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**TITLE OF PROGRAMME:** BSc MATHEMATICS

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# **PROJECT TITLE**

Mathematical Modelling of the Transmission Dynamics of Rift Valley Fever

# **STATEMENT OF PROBLEM**

Rift Valley Fever (RVF) is a zoonotic viral disease that affects livestock and humans, causing significant economic losses and public health concerns. The transmission dynamics of RVF involve complex interactions between livestock, mosquito vectors, and environmental factors such as rainfall and humidity. Despite numerous studies, the disease's spread remains difficult to predict and control, particularly in regions where sheep serve as key amplifiers. Existing models often generalize livestock or focus on multi-species dynamics, leaving gaps in understanding species-specific contributions to RVF outbreaks. This project addresses these gaps by formulating a mathematical model focusing on sheep as the primary host, capturing their unique role in amplifying RVF transmission. The model will incorporate environmental factors, enabling a detailed exploration of their influence on disease spread and providing insights for targeted intervention strategies.

# **OBJECTIVES OF THE PROJECT**

The research objectives are:

1. To formulate a mathematical model to describe the transmission dynamics of Rift Valley Fever.
2. To derive the basic reproductive number of the model.
3. Perform stability analysis of the disease-free and endemic equilibria.
4. To conduct sensitivity analysis of the model parameters.
5. To perform numerical simulations to validate and illustrate the model dynamics.

# **EXPECTED OUTCOMES**

1. A mathematical model that effectively captures the transmission dynamics of Rift Valley Fever.
2. The basic reproductive number (R₀) derived and analyzed.
3. Stability conditions for the disease-free and endemic states established.
4. Sensitivity of key parameters quantified to guide intervention strategies.
5. Numerical simulations demonstrating the impact of parameter variations and validating theoretical findings.

# **FACILITIES TO BE USED**

The facilities and resources used for the project were:

1. The University of Mines and Technology Library.
2. Personal Computer (PC).
3. The Internet.
4. Python Programming Language and Libraries (e.g., NumPy, SciPy, Matplotlib).
5. MATLAB Software Package.

# **ORGANIZATION OF THE THESIS**

The project is organized into five chapters. It begins with an introduction, providing an overview and context for the study, followed by a comprehensive literature review to establish the research background. The subsequent chapters detail the methods employed, the formulation of the mathematical model, and its analysis and simulations. The final chapter presents the conclusions and recommendations, accompanied by references.