

Applications of Fixed Point Theory to Differential Equations

Sujoy Pradhan¹ and Dr. Syed Shahnawaz Ali²

¹ Scholar & ² Assistant Professor / Guide Department of Mathematics,

Sri Satya Sai University of Technology and Medical Science (SSSUTMS), Sehore, Madhya Pradesh, India.

Abstract: *Fixed point theory is one of the most important branches of modern mathematics and has wide applications in analysis, topology, differential equations, optimization, economics, and computer science. A fixed point of a mapping is a point that remains invariant under the action of the mapping. The study of fixed point theorems in different mathematical spaces has attracted considerable attention due to its theoretical significance and practical applications.*

This paper discusses several important fixed point results in different spaces, including metric spaces, normed spaces, Banach spaces, and complete metric spaces. The study mainly focuses on contraction mappings, non-expansive mappings, and common fixed point results. Special emphasis is given to the classical Banach Fixed Point Theorem and its applications in various mathematical structures. The paper also examines conditions for the existence and uniqueness of fixed points in different spaces and highlights the importance of completeness and continuity in fixed point analysis.

Furthermore, the study explores generalized contractive conditions and discusses how fixed point techniques can be applied to solve nonlinear equations and functional equations. The results demonstrate that fixed point theory provides a powerful framework for studying mathematical problems arising in both pure and applied sciences.

Keywords: Fixed Point; Metric Space; Banach Space; Normed Space; Contraction Mapping; Complete Metric Space; Common Fixed Point; Nonlinear Analysis; Functional Analysis; Banach Fixed Point Theorem.