UNIVERSITI TEKNOLOGI MARA

ALIGNED MHD OF DUSTY ELLIS TRIHYBRID NANOFLUID OVER A RIGA PLATE USING THE HAMILTON-CROSSER MODEL

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TABLE OF CONTENTS

		Page
DECLARATION BY THE CANDIDATE		**iii**
ABSTRACT		**iv**
ACKNOWLEDGEMENT		**v**
TABLE OF CONTENTS		**vi**
LIST OF TABLES		**viii**
LIST OF FIGURES		**ix**
LIST OF SYMBOLS		**xi**
LIST OF ABBREVIATIONS		**xv**
CHAPTER 1 INTRODUCTION		**1**
1.1	Research Background	1
1.2	Problem Statement	3
1.3	Research Objectives	4
1.4	Significance of Study	4
1.5	Thesis Scope	5
1.6	Definition of Terms and Concepts	6
1.7	Project Benefits	7
1.8	Thesis Outline	7
CHAPTER 2 LITERATURE REVIEW		**9**
2.1	Introduction	9
2.2	Nanofluids	9
2.3	Trihybrid Nanofluids	9
2.4	Non-Newtonian Fluids and the Ellis Model	10
2.5	Dusty Fluid Flow Interactions	10
2.6	Hamilton-Crosser Thermal Conductivity Model	11
2.7	Electromagnetic Influence of a Riga Plate	11
2.8	Aligned Magnetic Field in Nanofluids	12
2.9	Research Gap in Dusty Ellis Trihybrid Nanofluid Flow	12

CHAPTER 3 RESEARCH METHODOLOGY **14**
3.1 Introduction 14
3.2 Research Steps 14
3.3 Conclusion 24

CHAPTER 4 INPLEMENTATION **25**
4.1 Introduction 25
4.2 Mathematical Formulation 26
4.2.1 Governing Equations 27
4.2.2 Derivation of PDEs to ODEs 27
4.2.3 Formulation for Boundary Conditions 36
4.2.4 Formulation for Physical Quantities 38
4.3 Numerical Method 42
4.3.1 BVP4C Method 42
4.4 Conclusion 47

CHAPTER 5 RESULTS AND DISCUSSION **48**
5.1 Introduction 48
5.2 Result and Analysis 48
5.2.1 Validation of Result 49
5.2.2 Analysis of Results 49
5.3 Conclusion 60

CHAPTER 6 CONCLUSION AND RECOMMENDATIONS **61**
6.1 Introduction 61
6.2 Conclusion 61
6.3 Recommendation 62

REFERENCES **63**

APPENDICES **67**

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ABSTRACT

This study analyses the boundary layer flow, heat and mass transfer of a dusty non-Newtonian Ellis trihybrid nanofluid over a Riga plate under aligned magnetohydrodynamics. The two-phase model incorporates Marangoni convection, a Darcy-Forchheimer porous medium and Arrhenius activation energy, with thermal conductivity evaluated via the Hamilton-Crosser formulation. Similarity variables reduce the governing partial differential equations to ordinary differential equations, solved using the BVP4C method in MATLAB. Results show that fluid velocity decreases while temperature rises with higher nanoparticle volume fraction, Forchheimer number, porosity and aligned magnetic field strength, whereas increasing the Ellis fluid parameter, modified Hartmann number and Marangoni convection accelerates the flow and lowers the temperature. Concentration falls with stronger Marangoni convection but rises with higher activation energy and aligned magnetic field strength, due to slowed chemical reaction and flow deceleration respectively. These findings extend understanding of dusty, non-Newtonian, multiphase nanofluid flow under combined electromagnetic actuation, offering theoretical guidance for advanced thermal management design.