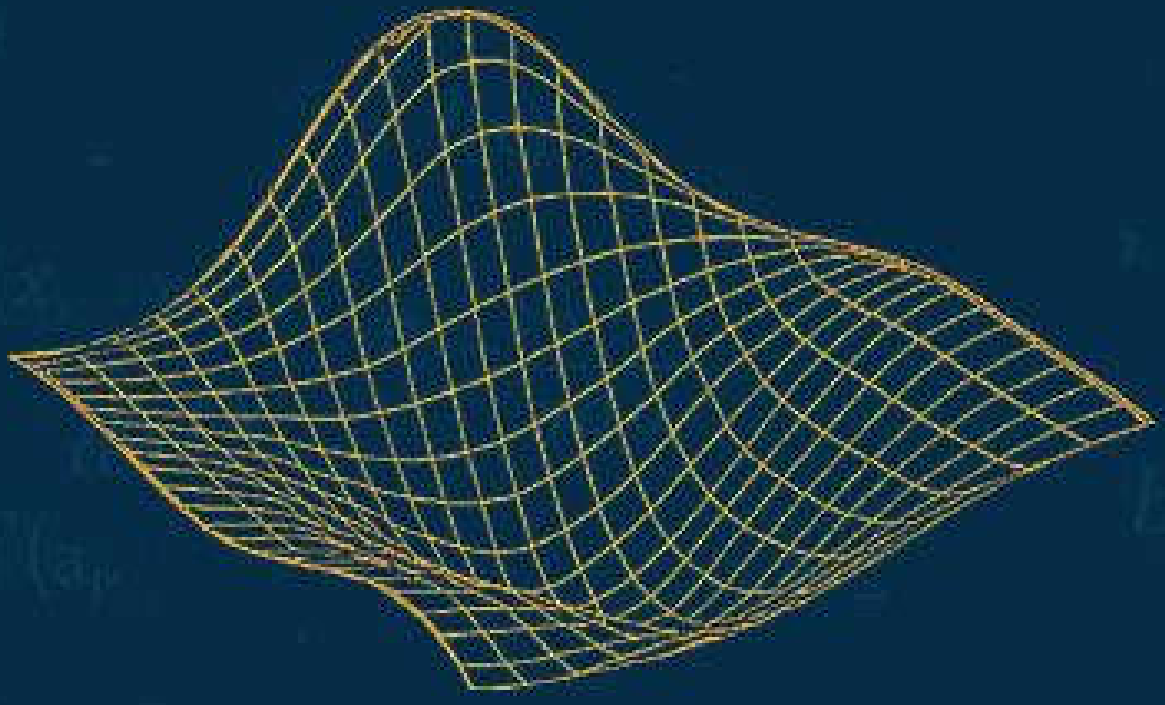
ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

VOLUME-1



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ADVANCED STUDIES IN MATHEMATICS AND STATISTICS

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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 – 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

Contents

S. No	Title	Page No
1.	Numerical Solutions of Non-Linear Equations by Newton's, Steffensen's & Halley's Method	**2-22**
2.	Non-linear Equations and Their Numerical Solution by Fast Convergent Methods	**24-35**
3.	Goal Programming	**37-50**
4.	Graph Theory	**52-72**
5.	Comprehensive Overview of Ring Theory and Polynomial Structures	**74-85**
6.	An Introduction to Approximation Theory	**87-99**
7.	Hypersurfaces Immersed in Metallic Riemannian Manifolds	**101-113**
8.	Fuzzy Ideals in Ordered Semigroups	**115-132**
9.	Perturbation Theory and Eigenvalue Localization for Quaternionic Matrices	**134-159**
10.	Fundamentals of Statistics	**161-180**
11.	Fundamental Results of Fixed-Point Theory in Metric Spaces	**182-189**
12.	Hypergeometric Transformations and Their Applications	**191-200**
13.	Magnetic Field Effects on Rotating Mhd Flow Over an Impulsively Started Isothermal Plane	**202-212**
14.	A Fuzzy Optimization Model for Multi-Item Production Planning Problem in an Uncertain Environment	**214-237**
15.	Exploring The Accuracy of Interpolation Methods Through Error Analysis	**239-249**

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Advanced Studies in Mathematics and Statistics Vol. 1 (2025), 101-113

HYPERSURFACES IMMERSED IN METALLIC RIEMANNIAN MANIFOLDS

Mohammad Aamir Qayyoom and Mobin Ahmad*

Department of Mathematics & Statistics,

Faculty of Science, Integral University, Lucknow

226026, India

Email: ***qayyoom@iul.ac.in, mobin@iul.ac.in***

Abstract: In this chapter, we find some properties of an *n*- dimensional hypersurface *M* in a metallic Riemannian manifold ($\overline{M}_{n+1}$,g, *J*). The totally geodesic, minimal and umbilical hypersurface in metallic Riemannian manifolds are studied and example is presented.

1. Introduction:

Differential geometry is probably as old as any mathematical discipline and certainly was well launched after Newton and Leibnitz has laid the foundation of calculus. Gauss laid down the foundation of differential geometry of surface in three dimenssional Euclidean spaces in early nineteenth century. Riemann (1854) introduced the concept of differential geometry of more than three dimensions. Riemann used the concept of tensor in defining the space, Riemannian metric and various other results in an defining the space, Riemannian metric and various other results in an excellent manner. At the end of century Levi-Civita and Ricci developed the concept of parallel translation in the classical language of tensors. In 1868, after the publication of Riemann`s work a number of mathematicians like Beltrami (1868), Lipschitz (1869), enriched the subject by introducing the idea of Beltrami parameters, Christoffel symbols, covariant differentiation and Gauss equations etc. Schouten and Dontzing (1930) introduced the concept of complex structure and a Hermitian metric in a differentiable manifold and called it a complex manifold. In 1933, Kaehler initally presented the idea of a Kaehlerian structure on a complex manifold.