# Review of Literature

# REVIEW OF LITERATURE

In 1999, Russian researcher Molodtsov initiated a novel concept of soft set theory, which is completely a new approach for modeling vagueness and uncertainties. Soft set theory has a rich potential for application in solving practical problems in Economics, Social Science, Medical Science etc. Applications of soft set theory in real life problems are now catching momentum. Molodtsov successfully applied soft theory into several directions, such as Smoothness of Functions, Game Theory, Operations Research, Riemann Integration, Perron Integration, Theory of Probability, Theory of Measurement and so on.

Maji et al. (2002) gave first practical application of soft sets in decision making problems. Pei and Miao (2005) investigated the relationships between soft sets and information systems. Maji-Biswas-Roy (2003) presented the operations of soft sets. Cagman-Enginoglu (2010) redefined the operations of soft sets and constructed a uni-intdecision making method by using these new operations and developed soft set theory. Then to make easy compaction with the operations of soft sets, they presented the soft matrix theory and set up the soft maximin decision making method (2010). These decision making methods can be successfully applied to many problems that contain uncertainties.

Many researchers have contributed towards the algebraic structure of the soft set theory. The application of the soft set theory in algebraic structures was introduced by Aktas and Cagman (2007). They established the basic notions of soft groups as a generalization of the idea of fuzzy groups. Feng et al. (2008) worked on soft semirings, soft ideals and idealistic soft semirings.

In 2011, Shabir and Naz and Cagman et al. initiated the study of soft topology and soft topological spaces independently. Shabir and Naz defined soft topology on the collection $\tau$ of soft sets over X. Consequently, they

defined basic notions of soft topological spaces such as soft open and closed sets, soft subspace, soft closure, soft neighborhood of a point, soft $T_i$ spaces, i = 1, 2, 3, 4, soft regular spaces and soft normal spaces and established several of their properties. On the other hand, Cagman et al. introduced a soft topology on a soft set and defined a soft topological space. They defined basic notions and concepts of soft topological spaces such as soft open and closed sets, soft interior, soft closure, soft basis, soft neighborhood of a point, soft limit point of a soft set, soft complement, soft difference and soft boundary and established several properties of these soft notions.

B.V.S.T.Sai and V.Srinivasa Kumar (2013) introduced soft semi-open sets and some related concepts by following Cagman's theory of soft topology and introduced a soft semitopology on a soft set.

E.Peyghan, B.Samadi, A.Tayebi (2012) introduced the concept of soft connectedness and studied their properties.

In 2012, Banu Pazar Varol, Halis Aygun introduced Hausdorff axiom in soft topological spaces.

Zorlutuna et al. (2011) introduced the concept of soft compactness and studied their basic properties.

The concept of soft sets enhanced the application potential of the different generalizations of crisp sets due to the additional advantage of parametrization tools. Various generalization of closed and open sets in topological spaces and fuzzy topological spaces are of recent developments. Juthika (2013) introduced semiopen and semiclosed soft sets and studied various properties and notions related to these structures.

Soft set theory became a very good source of research for many mathematicians of recent years because of its wide range of applicability. The development in the fields of soft set theory and its application has been taking place in a rapid pace.

In this review of literature a brief survey of some of the articles published on soft sets, soft topological spaces and some of their applications are given.

1. **"Soft set theory – first results"**
   **Molodtsov, D. (1999) [31]**

The soft set theory offers a general mathematical tool for dealing objects. The basic notions of the theory of soft sets are introduced, the first results of the theory are presented and some problems of the future are discussed.

2. **"From soft sets to information systems"**
   **Daowu Pei and Duoqian Miao (2005) [14]**

This paper discusses the relationship between soft sets and information systems. It is showed that soft sets are a class of special information systems. After soft sets are extended to several classes of general cases, the more general results also show that partition – type soft sets and information systems have the same formal structures and that fuzzy soft sets and fuzzy information systems are equivalent.

3. **"Distance and similarity measures for soft sets"**
   **Athar Kharal (2010) [4]**

In this paper, new similarity measures for soft sets using set theoretic operations are proposed. An application of the proposed measures of similarity in the area of automated financial analysis is also presented.

4. **"Matrices in soft set theory and their applications in decision making problems"**
   **Tanushree Mitra Basu, Nirmal Kumar Mahapatra and Shyamal Kumar Mondal (2012) [43]**

The purpose of this paper is to define different types of matrices in soft set theory. We have introduced here some new operations on these matrices and discussed here all these definitions and operations by appropriate examples. Moreover a new efficient solution procedure has been developed to solve soft set based real life decision making problems which may contain more than one decision maker.

5. **"An application of soft sets in a decision making problem"**
   **Maji, P.K., Biswas, R. and Roy, A.R. (2002) [29]**

In this paper, the theory of soft sets are applied to solve a decision making problem.

6. **"On some structures of soft topology"**
   **Bashir Ahmad and Sabir Hussain (2012) [8]**

In this paper, soft exterior is defined and its basic properties are studied. Several important results relating soft interior, soft exterior, soft closure and soft boundary in soft topological spaces are established.

7. **"On soft semiopen sets and soft semitopology"**
   **Sai, B.V.S.T. and Srinivasa Kumar, V. (2013) [39]**

In this paper, some interesting properties of soft semiopen sets are studied. Soft semitopology on the collection of all soft semiopen sets over a fixed universe set is introduced.

8. **"On soft connectedness"**
   **Peyghan, E., Samadi, B. Tayebi, A. (2012) [36]**

In this paper, some concepts such as soft connectedness, soft locally connectedness are introduced. Some results related to these concepts and soft product spaces are established.

9. **"The countabilities of soft topological spaces"**
   **Weijian Rong (2012) [44]**

In this paper, some new concepts in soft topological spaces such as soft first-countable spaces, soft second-countable spaces and soft separable spaces are introduced and some basic properties of these concepts are explored.

10. **"On soft generalized closed sets in soft topological spaces"**
    **Saziye Yuksel, Naime Tozlu, Zehra Guzel Ergul (2013) [40]**

In this paper, a representation of soft sets and soft topological spaces is given. It is shown that behavior relative to soft subspaces of soft generalized closed sets are investigated. A soft generalized closed set in a soft compact (soft Lindelof, soft countably compact) space is also soft compact. It is also shown that a soft compact set in a soft regular space is soft generalized closed and disjoint soft g-closed sets in a soft normal space generally cannot be separated by soft open sets. Finally, some properties of soft generalized open sets are investigated.

11. **"Algebraic Hyperstructures of soft sets Associated with Ternary semiHypergroups"**
    **Kostaq Hila, Krisanthi Naka (2013) [27]**

In this paper, soft ternary semihypergroups are introduced by using soft set theory. The notions of soft ternary semihypergroups, soft ternary subsemihypergroups, soft left (right, lateral) hyperideals, soft hyperideals, soft

quasi-hyperideals and soft bi-hyperideals are introduced and several related properties are investigated.

**12. "On soft topological spaces"**
**Muhammad Shabir, Munazza Naz (2011) [32]**

In this paper, it is shown that a soft topological space gives a parametrized family of topological spaces. Furthermore, with the help of an example it is established that the converse does not hold. The soft subspaces of a soft topological space are defined and inherent concept as well as the characterization of soft open and soft closed sets in soft subspaces are investigated. Finally, soft $T_i$-spaces and notions of soft normal and soft regular spaces are discussed. A sufficient condition for a soft topological space to be a soft $T_1$ – space is also presented.

**13. "On soft topological spaces"**
**Georgiou, D.N., Megaritis, A.C. and Petropoulos, V.I. (2013) [16]**

In this paper, the notions concerning the soft $\theta$-open sets, the soft $\theta$-closed sets, and the soft $\theta$-continuity are introduced and studied.

**14. "A new approach to soft topology"**
**Banu Pazar Varol, Alexander Shostak and Halis Aygun (2012) [6]**

In this paper, soft topology and L-fuzzy soft topology, which are mappings from the parameter set E to $2^{2^X}$ and from E to $L^{L^X}$ respectively (where L is a fuzzy lattice) are defined. The L-fuzzy soft topology $\tau$ is an L-fuzzy soft set on the family of all L-fuzzy sets on X. Finally the concepts of soft compactness and L-fuzzy soft compactness for soft topological spaces and L-fuzzy soft topological spaces respectively are presented.

**15. "Category of soft sets"**
**Zahiri, O. (2013) [45]**

In this paper a category, whose objects are soft sets is introduced and some basic results of this category, such as existence of product and co-product is obtained.

**16. "Some local properties of soft semi-open sets"**
**Bin Chen (2013) [9]**

In this paper some local properties by soft semi-open sets, namely, soft semi-neighborhoods of the soft point, soft semi-first-countable spaces and soft semi-pu-continuous at the soft point are introduced. Furthermore, soft semi-connectedness is defined and it is proved that a soft topological space is soft semiconnected if and only if both soft semi-open and soft semi-closed sets are only $\Phi$ and $\tilde{X}$.

**17. "Soft gsg-closed set in soft topological spaces"**
**Seenivasan, V. and Kalaiselvi, S. (2013) [41]**

In this paper a new class of soft set called soft generalized semi generalized closed sets in soft topological spaces are introduced and some basic properties are discussed.

**18. "On semi*-connected and semi*-compact spaces"**
**Robert, A. and Pious Missier, S. (2012) [38]**

In this paper the concepts of semi*-connected spaces, semi*-compact spaces and semi*-Lindelof spaces are introduced and studied.

**19. "On soft topological space via semiopen and semiclosed soft sets"**
**Mahanta, J. and Das, P.K. (2012) [28]**

This paper introduces semiopen and semiclosed soft sets in soft topological spaces. The notions of interior and closure are generalized using

these sets. A detail study is carried out on properties of semiopen, semiclosed soft sets, semi interior and semi closure of a soft set in a soft topological space. Various forms of soft functions, like semicontinous, irresolute, semiopen soft functions are introduced and characterized. Further soft semicompactness, soft semiconnectedness and soft semiseparation axioms are introduced and studied.