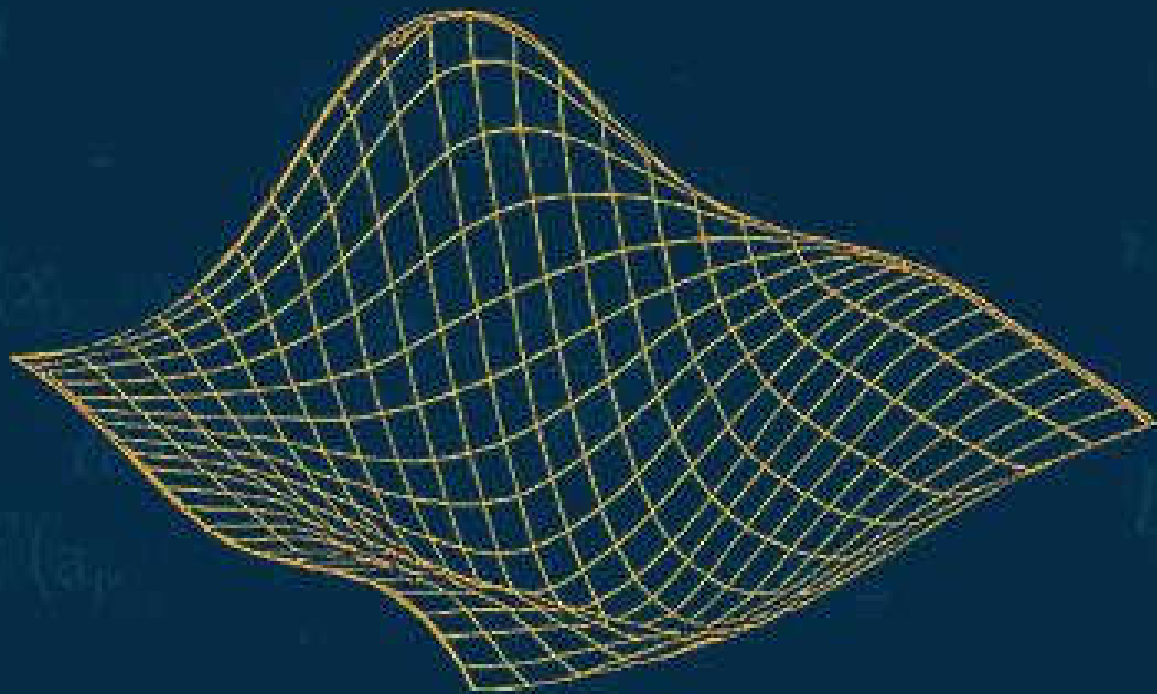


ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

VOLUME-1



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MOBIN AHMAD

ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

**ADVANCED STUDIES IN
MATHEMATICS AND STATISTICS
VOLUME-1**

Mobin Ahmad

Department of Mathematics & Statistics
Integral University, Lucknow-226026
Email: mobin@iul.ac.in



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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 – I* 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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HYPERGEOMETRIC TRANSFORMATIONS AND THEIR APPLICATIONS

M. KASHIF KHAN

Department of Mathematics & Statistics, Faculty of Science, Integral University,
Lucknow-226026, India

Email: md.kashifkhan85@gmail.com

In this chapter, I have investigated certain hypergeometric transformations by means of a series rearrangement technique and a suitable hypergeometric summation theorem for the Clausen function. Some interesting applications are also discussed. Furthermore, the generalizations of transformation formulas in terms of double-series identity having bounded sequence and Srivastava-Daoust double hypergeometric function are also discussed.

Keywords and Phrases: Generalized hypergeometric function; Hypergeometric summation theorem; transformations; Bounded sequence; Srivastava-Daoust.

Introduction

The hypergeometric function has many applications in various branches of Mathematics, Physics, Statistics and Engineering. Many researchers gave some beautiful applications of hypergeometric functions, generalized hypergeometric functions, Wright function and generalized Wright function in the Geometric Function Theory and established a correlation between Complex Analysis and Special functions. The surprising use of generalized hypergeometric functions by Branges [4] has generated considerable interest and the geometric properties of the generalized Gauss and Kummer hypergeometric functions have been investigated by many authors in the last few decades. During 1997-2009, a good progress has been made in extending and generalizing of hypergeometric summations, transformations and reduction formulas and very recently the authors have investigated the generalized hypergeometric function and derived several further summation, transformations and reduction formulas.

Now, recalling the well-known definitions: