THE NELSON MANDELA
AFRICAN INSTITUTION OF SCIENCE AND TECHNOLOGY
(NM-AIST)

26th August 2021

VIVA VOCE ANNOUNCEMENT

FROM: Dean CoCSE

TO: The Public

Ref: **VIVA VOCE EXAMINATION OF A PhD CANDIDATE, MR. ARISTIDE GENES LAMBURA (REG. NO. P.256/T.17)**

Please, refer to the heading above,

The School of **Computational and Communication Science and Engineering (CoCSE)** at **the NM-AIST**, wishes to announce the VIVA-VOCE Examination of **Mr. Aristide Genes Lambura,** a PhD candidate in **Mathematical and Computer Science and Engineering**, specialized in **Applied Mathematics and Computational Science (AMCS).**

The VIVA VOCE examination is scheduled on **Friday, 10th September 2021 in Room L 2 from 09:00 am to 12:00 noon.**

Research Title: Mathematical Modeling for Helminths and Mycobacterium Tuberculosis Co-Infection

ABSTRACT

Tuberculosis continues to be a life-threatening disease in Sub-Saharan African countries despite the available vaccine whereas soil-transmitted helminth is among the Neglected tropical disease that causes threats to pre-school, school-aged children and child-bearing mothers. The infection by helminths increases susceptibility to tuberculosis. Thus, there is a need to investigate the possibility of co-infection of the two diseases due to its geographical overlap at cellular and population levels.

This dissertation presents deterministic mathematical models that are aimed at describing the transmission dynamics of soil-transmitted disease and the co-infection with tuberculosis. The first model that describes the transmission dynamics of soil-transmitted helminth with optimal

control is presented. The qualitative analysis was made and the threshold that governs the spread of the disease was determined.The best control model was developed, and numerical simulations were run using a variety of control measures to determine the most cost-effective method for effectively containing the disease. According to the findings, the most cost-effective method for combating the spread of soil-transmitted helminths is a combination of health education and sanitation.

The soil-transmitted helminth model was modified to form the second model for the co-infection with tuberculosis. The qualitative analysis was made to determine the equilibrium points and the conditions for the disease eradication. The impact of helminth infection on tuberculosis and vice-versa were discussed and it was observed that helminth infection enhances tuberculosis in the community. Numerical simulation for the model revealed that the interventions that include a combination of measures for controlling helminth infection, vaccinating the babies with BCG and the treatment of individuals with active tuberculosis were effective in controlling the spread of the diseases.

The last model considered the interaction of the helminth parasites, Mtb pathogens, and the immune competence within an individual host. Numerical simulations showed that primary infection by either helminth parasite or Mtb bacteria is unsuccessful within the host when the basic reproduction number is less than the unit.

You are all welcome

Shubi Kaijage, *Dr, Eng.*
Ag. Dean - CoCSE