Electronic Journal of Mathematical Analysis and Applications
Vol. 6(1) Jan. 2018, pp.109-116.
ISSN: 2090-729X(online)
http://fcag-egypt.com/Journals/EJMAA/

A NEW COMMON FIXED POINT THEOREM IN INTUITIONISTIC FUZZY METRIC SPACES

J.JEYACHRISTY PRISKILLAL AND P.THANGAVELU

Abstract. In this article, we prove a common fixed point theorem for compatible mapping in intuitionistic fuzzy metric spaces. An example is given to support the main result.

1. Introduction

Gerald Jungck[5] introduced the concept of compatible mapping which is the generalization of the commuting mapping. Mishra et al.[8] generalized this concept to fuzzy metric spaces. The fuzzy version of the result of Pant[10] was proved by Vasuki. She proved a common fixed point theorem using R-weakly commuting. Common fixed point theorems for weakly commuting maps are given by so many authors[13],[15],[21]. Y.J.Cho introduced the concept of compatible mapping of type (α)[2] and compatible mapping of type (β)[3]. Further some Mathematicians proved common fixed point theorem for compatible mappings in fuzzy metric spaces[18],[17],[19] and intuitionistic fuzzy metric spaces[9],[11],[16],[20],[22]. In this article, we prove a common fixed point theorem for compatible mapping in intuitionistic fuzzy metric spaces.

Definition 1 [14] A binary operation $* : [0,1] \times [0,1] \to [0,1]$ is called a t-norm if the following conditions hold:
(i)$*$ is associative and commutative;
(ii)$a * 1 = a, \forall a \in [0,1]$;
(iii)$a * b \leq c * d$ whenever $a \leq c$ and $b \leq d, \forall a, b, c, d \in [0,1]$.
If $*$ is continuous then it is called a continuous t-norm.

Definition 2 [14] A binary operation $\diamond : [0,1] \times [0,1] \to [0,1]$ is called a t-conorm if the following conditions hold:
(i)$\diamond$ is associative and commutative;
(ii)$a \diamond 0 = a, \forall a \in [0,1]$;
(iii)$a \diamond b \leq c \diamond d$ whenever $a \leq c$ and $b \leq d, \forall a, b, c, d \in [0,1]$.
If $\diamond$ is continuous then it is called a continuous t-conorm.

Definition 3 [12] Let X be an arbitrary set, $*$ be a continuous t-norm, $\diamond$ be a

---

2010 *Mathematics Subject Classification.* 47H10, 37C25, 54E70.
Key words and phrases. intuitionistic fuzzy metric space; compatible mapping; common fixed point.
Submitted April 11, 2017.

continuous t-conorm and Let X be an arbitrary set, $*$ be a continuous t-norm, $\diamond$ be a continuous t-conorm and M, N be fuzzy sets on $X^2 \times (0, \infty)$. Consider the following conditions $\forall u, v, w \in X$ and $t > 0$,
(i)$M(u, v, t) + N(u, v, t) \leq 1$;
(ii)$M(u, v, 0) = 0$;
(iii)$M(u, v, t) = 1$ if and only if $u = v$;
(iv)$M(u, v, t) = M(v, u, t)$;
(v)$M(u, w, t + s) \geq M(u, v, t) * M(v, w, s)$;
(vi)$M(u, v, .) : (0, \infty) \to [0, 1]$ is left continuous;
(vii)$N(u, v, 0) = 1$;
(viii)$N(u, v, t) = 0$ if and only if $u = v$;
(ix)$N(u, v, t) = N(v, u, t)$;
(x)$N(u, w, t + s) \leq N(u, v, t) \diamond N(v, w, s)$;
(xi)$N(u, v, .) : (0, \infty) \to [0, 1]$ is left continuous.
If M satisfies conditions (ii)-(vi), then the pair $(M, *)$ is called fuzzy metric on X. In this case, the triple $(X, M, *)$ is called a fuzzy metric space. If N satisfies conditions (vii)-(xi), then the pair $(N, \diamond)$ is called dual fuzzy metric on X. Then the triple $(X, N, \diamond)$ is called a dual fuzzy metric space.
If $(M, *)$ is a fuzzy metric on X and $(N, \diamond)$ is a dual fuzzy metric on X satisfying condition (i), then the 4-tuple $(M, N, *, \diamond)$ is called an intuitionistic fuzzy metric on X. In this case, the 5-tuple $(X, M, N, *, \diamond)$ is called an intuitionistic fuzzy metric space.
Example 4 [1] Let (X, d) be a metric space. Denote $a * b = ab$ and $a \diamond b = \min\{1, a + b\}, \forall a, b \in [0, 1]$ and let M_d and N_d be fuzzy sets on $X \times X \times (0, +\infty)$ defined as follows:$M_d(u, v, t) = \frac{t}{t+d(u,v)}$ and $N_d(u, v, t) = \frac{d(u,v)}{t+d(u,v)}, \forall t > 0$, then $(X, M_d, N_d, *, \diamond)$ is an intuitionistic fuzzy metric space.
Definition 5 [6] Let $(X, M, N, *, \diamond)$ be an intuitionistic fuzzy metric space. A sequence $\{u_n\}$ in X is called
(a)convergent to a point $u \in X$ if and only if $\lim_{n\to+\infty} M(u_n, u, t) = 1$, and $\lim_{n\to+\infty} N(u_n, u, t) = 0, \forall t > 0$,
(b)Cauchy if $\lim_{n\to\infty} M(u_n, u_{n+p}, t) = 1$, and $\lim_{n\to+\infty} N(u_n, u_{n+p}, t) = 0, \forall t > 0$ and $p > 0$.
Definition 6 An intuitionistic fuzzy metric space $(X, M, N, *, \diamond)$ is said to be complete if every Cauchy sequence in X is convergent.
Definition 7 [8] In an intuitionistic fuzzy metric space $(X, M, N, *, \diamond)$, two self mappings A and B are said to be compatible if $\lim_{n\to\infty} M(ABu_n, BAu_n, t) = 1$ and $\lim_{n\to\infty} N(ABu_n, BAu_n, t) = 0$ whenever u_n is a sequence in X such that $\lim_{n\to\infty} Au_n = \lim_{n\to\infty} Bu_n = w$ for some $w \in X$.

2. Main Results

Definition 1 Let Ψ be the class of all non decreasing mappings $\psi : [0, 1] \to [0, 1]$ and $\eta : [0, 1] \to [0, 1]$ such that
(i)$\lim_{n\to\infty} \psi^n(s) = 1, \forall s \in (0, 1]$;
(ii)$\psi(s) > s, \forall s \in (0, 1)$;
(iii)$\psi(1) = 1$;
(iv)$\lim_{n\to\infty} \eta^n(r) = 0, \forall r \in [0, 1)$;
(v)$\eta(r) < r, \forall r \in (0, 1)$;
(vi)$\eta(0) = 0$.

Example 2 Define $\psi : [0,1] \to [0,1]$ by $\psi(s) = \frac{2s}{s+1}, \forall s \in [0,1]$.
$\psi^2(s) = \frac{4s}{3s+1}, \psi^3(s) = \frac{8s}{7s+1}, \ldots, \psi^n(s) = \frac{2^n s}{(2^n-1)s+1}, \forall s \in [0,1]$.
$\lim_{n\to\infty} \psi^n(s) = \lim_{n\to\infty} \frac{2^n s}{(2^n-1)s+1} = 1, \forall s \in (0,1)$.
Clearly, $\psi(s) > s, \forall s \in (0,1)$ and $\psi(1) = 1$.
Define $\eta : [0,1] \to [0,1]$ by $\eta(r) = \frac{r}{2-r} \forall r \in [0,1]$.
$\eta^2(r) = \frac{r}{4-3r}, \eta^3(r) = \frac{r}{8-7r}, \ldots, \eta^n(s) = \frac{r}{2^n(1-r)+r}, \forall r \in [0,1]$.
$\lim_{n\to\infty} \eta^n(r) = \lim_{n\to\infty} \frac{r}{2^n(1-r)+r} = 0, \forall r \in [0,1)$.
Clearly, $\eta(r) < r, \forall r \in (0,1)$ and $\eta(0) = 0$.

Proposition 3 Let A and B be compatible mappings of an intuitionistic fuzzy metric space $(X, M, N, *, \diamond)$ into itself. If $Aw = Bw$ for some $w \in X$, then $ABw = BAw$.

Proof. Suppose that $\{u_n\}$ is a sequence in X defined by $u_n = w, n = 1, 2, ...$ for some $w \in X$ and $Aw = Bw$. Then we have $Au_n, Bu_n \to Aw$ as $n \to \infty$. Since A and B are compatible mapping,

$$M(ABw, BAw, t) = \lim_{n\to\infty} M(ABu_n, BAu_n, t) = 1,$$

$$N(ABw, BAw, t) = \lim_{n\to\infty} N(ABu_n, BAu_n, t) = 0.$$

Hence, we have $ABw = BAw$.

Proposition 4 If A and B are compatible maps on an intuitionistic fuzzy metric space X and $Au_n, Bu_n \to w$ for some $w \in X$,(u_n being a sequence in X) then $ABu_n \to Bw$ provided B is continuous (at w).

Proof. Since B is continuous at w, $BAu_n \to Bw$ and $BBu_n \to Bw$. Since A and B are compatible maps, $M(ABu_n, BAu_n, t) \to 1$ and $N(ABu_n, BAu_n, t) \to 0$ as $n \to \infty$.

$$M(Bw, ABu_n, t) \geq M(Bw, BAu_n, \frac{t}{2}) * M(BAu_n, ABu_n, \frac{t}{2}),$$

$$N(Bw, ABu_n, t) \leq N(Bw, BAu_n, \frac{t}{2}) \diamond N(BAu_n, ABu_n, \frac{t}{2}).$$

Taking limit as $n \to \infty$, we get
$\lim_{n\to\infty} M(Bw, ABu_n, t) = 1$ and $\lim_{n\to\infty} N(Bw, ABu_n, t) = 0$.
Hence, $ABu_n \to Bw$.

Theorem 5 Let A and B be self maps on a complete intuitionistic fuzzy metric space X and $\psi \in \Psi$ such that satisfy the following conditions:
(I)$A(X) \subset B(X)$,
(II)$M(A(u), A(v), t) \geq \psi(M(Bu, Bv, t))$ and $N(A(u), A(v), t) \leq \eta(N(Bu, Bv, t)) \forall u, v \in X$ and $t > 0$,
(III)A or B is continuous.
Assume that A and B are weakly compatible. Then A and B have a unique common fixed point in X.

Proof. Let $u_0 \in X$ and $A(X) \subset B(X)$ define a sequence u_n in $X, \forall n \in N$ as follows:

$$Au_n = B(u_{n+1})$$

Then for all $t > 0$,

$$\begin{aligned} M(Au_n, Au_{n+1}, t) &\geq \psi(M(Bu_n, Bu_{n+1}, t)) \\ &= \psi(M(Au_{n-1}, Au_n, t)) \\ &\geq \psi^2(M(Bu_{n-1}, Bu_n, t)) \\ &\dots \\ &\geq \psi^n(M(Au_0, Au_1, t)). \end{aligned}$$

That is,$M(Au_n, Au_{n+1}, t) \geq \psi^n(M(Au_0, Au_1, t))$.

$$\begin{aligned} N(Au_n, Au_{n+1}, t) &\leq \eta(N(Bu_n, Bu_{n+1}, t)) \\ &= \eta(N(Au_{n-1}, Au_n, t)) \\ &\leq \eta^2(N(Bu_{n-1}, Bu_n, t)) \\ &\dots \\ &\leq \eta^n(N(Au_0, Au_1, t)). \end{aligned}$$

That is,$N(Au_n, Au_{n+1}, t) \leq \eta^n(N(Au_0, Au_1, t))$.
By taking limit as $n \to \infty$, and since $\lim_{n\to\infty} \psi^n(s) = 1, \forall s \in (0, 1]$ and $\lim_{n\to\infty} \eta^n(r) = 0, \forall r \in [0, 1)$, $\lim_{n\to\infty} M(Au_n, Au_{n+1}, t) = 1$ and $\lim_{n\to\infty} N(Au_n, Au_{n+1}, t) = 0$.
Now for any positive integer p,

$$M(Au_n, Au_{n+p}, t) \geq M(Au_n, Au_{n+1}, \frac{t}{p}) * \dots * M(Au_{n+p-1}, Au_{n+p}, \frac{t}{p}).$$

$$N(Au_n, Au_{n+p}, t) \leq N(Au_n, Au_{n+1}, \frac{t}{p}) \diamond \dots \diamond N(Au_{n+p-1}, Au_{n+p}, \frac{t}{p}).$$

Taking limit $n \to \infty$, we have,

$$\begin{aligned} \lim_{n\to\infty} M(Au_n, Au_{n+p}, t) &\geq \lim_{n\to\infty} M(Au_n, Au_{n+1}, \frac{t}{p}) * \dots * \lim_{n\to\infty} M(Au_{n+p-1}, Au_{n+p}, \frac{t}{p}) \\ &\geq 1 * \dots * 1 \\ &= 1. \end{aligned}$$

That is,

$$\lim_{n\to\infty} M(Au_n, Au_{n+p}, t) = 1.$$

$$\begin{aligned} \lim_{n\to\infty} N(Au_n, Au_{n+p}, t) &\leq \lim_{n\to\infty} N(Au_n, Au_{n+1}, \frac{t}{p}) \diamond \dots \diamond \lim_{n\to\infty} N(Au_{n+p-1}, Au_{n+p}, \frac{t}{p}) \\ &\leq 0 \diamond \dots \diamond 0 \\ &= 0. \end{aligned}$$

That is,

$$\lim_{n\to\infty} N(Au_n, Au_{n+p}, t) = 0.$$

Hence,$\{Au_n\}$ is a Cauchy sequence in X.

Since $(X, M, N, *, \diamond)$ is a complete intuitionistic fuzzy metric space, there exists $w \in X$ such that $\lim_{n\to\infty} M(Au_n, w, t) = 1, \lim_{n\to\infty} M(Bu_n, w, t) = 1$ and $\lim_{n\to\infty} N(Au_n, w, t) = 0, \lim_{n\to\infty} N(Bu_n, w, t) = 0$ for each $t > 0$.
Suppose A is continuous. Since A and B are compatible and A is continuous, by Proposition 4, $BAu_n \to Aw$.
Now,

$$M(Au_n, AAu_n, t) \geq \psi(M(Bu_n, BAu_n, t)),$$

$$N(Au_n, AAu_n, t) \leq \eta(N(Bu_n, BAu_n, t)).$$

Taking limit as $n \to \infty$, we get

$$M(w, Aw, t) \geq \psi(M(w, Aw, t)) \geq M(w, Aw, t),$$

$$M(w, Aw, t) \leq \eta(N(w, Aw, t)) \leq N(w, Aw, t).$$

This is possible only when $M(w, Aw, t) = 1$ and $N(w, Aw, t) = 0$. That is $Aw = w$. Since $A(X) \subset B(X)$, there exists w_1 in X such that $w = Aw = Bw_1$. Now,

$$M(AAu_n, Aw_1, t) \geq \psi(M(BAu_n, Bw_1, t)),$$

$$N(AAu_n, Aw_1, t) \leq \eta(N(BAu_n, Bw_1, t)).$$

Taking limit as $n \to \infty$, we get

$$M(Aw, Aw_1, t) \geq \psi(M(Aw, Bw_1, t)) = \psi(1) = 1,$$

$$N(Aw, Aw_1, t) \leq \eta(N(Aw, Bw_1, t)) = \eta(0) = 0.$$

That is $Aw_1 = Bw_1$.
Now, we have $Aw = Aw_1$. By Proposition 3, $ABw_1 = BAw_1$.

$$M(Aw, Bw, t) = M(ABw_1, BAw_1, t) = 1,$$

$$N(Aw, Bw, t) = N(ABw_1, BAw_1, t) = 0.$$

Hence, $Aw = Bw = w$. Hence A and B have a common fixed point in X. **Uniqueness:**
Assume $\overline{w} \neq w$ for some $\overline{w} \in X$, is another common fixed point in X. Then for $t > 0$, we have,

$$\begin{aligned} M(w, \overline{w}, t) &= M(A(w), A(\overline{w}), t) \\ &\geq \psi(M(B(w), B(\overline{w}), t)) \\ &\dots \\ &\geq \psi^n(M(B(w), B(\overline{w}), t)), \end{aligned}$$

$$\begin{aligned} N(w, \overline{w}, t) &= N(A(w), A(\overline{w}), t) \\ &\leq \eta(N(B(w), B(\overline{w}), t)) \\ &\dots \\ &\leq \eta^n(N(B(w), B(\overline{w}), t)). \end{aligned}$$

Taking limit as $n \to \infty$ and by our assumption,
$M(u, v, t) \geq \lim_{n\to\infty} \psi^n(M(u, v, t)) = 1$,
$N(u, v, t) \leq \lim_{n\to\infty} \eta^n(N(u, v, t)) = 0$.
That is, $M(u, v, t) = 1$ and $N(u, v, t) = 0$.
Therefore, $u = v$.
Hence T has a unique fixed point in X.
Example 6 Let $X = [0, \infty)$ with the metric d defined by $d(u, v) = |u - v|$, define $M(u, v, t) = \frac{t}{t+d(u,v)}$, and $N(u, v, t) = \frac{d(u,v)}{t+d(u,v)} \forall u, v \in X$ and $t > 0$. Note that, $(X, M, N, *, \diamond)$ where $a * b = ab$ and $a \diamond b = \min\{1, a + b\}$ is a complete intuitionistic fuzzy metric space.

The maps $A, B : X \to X$ is defined by $A(u) = \frac{2+u}{3}$ and $B(u) = u$. Let $u_n = 1 - \frac{1}{n}$

$$\begin{aligned}\lim_{n\to\infty} M(ABu_n, BAu_n, t) &= \lim_{n\to\infty} M(Au_n, B\frac{2+u_n}{3}, t)\\ &= \lim_{n\to\infty} M(\frac{2+u_n}{3}, \frac{2+u_n}{3}, t)\\ &= 1.\end{aligned}$$

$$\begin{aligned}\lim_{n\to\infty} N(ABu_n, BAu_n, t) &= \lim_{n\to\infty} N(Au_n, B\frac{2+u_n}{3}, t)\\ &= \lim_{n\to\infty} N(\frac{2+u_n}{3}, \frac{2+u_n}{3}, t)\\ &= 0.\end{aligned}$$

$\lim_{n\to\infty} M(ABu_n, BAu_n, t) = 1$ and $\lim_{n\to\infty} N(ABu_n, BAu_n, t) = 0$.
$\lim_{n\to\infty} Au_n = \lim_{n\to\infty} \frac{2+u_n}{3} = \lim_{n\to\infty} \frac{2+(1-\frac{1}{n})}{3} = 1$.
$\lim_{n\to\infty} Bu_n = \lim_{n\to\infty} u_n = \lim_{n\to\infty} 1 - \frac{1}{n} = 1$.
Therefore, A and B are compatible mapping. Also $AX \subset BX$ and B is continuous.

Define the map $\psi : [0,1] \to [0,1]$ by $\psi(s) = \frac{2s}{s+1}$ for each $s \in [0,1]$ and $\psi \in \Psi$.

$$\begin{aligned}M(A(u), A(v), t) &\geq \psi(M(B(u), B(v), t))\\ \text{if} \quad M(\frac{2+u}{3}, \frac{2+v}{3}, t) &\geq \psi(M(u, v, t))\\ \text{That is if} \quad \frac{t}{t + d(\frac{2+u}{3}, \frac{8-v}{3})} &\geq \frac{\frac{2t}{t+d(u,v)}}{\frac{t}{t+d(u,v)} + 1}\\ \text{That is if} \quad \frac{t}{t + \left|\frac{2+u}{3} - \frac{2+v}{3}\right|} &\geq \frac{\frac{2t}{t+|u-v|}}{\frac{t}{t+|u-v|} + 1}\\ \text{That is if} \quad \frac{t}{t + \frac{|u-v|}{3}} &\geq \frac{t}{t + \frac{|u-v|}{2}}\\ \text{That is if} \quad t + \frac{|u-v|}{2} &\geq t + \frac{|u-v|}{3}\\ \text{That is if} \quad 3 &\geq 2.\end{aligned}$$

Define the map $\eta : [0,1] \to [0,1]$ by $\eta(r) = \frac{r}{2-r}$ for each $r \in [0,1]$ and $\eta \in \Psi$.

$$N(A(u), A(v), t) \leq \eta(N(B(u), B(v), t))$$

$$\text{if} \quad N(\frac{2+u}{3}, \frac{2+u}{3}, t) \leq \frac{N(u,v,t)}{2 - N(u,v,t)}$$

$$\text{That is if} \quad \frac{d(\frac{2+u}{3}, \frac{2+u}{3})}{t + d(\frac{2+u}{3}, \frac{2+u}{3})} \leq \frac{\frac{d(u,v)}{t+d(u,v)}}{2 - \frac{d(u,v)}{t+d(u,v)}}$$

$$\text{That is if} \quad \frac{\left|\frac{2+u}{3} - \frac{2+v}{3}\right|}{t + \left|\frac{2+u}{3} - \frac{2+v}{3}\right|} \leq \frac{\frac{|u-v|}{t+|u-v|}}{2 - \frac{|u-v|}{t+|u-v|}}$$

$$\text{That is if} \quad \frac{\frac{|u-v|}{3}}{t + \frac{|u-v|}{3}} \leq \frac{|u-v|}{2t + |u-v|}$$

$$\text{That is if} \quad 2t + |u-v| \leq 3t + |u-v|$$

$$\text{That is if} \quad 2 \leq 3.$$

All the conditions of the previous theorem are verified.
Then 1 is the unique fixed point.
Hence A and B have the unique common fixed point in X.

References

[1] Abdul Mohamad, Fixed-point theorems in intuitionistic fuzzy metric spaces, Chaos, Solitons and Fractals, 34(5), 1689-1695, 2007.

[2] Y. J. Cho, Fixed points in fuzzy metric spaces, J. Fuzzy Math., Vol. 5, 949-962, 1997.

[3] Y. J. Cho, A. Pathak. H. K., S. M. Kang, and J. S. Jung, Common fixed points of compatible maps of type (β) in fuzzy metric spaces, Fuzzy sets and Systems, Vol. 93, 99-111, 1998.

[4] A. George and P. Veeramani, On some results in fuzzy metric spaces, Fuzzy sets and Systems, Vol. 64, 395-399, 1994.

[5] Gerald Jungck, Compatible mappings and common fixed points, International journal of Mathematics and Mathematical sciences, Vol. 9, no.4, 771-779, 1986.

[6] M. Grabiec, Fixed points in fuzzy metric spaces, Fuzzy sets and Systems, 27(3), 385-389, 1988.

[7] I.Kramsoil and J.Michalek, Fuzzy metric and statistical metric spaces, Kybernetica, 11(5), 336-344, 1975.

[8] S. N. Mishra, N. Sharma and S. L. Singh, Common fixed points of maps in fuzzy metric spaces, Int. J. Math. Sci, Vol. 17, 253-258, 1994.

[9] Mohammad Hasan and Ramadan Sabra, Common fixed point theorems in intuitionistic fuzzy metric spaces, Advances in fixed point theory, 4(2), 207-228, 2014.

[10] R. P. Pant, Common fixed points of noncomputing mappings, J. Math. Anal. Appl., 188:2, 436-440, 1994.

[11] Preeti Malviya, Vandna Gupta and V. H. Badshah, Common fixed point theorem in intuitionistic fuzzy metric space satisfying integral type inequality, International journal of science and research, 5(5), 2319-7064, 2016.

[12] M. Rafi and M. S. M. Noorani, Fixed point theorem on intuitionistic fuzzy metric spaces, Iranian journal of fuzzy systems 3(1), 23-29, 2006.

[13] Sanjay Kumar, Fixed point theorems for weakly compatible maps under E.A property in fuzzy metric spaces, Journal of applied Mathematics and Informatics, 29(1), 395-405, 2011.

[14] B. Schweizer and A. Sklar, Statistical metric spaces, Pacific J. Math., 10(1), 385-389, 1960.

[15] Servet Kutukcu, Sushil Sharma and Hani? Tokgoz, A Fixed Point Theorem in Fuzzy Metric Spaces, Int. Journal of Math. Analysis, 1(18), 861-872 2007.

[16] Sedghi, Nabi Shobe and A. Aliouche, Common fixed point theorems in intuitionistic fuzzy metric spaces through conditions of integral type, Applied Mathematics and information sciences, 2(1), 61-82, 2008.

[17] S. Sharma, Common fixed point theorems in fuzzy metric spaces, Fuzzy sets and systems, Vol. 127, 345-352, 2002.
[18] Shin Min Kang, Praveen Kumar and Sanjay Kumar and Bu Young Lee, Common fixed points for compatible mappings of types in multiplicative metric spaces, International journal of Mathematical Analysis 9(36), 1755-1767, 2015.
[19] B. Sing and M. S. Chauhan, Common fixed points of compatible maps in fuzzy metric spaces, Fuzzy sets and systems, Vol. 115, 471-475, 2000.
[20] Surendra Singh Khichi and Amardeep Singh, Intuitionistic fuzzy metric spaces and common fixed point theorems using occasionally weakly compatible (OWC) self mappings, International journal of fuzzy Mathematics and systems, 4(2), 135-144, 2014.
[21] Tanmoy Som, Some results on common fixed point in fuzzy metric spaces, Soochow journal of Mathematics, 33(4), 553-561, 2007.
[22] D. Turkoglu, C. Alaca, Y. J. Cho and C. Yildiz, Common fixed point theorems in intuitionistic fuzzy metric spaces, Journal of applied Mathematics and computing, 22(1-2), 411-424, 2006.
[23] R. Vasuki, Common fixed points for R-weakly commuting maps in fuzzy metric spaces, Indian journal of pure and applied Mathematics, Vol. 30, 419-423, 1999.

J.Jeyachristy Priskillal

Department of Mathematics, Karunya University, Coimbatore, Tamil Nadu, India-641114

E-mail address: jeyachristypriskillal@gmail.com

P.Thangavelu

Ramanujam Centre for Mathematical Sciences, Thiruppuvanam, Tamil Nadu, India-630611

E-mail address: ptvelu12@gmail.com