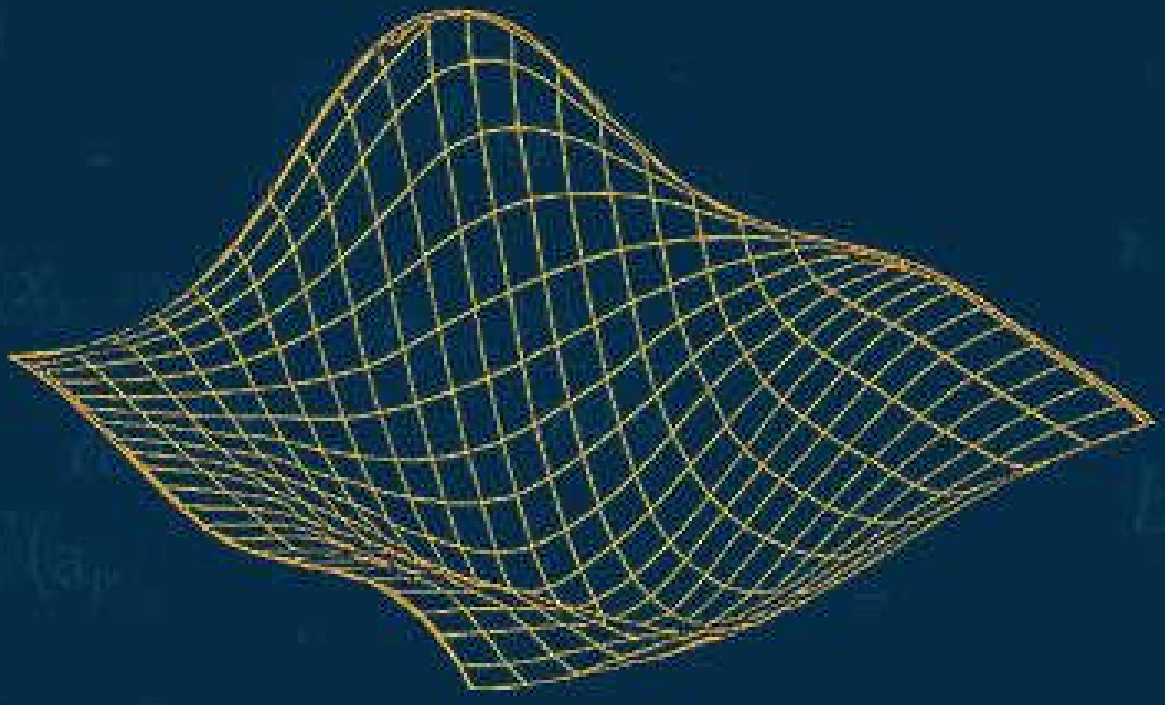
ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

VOLUME-1



EDITOR
MOBIN AHMAD

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VOLUME-1

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Published by: Book Rivers

Website: **https://www.bookrivers.com/**

Email: publish@bookrivers.com

First Print Edition - 2025

Title: ADVANCED STUDIES IN MATHEMATICS AND STATISTICS VOLUME – 1

Author: Mobin Ahmad

ISBN: 978-93-6884-936-0

MRP: 599 /-INR

(Printed In India)

Preface

The field of mathematics and statistics continues to evolve, bridging theoretical advancements with practical applications across diverse disciplines. *Advanced Studies in Mathematics and Statistics-I Volume – 1* is a comprehensive volume that brings together cutting-edge research and foundational concepts in these fields, offering a rich resource for researchers, graduate students, and professionals seeking to deepen their understanding of advanced mathematical and statistical methodologies.

This book encompasses a broad spectrum of topics, carefully curated to reflect the dynamic interplay between pure and applied mathematics, as well as statistical theory. The chapters cover a range of subjects, from numerical methods for solving non-linear equations to the intricacies of graph theory, ring theory, and fuzzy optimization. Each chapter is designed to provide both theoretical rigor and practical insights, making the content accessible to those with a strong mathematical foundation while also serving as a reference for specialized research.

The book begins with an exploration of numerical solutions to non-linear equations, presenting classical and fast-convergent methods such as Newton's, Steffensen's, and Halley's approaches. These foundational techniques set the stage for subsequent discussions on optimization, including goal programming and fuzzy optimization models for production planning in uncertain environments. The inclusion of graph theory and fixed-point theory in metric spaces highlights the structural elegance of mathematics, while topics like ring theory, approximation theory, and hypersurfaces in metallic Riemannian manifolds delve into abstract and geometric frameworks.

Statistical methodologies are equally prominent, with a dedicated chapter on the fundamentals of statistics, complemented by advanced discussions on error analysis in interpolation methods and eigen value localization for quaternionic matrices. The book also addresses interdisciplinary applications, such as the study of magnetic field effects on rotating magneto-hydrodynamic (MHD) flows and hypergeometric transformations, which underscore the relevance of mathematics in physical and engineering contexts.

Our aim is to provide a cohesive yet diverse collection of topics that inspire further exploration and research. Each chapter is authored by experts in their respective fields, ensuring depth and clarity. Whether you are a mathematician, statistician, or practitioner in a related discipline, this book offers valuable insights into the theoretical underpinnings and practical applications of advanced mathematics and statistics.

We hope that *Advanced Studies in Mathematics and Statistics-I Volume-1* serves as a catalyst for intellectual curiosity and fosters a deeper appreciation for the beauty and utility of these disciplines. We invite readers to engage with the material, explore its applications, and contribute to the ongoing advancement of mathematical and statistical sciences.

Editor
Mobin Ahmad
Department of Mathematics & Statistics
Integral University, Lucknow
Date: May 28, 2025

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MAGNETIC FIELD EFFECTS ON ROTATING MHD FLOW OVER AN IMPULSIVELY STARTED ISOTHERMAL PLANE

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This chapter presents a comprehensive investigation into the influence of magnetic field and internal heat generation on unsteady Magnetohydrodynamic (MHD) flow within a rotating system. The study is focused on flow past an infinitely long vertical plate maintained at a constant temperature, under isothermal boundary conditions. The working fluid considered is incompressible, viscous, and electrically conducting, with the assumption of a low Reynolds number to simplify the analysis. The medium surrounding the plate is porous, allowing for the interaction between the fluid and the permeable structure. To explore the physical behaviour of the flow, a set of coupled partial differential equations governing momentum, energy, and mass transfer is formulated. These equations incorporate the effects of magnetic fields, rotational forces, thermal diffusion, and mass diffusion. An analytical approach is employed to obtain exact solutions for velocity, temperature, and concentration profiles. The impact of key physical parameters; such as the porosity of the medium, magnetic field strength, heat source intensity, and rotation rate on the flow characteristics is thoroughly examined. Graphical representations are provided to illustrate how variations in these parameters influence the fluid's velocity field, thermal distribution, and species concentration.

Keywords: Porous Medium, Hall Current, Magnetic Field, Rotation, heat transfer, Radiation.

1. Introduction

The study of convective heat and mass transfer in fluid flow past an infinite flat plate represents a fundamental problem in fluid dynamics, with wide-ranging applications in engineering and industrial processes. One of the earliest contributions to this area was made by Stewartson [10, 11], who investigated the impulsive motion of a flat plate immersed in a viscous fluid. His work was rooted in the framework of boundary layer