REVIEW OF LITERATURE

The concept of fuzzy sets was introduced by Zadeh in 1965.Since then the fuzzy sets and fuzzy logic have been applied in many real life problems in uncertain, ambiguous environment. The traditional fuzzy set is characterized by the membership value or the grade of membership value. Some times it may be very difficult to assign the membership value for a fuzzy set. Consequently the concept of interval valued fuzzy sets was proposed by Turksen in 1986 to capture the uncertainty of grade of membership value. In some real life problems in expert system, belief system, information fusion and so on, one must consider the truth membership as well as the falsity membership for proper description of an object in uncertain, ambiguous environment. Neither the fuzzy sets nor the interval valued fuzzy sets is appropriate for such a situation. Intuitionistic fuzzy sets introduced by Atanassov (1986) is appropriate for such a situation. The intuitionistic fuzzy sets can only handle the incomplete information considering both the truth membership and falsity membership values. It does not handle the indeterminate and inconsistent information which exists in belief system. Smarandache (2005) introduced the concept of Neutrosophic set which is a mathematical tool for handling problems involving imprecise, indeterminacy and inconsistent data.

In 1999, Molodtsov introduced the concept of Soft set which was completely a new approach for dealing with vagueness and uncertainties. After Molodtsovs' work, many researchers combine fuzzy set with Soft set, which incorporates the beneficial properties of both fuzzy set and Soft set techniques. By combining the soft set theory with Neutrosophic set theory, Maji (2012) introduced the notion of "Neutrosophic soft set". Combining Neutrosophic set models with other mathematical models has attracted the

attention of many researchers:

1. Neutrosophic soft sets, Maji (2012)

2. Generalized Neutrosophic soft sets, Broumi (2013)

3. Intuitionistic Neutrosophic soft sets, Broumi and Smarandache (2013)

4. Interval valued Neutrosophic soft sets, Deli (2014)

5. Generalised interval valued Neutrosophic soft sets, Broumi, Sahin and Smarandache (2014)

6. Neutrosophic parameterized soft sets, Broumi, Deli and Smarandache (2014)

7. Interval valued Neutrosophic parameterized soft sets, Broumi, Deli and Smarandache (2014)

8.Interval valued fuzzy Neutrosophic soft sets, Arockiarani and sumathi(2014)

9. (α, β, γ) –cut fuzzy Neutrosophic soft sets, Arockiarani and sumathi (2014)

10. Neutrosophic soft expert sets, Sahin, Alkhazaleh and Ulucay (2014)

11. Weighted Neutrosophic soft sets, Maji (2015)

12. Intuitionistic fuzzy Neutrosophic soft sets, Saroja and Kalaichelvi (2015)

Soft sets, Neutrosophic sets, Neutrosophic soft sets, fuzzy Neutrosophic soft sets has become an important area of research in different disciplines such as Engineering, Medical science, Social science, Physics, Statistics, Graph theory, Signal processing, Pattern Recognition, Computer

networks, Expert systems, Decision making and so on.

In this Review of Literature, a brief survey of some of the articles published on Soft sets, fuzzy soft sets, Neutrosophic sets, Neutrosophic soft sets, Soft topological spaces, fuzzy soft topological spaces, Neutrosophic topological spaces, Neutrosophic soft topological spaces, fuzzy Neutrosophic soft topological spaces are given.

1. **"Soft set theory- first results"**

   Molodtsov , D ., (1999) [38]

   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) [21]

   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. **"Matrices in soft set theory and their applications in decision making problems" Tanushree Mitra Basu, Nirmal Kumar Mahapatra and Shyamal Kumar Mondal (2012) [51]**

   The purpose of this paper is to define different types of matrices in soft set theory. The authors have introduced some new

operations on the matrices and discussed all the 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.

4. **"Intuitionistic fuzzy sets"**

Atanassov , K.T ., (1986) [8]

In this paper, the concept of "intuitionistic fuzzy set" (IFS) is given, the later being a generalization of the concept 'fuzzy set'. Various properties are proved, which are connected to the operations and relations over sets, with model and topological operators defined over the set of IFS.

5. **"Intuitionistic fuzzy set and its application in career determination via normalized Euclidean distance method"**

Ejegwa , P , Akubo , A.J and Joshua , O.M ., (2014) [24]

In this paper, the authors reviewed the concept of IFS and proposed its application in career determination using normalized Euclidean distance method to measure the distance between each student and each career respectively. Solution is obtained by looking for the smallest distance between each student and each career.

6. **"interval valued intuitionistic fuzzy sets"**

Atanassov , K.T and Gargov , G ., (1988) [9]

This paper offers a generalization of the notion of intuitionistic fuzzy set in the spirit of ordinary interval valued fuzzy sets. The notion of interval valued intuitionistic fuzzy set is introduced. The basic preliminaries of IVIFS theory are presented.

7. **"interval valued intuitionistic fuzzy soft sets and their properties"**

   Yuncheng Jiang,Yong Tang,Qimai Chen, Hai Liu and Jianchao Tang (2010)[55]

   In this paper, the notion of the interval valued intuitionistic fuzzy soft set theory is proposed. Interval valued intuitionistic fuzzy soft set theory is an interval valued fuzzy extension of the intuitionistic fuzzy Soft set theory. The complement, "and", "or", union, intersection, necessity and possibility operations are defined and some basic properties are presented and discussed.

8. **"Neutrosophic set- A generalization of the intuitionistic fuzzy set"**

   Smarandache , F ., (2005) [49]

   This paper generalizes the intuitionistic fuzzy sets (IFS), para consistent set and the spirit of ordinary interval valued fuzzy sets. The notion of interval valued intuitionistic fuzzy set is introduced. The basic preliminaries of IVIFS theory are presented.

9. **" Several similarity measures of Neutrosophic soft sets and its application in real life problems"**

   Anjan Mukherjee and Sadhan Sarkar (2014) [2]

   In this paper, the authors introduced the concept of similarity measures between two Neutrosophic soft sets based on set theoretic approach and distance between two Neutrosophic soft sets. Some basic

properties are studied and a decision making method is established. Finally, a decision making method in a medical diagnosis problem is proposed.

10. "Neutrosophic soft sets with applications in decision making" Faruk Karaaslan (2015) [28]

In this paper, the author redefine the notion of Neutrosophic soft set and Neutrosophic soft set operations to make more functional. A decision making method and a group decision making method which selects a set of optimum elements from the alternatives are constructed. Finally, an example which applied to many problems that contain uncertainty are presented.

11. " A fuzzy Neutrosophic soft set model in medical diagnosis" Arockiarani , I ., (2014) [7]

This paper, explore the notion of fuzzy neutrosophic sets and soft sets. A novel approach to meet the challenges in medical diagnosis are proposed. The calculation of distances a new score function to discuss in decision making problem are defined. A topological structure on fuzzy soft set is considered.

12. "Generalized Neutrosophic set and generalized Neutrosophic topological spaces"

Salama , A.A and Alblowi , S.A ., (2012) [45]

In this paper, definition of generalized Neutrosophic sets are introduced. Fundamental definitions of generalized Neutrosophic set operations and several properties are obtained. The relationship between generalized Neutrosophic sets and others are discussed. Finally, the authors extended the concept of Neutrosophic topological spaces, intuitionistic fuzzy topological space and fuzzy topological

space to the case of generalized Neutrosophic sets.

13. **"Generalized Neutrosophic soft sets and its integration to decision making problem"**

Ridvan Sahin and Ahmet Kucuk ., (2014) [42]

This paper generalizes the concept of Neutrosophic soft set and basic operations on generalized Neutrosophic soft sets are studied. Finally, an application of generalized Neutrosophic soft set in decision making problem is presented.

14. **"Relations on interval valued neutrosophic Soft sets"**

Broumi , S., Deli , I. and Smarandache , F ., (2014) [18]

In this paper, the authors extended the concept of interval valued neutrosophic soft (IVNS) relation which can be discussed as a generalization of soft relations, fuzzy soft relation, intuitionistic fuzzy soft relations and Neutrosophic soft relations. Basic operations and properties like reflexivity, symmetry, transitivity of IVNSS are studied.

15. **"Interval valued Neutrosophic parameterized soft set theory and its decision making"**

Broumi ,S., Deli , I. and Smarandache , F ., (2014) [16]

In this paper, definition of interval valued neutrosophic parameterized soft set (IVNPSS) and its operations are defined. The parameter reduction method for IVNP-soft set are defined and also an example applied to problem that contains indeterminacy have been given.

16. **"Some results on interval valued fuzzy neutrosophic soft sets"**

Arockiarani , I. and Sumathi I.R ., (2014) [6]

This paper proposes the notion of interval valued fuzzy Neutrosophic soft sets and some of its operations are defined. The properties of interval valued fuzzy Neutrosophic soft set have characterized.

17. **"Similarity measure between possibility Neutrosophic soft set and its applications"**

Faruk Karaaslan (2014) [26]

In this paper, a similarity measure between possibility Neutrosophic soft sets are defined and its properties are studied. A decision making method is established. Finally, an application of this similarity measure involving the real life problem is established.

18. **"Possibility Neutrosophic soft sets with applications in decision making and similarity measure"**

Faruk Karaaslan (2014) [27]

In this paper, the concept of possibility Neutrosophic soft sets and its operations are defined. Some properties are studied and an application of this theory in decision making is investigated. A similarity measure of two possibility Neutrosophic soft sets are introduced and an application of this similarity measure is discussed.

19. **"On similarity and entropy of Neutrosophic soft sets"**

Sahin Ridvan and Kucuk Ahmet (2014) [43]

In this paper, Several distance measures between Neutrosophic soft sets and an axiomatic definition of Neutrosophic entropy for a Neutrosophic soft set is defined. The most alternatives from all possible alternatives based on similarity measure is proposed. Finally, the similarity measure is applied to a multi criteria decision making problem is proposed.

20. "Weighted Neutrosophic soft sets approach in a multi criteria decision making problem"

Maji , P.K ., (2015) [36]

In this paper, weighted Neutrosophic soft sets which are a hybridization of Neutrosophic sets with soft sets corresponding to weighted parameters are studied. A multi criteria decision making problem as an application of weighted Neutrosophic soft sets are considered.

21. "Neutrosophic soft expert sets"

Mehmet Sahin, Shawkat Alkhazaleh and Vakkas Ulucay (2014) [37]

In this paper, the concept of Neutrosophic soft expert set is introduced and basic operations namely complement, union, intersection, 'AND' and 'OR' are defined. Some of their properties and examples are studied. Finally, an application of this concept in a decision making problem are given.

22. "On (α, β, γ)- cut fuzzy Neutrosophic soft sets"

Arockiarani , I. and Sumathi , I.R ., (2014) [5]

In this paper, the notion of (α, β, γ)- cut and (α, β, γ)- strong cut

of an fuzzy Neutrosophic soft set is studied. Some related properties have been established with counter example. Disjunctive sum and difference of two fuzzy Neutrosophic soft sets and characterizations are discussed.

23. "On some structures of soft topology"

Bashir Ahmed and Sabir Hussian (2012) [11]

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.

24. "On soft topological spaces"

Muhammad Shabir and Munazza Naz (2011) [39]

In this paper, a soft topological space gives a parameterized 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 spaces are defined and inherent concepts 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 also presented.

25. "Fuzzy soft topological spaces"

Tridiv Jyoti Neog, Dusmanta Kumar Sut and Hazarika (2012) [52]

In this paper, some properties related to fuzzy soft topological spaces have been established. The concepts on fuzzy soft point, fuzzy soft neighborhood, fuzzy soft closure, fuzzy soft interior and fuzzy subspace topology are introduced and studied.

26. "Fuzzy Soft topology"

Banu PazarVarol , Alexander Shostak and Halis Aygun (2012) [10]

In this paper, the authors introduced the topological structure of fuzzy soft sets and fuzzy soft continuity of fuzzy soft mappings.Also showed that a fuzzy soft topological space gives a parameterized family of fuzzy topological spaces. Further more, with the help of an example it is shown that the constant mapping is not continuous in general. Then the notions of fuzzy soft closure and interior are introduced and their basic properties are investigated. Finally, the initial fuzzy soft topology and some properties of projection mappings are studied.

26. "Results on fuzzy soft topological spaces"

Mahanta , J. and Das , P.K ., (2012) [32]

In this paper, Separation axioms and connectedness are introduced and investigated for fuzzy soft topological spaces.

27. "Fuzzy soft topological spaces"

Tughahan Simsekler and Saziye Yuksel (2013)

In this paper, the authors introduced and studied fuzzy soft topology, fuzzy soft open set, fuzzy soft closed set, fuzzy soft interior and fuzzy soft closure point, fuzzy soft and fuzzy soft Q-neighborhood.

28. " On some structural properties of fuzzy soft topological spaces"

Pradip Kumar Gain, Prakash Mukherjee, Ramkrishna Prasad Chakraborty and Madhumangal Pal (2013) [40]

In this paper, some structural properties of fuzzy soft topological spaces. Fuzzy soft closure and fuzzy soft interior of a fuzzy soft sets are studied and investigated. Fuzzy soft exterior and Fuzzy soft boundary of a fuzzy soft set are introduced and some properties related to these structures are established.

29. "Some notes on soft topological spaces"

Abdulkadir Aygunoglu and Halis Aygun (2011) [1]

In this paper, soft topological spaces are studied. Soft continuity of soft mapping are defined. soft product topology and soft projection mappings are studied. Finally, soft compactness and generalize Alexander sub base theorem and Tychonoff theorem to soft topological spaces are defined.

30. **"On intuitionistic fuzzy soft topology"**

Ismail Osmanoglu and Deniz Tokat (2013) [31]

In this paper, a sub space, separation axioms, compactness and connectedness on intuitionistic fuzzy soft topological spaces are defined and also some base theorems of these concepts are presented.

31. " A note on fuzzy soft topological spaces"

Sanjay Roy and Samanta T.K ., (2012) [46]

In this paper, a topology on a fuzzy soft set is constructed. The concepts of fuzzy soft base, fuzzy soft sub base are introduced and some important theorems are established.

32. "Fuzzy Neutrosophic soft topological spaces"

Arockiarani , I., Sumathi , I.R and Martina Jency , J .,(2013) [3]

This paper proposes a new notion of fuzzy Neutrosophic soft set and some basic operations and results are studied. The authors developed a systematic study on fuzzy Neutrosophic soft set and various properties are obtained. Some equivalent characterization and inter relations among them are discussed.

33. **"More on fuzzy Neutrosophic sets and fuzzy Neutrosophic topological spaces"**

Arockiarani , I ., and Martina Jency , J., (2014) [4]

This paper signifies the basic properties of fuzzy Neutrosophic sets. Fuzzy Neutrosophic set and fuzzy Neutrosophic topological spaces are introduced. Some properties are characterized.