JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

COMMON FIXED POINT THEOREMS IN MODIFIED INTUITIONISTIC FUZZY SYMMETRIC SPACES FOR CONTRACTIVE CONDITIONS OF INTEGRAL TYPE

[1] **Dr.Aarti Sugandhi,** [2] **Dr.Preeti Sengar**
[1] *Govt.College Mandleshwar* , [2] SGSITS Indore

Abstract: The aim of present paper is to prove common fixed point theorems for occasionally weakly compatible mappings satisfying general contractive condition of integral type in modified intuitionistic fuzzy symmetric space.

Keywords: Modified intuitionistic fuzzy symmetric space, Occasionally weakly compatible, Contractive condition of integral type.

AMS Mathematics Subject Classification (2010): Primary 54H25, Secondary 47H10.

I. Introduction

First Zadeh [15] investigated the concept of a fuzzy set. Atanassov [2] introduced the concept of intuitionistic fuzzy metric spaces. Saadati et al. [11] reframed the idea of intuitionistic fuzzy metric spaces and proposed a new notion under the name of modified intuitionistic fuzzy metric spaces by introducing the idea of continuous t – representable. Branciari [4] gave a fixed point result for a single mapping satisfying Banach's contraction principle for an integral type inequality. This result was further generalized by Alioche [1], Rhoades [10], Suzuki [12] shows that meir-keeler contractions of integral type are still meir-keeler contraction. Hickes and Rhoades [9], Badshah and Pariya [3] gave the fact of symmetric spaces and proved some common fixed point theorems in symmetric spaces. Recently, Yaoyao [14] proved common fixed point theorems in intuitionistic fuzzy symmetric spaces under non linear contractive condition. Now introduce modified intuitionistic fuzzy symmetric space and prove some fixed point theorems for contractive conditions of integral type in modified intuitionistic fuzzy symmetric space.

2. Basic Definitions and Preliminaries.

Recall that a symmetric on X is a nonnegative real valued function d on $X \times X$ such that

(I) $d(x, y) = 0$ if and only if $x = y$, and
(II) $d(x, y) = d(y, x)$

Definition 2.1. [5] A subset S of a symmetric space (X, d) is said to be d- closed if for a sequence $\{x_n\}$ in S and a point $x \in X, \lim_{n\to\infty} d(x_n, x) = 0 \text{ implies } x \in S.$

For a symmetric space (X, d), d- closedness implies $\mathfrak{I}(d)$- closedness, and if d is a symmetric, the converse is also true.

Some definitions and known results are in modified intuitionistic fuzzy metric spaces.

Lemma 2.1. [6] Consider the set L^* and operation $\leq_{L^*}$ defined by

$$L^* = \{(x_1, x_2): (x_1, x_2) \in [0,1]^2 \text{ and } x_1 + x_2 \leq 1\}$$

$(x_1, x_2) \leq_{L^*} (y_1, y_2) \Leftrightarrow x_1 \leq y_1 \text{ and } x_2 \geq y_2 \text{ , for every } (x_1, x_2), (y_1, y_2) \in L^*$.

Then $(L^*, \leq_{L^*})$ is a complete lattice.

Definition 2.2. [2] An intuitionistic fuzzy set $\mathcal{A}_{\zeta,\eta}$ in a universe U is an object $\mathcal{A}_{\zeta,\eta} = \{(\zeta_{\mathcal{A}}(u), \eta_{\mathcal{A}}(u): u \in U)\}$, where, for all $u \in U$, $\zeta_{\mathcal{A}}(u) \in [0,1]$ *and* $\eta_{\mathcal{A}}(u) \in [0,1]$ are called the membership degree and the non – membership degree respectively, of $u \in \mathcal{A}_{\zeta,\eta}$ and further more they satisfy $\zeta_{\mathcal{A}}(u) + \eta_{\mathcal{A}}(u) \leq 1$.

for every $z_i = (x_i, y_i) \in L^*$, $if\ c_i \in [0,1]$ such that $\sum_{i=1}^{n} c_i = 1$ then it is easy to see that

$$c_1(x_1, y_1) + \ \dots\dots + c_n(x_n, y_n) = \sum_{i=1}^{n} c_i(x_i, y_i) = \left(\sum_{i=1}^{n} c_i x_i\, , \sum_{i=1}^{n} c_i y_i\right) \in L^*$$

We denote its unit by 0_{L^*}= (0, 1) and 1_{L^*}= (1, 0). Classically, a triangular norm * = T on [0, 1] is defined as an increasing, commutative, associative mapping $T: [0,1]^2 \to [0,1]$ satisfying $T(1, x) = 1 * x = x, for\ all\ x \in [0,1]$. A triangular co - norm $S = \Diamond$ is defined as an increasing, commutative, associative mapping $S: [0,1]^2 \to [0,1]$ satisfying $S(0, x) = 0 * x = x, for\ all\ x \in [0,1]$using the lattice $(L^*, \leq_{L^*})$ these definitions can straightforwardly be extended.

Definition 2.3. [8] A triangular norm (t - norm) on L^* is a mapping $T: (L^*)^2 \to L^*$ satisfying the following conditions:

(I) $(\forall x \in L^*)(T(x, 1_{L^*}) = x)$(boundary condition),

(II) $(\forall (x, y) \in (L^*)^2)(T(x, y) = T(y, x))$(commutativity),

(III) $(\forall (x, y, z) \in (L^*)^3)(T(x, T(y, Z)) = T(T(x, y), z))$(associativity),

(IV) $(\forall (x, x', y, y') \in (L^*)^4)(x \leq_{L^*} x')$ and $\left(y \leq_{L^*} y' \to T(x, y) \leq_{L^*} T(x', y')\right)$ (monotonicity).

Definition 2.4. [6] A continuous t – norm on L^* is called continuous t – representable if and only if there exist a continuous t – norm * and a continuous t – conorm ◊ on [0, 1] such that, for all $x = (x_1, x_2), y = (y_1, y_2) \in L^*$,

$$T(x, y) = (x_1 * y_1, x_2 \Diamond y_2).$$

Now, we define a sequence $\{T^n\}$ recursively by $\{T^1 = T\}$ and

$T^n\left(x^{(1)}, \dots\dots, x^{(n+1)}\right) = T\left(T^{n-1}\left(x^{(1)}, \dots\dots, x^{(n)}\right), x^{(n+1)}\right)$ for $n \geq 2\ and\ x^i \in L^*$.

Definition 2.5. [6, 7] A negator on L^* is any decreasing mapping $N: L^* \to L^*$ satisfying $N(0_{L^*}) = 1_{L^*}$ and $N(1_{L^*}) = 0_{L^*}$. If $N(N(x)) = x,\ for\ all\ x \in L^*$ then N is called an involutive negator. A negator on [0, 1] is a decreasing mapping $N : [0,1] \to [0,1]$ satisfying $N(0) = 1\ and\ N(1) = 0$. N_s denotes the standard negator on [0, 1] defined as (for all $x \in [0,1]$) $N_S(x) = 1 - x$.

Now define some definitions for a modified intuitionistic fuzzy symmetric space using the concept of Yaoyao [14] as follows:

Definition 2.6. Let M, N are fuzzy sets from $X^2 \times\ (0, \infty)$ to [0, 1] such that $M(x, y, t) + N(x, y, t) \leq 1 for\ all\ x, y\ \in X\ and\ t > 0$. The 3 – tuple $(X, M_{M,N}, T)$ is said to be modified intuitionistic fuzzy symmetric space if X is an arbitrary (non – empty) set, T is continuous representable and $M_{M,N}$ is a mapping $X^2\ \times (0, \infty) \to L^*$(an intuitionistic fuzzy set) satisfying the following conditions for every $x, y \in X\ and\ t, s > 0$;

(MIFSym – 1) $M_{M,N}(x, y, t) >_{L^*} 0_{L^*}$,

(MIFSym – 2) $M_{M,N}(x, y, t) = 1_{L^*}, if\ and\ only\ if\ x = y$,

(MIFSym – 3) $M_{M,N}(x, y, t) = M_{M,N}(y, x, t)$

(MIFSym – 4) $M_{M,N}(x, y, .): (0, \infty) \to L^*$is continuous.

In this case $M_{M,N}$is called an intuitionistic fuzzy symmetric. Hence,

$$M_{M,N}(x, y, t) = \left(M(x, y, t), N(x, y, t)\right).$$

Remark 2.1. [13] In an intuitionistic fuzzy symmetric space $(X, M_{M,N}, T), M(x, y, .)$ is non - decreasing and $N(x, y, .)$ is non – increasing function for $all\ x, y\ \in X$. Hence $(X, M_{M,N}, T)$ is non- decreasing function for all $x, y\ \in X$.

Example 2.1. Let d be a symmetric on X defined by for all $x, y\ \in X$

$$d(x, y) = e^{|x-y|} - 1.$$

$$M_{M,N}(x, y, t) = \left(M(x, y, t), N(x, y, t)\right) = \left(\frac{t}{t + d(x, y)}, \frac{d(x, y)}{t + d(x, y)}\right)$$

Then $(X, M_{M,N}, T)$ is an intuitionistic fuzzy symmetric space induced by the symmetric d. It is obvious that $N(x, y, t) = 1 - M(x, y, t)$.

Now consider a modified intuitionistic fuzzy symmetric space with the following two conditions using the concept of Yaoyao [14]:

MIFW.1. Given $\{x_n\}$, x and y in X,

$$\lim_{n\to\infty} M_{M,N}(x_n, x, t) = 1_{L^*},$$

and $$\lim_{n\to\infty} M_{M,N}(x_n, y, t) = 1_{L^*}$$

imply $$x = y.$$

MIFW.2. Given $\{x_n\}, \{y_n\}$ and $x \in X$,

$$\lim_{n\to\infty} M_{M,N}(x_n, x, t) = 1_{L^*},$$

and $$\lim_{n\to\infty} M_{M,N}(y_n, x_n, t) = 1_{L^*}$$

imply $$\lim_{n\to\infty} M_{M,N}(y_n, x, t) = 1_{L^*}.$$

Definition 2.7. Let f and g be mappings from a modified intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$ into itself. Then the mappings are said to be compatible if

$$\lim_{n\to\infty} M_{M,N}(fgx_n, gfx_n, t) = 1_{L^*}, \quad \forall\, t > 0$$

whenever $\{x_n\}$ *is a sequence in X such that*

$$\lim_{n\to\infty} fx_n = \lim_{n\to\infty} gx_n = x \in X.$$

Definition 2.8. Let f and g be self mappings of a modified intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$. f and g are said to be weakly compatible if they commute at their coincidence points i.e. $fu = gu$ *for some* $u \in X$*. then* $fgu = gfu$.

Definition 2.9. Self mappings f and g of an intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$ is said to be occasionally weakly compatible (*owc*) if there exists a point $x \in X$ which is a coincidence point of f and g at which f and g commute.

Definition 2.10. Let f and g be mappings of a modified intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$. We say that f and g satisfy the property (E. A.) if there exists a sequence $\{x_n\}$ in X such that

$$\lim_{n\to\infty} M_{M,N}(fx_n, u, t) = \lim_{n\to\infty} M_{M,N}(gx_n, u, t) = 1_{L^*}$$

for some $u \in X$ *and* $t > 0$.

Example 2.2. Let $(X, M_{M,N}, T)$ be an intuitionistic fuzzy symmetric space, where X =R and $M_{M,N}(x, y, t) = \left(\frac{1}{t+|x-y|}, \frac{|x-y|}{t+|x-y|}\right)$ *for every* $x, y \in X$ *and* $t > 0$. Define self maps f and g on X as follows:

$$fx = 2x + 1, \quad gx = x + 2.$$

Consider the sequence $\left\{x_n = 1 + \frac{1}{n}, n = 1, 2, \ldots\right\}$ thus we have

$$\lim_{n\to\infty} M_{M,N}(fx_n, 3, t) = \lim_{n\to\infty} M_{M,N}(gx_n, 3, t) = 1_{L^*}$$

for every $t > 0$. Then f and g satisfy the property (E. A.).

Remark 2.2 It is clear from the above Definition 2.10 that two self mappings f and g of a modified intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$ will be non – compatible if there exists at least one sequence $\{x_n\}$ such that

$$\lim_{n\to\infty} M_{M,N}(fx_n, u, t) = \lim_{n\to\infty} M_{M,N}(gx_n, u, t) = 1_{L^*}$$

for some $u \in X$, *but* $$\lim_{n\to\infty} M_{M,N}(fgx_n, gfx_n, t) \neq 1_{L^*}$$

or do not exists.

clearly, two non – compatible self mappings of an intuitionistic fuzzy symmetric space $(X, M_{M,N}, T)$ satisfy the property (E.A).

Definition 2.11. Let $(X, M_{M,N}, T)$ be a modified intuitionistic fuzzy symmetric space, we say that $(X, M_{M,N}, T)$ satisfies the property (MIFH_E) if given sequences $\{x_n\}$, $\{y_n\}$ such that

$$\lim_{n\to\infty} M_{M,N}(x_n, x, t) = 1_{L^*} \quad \text{and} \quad \lim_{n\to\infty} M_{M,N}(y_n, x, t) = 1_{L^*},$$

imply that $$\lim_{n\to\infty} M_{M,N}(y_n, x_n, t) = 1_{L^*},$$

Lemma 2.2.[10] Let A and B be self maps on X and let A and B have a unique point of coincidence, w = Ax = Bx, then w is unique fixed point of A and B.

Definition 2.12. Let $\phi : R^+ \to R^+$ is continuous function satisfying the conditions ,

$$\phi(0) = 1_{L^*},\ \phi(t) \leq_{L^*} t \quad for\ every\ t > 0. \text{where } 1_{L^*} = (1,0).$$

3. Main Result.

Theorem 3.1. Let $(X, M_{M,N}, T)$ be a modified intuitionistic fuzzy symmetric space that satisfy (MIFW1), (MIFW2), (MIFH_E), and let A, B, S, and T be self mapping of X such that

(I) $A(X) \subset T(X) and B(X) \subset S(X)$,

(II) $For\ all\ x, y \in X$, **let** $\phi: R^+ \to R^+$ is continuous function satisfying the condition $\phi(0) = 1_{L^*}$, $\phi(t) \leq_{L^*} t$, for every t > 0 such that

$$\int_0^{M_{M,N}(Ax,By,t)} \varphi(t)dt \leq_{L^*} \phi\left(\int_0^{m_{M,N}(x,y,t)} \varphi(t)dt\right)$$

where $\varphi: R^+ \to R^+$ is a lebesgue integrable mapping which is summable, non-negative and such that $\int_0^{\varepsilon} \varphi(t)dt > 0$ for each $\varepsilon > 0$ and

$$m_{M,N}(x,y,t) = F\{M_{M,N}(Sx,Ty,t), M_{M,N}(By,Sx,t), M_{M,N}(Sx,Ax,t), M_{M,N}(By,Ty,t), M_{M,N}(Ax,Ty,t), \left(\frac{2M_{M,N}(Sx,Ax,t)}{1 + M_{M,N}(By,Ty,t)}\right)\}$$

and F shows minimum of metric M and maximum of metric N.

(III) Suppose that (B, T) satisfied property (E.A.)(respectively, (A, S) satisfies property (E.A.)) and

(IV) the pairs (A, S) and (B, T) are occasionally weakly compatible.

(V) S(X) is a d- closed subset of X(resp., T(X) is a d- closed subset of X).

Then A, B, S and T have a unique common fixed point in X.

Proof : Since the pair(B, T) satisfies property (E.A.), so there exists a sequence $\{x_n\}$ in X, and a point $z \in X$ such that $\lim_{n\to\infty} M_{M,N}(Tx_n, z, t) = \lim_{n\to\infty} M_{M,N}(Bx_n, z, t) = 1_{L^*}$ From (I), $B(X) \subset S(X)$, there exists a sequence $\{y_n\}$ in X such that $Bx_n = Sy_n$ and hence $\lim_{n\to\infty} M_{M,N}(Sy_n, z, t) = 1_{L^*}$.

By property (MIFH_E), $\lim_{n\to\infty} M_{M,N}(Bx_n, Tx_n, t) = \lim_{n\to\infty} M_{M,N}(Sy_n, Tx_n, t) = 1_{L^*}$

From (V), S(X) is a d- closed subset of X there exist a point $u \in X\ such\ that\ Su = z.$

Now to prove Au =Su. Suppose not then

$$\int_0^{M_{M,N}(Au,z,t)} \varphi(t)dt = \int_0^{r} \varphi(t)dt \text{ , where } r = \lim_{n\to\infty} m_{M,N}(Au, Bx_n, t)$$

$$\geq_{L^*} \phi\left(\int_0^{M_{M,N}(u,x_n,t)} \varphi(t)dt\right)$$

$$\text{Where } \lim_{n\to\infty} m_{M,N}(u,x_n,t) = \lim_{n\to\infty} F\{M_{M,N}(Su,Tx_n,t), M_{M,N}(Bx_n,Su,t), M_{M,N}(Su,Au,t),\ M_{M,N}(Bx_n,Tx_n,t), M_{M,N}(Au,Tx_n,t), \left(\frac{2M_{M,N}(Su,Au,t)}{1+M_{M,N}(Bx_n,Tx_n,t)}\right)\}$$

On using the property (MIFH_E), we get

$$\lim_{n\to\infty} m_{M,N}(u,x_n,t) = \lim_{n\to\infty} F\{1_{L^*}, M_{M,N}(z,z,t), M_{M,N}(z,Au,t), 1_{L^*}, M_{M,N}(z,Au,t), M_{M,N}(z,Au,t)\}$$

$$\text{we have } \int_0^{M_{M,N}(Au,z,t)} \varphi(t)dt \geq_{L^*} \phi\left(\int_0^{M_{M,N}(Au,z,t)} \varphi(t)dt\right)$$

$$>_{L^*} \int_0^{M_{M,N}(Au,z,t)} \varphi(t)dt$$

which is contradiction. Hence Au = Su = z.

Again by (I) $A(X) \subset T(X)$, there exists a point $w \in X\ such\ that\ Au = Tw$. Now we will show that $Tw =$ Bw. Suppose not, then by (II) we have

$$\int_0^{M(Au,Bw,t)} \varphi(t)dt \geq_{L^*} \phi\left(\int_0^{m(u,w,t)} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\{M_{M,N}(Su,Tw,t), M_{M,N}(Bw,Su,t), M_{M,N}(Su,Au,t), M_{M,N}(Bw,Tw,t), M_{M,N}(Au,Tw,t), \left(\frac{2M_{M,N}(Su,Au,t)}{1+M_{M,N}(Bw,Tw,t)}\right)\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\{1_{L^*}, M_{M,N}(Bw,Au,t), 1_{L^*}, M_{M,N}(Bw,Au,t), 1_{L^*}, M_{M,N}(Bw,Au,t), \left(\frac{2}{1+M_{M,N}(Bw,Au,t)}\right)\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{M_{M,N}(Au,Bw,t)} \varphi(t)dt\right)$$

$$>_{L^*} \int_0^{M_{M,N}(\mathrm{Au,Bw,t})} \varphi(t)dt$$

Which is contradiction. Hence Tw = Bw.

Thus Au = Su = Tw = Bw = z.

Now by (IV), (A, S) and (B, T) are occasionally weakly compatible, we have

AAu = ASu = SAu = SSu and BTw = TBw = TTw = BBw.

Now we will show that Au = w. Suppose Au$\neq w$ then by (II)

$$\int_0^{M_{M,N}(Au,AAu,t)} \varphi(t)dt = \left(\int_0^{M_{M,N}(\mathrm{AAu},Bw,t)} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{m_{M,N}(\mathrm{Au,w},t)} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\left\{M_{M,N}(\mathrm{SAu},Tw,t),M_{M,N}(\mathrm{Bw,SAu,t}),M_{M,N}(\mathrm{SAu,AAu,t}),M_{M,N}(\mathrm{Bw,Tw,t}),M_{M,N}(AAu,Tw,t),\left(\frac{2M_{M,N}(SAu,AAu,t)}{1+M_{M,N}(\mathrm{Bw,Tw,t})}\right)\right\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\{M_{M,N}(\mathrm{AAu,Bw,t}),M_{M,N}(\mathrm{Bw,SAu,t}),1_{L^*},1_{L^*},M_{M,N}(\mathrm{AAu,Bw,t}),1_{L^*}\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{M_{M,N}(\mathrm{AAu,Bw},t)} \varphi(t)dt\right)$$

$$>_{L^*} \int_0^{M_{M,N}(\mathrm{AAu,Bw},t)} \varphi(t)dt = \int_0^{M_{M,N}(\mathrm{AAu,Au},t)} \varphi(t)dt$$

i.e. $\int_0^{M_{M,N}(\mathrm{AAu,Au},t)} \varphi(t)dt >_{L^*} \int_0^{M_{M,N}(\mathrm{AAu,Au},t)} \varphi(t)dt$

which is a contradiction . Hence Au = Su = w. Similarly if $Bw \neq u$.

we have a contradiction. Thus $w = Au = Su = Bw = Tw = u$, so w = u is a common fixed point of A, B, S and T.

For the uniqueness, let v be another common fixed point of A, B, S and T.

If $w \neq v$, then from (II) we have

$$\int_0^{M_{M,N}(v,w,t)} \varphi(t)dt = \int_0^{M_{M,N}(Av,Bw,t)} \varphi(t)dt \geq_{L^*} \phi\left(\int_0^{m_{M,N}(\mathrm{v,w},t)} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\{M_{M,N}(\mathrm{Sv,Tw},t),M_{M,N}(Bw,Sv,t),M_{M,N}(Sv,Av,t),M_{M,N}(\mathrm{Bw,Tw,t}),M_{M,N}(\mathrm{Av,Tw,t}),\left(\frac{2M_{M,N}(Sv,Av,t)}{1+M_{M,N}(Bw,Tw,t)}\right)\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{F\{M_{M,N}(\mathrm{v,w},t),M_{M,N}(\mathrm{w,v},t),1_{L^*},1_{L^*},M_{M,N}(\mathrm{v,w},t),1_{L^*}\}} \varphi(t)dt\right)$$

$$\geq_{L^*} \phi\left(\int_0^{\mathrm{M(v,w},t)} \varphi(t)dt\right)$$

$$>_{L^*} \int_0^{\mathrm{M(v,w},t)} \varphi(t)dt$$

Which is a contradiction. Hence w = v.

This complete the proof.

Corollary 3.1. Let $(X, M_{M,N}, T)$be a modified intuitionistic fuzzy symmetric space that satisfy (MIFW1), (MIFW2), (MIFH_E), and let A, B, S, and T be self mapping of X satisfy the conditions (I), (II), (III) and (V) and the pairs (A, S), (B, T) are weakly compatible then A, B, S and T have a unique common fixed point in X.

Proof. Since weakly compatible mappings are occasionally weakly compatible mappings result follows from theorem 3.1.

Corollary 3.2. Let $(X, M_{M,N}, T)$ be a modified intuitionistic fuzzy symmetric space that satisfy (MIFW1), (MIFW2), (MIFH_E), and let A, B, S, and T be self mapping of X such that

(I) $A(X) \subset T(X) and B(X) \subset S(X)$,

(II) $For\ all\ x, y \in X$, **let** $\phi: R^+ \to R^+$ is continuous function satisfying the conditions , $\phi(0) = 1_{L^*}$, $\phi(t) \leq_{L^*} t,\ for\ every$ t > 0 such that

$$M_{M,N}(\mathrm{Ax,By,t}) \geq_{L^*} \phi(m_{M,N}(\mathrm{x,y,t}))$$

$$m_{M,N}(x,y,t) = F\{M_{M,N}(Sx,Ty,t), M_{M,N}(By,Sx,t), M_{M,N}(Sx,Ax,t), M_{M,N}(By,Ty,t), M_{M,N}(Ax,Ty,t), \left(\frac{2M_{M,N}(Sx,Ax,t)}{1+M_{M,N}(By,Ty,t)}\right)\}$$

(III) Suppose that (B, T) satisfied property (E.A.)(respectively, (A, S) satisfies property (E.A.)) and

(IV) the pairs (A, S) and (B, T) are occasionally weakly compatible.

(V) S(X) is a d- closed subset of X(resp., T(X) is a d- closed subset of X).

Then A, B, S and T have a unique common fixed point in X.

Proof. If we put $\varphi(t)$ = 1 in theorem 3.1, the result follows.

References.

1. Aliouche, A., A common fixed point theorems for weakly compatible mappings in symmetric spaces satisfying a contractive condition of integral type, J.Math. Anal. Appl. 322(2006)no. 2, 796-802.
2. Atanassov, K.T., intuitionistic fuzzy sets, Fuzzy sets and system, 20, 1986, 87-96.
3. Badshah, V.H. and Pariya, A., A common fixed point theorem for occasionally weakly compatible maps satisfying general contractive condition of integral type,Varahmihir Journal of Mathematical Sciences, Vol. 9No. 1(2009), 125-134.
4. Branciari, A., A fixed point theorem for mappings satisfying general contractive condition of integral type, Int. J. Math. Math. Sci. 29(2002),No.9,531-536.
5. Cho. S.H., Lee G.Y. and Bae, J.S. On coincidence and fixed point theorems in symmetric spaces, Fixed point theory and Application, Vol. 2008, article ID 562130.
6. Deschrijver, G, Kerre, EE: On the relationship between some extensions of fuzzy set theory. Fuzzy Sets Syst. 133, 227–235, (2003).
7. Deschrijver, G, Cornelis, C, Kerre, EE: On the representation of intuitionistic fuzzy t-norms and t-conorms. IEEE Trans Fuzzy Syst. 12, 45–61 (2004).
8. Erceg, MA: Metric spaces in fuzzy set theory. J Math Anal Appl. 69, 205–230 (1979).
9. Hicks, T.L. and Rhoades, B.E., Fixed point theory with application to probabilistic spaces, Non linear analysis, 36(1999), 331-334.
10. Rhoades, B. E., Two fixed point theorems for mappings satisfying general contractive condition of integral type, Sochow J. Math. 33(2)(2007), 181 – 185.
11. Saadati, R, Sedgi, S, Shobe, N: Modified intuitionistic fuzzy metric spaces and some fixed point theorems. Chaos Solitons and Fractals. 38, 36–47 (2008).
12. Suzuki,T., Meir-Keelar contractions of Integral type are still Meir-Keelar contractions, Int. J.Math.Sci. Vol.2007, Article ID 39281, 6 pages.
13. Turkoglu, D, Alaca, C, Cho, YJ, Yildiz, C: Common fixed point theorems in intuitionistic fuzzy metric spaces. J Appl Math Comput. 22(1-2):411–424 (2006).
14. Yaoyao, Lan, Common fixed point theorems in intuitionistic fuzzy symmetric spaces under non linear contractive conditions, Contemporary Mathematics and statistics , vol. 1(2013), 1-09.
15. Zadeh, L. A., (1965): Fuzzy sets, *Infom. and Control*, Vol. 89, pp. 388 -353.