INDEX NO-99/19/Maths./26

ABSTRACT

Thesis Title: **Study of Some Problems on Thermoelasticity and Generalized Thermoelasticity.**

Submitted by: **Sourov Roy**

This research is dedicated to the application field of continuum mechanics, focusing on exploring problems in thermoelasticity and generalized thermoelasticity. This thesis is organized into four chapters, each covering different aspects of thermoelastic models and presenting solutions to seven distinct problems within this context.

The **first chapter** provides essential definitions, discusses thermoelasticity and related theories, and explores the applications of thermoelasticity.

The **second chapter** discusses two problems on generalized thermoelasticity. **Problem-1** investigates a one-dimensional problem on fractional-order generalized thermoelasticity in a half-space with an instantaneous heat source. The Laplace transform and eigenvalue approach techniques are applied to obtain closed-form solutions for displacement, temperature, and stress, which are presented graphically. In **Problem-2**, a fractional-order thermoelasticity model with dual-phase lag is studied in a half-space isotropic elastic medium. The eigenvalue approach is employed to solve the vector-matrix differential equation obtained from normal mode analysis, and graphical representations illustrate the impact of the heat source, fractional order, and a comparison of different thermoelastic models.

The **third chapter** explores three thermoelasticity problems with microstructure. **Problem-3** focuses on a multiphase lag micropolar thermoelastic model in a rotating half-space medium with a moving heat source in the presence of an electromagnetic field. The eigenvalue approach is used, and graphical representations depict the impact of heat source, rotation, and magnetic field. **Problem-4** addresses fractional order three-phase-lag thermoelasticity in a micropolar thermoelastic half-space medium with voids, providing numerical computations and graphical depictions. **Problem-5** investigates the influence of initial stress, gravitational force, and electromagnetic force on a micro-elongated thermoelastic layer. A three-phase-lag (TPL) heat conduction equation is employed for microelongated layer. The study concentrates on the two-dimensional plane of a microelongated and elastic layer.

In the **fourth chapter**, two thermoelastic problems in a semi-conducting medium are discussed. **Problem-6** presents a comprehensive model investigating various factors on an isotropic homogeneous semiconducting plate. The study considers volume fraction, photothermal phenomena, initial stress, electromagnetic fields, gravity, and rotation within the framework of multi-three-phase lag thermoelastic models. Normal mode analysis is employed to solve partial differential equations with specific boundary conditions. The results, presented through analytical expressions, illustrative figures, and tabular data, contribute to understanding the interplay of factors in semiconducting materials for theoretical developments and practical applications. **Problem-7** explores fractional thermoelasticity for the photothermal response of a rotating semiconducting half-space medium. Investigating the propagation of photothermal waves in a prestressed semiconducting half-space with a gravity effect, the study employs normal mode analysis and the eigenvalue approach to derive analytical solutions. The results illustrate the dependence of field variables on internal heat source, initial stress, rotation, electromagnetic field, fractional order parameter, and gravity, offering benchmarks for future comparisons.

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