

UNIVERSITI TEKNOLOGI MARA

TECHNICAL REPORT

**NUMERICAL SOLUTION OF SIR MODEL FOR DENGUE
FEVER TRANSMISSION IN SELANGOR, MALAYSIA WITH
VARIATIONAL ITERATION METHOD AND RUNGE-
KUTTA METHOD**

**NURUL IZZATI SYAZWANI BINTI MOHD RAZI 2020845036
CS2496A1**

**NUR AINA FARHANA BINTI ROSLI
2020819872 CS2496A1**

NUREEN JAZLINA BINTI AZLISHAM 2020819644 CS2496A1

**Supervisor:
Puan Rosha Mohamed**

**Bachelor of Science (Hons.) (Mathematics)
Center of Mathematics Studies
College of Computing, Information and Media**

AUGUST 2023

ACKNOWLEDGEMENTS

In the name of Allah, The Most Gracious, The Most Merciful.

Firstly, we would like to express our sincere gratitude to Madam Rosha Mohamed as our project supervisor who made this work possible and gave us the golden opportunity to do this wonderful project on the topic, Numerical Solution of SIR Model for Dengue Fever Transmission in Selangor, Malaysia with Variational Iteration Method and Runge-Kutta Method.

Secondly, we would also like to thank our MSP660 lecturer Dr Zahari bin Md Rodzi as well as our MAT530 lecturer Dr. Zati Aqmar Zaharudin who has also inspired us in preparing to complete this project since doing the proposal process include conducting us in doing literature review. We also wish to express our special thanks of gratitude to our others lecturer which helped us a lot, especially Madam Rahmah Shahril and Dr Mat Salim Selamat. Despite their busy schedules, they still gave us important information in sharing their different ideas, guidance from time to time, support, and encouragement throughout this final year project.

Last but not least, we also sincerely thank all the people who were involved directly or indirectly for helping us in completing this technical report by giving them their time, ideas, and suggestions. We had been doing a lot of research and we came to know about so many new things. Especially to our friends and family for their continuous support and prayer was what sustained us this far. We are very thankful to them.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	1
LIST OF FIGURES	3
LIST OF TABLES	1
ABSTRACT.....	1
CHAPTER 1	1
INTRODUCTION	1
1.1 Motivation	1
1.2 Problem Statement	2
1.3 Objectives.....	3
1.4 Significant and Benefit of Study	3
1.5 Scope and Limitation of Study.....	4
CHAPTER 2	6
BACKGROUND THEORY AND LITERATURE REVIEW	6
2.1 Background Theory	6
2.2 Literature Review / Related Research.....	6
2.3 Advantage of SIR Model.....	11
2.4 Conclusion.....	11
CHAPTER 3	12
METHODOLOGY AND IMPLEMENTATION	12
3.1 Overview	12
3.2 Phase 1: Data Collection	13
3.3 Phase 2: SIR Model using Runge-Kutta Equation and Variational Iteration Method	14
3.3.1 Formulation of SIR Model.....	14
3.3.2 Transformation of Runge-Kutta Equation for SIR model	15
3.3.3 Transformation of Variational Iteration Method (VIM).....	18
3.4 Phase 3: Implementation of Runge-Kutta (RK) and Variational Iteration Method (VIM) Analysis for SIR Model	19

3.4.1	Runge-Kutta Equation	20
3.4.2	Variational Iteration Method (VIM) to SIR Model	24
CHAPTER 4		28
RESULTS AND DISCUSSION		28
4.1	SIR Model	28
4.2	Runge-Kutta (RK4) and Variational Iteration Method (VIM).....	30
CHAPTER 5		32
CONCLUSIONS AND RECOMMENDATIONS		32
5.1	Conclusion of the study	32
5.2	Recommendations	32
REFERENCES		33
APPENDIX.....		38

ABSTRACT

One of the biggest public health issues in Malaysia is dengue fever, an infectious disease spread by the bite of an Aedes mosquito in Malaysia. The number of dengue fever infections has been frequently increasing with periodic outbreaks occurring every few years. Dengue hemorrhagic fever and dengue shock syndrome are only two of the serious consequences that can occur from the disease, which puts a significant burden on the healthcare system. Most of the time, clinical symptoms and laboratory testing are used to diagnose the disease. In this research, mathematical models are powerful tools to be considered in the spread of many infectious diseases, one amongst which is Dengue Fever (DF). The main objective of this paper is to form a susceptible-infected-recovered (SIR) model for dengue fever transmission. Then, we implemented fourth-order Runge-Kutta Method (RK4) and the Variational Iteration Method (VIM) for solving the SIR Model by using Excel and Maple Software. Lastly, we discussed the numerical comparison between RK4 and VIM method by comparing the numerical solution between two methods.

A complex cycle was involved between mosquitoes and human hosts. A female Aedes mosquito feeds on the blood of an infected person to begin the cycle. Along with the blood, the mosquito also ingests the dengue virus. After an incubation period, the virus reproduces inside the mosquito's body and moves to its salivary glands. The virus can spread to people when the infected mosquito feeds on blood once again.