

CONTENTS

TITLE PAGE	i
CERTIFICATE	iii
DECLARATION BY THE CANDIDATE	v
COPYRIGHT TRANSFER CERTIFICATE	vii
DEDICATION	ix
ACKNOWLEDGEMENTS	xi
CONTENTS	xiii
LIST OF FIGURES	xvii
LIST OF SYMBOLS	xix
ABBREVIATIONS	xxi
PREFACE	xxiii
1 INTRODUCTION AND LITERATURE REVIEW	1
1.1 Thermoelasticity: Definition and Applications	1
1.2 Classical Coupled Thermoelasticity Theory (CTE)	2
1.3 Drawback of Fourier's law	5
1.4 Generalized Thermoelasticity Theory	7
1.4.1 Overview of generalized thermoelasticity theories based on non-Fourier models	8
1.4.1.1 Thermoelasticity with one relaxation time (LS or ETE)	8
1.4.1.2 Dual-phase-lag thermoelasticity theory (DPL)	11
1.4.1.3 Green-Naghdi thermoelasticity theory (GN I, II, and III)	13

1.4.1.4	Three-phase-lag (TPL) thermoelasticity theory	15
1.4.1.5	Quintanilla-Moore-Gibson-Thompson (QMGT) thermoelasticity theory	15
1.4.2	Overview of generalized thermoelasticity theories based on classical Fourier's Law	16
1.4.2.1	Green-Lindsay thermoelasticity theory (GL)	16
1.4.2.2	Modified Green-Lindsay thermoelasticity theory (MGL)	18
1.5	Bio-thermoelasticity Theory	19
1.6	Literature Review	21
1.7	Objective of the Thesis	34
2	AN INVESTIGATION ON STRAIN AND TEMPERATURE RATE-DEPENDENT THERMOELASTICITY AND ITS INFINITE SPEED BEHAVIOUR	37
2.1	Introduction ¹	37
2.2	Governing Equations	40
2.3	Formulation of the Problem	41
2.4	Boundary Conditions	44
2.5	Formulation in Laplace Transform Domain	44
2.6	Short-Time Approximated Solution	47
2.7	Analysis of Analytical Results	51
2.8	Numerical Results and Discussions	53
2.9	Conclusion	56
3	INVESTIGATION ON MGL THERMOELASTICITY THEORY	59
3.1	Introduction ²	59
3.2	Investigation on Effects of Strain and Temperature Rates on Thermoelastic Interactions due to Line Heat Source	61
3.2.1	Problem formulation	62
3.2.2	Solution in the Laplace transform domain	66
3.2.3	Small-time approximated solution in (r, t) domain	68
3.2.4	Numerical results and discussions	74
3.2.5	Conclusions	78
3.3	Relaxation Effects on Thermoelastic Interactions for Time Dependent Moving Heat Source under MGL Thermoelasticity	79
3.3.1	Introduction ³	79
3.3.2	Basic governing equations	81

3.3.3	Formulation of the problem	82
3.3.4	Numerical implementation and result discussion	89
3.3.5	Conclusion	95
4	STUDY THE EFFECTS OF TEMPERATURE AND STRAIN RATES ON TRANSIENT THERMOMECHANICAL RESPONSES ON MULTI-LAYER SKIN TISSUE	97
4.1	Introduction ⁴	97
4.2	Mathematical Formulation of the Problem	100
4.3	Numerical Results and Discussions	109
4.4	Conclusion	113
5	BOUNDARY INTEGRAL EQUATION FORMULATION FOR STRAIN AND TEMPERATURE-RATE DEPENDENT THERMOELASTICITY	115
5.1	Introduction ⁵	115
5.2	Basic Equations and Problem Formulation	117
5.3	Formulation of the Problem in Laplace Transform Domain	119
5.4	Fundamental Solutions in the Laplace Transform Domain	121
5.5	Reciprocal Relation for Thermoelasticity	126
5.6	BIE Formulation for MGL Model	129
5.7	Example	132
5.8	Conclusion	134
6	STUDY OF WAVE PROPAGATION IN AN INFINITE SOLID DUE TO LINE HEAT SOURCE UNDER MOORE-GIBSON-THOMPSON THERMOELASTICITY	135
6.1	Introduction ⁶	135
6.2	Governing Equations	137
6.3	Problem Formulation	138
6.4	Conditions	141
6.5	Solution in Laplace Transform Domain	141
6.6	Short-Time Approximated Solution	143
6.7	Analysis of Analytical Results	146
6.8	Numerical Results & Discussion	148
6.9	Conclusion	153

7 SUMMARY OF THE THESIS AND FUTURE SCOPE	157
7.1 Summary	157
7.2 Future Scope	162
BIBLIOGRAPHY	165
PUBLICATIONS AND CONFERENCES	195