Int. J. Math. And Appl., 6(1–E)(2018), 1035–1042
ISSN: 2347-1557
Available Online: http://ijmaa.in/

International Journal of *Mathematics And its Applications*

M-N Anti Fuzzy Normal Soft Groups

M. Kaliraja[1,*] and S. Rumenaka[1]

1 PG and Research Department of Mathematics, H.H.The Rajah's college, Pudukkottai, Tamilnadu, India.

Abstract: In this paper, we have discussed the concept of M-N anti fuzzy normal soft group, we then define the M-N anti level subsets of a normal fuzzy soft subgroup and its some elementary properties are also discussed.

MSC: 20N25, 06D72, 20E15.

Keywords: Fuzzy group, M-N anti fuzzy group, M-N anti fuzzy soft subgroup, M-N anti level subset, M-N anti fuzzy soft normalize.

1. Introduction

There are various types of uncertainties in the real world, but few classical mathematical tools may not be suitable to model these uncertainties. Many intricate problems in economics, social science, engineering, medical science and many other fields involve undefined data. These problems which one comes face to face with in life cannot be solved using classical mathematic methods. In classical mathematics, a mathematical model of an object is devised and the concept of the exact solution of this model is not yet determined. Since, the classical mathematical model is too complex, the exact solution cannot be found. There are several well-renowned theories available to describe uncertainty. For instance, Rosenfeld [12] introduced the concept of fuzzy subgroup in 1971 and the fuzzy normal subgroup was revealed by Wu [16] during 1981. Further, the theory of fuzzy sets was inspired by Zadoh [18] in addition to this, Molodtsov [9] have introduced the concept of soft sets in 1999. Furthermore, Majiet. al., [8] as well introduction the concept of fuzzy soft sets in 2001 and Jacobson [6].

In 2015, R. Patel, Ramakant Bhardmal, Sanjay Choudhary, Sunil [11] were developed three variables on normal fuzzy soft subgroup. Sarala and Suganya [13] be unraveled the three variables on normal fuzzy soft subgroup in 2004. In addition, Vasantha Kandasamy and Smarandache [15] have introduced the Fuzzy Algebra during 2003. An introduction to the new definition of Soft sets and soft groups depending on inclusion relation and intersection of sets were exposed by Akta and Cagman [1]. In 1981, Das [2] studied the Fuzzy groups and level subgroups. Moreover, Maij, Biswas and Ray [8] were introduced the fuzzy soft set in 2001.

In [4] Biswas introduced the concept of anti-fuzzy subgroup of groups. Shen researched anti-fuzzy subgroups in [14] and Dong [3] studied the product of anti- fuzzy subgroups. Feng and Yao [5] studied the concept of (λ, μ) anti-fuzzy subgroups. Pandiamml et al, (2010) defined a new algebraic structure of anti L-fuzzy normal M-subgroups. Wang Sheng-hai [17] further obtained some basic properties of anti fuzzy subgroups and anti fuzzy normal fuzzy subgroups of group. Mourad Oqla Massa'deh [10] have discussed The M-N-homomorphism and M-N-anti homomorphism over M-N-fuzzy subgroups in 2012,

* *E-mail: mkr.maths009@gmail.com*

In our earlier work have discussed the concept of M-N fuzzy normal soft groups [7].

In the present manuscript, we have discussed the concept of M-N anti fuzzy normal soft group based on the concept of Normal fuzzy soft group [2, 7, 10, 13]. In section 2, we presented the basic definition; notations on M-N fuzzy normal soft group and M-N anti fuzzy normal soft subgroup are required results on fuzzy normal soft group. In section 3, we define the M-N anti fuzzy soft group, normal fuzzy soft group and also define the M-N anti level subsets of a normal fuzzy soft subgroup. We have also discussed the concept of M-N anti fuzzy normal soft group and some of its elementary properties.

2. Preliminaries

In this section, some basic definitions and results needed are given. For the sake of convenience we set out the former concepts which will be used in this paper.

Definition 2.1. *Let G be any non-empty set. A mapping $\alpha : G \to [0,1]$ is called fuzzy set in G.*

Definition 2.2. *Let x be a non-empty set. A fuzzy subset α of X is a function $\alpha : X \to [0,1]$.*

Definition 2.3. *Let G be a group. A fuzzy subset α of G is called an anti fuzzy subgroup if for$x, y \in G$*

(1). $\alpha(xy) \leq \max\{\alpha(x), \alpha(y)\}$.

(2). $\alpha(x^{-1}) = \alpha(x)$.

Definition 2.4. *A pair (F, A) is called a soft set over U, where F is a mapping given by $F : A \to P(U)$.*

Definition 2.5. *Let (F, A) be a soft set over G. Then (F, A) is called a soft group over G if $F(\alpha)$ is a group G for all $\alpha \in A$.*

Definition 2.6. *A pair (F, A) is called a fuzzy soft set over U, where $F : A \to I^U$ is a mapping $I = [0,1], F(\alpha)$ is a fuzzy subset of U for all $\alpha \in A$.*

Definition 2.7. *Let (F, A) be a fuzzy soft set over G. Then (F, A) is a called a fuzzy soft group if $F(\alpha)$ is a fuzzy subgroup G for all $\alpha \in A$.*

Definition 2.8. *Let (F, A) and (G, B) be two fuzzy soft set over U. Then (F, A) is called a fuzzy soft subset of (G, B) denoted by $(F, A) \subseteq (G, B)$ if*

(1). $A \subseteq B$.

(2). $F(\alpha)$ is a fuzzy subset of $G(\alpha)$, for each $\alpha \in A$.

Definition 2.9. *A fuzzy set α is called an anti fuzzy soft subgroup of a group G, if for $x, y \in G$*

(1). $\alpha(xy) \leq \max\{\alpha(x), \alpha(y)\}$.

(2). $\alpha(x^{-1}) \leq \alpha(x)$.

Definition 2.10. *Let G be a group. A fuzzy soft subgroup α of G is said be an anti fuzzy normal soft subgroup, if for all $x, y \in G$ and $\alpha(xyx^{-1}) = \alpha(y)(or)\alpha(xy) \leq \alpha(yx)$.*

Definition 2.11. *Let $\alpha \cup \beta$ be an anti fuzzy soft subgroup of a group G, for any $t \in [0,1]$, we define the anti level subset of $\alpha \cup \beta$ is the set $(\alpha \cup \beta)_t = \{x \in X/(\alpha \cup \beta)(x) \leq t\}$.*

Definition 2.12. *Let G be a group and $\alpha \cup \beta$ be an anti fuzzy normal soft subgroup of G. Let $N(\alpha \cup \beta) = \{y \in G/(\alpha \cup \beta)(yxy^{-1}) = (\alpha \cup \beta)(x)$ for all $x \in G\}$, then $N(\alpha \cup \beta)$ is called an anti fuzzy soft Normalize of $\alpha \cup \beta$.*

Definition 2.13. *Let M, N be left and right operator sets of group G respectively, if $(mx)n = m(xn)$ for all $x \in G, m \in M, n \in N$. Then G is said be an $M - N$ group.*

Definition 2.14. *If α is an $M - N$ fuzzy subgroup of an MN group G. Then the following statement holds for all $x, y \in G, m \in M$, and $n \in N$*

(1). $\alpha(m(xy)n) \geq min\{\alpha(x), \alpha(y)\}$.

(2). $\alpha(mx^{-1}n) \geq \alpha(x)$.

Definition 2.15. *Let G be an $M - N$ group. α is said be an $M - N$ normal fuzzy subgroup of G if α is not only an $M - N$ fuzzy subgroup of G, but also normal fuzzy subgroup of G.*

Definition 2.16. *Let G be an $M - N$ group and (F, A) be a fuzzy soft subgroup of G if*

(1). $F\{m(xy)n\} \geq min\{F(x), F(y)\}$.

(2). $F\{(mx^{-1})n\} \geq F(x)$ *hold for any $x, y \in G, m \in M, n \in N$, then (F, A) is said be an $M - N$ fuzzy soft subgroup of G. Here $F : A \to P(G)$.*

Definition 2.17. *Let G be an $M - N$ group and (F, A) be a fuzzy soft subgroup of G if*

(1). $F(mx) \geq F(x)$.

(2). $F(xn) \geq F(x)$ *hold for any $x \in G, m \in M$, and $n \in N$, then (F, A) is said be an $M - N$ fuzzy soft subgroup of G.*

Definition 2.18. *Let G be an $M - N$ group. (F, A) is said be an $M - N$ fuzzy normal soft subgroup of G if (F, A) is not only an $M - N$ fuzzy soft subgroup of G, but also normal fuzzy soft subgroup of G.*

Definition 2.19. *Let G be a group, α is a $M - N$ fuzzy soft subgroup of G is said be a $M - N$ fuzzy normal soft subgroup if $\alpha(m(xyx^{-1})n) = \alpha(myn)$ (or) $\alpha(m(xy)n) \geq \alpha(m(yx)n)$ for all $x, y \in G, m \in M$, and $n \in N$.*

Definition 2.20. *Let $\alpha \cap \beta$ be an $M - N$ fuzzy soft subgroup of a group G. For any $t \in [0, 1]$, we define the $M - N$ level subset of $\alpha \cap \beta$ is the set $(\alpha \cap \beta)_t = \{x \in G/(\alpha \cap \beta)(mx) \geq t, (\alpha \cap \beta)(xn) \geq t$ for all $m \in M, n \in N\}$.*

Definition 2.21. *Let G be a group and $\alpha \cap \beta$ be an $M - N$ fuzzy normal soft subgroup of G. Let $N(\alpha \cap \beta) = \{y \in G/(\alpha \cap \beta)(m(yxy^{-1})n) = (\alpha \cap \beta)(mxn)$ for all $x \in G, m \in M, n \in N\}$, then $N(\alpha \cap \beta)$ is called the $M - N$ fuzzy soft Normalizer of $\alpha \cap \beta$.*

Definition 2.22. *If α is an $M - N$ anti fuzzy subgroup of an $M - N$ group G. Then the following statement holds for all $x, y \in G, m \in M$, and $n \in N$*

(1). $\alpha(m(xy)n) \leq \max\{\alpha(x), \alpha(y)\}$.

(2). $\alpha(mx^{-1}n) \leq \alpha(x)$.

Definition 2.23. *Let G be an $M - N$ group. α is said be an $M - N$ anti fuzzy normal subgroup of G if α is not only an $M - N$ anti fuzzy subgroup of G, but also an anti fuzzy normal subgroup of G.*

3. M-N Anti Fuzzy Normal Soft Groups

In this section, we shall define M-N anti fuzzy soft group, anti fuzzy normal soft subgroup, discussed the concept of M-N anti fuzzy normal soft group based on the concept of fuzzy Normal soft group [2, 7, 10, 13], also define the M-N anti level subsets of a fuzzy Normal soft subgroup and its some elementary properties are discussed.

Definition 3.1. *Let G be an $M-N$ group and (F,A) be an anti fuzzy soft subgroup of G if*

(1). $F\{m(xy)n\} \leq \max\{F(x), F(y)\}$

(2). $F\{(mx^{-1})n\} \leq F(x)$ *hold for any* $x, y \in G, m \in M, n \in N$*, then* (F,A) *is said be an* $M-N$ *anti fuzzy soft subgroup of* G*. Here* $F : A \to P(G)$*.*

Definition 3.2. *Let G be an $M-N$ group and (F,A) be an anti fuzzy soft subgroup of G if*

(1). $F(mx) \leq F(x)$

(2). $F(xn) \leq F(x)$ *hold for any* $x \in G, m \in M,$ *and* $n \in N$*, then* (F,A) *is said be an* $M-N$ *anti fuzzy soft subgroup of* G*.*

Definition 3.3. *Let G be an $M-N$ group. (F,A) is said be an $M-N$ anti fuzzy normal soft subgroup of G if (F,A) is not only an $M-N$ anti fuzzy soft subgroup of G, but also an anti fuzzy normal soft subgroup of G.*

Theorem 3.4. *Let G be an $M-N$ group, A and B both be $M-N$ anti fuzzy subgroup of G. Then $A \cup B$ is an $M-N$ anti fuzzy subgroup of G.*

Proof.

(1). $(A \cup B)(m(xy)n) \leq \max\{(A \cup B)(x), (A \cup B)(y)\}$.

(2). $(A \cup B)(mx^{-1}n) = (A \cup B)(x)$.

$$\begin{aligned}
(1) \Rightarrow (A \cup B)(m(xy)n) &= \max\{A(m(xy)n), B(m(xy)n)\} \\
&\leq \max\{\max\{A(mx), A(ny)\}, \max\{B(mx), B(yn)\}\} \\
&\leq \max\{\max\{A(x), B(x)\}, \max\{A(y), B(y)\}\}, A(mx) \leq A(x) \\
(A \cup B)(m(xy)n) &\leq \max\{A \cup B)(x), (A \cup B)(y)\} \\
(2) \Rightarrow (A \cup B)(mx^{-1}n) &= (A \cup B)(mxx^{-1}xn) \\
(A \cup B)(mx^{-1}n) &= \max\{A(mxx^{-1}), B(xn)\} \\
&\leq \max\{\max\{A(mx), A(x^{-1})\}, B(x)\} \\
&\leq \max\{\max\{A(x), A(x^{-1})\}, B(x)\} \\
&\leq \max\{A(x), B(x)\} \\
&= (A \cup B)(x) \\
(A \cup B)(mx^{-1}n) &= (A \cup B)(x)
\end{aligned}$$

Hence (1) and (2) is proved. □

Theorem 3.5. *If α and β are the two $M-N$ anti fuzzy soft subgroup of G, then $\alpha \cup \beta$ is an $M-N$ anti fuzzy soft subgroup of G.*

Proof. Let α and β be two $M-$N anti fuzzy soft subgroup of G.

(1). $(\alpha\cup\beta)(m(xy^{-1})n) \leq \max\{(\alpha\cup\beta)(mx), (\alpha\cup\beta)(y^{-1}n)\}$

$$\begin{aligned}(\alpha\cup\beta)(m(xy^{-1})n) &= \max\{\alpha(m(xy^{-1})n), \beta(m(xy^{-1})n)\}\\ &\leq \max\{\max\{(\alpha(mx), (\alpha(y^{-1}n)\}, \max\{\beta(mx), \beta(y^{-1}n)\}\}\\ &\leq \max\{\max\{(\alpha(mx), \beta(mx)\}, \max\{(\alpha(y^{-1}n), \beta(y^{-1}n)\}\\ &\leq \max\{(\alpha\cup\beta)(mx), (\alpha\cup\beta)(y^{-1}n)\}\end{aligned}$$

Therefore $(\alpha\cup\beta)(m(xy^{-1})n) \leq \max\{(\alpha\cup\beta)(mx), (\alpha\cup\beta)(y^{-1}n)\}$.

(2). $(\alpha\cup\beta)(mxn) = (\alpha\cup\beta)(mx^{-1}n)$

$$\begin{aligned}(\alpha\cup\beta)(mxn) &= \max\{\alpha(mxn), \beta(mxn)\}\\ &= \max\{\alpha(mx^{-1}n), \beta(mx^{-1}n)\}\\ &= (\alpha\cup\beta)(mx^{-1}n)\end{aligned}$$

Hence $\alpha\cup\beta$ is an $M-N$ anti fuzzy soft subgroup of G. □

Theorem 3.6. *The union of any two $M-N$ anti fuzzy normal soft subgroup of G is also an $M-N$ anti fuzzy normal soft subgroup G.*

Proof. Let α, and β be the $M-N$ anti fuzzy normal soft subgroup of G. By the previous theorem we know that, $\alpha\cup\beta$ is an $M-N$ anti fuzzy soft subgroup of G. Let $x, y \in G, m \in M$, and $n \in N$. To prove that $(\alpha\cup\beta)(m(yxy^{-1})n) = (\alpha\cup\beta)(mxn)$. Now

$$\begin{aligned}(\alpha\cup\beta)(m(yxy^{-1})n) &= \max\{\alpha(m(yxy^{-1})n), \beta(m(yxy^{-1})n)\}\\ &= \max\{[\alpha(mxn), \beta(mxn)]\}\\ &= (\alpha\cup\beta)(mxn)\end{aligned}$$

Hence $(\alpha\cup\beta)(m(yxy^{-1})n) = (\alpha\cup\beta)(mxn)$. Hence $\alpha\cup\beta$ is an $M-N$ anti fuzzy normal soft subgroup of G. □

Note 3.7. *If $(\alpha\cup\beta)_i, i \in \Delta$ are $M-N$ anti fuzzy normal soft subgroup of G, then $U_{i\in\Delta}(\alpha\cup\beta)_i$ is a $M-N$ anti fuzzy normal soft subgroup of G.*

Definition 3.8. *Let G be a group, α is a $M-N$ anti fuzzy soft subgroup of G is said be a $M-N$ anti fuzzy normal soft subgroup if $\alpha(m(xyx^{-1})n) = \alpha(myn)$ (or) $\alpha(m(xy)n) \leq \alpha(m(yx)n)$ $for\ all\ x, y \in G, m \in M,\ and\ n \in N$.*

Theorem 3.9. *Let α be an $M-N$ anti fuzzy normal soft subgroup of G, then for any $y \in G$ we have $\alpha(m(y^{-1}xy)n) = \alpha(m(yxy^{-1})n)$.*

Proof. Let α be an $M-N$ anti fuzzy normal soft subgroup G, then for any $y \in G$. Now

$$\begin{aligned}\alpha(m(y^{-1}xy)n) &= \alpha(m(xy^{-1}y)n)\\ &= \alpha(m(x)n)\\ &= \alpha(m(yy^{-1}x)n)\\ &= \alpha(m(yxy^{-1})n)\end{aligned}$$

Therefore $\alpha(m(y^{-1}xy)n) = \alpha(m(yxy^{-1})n)$. □

Theorem 3.10. *If α is an $M-N$ anti fuzzy normal soft subgroup of G, then $g\alpha g^{-1}$ is also $M-N$ anti fuzzy normal soft subgroup of G, for all $g \in G$.*

Proof. Let α be an $M-N$ anti fuzzy normal soft subgroup of G, then $g\alpha g^{-1}$ is an $M-N$ anti fuzzy subgroup of G, for all $g \in G$. Now

$$\begin{aligned} g\alpha g^{-1}m(yxy^{-1})n) &= \alpha(g^{-1}m(yxy^{-1})n)g) \\ &= \alpha(m(yxy^{-1})n) \\ &= \alpha(mxn) \\ &= \alpha(g(mxn))g^{-1} \\ &= g\alpha g^{-1}(mxn) \end{aligned}$$

Therefore $g\alpha g^{-1}(m(yxy^{-1})n) = g\alpha g^{-1}(mxn)$. □

Theorem 3.11. *If $\alpha \cup \beta$ is an $M-N$ anti fuzzy normal soft subgroup of G, then $g(\alpha \cup \beta)g^{-1}$ is also an $M-N$ anti fuzzy normal soft subgroup of G, for all $g \in G$.*

Proof. If $\alpha \cup \beta$ is an $M-N$ anti fuzzy normal soft subgroup of G, then $g(\alpha \cup \beta)g^{-1}$ is also an $M-N$ anti fuzzy normal soft subgroup of G, for all $g \in G$.
To prove that $g(\alpha \cup \beta)g^{-1}(m(yxy^{-1})n) = g(\alpha \cup \beta)g^{-1}(mxn)$. Now

$$\begin{aligned} g(\alpha \cup \beta)g^{-1}(m(yxy^{-1})n) &= (\alpha \cup \beta)(g^{-1}(m(yxy^{-1})n)g) \\ &= (\alpha \cup \beta)(m(yxy^{-1})n) \\ &= (\alpha \cup \beta)(mxn) \\ &= (\alpha \cup \beta)(g(mxn)g^{-1} \\ &= g(\alpha \cup \beta)g^{-1}(mxn) \end{aligned}$$

Therefore $g(\alpha \cup \beta)g^{-1}(m(yxy^{-1})n) = g(\alpha \cup \beta)g^{-1}(mxn)$. □

Definition 3.12. *Let $\alpha \cup \beta$ be an $M-N$ anti fuzzy soft subgroup of a group G. For any $t \in [0,1]$, we define the $M-N$ anti level subset of $\alpha \cup \beta$ is the set $(\alpha \cup \beta)_t = \{x \in G/(\alpha \cup \beta)(mx) \leq t, (\alpha \cup \beta)(xn) \leq t \text{ for all } m \in M, n \in N\}$.*

Theorem 3.13. *Let G be a group and $\alpha \cup \beta$ be an anti fuzzy subset of G. Then $\alpha \cup \beta$ is an $M-N$ anti fuzzy normal soft subgroup of G iff the anti level subset $(\alpha \cup \beta)_t, t \in [0,1]$ are $M-N$ anti fuzzy subgroup of G.*

Proof. Let $\alpha \cup \beta$ be an $M-N$ anti fuzzy normal soft subgroup of G and the anti level subset

$$(\alpha \cup \beta)_t = \{x \in G/(\alpha \cup \beta)(mx) \leq t, (\alpha \cup \beta)(xn) \leq t, t \in [0,1] m \in M, n \in N\}$$

Let $x, y \in (\alpha \cup \beta)_t$, then $(\alpha \cup \beta)(mx) \leq t$ and $(\alpha \cup \beta)(xn) \leq t$. Now

$$\begin{aligned} (\alpha \cup \beta)(m(xy^{-1})n) &\leq \max\{(\alpha \cup \beta)(mx), (\alpha \cup \beta)(y^{-1}n)\} \\ &= \max\{(\alpha \cup \beta)(mx), (\alpha \cup \beta)(yn)\} \\ &\leq \max\{t, t\} \end{aligned}$$

$$(\alpha \cup \beta)(m(xy^{-1})n) \leq t$$

$m(xy^{-1})n \in (\alpha \cup \beta)_t$. Therefore $(\alpha \cup \beta)_t$ is an $M - N$ anti fuzzy subgroup of G.

Conversely, let us assume that $(\alpha \cup \beta)_t$ is an $M - N$ anti fuzzy subgroup G. Let $x, y \in (\alpha \cup \beta)_t$ then $(\alpha \cup \beta)(mx) \leq t$ and $(\alpha \cup \beta)(xn) \leq t$. Also $(\alpha \cup \beta)(m(xy^{-1})n) \leq t$. Since $m(xy^{-1})n \in (\alpha \cup \beta)_t = \max\{t, t\} = \max\{(\alpha \cup \beta)(mx), (\alpha \cup \beta)(yn)\}$. Therefore $(\alpha \cup \beta)(m(xy^{-1})n) \leq \max\{(\alpha \cup \beta(mx), (\alpha \cup \beta)(yn)\}$. Hence $\alpha \cup \beta$ is an $M - N$ anti fuzzy normal soft subgroup of G. □

Definition 3.14. *Let G be a group and $\alpha \cup \beta$ be an $M - N$ anti fuzzy normal soft subgroup of G. Let $N(\alpha \cup \beta) = \{y \in G/(\alpha \cup \beta)(m(yxy^{-1})n) = (\alpha \cup \beta)(mxn)\ for\ all\ x \in G, m \in M, n \in N\}$, then $N(\alpha \cup \beta)$ is called the $M - N$ anti fuzzy soft Normalize of $\alpha \cup \beta$.*

Theorem 3.15. *Let G be a group and $\alpha \cup \beta$ be an anti fuzzy subset of G. Then $\alpha \cup \beta$ is an $M - N$ anti fuzzy normal soft subgroup of G iff the anti level subset $(\alpha \cup \beta)_t, t \in [0, 1]$ are $M - N$ anti fuzzy normal subgroup of G.*

Proof. Let $\alpha \cup \beta$ be a $M - N$ anti fuzzy normal soft subgroup of G and the anti level subset $(\alpha \cup \beta)_t, t \in [0, 1]$. Let $x \in G$ and $y \in (\alpha \cup \beta)_t$, then $(\alpha \cup \beta)(myn) \leq t,\ for\ all\ m \in M, n \in N$. Now $(\alpha \cup \beta)(m(xyx^{-1})n) = (\alpha \cup \beta)(myn) \leq t$. Since $\alpha \cup \beta$ is an $M - N$ anti fuzzy normal softsubgroup of G. That is $(\alpha \cup \beta)(m(xyx^{-1})n) \leq t$. Therefore $(m(xyx^{-1})n \leq (\alpha \cup \beta)_t$. Hence $(\alpha \cup \beta)_t$ is an $M - N$ anti fuzzy normal subgroup of G. □

4. Conclusion

The main results in the present manuscript are based on the concept ofAnti fuzzy normal soft group [2, 7, 10, 13]. We have also defined the M-N anti level subsets of a fuzzy normal soft subgroup and its some elementary properties are discussed.

References

[1] H.Akta and N.Cagman, *Soft sets and soft group*, Information Science, 177(2007), 2726-2735.

[2] R.Biswas, *Fuzzy subgroups and anti fuzzy subgroups*, Fuzzy Sets and Systems, 35(1990), 121-124.

[3] B.Dong, *Direct product of anti fuzzy subgroups*, J Shaoxing Teachers College, 5(1992), 29-34.

[4] P.S.Das, *Fuzzy groups and level subgroups*, J. Math. Anal. Appl., 84(1981), 264-269.

[5] Yuming Feng and Bingxue Yao, On (λ, μ)-anti-fuzzy subgroups, Journal of Inequalities and Applications, 78(2012).

[6] N.Jacobson, *Lectures in Abstract Algebra*, East-West Pess, (1951).

[7] M.Kaliraja and S.Rumenaka, *M - N fuzzy normal soft groups*, Int. J. Fuzzy Math. Archive, 13(2)(2017), 159-165.

[8] P.K.Maij, R.Biswas and A.R.Ray, *Fuzzy soft set*, J. Fuzzy Math,, 9(2001), 589-602.

[9] D.Molodtsov, *Soft set theory-first result*, Comput. Math. Appl., 37(1999), 19-31.

[10] Mourad Oqla Massa'deh, *The M-N-homomorphism and M-N-anti homomorphism over M-N-fuzzy subgroups*, Int. J. of Pure and Appl. Math., 78(7)(2012), 1019-1027.

[11] R.Patel, Ramakant Bhardwaj, Sanjay Choudhary and Sunil Garge, *On Normal Fuzzy Soft Group*, Mathematical Theory and Modeling, 5(7)(2015).

[12] A.Rosenfield, *Fuzzy groups*, J. Math. Anal. Appl., 35(1971), 512-517.

[13] N.Sarala and B.Suganya, *On Normal Fuzzy Soft Group*, International Journal of MathematicsTrend and Technology, 10(2)(2014), 70-75.

[14] Z.Shen, *The anti-fuzzy subgroup of a group*, J Liaoning Normat Univ. (Nat Sci), 18(2)(1995), 99-101.

[15] W.B.VasanthaKandasamy and Smarandache, *Fuzzy Algebra*, American Research Press, (2003).

[16] W.M.Wu, *Normal fuzzy subgroups*, Fuzzy Math., 1(1981), 21-23.

[17] S.H.Wang, *The Anti-fuzzy subgroup in Group G*, Fuzzy System and Mathematics, 19(2005), 58-60.

[18] L.A.Zadeh, *Fuzzy sets*, Inform and Control, 8(1965), 338-353.