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

08th July 2021

VIVA VOCE ANNOUNCEMENT

FROM: Dean CoCSE

TO: The Public

Ref: **VIVA VOCE EXAMINATION OF A PhD CANDIDATE, MR. ANNORD MWAPINGA (REG. NO. P.177/T.16)**

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. Annord Mwapinga,** 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 **Thursday, 22th July 2021 in Room L 2 from 09:00 am to 12:00 noon.**

Research Title: Computational Analysis of MHD Blood Flow Through a Stenosed Artery in the Presence of Body Acceleration and Chemical Reaction

ABSTRACT

The unsteady, laminar and two-dimensional pulsatile flow of both, Newtonian and non-Newtonian chemically reacting blood in an axisymmetric stenosed artery subject to body acceleration and magnetic fields are studied. In case of non-Newtonian blood, heat transfer is also taken into consideration. The combined effects of body acceleration, magnetic fields and chemical reaction on blood flow is considered. The non-Newtonian model is chosen to suit the Herschel-Bulkley (HB) fluid characteristics.

In both models, the governing dimensional equations are transformed into non-dimensional form, followed by transforming the constricted part of the artery into rectangular domain using a radial coordinate transformation. The non-dimensional governing equations are solved using the

explicit finite difference method and executed using MATLAB programming language. The solutions showing the velocity, temperature and concentration profiles are illustrated. The effects of Reynolds number, Hartman number, Schmidt number, Eckert number and Peclet number are examined. Additionally, the effects of stenosis and body acceleration on blood flow are also explored. Furthermore, the chemical reaction parameter is studied to see its impact on the profiles of concentration.

For the case when blood is considered to behave like a Newtonian fluid, the study has found that, body acceleration, magnetic fields and stenosis affect the normal flow of blood. Body acceleration is observed to have more effect on blood flow than the magnetic fields and stenosis. Furthermore, as the key findings of the study, it is noticed that the combined effect of stenosis, body acceleration, magnetic field and chemical reaction, generally reduce the concentration profile of the blood flow and the blood flow velocity. It is also observed that, the axial velocity, concentration and skin friction, decrease with increasing stenotic height. The velocity on the other hand increases as the body acceleration increases. Furthermore, as the Hartman number increases, both the radial and axial velocities diminish. Increase of the Reynolds number results in the increase of the velocity profiles. The higher the chemical reaction parameter is, the lower are the concentration profiles.

For the non-Newtonian model, the study found (like in the Newtonian model) that, the velocity profile diminishes with increase in the Hartman number and increases with the body acceleration. The temperature profile is raised by the increase of body acceleration and the Eckert number, while it diminishes with the increase of the Peclet number. It is also found that, the concentration profile increases with the increase of the Soret number and decreases with the increase of the chemical reaction. It was further observed that the shear stress deviates more when the power law index, $n > 1$ than when $n < 1$. The shear stress for the power law fluid when $n > 1$ exhibited higher magnitude value than for the Newtonian, Bingham and Herschel-Bulkley fluids.

You are all welcome

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