principal, College of Natural Sciences to present the following  
Conferment of the Degree of Doctor of Philosophy (Botany)**

MULUMBA John Waswa

**"Phonetic, Distribution and Genetic structure Genetic structure of Acacia senegal (l.) wild. in Uganda"**

Mr. Mulumba Wasswa's research focused on the taxonomy, diversity distribution and population structure of the Gum Arabica tree (*Acacia senegal*). He described the three varieties that occur in Uganda and developed taxonomic keys for their identification. He mapped the distribution of the species' varieties and determined the climatic factors that influence their distribution. He determined genetic variability in the species and the population structure across the cattle corridor. The results provide a basis for developing management plans for the species and for developing the species as an important industrial crop in the cattle corridor and particularly for Karamoja. Gratitude to Dr Esether Kakudidi and Dr Silvester Nyakaana, the Supervisors plus the Doctoral Committee.

**The Principal, College of Natural Sciences to present the following  
Conferment of the Degree of Doctor of Philosophy (Fisheries)**

NALUKENGE Winnie Nkalubo (Ms)

**“Life history traits and growth of Nile perch, *Lates niloticus* (L.), in Lake Victoria, Uganda: Implications for management of the fishery.”**

Ms. Nkalubo’s research quantified key life history traits of the introduced Nile perch in northern Lake Victoria (Uganda) with the major goal of providing information to facilitate the development of predictive sustainable management strategies for this fishery. This study was the first to validate aging of Nile perch using sagittal otoliths (ear stones) by quantifying the periodicity and timing of opaque zone formation. Male Nile perch attained maximum size faster than their female counterparts, while the females reached a much larger size at older ages. A downward trend in both the age and size at maturity was detected suggesting a shift in maturation schedule. Overall, size selective mortality and its effects on yield determining traits seem to be, at least in part, responsible for the changes observed over time in the Nile perch population.

**The Principal, College of Natural Sciences to present the following Conferment of the Degree of Doctor of Philosophy (Physics)**

NYEINGA Edward Drani

**"Dynamic Model for Small Scale Concentrating Solar Energy System with Heat Storage'**

The research focused on the development of a dynamic model for solar thermal storage systems at high temperature. The model is based on numerical integration of a set of conservation equations for mass, momentum and energy of the heat carrier, the rock pebbles and the walls. The numerical solutions are implemented based on implicit time integration without iterations. Stability problems at large time steps do not occur. The model predicts pressure, air velocity, air density and temperatures of the air, rock bed and wall in time and along the container. Nyeinga has developed a compressive tool that can be used for design and operational studies to aid the rapid development of a solar oven system with high temperature heat storage. The supervisors were Professor Eldad E.J.K Banda, Department of Physics, Makerere University and Professor Ole Jorgen Nydal, Department of Energy and Process Engineering, Norwegian University of Science and Technology (NTNU), Norway.

**Conferment of the Degree of Doctor of Philosophy (Physics)**

OKELLO Denis

**"Rock bed thermal energy storage for solar cooking"**

"Mr Okello examined the use of rock particles packed in a container for storing thermal energy that can be used for cooking and for other applications requiring heat in the range of 100 oC to 350 oC. The research was motivated by the desire to design a system that can use solar energy to cook at any time. The potential of using such systems for solar application in Uganda is evaluated and it is observed that the northern and eastern parts of the country has highest potential for small domestic systems as well as for other large scale solar industrial applications. The results shows that rock particles can be used to store heat and both charging and discharging rates can be varied by varying the airflow speed through the system. The research was supervised by Professor Eldad Banda and Professor Ole Jorgen Nydal.

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**The Principal, College of Natural Sciences to present the following**

### **Conferment of the Degree of Doctor of Philosophy (Chemistry)**

TEBANDEKE Emmanuel

#### **“Synthesis and characterization of selected polyoxometallates and their applications in catalysis”**

Mr. Tebandeke developed catalysts that can be applied in the industrial production of useful chemical products. He designed highly efficient processes for the epoxidation of olefins using molecular oxygen or hydrogen peroxide oxidant, catalysed by gold or silver catalysts supported on polyoxometallates (POMs). He also developed methods for carbon dioxide (CO<sub>2</sub>) chemical fixation into epoxides to produce useful cyclic carbonates. In addition, he designed silver containing POMs for the direct synthesis of cyclic carbonates from olefins and CO<sub>2</sub>. The different catalysts can be adapted for large scale industrial production of epoxides and cyclic carbonates. He wishes to thank his supervisors Prof. Henry Ssekaalo and Prof. Ola F. Wendt for their guidance. He wishes to acknowledge financial support from IPICS, SIDA and DAAD. He also acknowledges support from the Principal CONAS, Dean SPS and members of the Department of Chemistry, Makerere University.

### **Conferment of the Degree of Doctor of Philosophy (Chemistry)**

WANYAMA Philip Aaron Guloba

#### **“Characterization and Analysis of Some Natural Dyes from Selected Plants in Uganda”**

Mr. Wanyama Aaron's PhD work focused on extraction and characterization of dyes from selected plants in Uganda. Thousands of plants in Uganda are potentially rich in natural dye compounds suitable for textile coloration. They represent a viable alternative to some of the toxic and environmentally harmful artificial chemical dyes being used in the textile industry today. His pioneer work in Uganda discovered novel dye compounds present in different plants, especially those having tannin chromophores in their molecular structures. These natural dyes exhibited very good colour and surface colour absorption characteristics on cotton fabrics. Through careful cultivation of these plants for dye extraction and commercialization of their extracts, they offer sustainable income generating opportunities for many of our people especially those in the rural communities of Uganda. The study was funded by Kyambogo University under the supervision of Prof. B.T. Kiremire and Dr. J.E.S. Murumu of the Chemistry Department, Makerere University.