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Bipolar Intuitionistic M Fuzzy Group and Anti M Fuzzy Group.

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Abstract: *The concept of a Bipolar intuitionistic M fuzzy group is a new algebraic structure of a bipolar intuitionistic M fuzzy subgroup of a M fuzzy group and anti M fuzzy group are defined and some related properties are investigated. The purpose of the study is to implement the fuzzy set theory and group theory of bipolar intuitionistic M fuzzy subgroup of a M fuzzy group and anti M fuzzy group. The relation between of a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group are established.*

Keywords: *M fuzzy group, anti M fuzzy group, bipolar intuitionistic fuzzy set, bipolar intuitionistic M fuzzy group, bipolar intuitionistic anti M fuzzy group.*

I. Introduction

The concept of fuzzy sets was initiated by L.A. Zadeh [13] then it has become a vigorous area of research in engineering, medical science, graph theory. Rosenfeld [12] gave the idea of fuzzy subgroups. Bipolar valued fuzzy sets was introduced by K.M. Lee [5] are an extension of fuzzy sets whose membership degree range is enlarged from the interval [0,1] to [-1,1]. In a bipolar valued fuzzy set, the membership degree 0 means that the elements are irrelevant to the corresponding property, the membership degree (0,1] indicates that elements somewhat satisfy the property and the membership degree[-1,0) indicates that elements somewhat satisfy the implicit counter property. The author W. R. Zhang [15] commenced the concept of bipolar fuzzy sets as a generalization of fuzzy sets in 1994. The author Mourad Oqla [6] commenced the concept of an intuitionistic anti M fuzzy group. Chakrabarthy and R.Nanda [1] investicated note on union and intersection of intuitionistic fuzzy sets. P.S. Das, A. Rajeshkumar [2,3] were analyzed fuzzy groups and level subgroups. R. Muthuraj [8,9] introduced the concept of bipolar fuzzy subgroup of a M fuzzy group and bipolar anti M fuzzy group. He was introduced the notion of an image and pre-image of a bipolar fuzzy subset of a bipolar fuzzy subgroup of a group and also discuss some of its properties of bipolar M fuzzy subgroup under M homomorphism and M anti homomorphism. We discuss some of its properties with bipolar intuitionistic M fuzzy subgroup of M fuzzy group and anti M fuzzy group are established under M homomorphism and M anti homomorphism.

II. Preliminaries

In this paper $G = (G,*)$ is a finite groups, e is the identity element of G, and xy mean x*y the fundamental definitions that will be used in the sequel.

Definition.2.1 Let G be a non empty set, A bipolar intuitionistic fuzzy set (IFS) A in G is an object of the form $A = \{x, \mu_A^+(x), \mu_A^-(x), \upsilon_A^+(x), \upsilon_A^-(x) / x \in G\}$ where $\mu_A^+ : G \to [0,1]$ and $\upsilon_A^+ : G \to [0,1]$, $\mu_A^- : G \to [-1,0]$ and $\upsilon_A^- : G \to [-1,0]$ is called degree of positive membership, degree of negative membership and the degree of positive non membership, degree of negative non membership respectively.

Definition.2.2 [8] Let G be a group. A bipolar valued intuitionistic fuzzy set (IFS) A of G is called a bipolar intuitionistic fuzzy subgroup of G, if for all x, y$\in$G

i) $\mu_A^+(xy) \geq \min(\mu_A^+(x), \mu_A^+(y))$ and $\upsilon_A^+(xy) \leq \max(\upsilon_A^+(x), \upsilon_A^+(y))$

ii) $\mu_A^-(xy) \leq \max(\mu_A^-(x), \mu_A^-(y))$ and $\upsilon_A^-(xy) \geq \min(\upsilon_A^-(x), \upsilon_A^-(y))$

iii) $\mu_A^+(x^{-1}) = \mu_A^+(x), \mu_A^-(x^{-1}) = \mu_A^-(x)$ and $\upsilon_A^+(x^{-1}) = \upsilon_A^+(x), \upsilon_A^-(x^{-1}) = \upsilon_A^-(x)$.

Example.2.3

$$\mu_A^+(x)=\begin{cases}0.7\ if\ \ x=1\\0.6\ if\ x=-1\\0.4\ if\ x=i,-i\end{cases};\ \upsilon_A^+(x)=\begin{cases}0.2\ if\ \ x=1\\0.3\ if\ x=-1\\0.5\ if\ x=i,-i\end{cases}\ \text{and}\ \ \mu_A^-(x)=\begin{cases}-0.8\ if\ \ x=1\\-0.5\ if\ x=-1\\-0.3\ if\ x=i,-i\end{cases};\ \upsilon_A^-(x)=\begin{cases}-0.1\ if\ \ x=1\\-0.4\ if\ x=-1\\-0.6\ if\ x=i,-i\end{cases}$$

Definition.2.4 [7] Let G be a group. A bipolar valued IFS (or) bipolar IFS A of G is called a bipolar intuitionistic anti fuzzy subgroup of G, if for all x, y $\in$ G

i) $\mu_A^+(xy)\le\max(\mu_A^+(x),\mu_A^+(y))$ and $\upsilon_A^+(xy)\ge\min(\upsilon_A^+(x),\upsilon_A^+(y))$

ii) $\mu_A^-(xy)\ge\min(\mu_A^-(x),\mu_A^-(y))$ and $\upsilon_A^-(xy)\le\max(\upsilon_A^-(x),\upsilon_A^-(y))$

iii) $\mu_A^+(x^{-1})=\mu_A^+(x),\mu_A^-(x^{-1})=\mu_A^-(x)$ and $\upsilon_A^+(x^{-1})=\upsilon_A^+(x),\upsilon_A^-(x^{-1})=\upsilon_A^-(x)$.

Example.2.5

$$\mu_A^+(x)=\begin{cases}0.4\ if\ \ x=1\\0.6\ if\ x=-1\\0.7\ if\ x=i,-i\end{cases};\ \upsilon_A^+(x)=\begin{cases}0.5\ if\ \ x=1\\0.3\ if\ x=-1\\0.2\ if\ x=i,-i\end{cases}\ \text{and}\ \ \mu_A^-(x)=\begin{cases}-0.3\ if\ \ x=1\\-0.5\ if\ x=-1\\-0.8\ if\ x=i,-i\end{cases};\ \upsilon_A^-(x)=\begin{cases}-0.6\ if\ \ x=1\\-0.4\ if\ x=-1\\-0.1\ if\ x=i,-i\end{cases}$$

Definition.2.6 Let G be an M group and A be a bipolar intuitionistic fuzzy subgroup of G, then A is called a bipolar intuitionistic M fuzzy group of G, if for all x $\in$ G and m $\in$ M then,

i) $\mu_A^+(mx)\ge\mu_A^+(x)$ and $\upsilon_A^+(mx)\le\upsilon_A^+(x)$. ii) $\mu_A^-(mx)\le\mu_A^-(x)$ and $\upsilon_A^-(mx)\ge\upsilon_A^-(x)$.

Example.2.7

Consider $1\in M$

$$\mu_A^+(x)=\begin{cases}0.7\ if\ \ x=1\\0.6\ if\ x=-1\\0.4\ if\ x=i,-i\end{cases};\ \upsilon_A^+(x)=\begin{cases}0.2\ if\ \ x=1\\0.3\ if\ x=-1\\0.5\ if\ x=i,-i\end{cases}\ \text{and}\ \ \mu_A^-(x)=\begin{cases}-0.8\ if\ \ x=1\\-0.5\ if\ x=-1\\-0.3\ if\ x=i,-i\end{cases};\ \upsilon_A^-(x)=\begin{cases}-0.1\ if\ \ x=1\\-0.4\ if\ x=-1\\-0.6\ if\ x=i,-i\end{cases}$$

Definition.2.8 Let G be an M group and A be a bipolar intuitionistic anti fuzzy subgroup of G, then A is called a bipolar intuitionistic anti M fuzzy group of G, if for all $x\in G$ and m $\in$ M then,

i) $\mu_A^+(mx)\le\mu_A^+(x)$ and $\upsilon_A^+(mx)\ge\upsilon_A^+(x)$. ii) $\mu_A^-(mx)\ge\mu_A^-(x)$ and $\upsilon_A^-(mx)\le\upsilon_A^-(x)$.

Example.2.9

Consider $1\in M$

$$\mu_A^+(x)=\begin{cases}0.4\ if\ \ x=1\\0.6\ if\ x=-1\\0.7\ if\ x=i,-i\end{cases};\ \upsilon_A^+(x)=\begin{cases}0.5\ if\ \ x=1\\0.3\ if\ x=-1\\0.2\ if\ x=i,-i\end{cases}\ \text{and}\ \ \mu_A^-(x)=\begin{cases}-0.3\ if\ \ x=1\\-0.5\ if\ x=-1\\-0.8\ if\ x=i,-i\end{cases};\ \upsilon_A^-(x)=\begin{cases}-0.6\ if\ \ x=1\\-0.4\ if\ x=-1\\-0.1\ if\ x=i,-i\end{cases}$$

Theorem.2.10 If A and B are bipolar intuitionistic M fuzzy group of G, then $A\cap B$ is a bipolar intuitionistic M fuzzy group of G.

Proof Consider $m\in M$ and $x\in A\cap B$ implies $x\in A, x\in B$

Consider $\mu^{+}_{A\cap B}(mx) = \min(\mu^{+}_{A}(mx), \mu^{+}_{B}(mx)) \geq \min(\mu^{+}_{A}(x), \mu^{+}_{B}(x)) = \mu^{+}_{A\cap B}(x).$

Therefore $\mu^{+}_{A\cap B}(mx) \geq \mu^{+}_{A\cap B}(x).$

Consider $\upsilon^{+}_{A\cap B}(mx) = \max(\upsilon^{+}_{A}(mx), \upsilon^{+}_{B}(mx)) \leq \max(\upsilon^{+}_{A}(x), \upsilon^{+}_{B}(x)) = \upsilon^{+}_{A\cap B}(x).$

Therefore $\upsilon^{+}_{A\cap B}(mx) \leq \upsilon^{+}_{A\cap B}(x).$

Consider $\mu^{-}_{A\cap B}(mx) = \max(\mu^{-}_{A}(mx), \mu^{-}_{B}(mx)) \leq \max(\mu^{-}_{A}(x), \mu^{-}_{B}(x)) = \mu^{-}_{A\cap B}(x).$

Therefore $\mu^{-}_{A\cap B}(mx) \leq \mu^{-}_{A\cap B}(x).$

Consider $\upsilon^{-}_{A\cap B}(mx) = \min(\upsilon^{-}_{A}(mx), \upsilon^{-}_{B}(mx)) \geq \min(\upsilon^{-}_{A}(x), \upsilon^{-}_{B}(x)) = \upsilon^{-}_{A\cap B}(x).$

Therefore $\upsilon^{-}_{A\cap B}(mx) \geq \upsilon^{-}_{A\cap B}(x).$

Therefore $A\cap B$ is a bipolar intuitionistic M fuzzy group of G

Theorem.2.11 If A is a bipolar intuitionistic M fuzzy group of G, then $\overline{\overline{A}} = A$ is also a bipolar intuitionistic M fuzzy group of G.

Proof Let $m \in M$ and $x \in A$

Consider $\mu^{+}_{\overline{\overline{A}}}(mx) = \upsilon^{+}_{\overline{A}}(mx) = \mu^{+}_{A}(mx) \geq \mu^{+}_{A}(x)$. Therefore $\mu^{+}_{\overline{\overline{A}}}(mx) \geq \mu^{+}_{A}(x).$

Consider $\upsilon^{+}_{\overline{\overline{A}}}(mx) = \mu^{+}_{\overline{A}}(mx) = \upsilon^{+}_{A}(mx) \leq \upsilon^{+}_{A}(x)$. Therefore $\upsilon^{+}_{\overline{\overline{A}}}(mx) \leq \upsilon^{+}_{A}(x).$

Consider $\mu^{-}_{\overline{\overline{A}}}(mx) = \upsilon^{-}_{\overline{A}}(mx) = \mu^{-}_{A}(mx) \leq \mu^{-}_{A}(x)$. Therefore $\mu^{-}_{\overline{\overline{A}}}(mx) \leq \mu^{-}_{A}(x).$

Consider $\upsilon^{-}_{\overline{\overline{A}}}(mx) = \mu^{-}_{\overline{A}}(mx) = \upsilon^{-}_{A}(mx) \geq \upsilon^{-}_{A}(x)$. Therefore $\upsilon^{-}_{\overline{\overline{A}}}(mx) \geq \upsilon^{-}_{A}(x).$

Therefore $\overline{\overline{A}} = A$ is a bipolar intuitionistic M fuzzy group of G.

Theorem.2.12 Union of any two bipolar intuitionistic M fuzzy group is also a bipolar intuitionistic M fuzzy group if either is contained in the other.

Proof Let A and B be a bipolar intuitionistic M fuzzy group of G .

To prove that $A\cup B$ is a bipolar intuitionistic M fuzzy group of G if $A \subseteq B\,(or)\,B \subseteq A$

If $A \subseteq B \Rightarrow A\cup B = B$ (or) $B \subseteq A \Rightarrow A\cup B = A$

Let $m \in M$ & $x \in A\cup B$

Consider $\mu^{+}_{A\cup B}(mx) = \max(\mu^{+}_{A}(mx), \mu^{+}_{B}(mx)) \geq \max(\mu^{+}_{A}(x), \mu^{+}_{B}(x)) = \mu^{+}_{A\cup B}(x).$

Therefore $\mu^{+}_{A\cup B}(mx) \geq \mu^{+}_{A\cup B}(x).$

Consider $\upsilon^{+}_{A\cup B}(mx) = \min(\upsilon^{+}_{A}(mx), \upsilon^{+}_{B}(mx)) \leq \min(\upsilon^{+}_{A}(x), \upsilon^{+}_{B}(x)) = \upsilon^{+}_{A\cup B}(x).$

Therefore $\upsilon^{+}_{A\cup B}(mx) \leq \upsilon^{+}_{A\cup B}(x).$

Consider $\mu^{-}_{A\cup B}(mx) = \min(\mu^{-}_{A}(mx), \mu^{-}_{B}(mx)) \leq \min(\mu^{-}_{A}(x), \mu^{-}_{B}(x)) = \mu^{-}_{A\cup B}(x).$

Therefore $\mu^{-}_{A\cup B}(mx) \leq \mu^{-}_{A\cup B}(x).$

Consider $\upsilon^{-}_{A\cup B}(mx) = \max(\upsilon^{-}_{A}(mx), \upsilon^{-}_{B}(mx)) \geq \max(\upsilon^{-}_{A}(x), \upsilon^{-}_{B}(x)) = \upsilon^{-}_{A\cup B}(x).$

Therefore $\upsilon^{-}_{A\cup B}(mx) \geq \upsilon^{-}_{A\cup B}(x).$

Hence union of any two bipolar intuitionistic M fuzzy group is also a bipolar intuitionistic M fuzzy group if either is contained in the other.

Theorem.2.13 If A is a bipolar intuitionistic anti M fuzzy group of G, then $\overline{\overline{A}} = A$ is also a bipolar intuitionistic anti M fuzzy group of G.

Proof Consider $m \in M \text{ and } x \in A$

Consider $\mu^{+}_{\overline{\overline{A}}}(mx) = \upsilon^{+}_{\overline{A}}(mx) = \mu^{+}_{A}(mx) \leq \mu^{+}_{A}(x).$ Therefore $\mu^{+}_{\overline{\overline{A}}}(mx) \leq \mu^{+}_{A}(x).$

Consider $\upsilon^{+}_{\overline{\overline{A}}}(mx) = \mu^{+}_{\overline{A}}(mx) = \upsilon^{+}_{A}(mx) \geq \upsilon^{+}_{A}(x).$ Therefore $\upsilon^{+}_{\overline{\overline{A}}}(mx) \geq \upsilon^{+}_{A}(x).$

Consider $\mu^{-}_{\overline{\overline{A}}}(mx) = \upsilon^{-}_{\overline{A}}(mx) = \mu^{-}_{A}(mx) \geq \mu^{-}_{A}(x).$ Therefore $\mu^{-}_{\overline{\overline{A}}}(mx) \geq \mu^{-}_{A}(x).$

Consider $\upsilon^{-}_{\overline{\overline{A}}}(mx) = \mu^{-}_{\overline{A}}(mx) = \upsilon^{-}_{A}(mx) \leq \upsilon^{-}_{A}(x).$ Therefore $\upsilon^{-}_{\overline{\overline{A}}}(mx) \leq \upsilon^{-}_{A}(x).$

Therefore $\overline{\overline{A}} = A$ is a bipolar intuitionistic anti M fuzzy group of G.

Theorem.2.14 Union of any two bipolar intuitionistic anti M fuzzy group is also a bipolar intuitionistic anti M fuzzy group if either is contained in the other.

Proof Let A and B be a bipolar intuitionistic anti M fuzzy group of G. To prove that $A \cup B$ is also a bipolar intuitionistic anti M fuzzy group of G if $A \subseteq B\,(or)\,B \subseteq A$

If $A \subseteq B \Rightarrow A \cup B = B \,(or)\, B \subseteq A \Rightarrow A \cup B = A.$

Consider $m \in M \text{ and } x \in A \cup B.$

Consider $\mu^{+}_{A\cup B}(mx) = \max(\mu^{+}_{A}(mx), \mu^{+}_{B}(mx)) \leq \max(\mu^{+}_{A}(x), \mu^{+}_{B}(x)) = \mu^{+}_{A\cup B}(x).$

Therefore $\mu^{+}_{A\cup B}(mx) \leq \mu^{+}_{A\cup B}(x).$

Consider $\upsilon^{+}_{A\cup B}(mx) = \min(\upsilon^{+}_{A}(mx), \upsilon^{+}_{B}(mx)) \geq \min(\upsilon^{+}_{A}(x), \upsilon^{+}_{B}(x)) = \upsilon^{+}_{A\cup B}(x).$

Therefore $\upsilon^{+}_{A\cup B}(mx) \geq \upsilon^{+}_{A\cup B}(x).$

Consider $\mu^{-}_{A\cup B}(mx) = \min(\mu^{-}_{A}(mx), \mu^{-}_{B}(mx)) \geq \min(\mu^{-}_{A}(x), \mu^{-}_{B}(x)) = \mu^{-}_{A\cup B}(x).$

Therefore $\mu^{-}_{A\cup B}(mx) \geq \mu^{-}_{A\cup B}(x).$

Consider $\upsilon^{-}_{A\cup B}(mx) = \max(\upsilon^{-}_{A}(mx), \upsilon^{-}_{B}(mx)) \leq \max(\upsilon^{-}_{A}(x), \upsilon^{-}_{B}(x)) = \upsilon^{-}_{A\cup B}(x).$

Therefore $\upsilon^{-}_{A\cup B}(mx) \leq \upsilon^{-}_{A\cup B}(x).$

Therefore union of any two bipolar intuitionistic anti M fuzzy group is also a bipolar intuitionistic anti M fuzzy group if either is contained in the other.

III. Some Result Based On Bipolar Intuitionistic M Fuzzy Group And Anti M Fuzzy Group Of G.

Theorem.3.1 Let μ and υ be a bipolar intuitionistic fuzzy subset of an M fuzzy group then $\mu = (\mu^+, \mu^-)$ is a bipolar intuitionistic M fuzzy group of G if and only if $\upsilon = (\upsilon^+, \upsilon^-)$ is a bipolar intuitionistic anti M fuzzy group of G.

Proof Let $\mu = (\mu^+, \mu^-)$ be a bipolar intuitionistic M fuzzy group of G. To prove $\upsilon = (\upsilon^+, \upsilon^-)$ is a bipolar intuitionistic anti M fuzzy group of G.

i) $\mu^+(xy) \geq \min\{\mu^+(x), \mu^+(y)\} \Leftrightarrow 1-\upsilon^+(xy) \geq \min\{1-\upsilon^+(x), 1-\upsilon^+(y)\}$

$\Leftrightarrow \upsilon^+(xy) \leq 1-\min\{1-\upsilon^+(x), 1-\upsilon^+(y)\}$

$\Leftrightarrow \upsilon^+(xy) \leq \max\{\upsilon^+(x), \upsilon^+(y)\}.$

Therefore $\mu^+(xy) \geq \min\{\mu^+(x), \mu^+(y)\} \Leftrightarrow \upsilon^+(xy) \leq \max\{\upsilon^+(x), \upsilon^+(y)\}.$

ii) $\mu^-(xy) \leq \max\{\mu^-(x), \mu^-(y)\} \Leftrightarrow -1-\upsilon^-(xy) \leq \max\{-1-\upsilon^-(x), -1-\upsilon^-(y)\}$

$\Leftrightarrow \upsilon^-(xy) \geq -1-\max\{-1-\upsilon^-(x), -1-\upsilon^-(y)\}$

$\Leftrightarrow \upsilon^-(xy) \geq \min\{\upsilon^-(x), \upsilon^-(y)\}.$

Therefore $\mu^-(xy) \leq \max\{\mu^-(x), \mu^-(y)\} \Leftrightarrow \upsilon^-(xy) \geq \min\{\upsilon^-(x), \upsilon^-(y)\}.$

iii) $\mu^+(x^{-1}) = \mu^+(x) \Leftrightarrow 1-\upsilon^+(x^{-1}) = 1-\upsilon^+(x) \Leftrightarrow \upsilon^+(x^{-1}) = \upsilon^+(x).$ and

$\mu^-(x^{-1}) = \mu^-(x) \Leftrightarrow -1-\upsilon^-(x^{-1}) = -1-\upsilon^-(x) \Leftrightarrow \upsilon^-(x^{-1}) = \upsilon^-(x).$

iv) $\mu^+(mx) \geq \mu^+(x) \Leftrightarrow 1-\mu^+(mx) \leq 1-\mu^+(x) \Leftrightarrow \upsilon^+(mx) \leq \upsilon^+(x).$

Therefore $\mu^+(mx) \geq \mu^+(x)$ and $\upsilon^+(mx) \leq \upsilon^+(x).$

v) $\mu^-(mx) \leq \mu^-(x) \Leftrightarrow -1-\mu^-(mx) \geq -1-\mu^-(x) \Leftrightarrow \upsilon^-(mx) \geq \upsilon^-(x).$

Therefore $\mu^-(mx) \leq \mu^-(x)$ and $\upsilon^-(mx) \geq \upsilon^-(x).$

Therefore $\mu = (\mu^+, \mu^-)$ is a bipolar intuitionistic M fuzzy group of G if and only if $\upsilon = (\upsilon^+, \upsilon^-)$ is a bipolar intuitionistic anti M fuzzy group of G.

Definition.3.2 [9] Let f and g be a mapping from a group G_1 to a group G_2. Let $\mu = (\mu^+, \mu^-)$ and $\phi = (\phi^+, \phi^-)$ and $\upsilon = (\upsilon^+, \upsilon^-)$, $\psi = (\psi^+, \psi^-)$ are bipolar intuitionistic fuzzy subset in G_1 and G_2 respectively, then the image $f(\mu)$ and $g(\upsilon)$ is a bipolar intuitionistic fuzzy subset is defined by $f(\mu) = (f(\mu)^+, f(\mu)^-)$ and $g(\upsilon) = (g(\upsilon)^+, g(\upsilon)^-)$ of G_2 for all u, v$\in G_2$.

$f(\mu^{+})(u)=\max\{\mu^{+}(x);x\in f^{-1}(u)\}$ if $f^{-1}(u)\neq\varphi,0$ and $g(\upsilon^{+})(v)=\min\{\upsilon^{+}(x);x\in g^{-1}(v)\}$ if $g^{-1}(v)\neq\varphi,0$ and $f(\mu^{-})(u)=\min\{\mu^{-}(x);\ x\in f^{-1}(u)\}$, if $f^{-1}(u)\neq\varphi,0$ $g(\upsilon^{-})(v)=\max\{\upsilon^{-}(x);$ $x\in g^{-1}(v)\}$ if $g^{-1}(v)\neq\varphi,0$. The preimage $f^{-1}(\phi)$ is under f and $g^{-1}(\psi)$ is under g is defined by the bipolar intuitionistic fuzzy subset of G_1 for all $x\in G_1$, $(f^{-1}(\phi)^{+})(x)=\phi^{+}(f(x));$ $(f^{-1}(\phi)^{-})(x)=\phi^{-}(f(x))$ and $(g^{-1}(\psi)^{+})(x)=\psi^{+}(g(x));$ $(g^{-1}(\psi)^{-})(x)=\psi^{-}(g(x))$.

Definition.3.3 [8] Let G_1 and G_2 be any two bipolar intuitionistic M groups then the function f: $G_1\rightarrow G_2$ and g: $G_1\rightarrow G_2$ is said to be an intuitionistic M homomorphism if,

i) f (xy) = f(x) f(y) for all $x,y\in G_1$
ii) f (mx) = m f(x) for all $m\in M$ and $x\in G_1$
iii) g (xy) = g(x) g(y) for all $x,y\in G_1$
iv) g (mx) = m g(x) for all $m\in M$ and $x\in G_1$.

Definition.3.4 [8] Let G_1 and G_2 be any two bipolar intuitionistic M groups (not necessarily commutative) then the function $f:G_1\rightarrow G_2$ and g: $G_1\rightarrow G_2$ is said to be an intuitionistic M anti homomorphism if ,

i) f (xy) = f(x) f(y) for all $x,y\in G_1$
ii) f (mx) = m f(x) for all $m\in M$ and $x\in G_1$
iii) g (xy) = g(x) g(y) for all $x,y\in G_1$
iv) g (mx) = m g(x) for all $m\in M$ and $x\in G_1$.

Theorem.3.5 Let f and g be an intuitionistic M homomorphism from an M fuzzy group of G_1 onto an M fuzzy group of G_2. If $\mu=(\mu^{+},\mu^{-})$ is a bipolar intuitionistic M fuzzy group of G_1 then $f(\mu)$ the image of μ under f is a bipolar intuitionistic M fuzzy group of G_2 if and only if $\upsilon=(\upsilon^{+},\upsilon^{-})$ is a bipolar intuitionistic anti M fuzzy group of G_1 then $g(\upsilon)$ is the image of υ under g is a bipolar intuitionistic anti M fuzzy group of G_2.

Proof Let $f:G_1\rightarrow G_2$ and $g:G_1\rightarrow G_2$ be an intuitionistic M homomorphism.

Let $\mu=(\mu^{+},\mu^{-})$ and $\upsilon=(\upsilon^{+},\upsilon^{-})$ is a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group of G_1. To prove a bipolar intuitionistic fuzzy subset $f(\mu)=(f(\mu)^{+},f(\mu)^{-})$ and $g(\upsilon)=(g(\upsilon)^{+},g(\upsilon)^{-})$ on G_2 is a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group.

Let $u,v\in G_2$ since f is a intuitionistic M homomorphism and so there exist $x,y\in G_1$ such that f(x)=u & f(y)=v it follows that $xy\in f^{-1}(uv)$. We have to prove that g is an intuitionistic M homomorphism so there exist $x,y\in G_1$ such that g(x)=u & g(y)=v it follows that $xy\in g^{-1}(uv)$.

i) $f(\mu)^{+}(uv) = \max\{\mu^{+}(z) : z = xy \in f^{-1}(uv)\}$

$\geq \max\{\min\{\mu^{+}(x), \mu^{+}(y)\} : x \in f^{-1}(u), y \in f^{-1}(v)\}$

$= \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}.$

Therefore $f(\mu)^{+}(uv) \geq \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}$

$\Leftrightarrow 1 - g(\upsilon)^{+}(uv) \geq \min\{(1-g(\upsilon)^{+})(u), (1-g(\upsilon)^{+})(v)\}$

$\Leftrightarrow g(\upsilon)^{+}(uv) \leq 1 - \min\{(1-g(\upsilon)^{+})(u), (1-g(\upsilon)^{+})(v)\}$

$\Leftrightarrow g(\upsilon)^{+}(uv) \leq \max\{g(\upsilon)^{+}(u), g(\upsilon)^{+}(v)\}.$

Hence $f(\mu)^{+}(uv) \geq \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}$

$\Leftrightarrow g(\upsilon)^{+}(uv) \leq \max\{g(\upsilon)^{+}(u), g(\upsilon)^{+}(v)\}.$

ii) $f(\mu)^{-}(uv) = \max\{\mu^{-}(z) : z = xy \in f^{-1}(uv)\}$

$\leq \max\{\max\{\mu^{-}(x), \mu^{-}(y)\} : x \in f^{-1}(u), y \in f^{-1}(v)\}$

$= \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}.$

Therefore $f(\mu)^{-}(uv) \leq \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}$

$\Leftrightarrow (-1 - g(\upsilon)^{-})(uv) \leq \max\{(-1-g(\upsilon)^{-})(u), (-1-g(\upsilon)^{-})(v)\}$

$\Leftrightarrow g(\upsilon)^{-}(uv) \geq -1 - \max\{(-1-g(\upsilon)^{-})(u), (-1-g(\upsilon)^{-})(v)\}$

$\Leftrightarrow g(\upsilon)^{-}(uv) \geq \min\{g(\upsilon)^{-}(u), g(\upsilon)^{-}(v)\}.$

Hence $f(\mu)^{-}(uv) \leq \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}$

$\Leftrightarrow g(\upsilon)^{-}(uv) \geq \min\{g(\upsilon)^{-}(u), g(\upsilon)^{-}(v)\}.$

iii) Now $f(\mu)^{+}(u^{-1}) = \max\{\mu^{+}(x) : x \in f^{-1}(u^{-1})\} = \max\{\mu^{+}(x^{-1}) : x^{-1} \in f^{-1}(u)\}$

$= f(\mu)^{+}(u)$

Therefore $f(\mu)^{+}(u^{-1}) = f(\mu)^{+}(u) \Leftrightarrow (1-g(\upsilon)^{+})(u^{-1}) = (1-g(\upsilon)^{+})(u)$

$\Leftrightarrow g(\upsilon)^{+}(u^{-1}) = g(\upsilon)^{+}(u).$

Hence $f(\mu)^{+}(u^{-1}) = (f(\mu)^{+}(u) \Leftrightarrow g(\upsilon)^{+}(u^{-1}) = g(\upsilon)^{+}(u).$

iv) $f(\mu)^{-}(u^{-1}) = \min\{\mu^{-}(x) : x \in f^{-1}(u^{-1})\} = \min\{\mu^{-}(x^{-1}) : x^{-1} \in f^{-1}(u)\}$

$= f(\mu)^{-}(u).$

Therefore $f(\mu)^{-}(u^{-1}) = f(\mu)^{-}(u) \Leftrightarrow (-1-g(\upsilon)^{-})(u^{-1}) = (-1-g(\upsilon)^{-})(u)$

$\Leftrightarrow g(\upsilon)^{-}(u^{-1}) = g(\upsilon)^{-}(u).$

Hence $f(\mu)^{-}(u^{-1}) = f(\mu)^{-}(u) \Leftrightarrow g(\upsilon)^{-}(u^{-1}) = g(\upsilon)^{-}(u)$

Therefore $f(\mu)$ and $g(\upsilon)$ is a bipolar fuzzy subgroup of G_2.

v) Let $m \in M$ and $u \in G_2$,

$$f(\mu)^{+}(mu) \geq \max\{\mu^{+}(x) : x \in f^{-1}(u)\} = f(\mu^{+})(u).$$

Therefore $f(\mu)^{+}(mu) \geq f(\mu)^{+}(u) \Leftrightarrow (1 - g(\upsilon)^{+})(mu) \geq (1 - g(\upsilon)^{+})(u)$

$\Leftrightarrow g(\upsilon)^{+}(mu) \leq g(\upsilon)^{+}(u).$

Hence $f(\mu)^{+}(mu) \geq f(\mu)^{+}(u) \Leftrightarrow g(\upsilon)^{+}(mu) \leq g(\upsilon)^{+}(u).$

vi) $f(\mu)^{-}(mu) \leq \min\{\mu^{-}(x) : x \in f^{-1}(u)\} = f(\mu^{-})(u).$

Therefore $f(\mu)^{-}(mu) \leq f(\mu)^{-}(u) \Leftrightarrow (-1 - g(\upsilon)^{-})(mu) \leq (-1 - g(\upsilon)^{-})(u)$

$\Leftrightarrow g(\upsilon)^{-}(mu) \geq g(\upsilon)^{-}(u).$

Hence $f(\mu)^{-}(mu) \leq f(\mu)^{-}(u) \Leftrightarrow g(\upsilon)^{-}(mu) \geq g(\upsilon)^{-}(u).$

Therefore if μ be a bipolar intuitionistic M fuzzy group of G_1 then $f(\mu)$ is a bipolar intuitionistic M fuzzy group of G_2 if and only if υ be a bipolar intuitionistic anti M fuzzy group of G_1 then $g(\upsilon)$ be a bipolar intuitionistic anti M fuzzy group of G_2.

Theorem.3.6 The M homomorphic preimage of a bipolar intuitionistic M fuzzy group of G_2 is a bipolar intuitionistic M fuzzy group of G_1 if and only if M homomorphic preimage of a bipolar intuitionistic anti M fuzzy group of G_2 is a bipolar intuitionistic anti M fuzzy group of G_1.

Proof Let $f : G_1 \to G_2$ and $g : G_1 \to G_2$ be an intuitionistic M homomorphism. let $\phi = (\phi^{+}, \phi^{-})$ is a bipolar intuitionistic M fuzzy group of G_2 and $\psi = (\psi^{+}, \psi^{-})$ is a bipolar intuitionistic anti M fuzzy group of G_2 ,to prove a bipolar fuzzy subset $\mu = (\mu^{+}, \mu^{-})$ and $\upsilon = (\upsilon^{+}, \upsilon^{-})$ on G_1 is a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group where $\mu = f^{-1}(\phi)$ & $\upsilon = g^{-1}(\psi)$

i) Consider $x,y \in G_1$

$$\begin{aligned}(f^{-1}(\phi))^{+}(xy) &= \phi^{+}(f(xy)) \\ &\geq \min\{\phi^{+}(f(x)), \phi^{+}(f(y))\} \\ &= \min\{(f^{-1}(\phi))^{+}(x), (f^{-1}(\phi))^{+}(y)\}.\end{aligned}$$

Therefore $(f^{-1}(\phi))^{+}(xy) \geq \min\{(f^{-1}(\phi))^{+}(x), (f^{-1}(\phi))^{+}(y)\}.$

$$\Leftrightarrow (g^{-1}(\psi))^{+}(xy) = \psi^{+}(g(xy)) \leq \max\{\psi^{+}(g(x)), \psi^{+}(g(y))\}$$
$$= \max\{(g^{-1}(\psi))^{+}(x), (g^{-1}(\psi))^{+}(y)\}.$$

Hence $(f^{-1}(\phi))^{+}(xy) \geq \min\{(f^{-1}(\phi))^{+}(x), (f^{-1}(\phi))^{+}(y)$

$$\Leftrightarrow (g^{-1}(\psi))^{+}(xy) \leq \max\{(g^{-1}(\psi))^{+}(x), (g^{-1}(\psi))^{+}(y)\}.$$

ii) Let $x, y \in G_1$ $(f^{-1}(\phi))^{-}(xy) = \phi^{-}(f(xy)) \leq \max\{\phi^{-}(f(x)), \phi^{-}(f(y))\}$

$$= \max\{(f^{-1}(\phi))^{-}(x), (f^{-1}(\phi))^{-}(y)\}.$$

Therefore $(f^{-1}(\phi))^{-}(xy) \leq \max\{(f^{-1}(\phi))^{-}(x), (f^{-1}(\phi))^{-}(y)\}$

$$\Leftrightarrow (g^{-1}(\psi))^{-}(xy) = \psi^{-}(g(xy))$$
$$\geq \min\{\psi^{-}(g(x)), \psi^{-}(g(y))\}$$
$$= \min\{(g^{-1}(\psi))^{-}(x), (g^{-1}(\psi))^{-}(y)\}.$$

Hence $(f^{-1}(\phi))^{-}(xy) \leq \max\{(f^{-1}(\phi))^{-}(x), (f^{-1}(\phi))^{-}(y)$

$$\Leftrightarrow (g^{-1}(\psi))^{-}(xy) \geq \min\{(g^{-1}(\psi))^{-}(x), (g^{-1}(\psi))^{-}(y)\}$$

iii) Consider $x \in G_1$

$$(f^{-1}(\phi))^{+}(x^{-1})) = \phi^{+}(f(x^{-1}))$$
$= \phi^{+}(f(x))$ as ϕ is a bipolar M fuzzy group
$$= (f^{-1}(\phi))^{+}(x).$$

Therefore $(f^{-1}(\phi))^{+}(x^{-1}) = (f^{-1}(\phi))^{+}(x)$

$$\Leftrightarrow (g^{-1}(\psi))^{+}(x^{-1}) = \psi^{+}(g(x^{-1}))$$
$= \psi^{+}(g(x)^{-1})$ as g is an M homomorphism
$= \psi^{+}(g(x))$ as ψ is a bipolar anti M fuzzy group
$$= (g^{-1}(\psi))^{+}(x).$$

Hence $(f^{-1}(\phi))^{+}(x^{-1}) = (f^{-1}(\phi))^{+}(x) \Leftrightarrow (g^{-1}(\psi))^{+}(x^{-1}) = (g^{-1}(\psi))^{+}(x)$.

iv) $(f^{-1}(\phi))^{-}(x^{-1})) = \phi^{-}(f(x^{-1}))$

$= \phi^{-}(f(x))$ as ϕ is a bipolar M fuzzy group
$$= (f^{-1}(\phi))^{-}(x).$$

Therefore $(f^{-1}(\phi))^{-}(x^{-1}) = (f^{-1}(\phi))^{-}(x)$

$\Leftrightarrow (g^{-1}(\psi))^{-}(x^{-1}) = \psi^{-}(g(x^{-1}))$

$= \psi^{-}(g(x)^{-1})$ as g is an M homomorphism

$=\psi^{-}(g(x))$ as ψ is a bipolar anti M fuzzy group

$= (g^{-1}(\psi))^{-}(x)$.

Hence $(f^{-1}(\phi))^{-}(x^{-1}) = (f^{-1}(\phi))^{-}(x) \Leftrightarrow (g^{-1}(\psi))^{-}(x^{-1}) = (g^{-1}(\psi))^{-}(x)$.

v) $(f^{-1}(\phi))^{+}(mx) = \phi^{+}(f(mx))$

$\geq \phi^{+}(f(x))$ as ϕ is bipolar M fuzzy group

$= (f^{-1}(\phi))^{+}(x)$.

Therefore $(f^{-1}(\phi))^{+}(mx) \geq (f^{-1}(\phi))^{+}(x)$

$\Leftrightarrow (g^{-1}(\psi))^{+}(mx) = \psi^{+}(g(mx))$

$= \psi^{+}(m\,g(x))$ as g is an M homomorphism

$\leq \psi^{+}(g(x))$ as ψ is a bipolar anti M fuzzy group

$=(g^{-1}(\psi))^{+}(x)$.

Hence $(f^{-1}(\phi))^{+}(mx) \geq (f^{-1}(\phi))^{+}(x) \Leftrightarrow (g^{-1}(\psi))^{+}(mx) \leq (g^{-1}(\psi))^{+}(x)$.

vi) $(f^{-1}(\phi))^{-}(mx) = \phi^{-}(f(mx))$

$\leq \phi^{-}(f(x))$ as ϕ is bipolar M fuzzy group

$= (f^{-1}(\phi))^{-}(x)$.

Therefore $(f^{-1}(\phi))^{-}(mx) \leq (f^{-1}(\phi))^{-}(x) \Leftrightarrow (g^{-1}(\psi))^{-}(mx)$

$= \psi^{-}(g(mx))$

$= \psi^{-}(m\,g(x))$ as g is an M homomorphism

$\geq \psi^{-}(g(x))$ as ψ is a bipolar anti M fuzzy group

$=(g^{-1}(\psi))^{-}(x)$.

Hence $(f^{-1}(\phi))^{-}(mx) \leq (f^{-1}(\phi))^{+}(x) \Leftrightarrow (g^{-1}(\psi))^{-}(mx) \geq (g^{-1}(\psi))^{-}(x)$.

Hence $f^{-1}(\phi) = \mu$ is a bipolar intuitionistic M fuzzy group of G_1 and $g^{-1}(\psi) = \upsilon$ is a bipolar intuitionistic anti M fuzzy group of G_1.

Theorem.3.7 Let f and g be an intuitionistic M anti homomorphism from an M fuzzy group of G_1 onto an M fuzzy group of G_2. If $\mu = (\mu^{+}, \mu^{-})$ is a bipolar intuitionistic M fuzzy group of G_1 then $f(\mu)$ the image of μ under f is a bipolar intuitionistic M fuzzy group of G_2 if and only if

$\upsilon = (\upsilon^{+}, \upsilon^{-})$ is a bipolar intuitionistic anti M fuzzy group of G_1 then $g(\upsilon)$ the image of υ under g is a bipolar intuitionistic anti M fuzzy group of G_2.

Proof Let $f : G_1 \to G_2$ and $g : G_1 \to G_2$ be an intuitionistic M anti homomorphism and let $\mu = (\mu^{+}, \mu^{-})$ and $\upsilon = (\upsilon^{+}, \upsilon^{-})$ is a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group of G_1. $\mu^{+} : G_1 \to [0,1]$ & $\mu^{-} : G_1 \to [-1, 0]$ and $\upsilon^{+} : G_1 \to [0,1]$ & $\upsilon^{-} : G_1 \to [-1, 0]$ are mappings, to prove a bipolar intuitionistic fuzzy subset $f(\mu) = (f(\mu)^{+}, f(\mu)^{-})$ and $g(\upsilon) = (g(\upsilon)^{+}, g(\upsilon)^{-})$ on G_2 is a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group.

Let $u, v \in G_2$ since f is an intuitionistic M anti homomorphism so there exist $x, y \in G_1$ such that f (x)= u and f (y)= v, it follows that $xy \in f^{-1}(uv)$ that g is intuitionistic M anti homomorphism so there exist $x, y \in G_1$ such that g (x)=u, g (y)= v which implies $xy \in g^{-1}(uv)$

i) Let $f(\mu)^{+}(uv) \geq \max\{\mu^{+}(xy) : x \in f^{-1}(u), y \in f^{-1}(v)\}$

$$\geq \max\{\min\{\mu^{+}(x), \mu^{+}(y)\} : x \in f^{-1}(u), y \in f^{-1}(v)\}$$
$$= \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}.$$

Therefore $f(\mu)^{+}(uv) \geq \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}$

$$\Leftrightarrow (1 - g(\upsilon)^{+})(uv) \geq \min\{(1 - g(\upsilon)^{+})(u), (1 - g(\upsilon)^{+})(v)\}$$
$$\Leftrightarrow g(\upsilon)^{+}(uv) \leq 1 - \min\{(1 - g(\upsilon)^{+})(u), (1 - g(\upsilon)^{+})(v)\}$$
$$\Leftrightarrow g(\upsilon)^{+}(uv) \leq \max\{g(\upsilon)^{+}(u), g(\upsilon)^{+}(v)\}.$$

Hence $(f(\mu)^{+})(uv) \geq \min\{f(\mu)^{+}(u), f(\mu)^{+}(v)\}$

$$\Leftrightarrow g(\upsilon)^{+}(uv) \leq \max\{g(\upsilon)^{+}(u), g(\upsilon)^{+}(v)\}.$$

ii) Let $f(\mu)^{-}(uv) \leq \max\{\mu^{-}(xy) : x \in f^{-1}(u), y \in f^{-1}(v)\}$

$$\leq \max\{\max\{\mu^{-}(x), \mu^{-}(y)\} : x \in f^{-1}(u), y \in f^{-1}(v)\}$$
$$= \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}.$$

Therefore $f(\mu)^{-}(uv) \leq \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}$

$$\Leftrightarrow (-1 - g(\upsilon)^{-})(uv) \leq \max\{(-1 - g(\upsilon)^{-})(u), (-1 - g(\upsilon)^{-})(v)\}$$
$$\Leftrightarrow g(\upsilon)^{-}(uv) \geq -1 - \max\{(-1 - g(\upsilon)^{-})(u), (-1 - g(\upsilon)^{-})(v)\}$$
$$\Leftrightarrow g(\upsilon)^{-}(uv) \geq \min\{g(\upsilon)^{-}(u), g(\upsilon)^{-}(v)\}.$$

Hence $f(\mu)^{-}(uv) \leq \max\{f(\mu)^{-}(u), f(\mu)^{-}(v)\}$

$$\Leftrightarrow g(\upsilon)^{-}(uv) \geq \min\{g(\upsilon)^{-}(u), g(\upsilon)^{-}(v)\}.$$

iii) Consider $f(\mu)^{+}(u^{-1}) = \max\{\mu^{+}(x); x \in f^{-1}(u^{-1})\}$

$= \max\{\mu^{+}(x^{-1}); x^{-1} \in f^{-1}(u)\}$

$= f(\mu)^{+}(u).$

Therefore $f(\mu)^{+}(u^{-1}) = f(\mu)^{+}(u) \Leftrightarrow (1 - g(\upsilon)^{+})(u^{-1}) = (1 - g(\upsilon)^{+})(u)$

$\Leftrightarrow g(\upsilon)^{+}(u^{-1}) = g(\upsilon)^{+}(u).$

Hence $f(\mu)^{+}(u^{-1}) = f(\mu)^{+}(u) \Leftrightarrow g(\upsilon)^{+}(u^{-1}) = g(\upsilon)^{+}(u).$

iv) Consider $f(\mu)^{-}(u^{-1}) = \min\{\mu^{-}(x); x \in f^{-1}(u^{-1})\} = \min\{\mu^{-}(x^{-1}); x^{-1} \in f^{-1}(u)\}$

$= (f(\mu)^{-})(u).$

Therefore $f(\mu)^{-}(u^{-1}) = f(\mu)^{-}(u) \Leftrightarrow (-1 - g(\upsilon)^{-})(u^{-1}) = (-1 - g(\upsilon)^{-})(u)$

$\Leftrightarrow g(\upsilon)^{-}(u^{-1}) = g(\upsilon)^{-}(u).$

Hence $f(\mu)^{-}(u^{-1}) = f(\mu)^{-}(u) \Leftrightarrow g(\upsilon)^{-}(u^{-1}) = g(\upsilon)^{-}(u).$

Therefore $f(\mu)$ and $g(\upsilon)$ is a bipolar fuzzy subgroup of G_2.

v) Consider $m \in M$ and $u \in G_2$

$f(\mu)^{+}(mu) = \max\{\mu^{+}(mu); x \in f^{-1}(u)\} \geq \max\{\mu^{+}(x); x \in f^{-1}(u)\}$

$= f(\mu)^{+}(u).$

Therefore $f(\mu)^{+}(mu) \geq f(\mu)^{+}(u) \Leftrightarrow (1 - g(\upsilon)^{+})(mu) \geq (1 - g(\upsilon)^{+})(u)$

$\Leftrightarrow g(\upsilon)^{+}(mu) \leq g(\upsilon)^{+}(u).$

Hence $f(\mu)^{+}(mu) \geq f(\mu)^{+}(u) \Leftrightarrow g(\upsilon)^{+}(mu) \leq g(\upsilon)^{+}(u).$

vi) Consider $m \in M$ and $u \in G_2$

$f(\mu)^{-}(mu) = \min\{\mu^{-}(mu); x \in f^{-1}(u)\} \leq \min\{\mu^{-}(x); x \in f^{-1}(u)\}$

$= f(\mu)^{-}(u).$

Therefore $f(\mu)^{-}(mu) \leq f(\mu)^{-}(u) \Leftrightarrow (-1 - g(\upsilon)^{-})(mu) \leq (-1 - g(\upsilon)^{-})(u)$

$\Leftrightarrow g(\upsilon)^{-}(mu) \geq g(\upsilon)^{-}(u).$

Hence $f(\mu)^{-}(mu) \leq f(\mu)^{-}(u) \Leftrightarrow g(\upsilon)^{-}(mu) \geq g(\upsilon)^{-}(u).$

Hence if μ be a bipolar intuitionistic M fuzzy group of G_1 then $f(\mu)$ is a bipolar M fuzzy group of G_2 if and only if υ be a bipolar anti M fuzzy group of G_1 then $g(\upsilon)$ be a bipolar intuitionistic anti M fuzzy group of G_2.

IV. Conclusion

The concept of a bipolar intuitionistic M fuzzy group is a new algebraic structure of a bipolar intuitionistic M fuzzy subgroup of a M fuzzy group and anti M fuzzy group are defined and some related properties are investigated. The purpose of the study is to implement the fuzzy set theory and group theory of bipolar intuitionistic M fuzzy subgroup of a M fuzzy group and anti M fuzzy group. The relation between of a bipolar intuitionistic M fuzzy group and bipolar intuitionistic anti M fuzzy group are established. We hope that our results can also be extended to other algebraic system.

References

[1]. K. Chakrabarthy, Biswas R. Nanda, A note on union and intersection of intuitionistic fuzzy sets, *Notes on intuitionistic fuzzy sets, 3(4)*, 1997.
[2]. P.S. Das, Fuzzy groups and level subgroups, *Journal of Mathematical Analysis and its Application, 84*, 1981, 264-269.
[3]. V.N. Dixit., A. Rajeshkumar, Naseem Ajmal , Level subgroups and union of fuzzy subgroups, *Fuzzy sets and systems, 37*, 1990, 359-371.
[4]. Krassimir T. Atanassov, *Intuitionistic fuzzy sets :Theory and Application* (Physica-verlag, A springer – verlag company).
[5]. K.. M. Lee, Bipolar valued fuzzy sets and their operations, *proceeding of International conference on Intelligent Technologies*, Bangkok, Thailand, 2000, 307-312.
[6]. Mourad Oqla MASSA'DEH , *Structure properties of an intuitionistic anti fuzzy M subgroups, mathematics section*.
[7]. R. Muthura, M. Sridharan, Bipolar anti fuzzy HX groups and its lower level sub HX groups, *Journal of physical sciences, 16*, 2012, 157-169.
[8]. R. Muthuraj, M. Rajinikannan, M. S. Muthuraman, The M- homomorphism and M-anti homomorphism of an M fuzzy subgroups and its lower level subgroups , *International journal of computer applications 2(1)*, 2010, 66-70.
[9]. R. Muthuraj, M. Sridharan, Homomorphism and anti homomorphism of bipolar fuzzy sub HX groups, *General mathematical notes, 17(2)*, 2013 , 53-65.
[10]. N. Palaniappan, R. Muthuraj, Anti fuzzy group and lower level subgroups, *Antarctica Journal of Mathematics, 1(1)*, 2004, 71-76.
[11]. A. Rajeshkumar, *Fuzzy Algebra: volume I* (Publication division, university of Delhi).
[12]. A. Rosenfeld , Fuzzy Groups, *Journal of Mathematical Analysis and its Application (35)*, 1971, 512-517.
[13]. L.A. Zadeh, Fuzzy sets, information *and control, 8*, 1965, 338-353.
[14]. H.J. Zimmermann, *Fuzzy set theory and its Applications* (Kluwer - Nijhoff publishing co., 1985).
[15]. W.R. Zhang, Bipolar fuzzy sets, *Proceeding of FUZZ - IEEE*, 1998, 835-840.