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# Fixed point theorems for $(F,\psi,\varphi)-$ contractions on ordered S-Complete Hausdorff uniform spaces

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**Abstract:** The aim of this paper is to proved some new fixed point theorems for $(F,\psi,\varphi)-$weak contractions on ordered S-complete Hausdorff uniform spaces. Our results extend existing results in the literature.

**Keywords:** Fixed point, $(F,\psi,\varphi)$-contraction, C-class function, E-distance ,S-complete space.

## 1 Introduction

Aamri and El Moutawakil [2] proved some common fixed point theorems for some new contractive or expansive maps in uniform spaces by introducing the notions of an $E-$distance. Some other authors proved fixed point theorems using this concept ([1],[3-5],[8],[10],[11],[18],[19],[22],[23]).

Existence of fixed points in partially ordered metric spaces was first investigated in 2004 by Ran and Reurings [21] and then by Nieto and Lopez [17]. Recently, some results were proved in this direction ([9],[10],[13],[16],[20]).

**Definition 1.** ([2]) *Let $(X,\vartheta)$ be a uniform space. A function $p : X\times X \longrightarrow \mathbb{R}^{+}$ is said to be an $A-$ distance if for any $V\in\vartheta$, there exists $\delta>0$, such that $p(z,x)\leq\delta$ and $p(z,y)\leq\delta$ for some $z\in X$ imply $(x,y)\in V$.*

**Definition 2.** ([2]) *Let $(X,\vartheta)$ be a uniform space. A function $p : X\times X \longrightarrow \mathbb{R}^{+}$ is said to be an $E-$ distance if*

$(p1)$ $p$ is an $A-$ distance, $(p2)$ $p(x,y)\leq p(x,z)+p(z,y)$ for all $x,y,z\in X$.

**Example 1.** ([2]) Let $X=[0,+\infty)$ and $p(x,y)=\max\{x,y\}$. The function $p$ is an $A-$distance. Also, $p$ is an $E-$distance.

The following lemma embodies some useful properties of $E-$ distance.

**Lemma 1.** ([1],[2]) *Let $(X,\vartheta)$ be a Hausdorff uniform space and p be an $E$-distance on $X$. Let $\{x_n\}$ and $\{y_n\}$ be arbitrary sequences in $X$ and $\{\alpha_n\}$,$\{\beta_n\}$be sequences in $\mathbb{R}^{+}$ converging to 0. Then, for $x,y,z\in X$, the following holds*

$(a)$ If $p(x_n,y)\leq\alpha_n$ and $p(x_n,z)\leq\beta_n$ for all $n\in\mathbb{N}$, then $y=z$. In partıcular, if $p(x,y)=0$ and $p(x,z)=0$, then $y=z$.

$(b)$ If $p(x_n,y_n)\leq\alpha_n$ and $p(x_n,z)\leq\beta_n$ for all $n\in\mathbb{N}$, then $\{y_n\}$ converges to $z$.

$(c)$ If $p(x_n,x_m)\leq\alpha_n$ for all $m>n$, then $\{x_n\}$ is a Cauchy sequence in $(X,\vartheta)$.

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Let $(X,\vartheta)$ be a uniform space equipped with $E-$ distance $p$. A sequence in $X$ is $p-$Cauchy if it satisfies the usual metric condition. There are several concepts of completeness in this setting.

**Definition 3.** $([1],[2])$ *Let $(X,\vartheta)$ be a uniform space and $p$ be an $E-$ distance on $X$.Then*

(i) $X$ is said to be $S-$complete if for every $p-$Cauchy sequence $\{x_n\}$ there exists $x\in X$ with $\lim\limits_{n\to\infty} p(x_n,x)=0$,
(ii) $X$ is said to be $p-$Cauchy complete if for every $p-$Cauchy sequence $\{x_n\}$ there exists $x\in X$ with $\lim\limits_{n\to\infty} x_n = x$ with respect to $\tau(\vartheta)$,
(iii) $f:X\longrightarrow X$ is $p-$continuous if $\lim\limits_{n\to\infty} p(x_n,x)=0$ implies $\lim\limits_{n\to\infty} p(fx_n,fx)=0$,
(iv) $f:X\longrightarrow X$ is $\tau(\vartheta)-$continuous if $\lim\limits_{n\to\infty} x_n = x$ with respect to $\tau(\vartheta)$ implies $\lim\limits_{n\to\infty} fx_n = fx$ with respect to $\tau(\vartheta)$.

*Remark.* ([2]) Let $(X,\vartheta)$ be a Hausdorff uniform space and let $\{x_n\}$ be a $p-$Cauchy sequence. Suppose that $X$ is $S-$complete, then there exists $x\in X$ such that $\lim\limits_{n\to\infty} p(x_n,x)=0$ . Lemma 4 (b) then gives $\lim\limits_{n\to\infty} x_n = x$ with respect to the topology $\tau(\vartheta)$. Therefore $S-$completeness implies $p-$Cauchy completeness.

In 2014, the concept of $C$-class functions were introduced by H. Ansari in [6]. After some fixed point theorems were gived using this concept ([7],[12],[14]).

**Definition 4.** *([6]) A mapping $F:[0,\infty)^2\to\mathbb{R}$ is called $C$-class function if it is continuous and satisfies following axioms.*

(1) $F(s,t)\le s$*;*
(2) $F(s,t)=s$ *implies that either* $s=0$ *or* $t=0$*; for all* $s,t\in[0,\infty)$.

Note for some $F$ we have that $F(0,0)=0$. We denote $C$-class functions as $\mathscr{C}$.

**Example 2.** The following functions $F:[0,\infty)^2\to\mathbb{R}$ are elements of $\mathscr{C}$, for all $s,t\in[0,\infty)$.

(1) $F(s,t)=s-t$, $F(s,t)=s\Rightarrow t=0$;
(2) $F(s,t)=ms$, $0<m<1$, $F(s,t)=s\Rightarrow s=0$;
(3) $F(s,t)=\frac{s}{(1+t)^r}$; $r\in(0,\infty)$, $F(s,t)=s\Rightarrow s=0$ or $t=0$;
(4) $F(s,t)=\log(t+a^s)/(1+t)$, $a>1$, $F(s,t)=s\Rightarrow s=0$ or $t=0$;
(5) $F(s,t)=\ln(1+a^s)/2$, $a>e$, $F(s,1)=s\Rightarrow s=0$;
(6) $F(s,t)=(s+l)^{(1/(1+t)^r)}-l$, $l>1, r\in(0,\infty)$, $F(s,t)=s\Rightarrow t=0$;
(7) $F(s,t)=s\log_{t+a}a$, $a>1$, $F(s,t)=s\Rightarrow s=0$ or $t=0$;
(8) $F(s,t)=s-(\frac{1+s}{2+s})(\frac{t}{1+t})$, $F(s,t)=s\Rightarrow t=0$;
(9) $F(s,t)=s\beta(s)$, $\beta:[0,\infty)\to(0,1)$,and is continuous, $F(s,t)=s\Rightarrow s=0$;
(10) $F(s,t)=s-\frac{t}{k+t}$,$F(s,t)=s\Rightarrow t=0$;
(11) $F(s,t)=s-\varphi(s)$,$F(s,t)=s\Rightarrow s=0$,here $\varphi:[0,\infty)\to[0,\infty)$ is a continuous function such that $\varphi(t)=0\Leftrightarrow t=0$;
(12) $F(s,t)=sh(s,t)$,$F(s,t)=s\Rightarrow s=0$,here $h:[0,\infty)\times[0,\infty)\to[0,\infty)$is a continuous function such that $h(t,s)<1$ for all $t,s>0$;
(13) $F(s,t)=s-(\frac{2+t}{1+t})t$, $F(s,t)=s\Rightarrow t=0$;
(14) $F(s,t)=\sqrt[n]{\ln(1+s^n)}$, $F(s,t)=s\Rightarrow s=0$;
(15) $F(s,t)=\phi(s)$,$F(s,t)=s\Rightarrow s=0$,here $\phi:[0,\infty)\to[0,\infty)$ is a upper semicontinuous function such that $\phi(0)=0$, and $\phi(t)<t$for $t>0$;
(16) $F(s,t)=\frac{s}{(1+s)^r}$; $r\in(0,\infty)$, $F(s,t)=s\Rightarrow s=0$.

We shall also state the following definition of altering distance function which is required in the sequel to establish a fixed point theorem in uniform space.

**Definition 5.** ([15]) *A function $\psi : [0,\infty) \to [0,\infty)$ is called an altering distance function if the following properties are satisfied:*

(i) $\psi(0) = 0$,
(ii) $\psi$ is continuous and monotonically nondecreasing.

*Remark.* We denote set of altering distance functions by $\Psi$.

In this paper, we assume that

**Definition 6.** *([6])An ultra altering distance function is a continuous, nondecreasing mapping $\varphi : [0,\infty) \to [0,\infty)$ such that $\varphi(t) > 0$ ,$t > 0$ and $\varphi(0) \geq 0$.*

*Remark.* We denote set ultra altering distance functions by $\Phi_u$.

## 2 Fixed point results

In this section, we prove some fixed point results using C-class function in ordered uniform spaces.

**Theorem 1.** *Let $(X,\vartheta,\preceq)$ be an ordered Hausdorff uniform space and $p$ be an $E$-distance on $S$-complete and $p$-bounded space $X$ . Let $f,g : X \to X$ be two commuting $p$-continuous or $\tau(\vartheta)-$continuos selfmappings such that*

(i) $f(X) \subseteq g(X)$,
(ii) *$f$ is $g-$nondecreasing,*
(iii) *$\psi(p(fx,fy)) \leq F(\psi(p(gx,gy)),\varphi(p(gx,gy)))$ for all $x,y \in X$ with $gx \preceq gy$ where $\psi \in \Psi, \varphi \in \Phi_u$ and $F \in \mathscr{C}$*

*If there exists $x_0 \in X$ with $gx_0 \preceq fx_0$ then $f$ and $g$ have an unique common fixed point.*

*Proof.* If $x_0 \in X$ such that $gx_0 \preceq fx_0$. Since $f(X) \subseteq g(X)$, we can choose $x_1 \in X$ such that $fx_0 = gx_1$. Then $gx_0 \preceq fx_0 = gx_1$. As $f$ is $g-$nondecreasing, we get $fx_0 \preceq fx_1$. Continuing this process, we can construct a sequence $\{x_n\}$ in $X$ such that

$$gx_n = fx_{n-1}, \quad n = 1,2,...$$

for which

$$gx_0 \preceq fx_0 = gx_1 \preceq fx_1 = gx_2 \preceq \cdots \preceq fx_{n-1} = gx_n \preceq \cdots.$$

From (iii),

$$\begin{aligned} \psi(p(fx_n,fx_{n+1})) &\leq F(\psi(p(gx_n,gx_{n+1})),\varphi(p(gx_n,gx_{n+1}))) \\ &\leq \psi(p(gx_n,gx_{n+1})) = \psi(p(fx_{n-1},fx_n)) \end{aligned} \tag{1}$$

so $p(fx_n,fx_{n+1}) \leq p(fx_{n-1},fx_n)$,therefore $\{p(fx_n,fx_{n+1})\}$, is decreasing so tend to $r \geq 0$,

In (1), on taking limit as $n \to \infty$, by definiton of $F$,

$$\psi(r) \leq F(\psi(r),\varphi(r)) \leq \psi(r).$$

So, $\psi(r) = 0$, or ,$\varphi(r) = 0$, therefore $r = 0$ . Hence

$$\lim_{n\to\infty} p(x_{n+1},x_n) = 0.$$

Similarly, we can show

$$\lim_{n\to\infty} p\left(x_n, x_{n+1}\right) = 0.$$

Next we show that $\{x_n\}$ is a $p-$Cauchy sequence. Assume $\{y_n = fx_n\}$ is not $p-$Cauchy. Then there exists an $\varepsilon > 0$ for which we can find subsequences $\{y_{m(k)}\}$ and $\{y_{n(k)}\}$ of $\{y_n\}$ with $m(k) > n(k) > k$ such that

$$p\left(y_{n(k)}, y_{m(k)}\right) \geq \varepsilon. \tag{2}$$

Further, corresponding to $n(k)$, we can choose $m(k)$ in such a way that it is the smallest integer with $m(k) > n(k)$ and satisfying (2). Hence,

$$p\left(y_{n(k)}, y_{m(k)-1}\right) < \varepsilon.$$

Then we have

$$\varepsilon \leq p\left(y_{n(k)}, y_{m(k)}\right) \leq p\left(y_{n(k)}, y_{m(k)-1}\right) + p\left(y_{m(k)-1}, y_{m(k)}\right),$$

that is

$$\varepsilon \leq p\left(y_{n(k)}, y_{m(k)}\right) < \varepsilon + p\left(y_{m(k)-1}, y_{n(k)}\right).$$

Taking the limit as $k \to \infty$, we have

$$\lim_{k\to\infty} p\left(x_{n(k)}, x_{m(k)}\right) = \varepsilon. \tag{3}$$

From (p2),

$$p\left(y_{n(k)}, y_{m(k)}\right) \leq p\left(y_{n(k)}, y_{n(k)+1}\right) + p\left(y_{n(k)+1}, y_{m(k)+1}\right) + p\left(y_{m(k)+1}, y_{m(k)}\right)$$

and

$$p\left(y_{n(k)+1}, y_{m(k)+1}\right) \leq p\left(y_{n(k)+1}, y_{n(k)}\right) + p\left(y_{n(k)}, y_{m(k)}\right) + p\left(y_{m(k)}, y_{m(k)+1}\right).$$

Taking the limit as $k \to \infty$ we have

$$\lim_{k\to\infty} p\left(y_{n(k)+1}, y_{m(k)+1}\right) = \varepsilon. \tag{4}$$

From (iii),

$$\begin{aligned}
\psi\left(p\left(y_{n(k)+1}, y_{m(k)+1}\right)\right) &= \psi\left(p\left(fx_{n(k)+1}, fx_{m(k)+1}\right)\right) \\
&\leq F\left(\psi\left(p\left(gx_{n(k)+1}, gx_{m(k)+1}\right)\right), \varphi\left(p\left(gx_{n(k)+1}, gx_{m(k)+1}\right)\right)\right) \\
&= F\left(\psi\left(p\left(fx_{n(k)}, fx_{m(k)}\right)\right), \varphi\left(p\left(fx_{n(k)}, fx_{m(k)}\right)\right)\right) \\
&= F\left(\psi\left(p\left(y_{n(k)}, y_{m(k)}\right)\right), \varphi\left(p\left(y_{n(k)}, y_{m(k)}\right)\right)\right).
\end{aligned}$$

Letting $k \to \infty$ in the above inequality, using (3), (4), the continuities of $\psi$ and $\varphi$ and definition of $F$, we have

$$\psi(\varepsilon) \leq F(\psi(\varepsilon), \varphi(\varepsilon)) \leq \psi(\varepsilon).$$

So, $\psi(\varepsilon) = 0$ or $\varphi(\varepsilon) = 0$, therefore $\varepsilon = 0$ which is a contradiction. Hence $\{fx_n\}$ is a $p$-Cauchy sequence. Since $S-$completeness of $X$, there exists a $z \in X$ such that

$$\lim_{n\to\infty} p(fx_n, z) = 0 \text{ and } \lim_{n\to\infty} p(gx_n, z) = 0$$

Moreover, the $p-$continuity of $f$ and $g$ implies that

$$\lim_{n\to\infty} p(gfx_n, gz) = \lim_{n\to\infty} p(fgx_n, fz) = 0.$$

Since $f$ and $g$ are commuting, then $fg = gf$. So we have

$$\lim_{n\to\infty} p(fgx_n, gz) = \lim_{n\to\infty} p(fgx_n, fz) = 0.$$

By Lemma 4(a), we have $fz = gz$. Since $fg = gf$, we have $ffz = fgz = gfz = ggz$. . From (iii) and definition of $F$, $\psi$ and $\varphi$,

$$\begin{aligned}\psi(p(fz, ffz)) &\le F(\psi(p(gz, gfz)), \varphi(p(gz, gfz)))\\ &= F(\psi(p(fz, ffz)), \varphi(p(fz, ffz)))\end{aligned} \tag{5}$$

so, $\psi(p(fz, ffz)) = 0$, or $,\varphi(p(fz, ffz)) = 0$ . Thus $p(fz, ffz) = 0$. Again From (iii), we have

$$\begin{aligned}\psi(p(fz, fz)) &\le F(\psi(p(gz, gz)), \varphi(p(gz, gz)))\\ &= F(\psi(p(fz, fz)), \varphi(p(fz, fz)))\end{aligned} \tag{6}$$

so, $\psi(p(fz, fz)) = 0$, or $,\varphi(p(fz, fz)) = 0$ . Thus $p(fz, fz) = 0$. Thus from (5) , (6) and Lemma 4(a), we get $ffz = fz$. Hence $fz$ is common fixed point of $f$ and $g$. The proof is similar when $T$ is $\tau(\vartheta)-$continuous.

Now, we show uniqueness. Suppose that there exists $u, t \in X$ such that $fu = gu = u$ and $ft = gt = t$. Then by (iii) ,

$$\begin{aligned}\psi(p(u,t)) = \psi(p(fu, ft)) &\le F(\psi(p(gu, gt)), \varphi(p(gu, gt)))\\ &= F(\psi(p(u,t)), \varphi(p(u,t)))\end{aligned}$$

so, $\psi(p(u,t)) = 0$, or $,\varphi(p(u,t)) = 0$ . Thus $p(u,t) = 0$. Similarly, we show that $p(t,u) = 0$. By (p2)

$$p(u,u) \le p(u,t) + p(t,u)$$

and therefore $p(u,u) = 0$. By Lemma 4 (a), we have $u = t$.

**Corollary 1.** *Let $(X, \vartheta, \preceq)$ be an ordered Hausdorff uniform space. Suppose $p$ be an $E$-distance on $S$-complete and $p-$bounded space $X$. Let $f : X \to X$ be a $p-$continuous or $\tau(\vartheta)-$continuous nondecreasing mapping such that for all comparable $x, y \in X$ with*

$$\psi(p(fx, fy)) \le F(\psi(p(x,y)), \varphi(p(x,y)))$$

*where $\psi \in \Psi$ , $\varphi \in \Phi$ and $F \in \mathscr{C}$.*

*If there exists $x_0 \in X$ with $x_0 \preceq f(x_0)$ then $f$ has a fixed point.*

**Corollary 2.** *([23]) Let $(X, \vartheta, \preceq)$ be a Hausdorff uniform space, " $\preceq$ " be a partial order on $X$ and $p$ be an $E$-distance on $S$-complete space $X$ . Let $f : X \to X$ be a $p-$continuous or $\tau(\vartheta)-$continuous nondecreasing mapping such that for all comparable $x, y \in X$ with*

$$\psi(p(fx, fy)) \le \psi(p(x,y)) - \varphi(p(x,y))$$

*where $\psi, \varphi : [0,\infty) \to [0,\infty)$ are altering distance functions.*

*If there exists $x_0 \in X$ with $x_0 \preceq f(x_0)$ then $f$ has a fixed point.*

**Corollary 3.** *Let $(X, \vartheta, \preceq)$ be an ordered Hausdorff uniform space. Suppose $p$ be an $E$-distance on $S$-complete and $p-$bounded space $X$. Let $f : X \to X$ be a $p-$continuous or $\tau(\vartheta)-$continuous nondecreasing mapping such that for all* *comparable* $x,y\in X$ *with*

$$\psi(p(fx,fy))\le k\psi(p(x,y))$$

*where* $\psi:[0,\infty)\to[0,\infty)$ *is an altering distance function and* $0<k<1$.

*If there exists* $x_0\in X$ *with* $x_0\preceq f(x_0)$ *then* $f$ *has a fixed point.*

**Example 3.** Let $F(s,t)=\ln(1+s)$ , $X=[0,1]$ equipped with usual metric $d(x,y)=|x-y|$ and a partial order be defined as $x\preceq y$ whenever $y\le x$ and suppose

$$\vartheta=\{V\subset X\times X:\Delta\subset V\}.$$

Define the function $p$ as $p(x,y)=y$ for all $x,y$ in $X$ and $f,g:X\to X$ defined by $f(t)=\frac{3t}{4}$ and $g(t)=\frac{t}{16}$ . Consider the function $\psi$ and $\varphi$ defined as follows

$$\psi(t)=\frac{t}{5}\text{ and }\varphi(t)=\frac{t}{3}.$$

Definition of $\vartheta$, $\cap_{V\in\vartheta}V=\Delta$ and this show that the uniform space $(X,\vartheta)$ is Hausdorff uniform space. And also $X$ is $S-$complete.On the other hand, $p$ is an $E-$distance. $f,g$ are commuting, $p-$continuous and $f$ is $g-$nondecreasing. We have that for all $x,y\in X$

$$p(fx,fy)\le\ln(1+\psi(p(x,y)))=F(\psi(p(gx,gy)),\varphi(p(gx,gy))).$$

And 0 is the unique common fixed point of $f$ and $g$.

## References

[1] M. Aamri, S. Bennari, D. El Moutawakil, Fixed points and variational principle in uniform spaces, Siberian Electronic Mathematical Reports 3 (2006) 137-142.

[2] M. Aamri, D. El Moutawakil, Common fixed point theorems for E-contractive or E-expansive maps in uniform spaces, Acta Mathematica Academiae Peadegogicae Nyiregyhaziensis 20 (2004) 83-91.

[3] M. Alimohammady, M. Ramzannezhad, On $\phi-$fixed point for maps on uniform spaces, J. Nonlinear Sci. and Appl 4 (1) (2008) 241-143.

[4] I. Altun, Common fixed point theorems for weakly increasing mappings on ordered uniform spaces, Miskolc Mathematical Notes 12 (1) (2011) 3–10.

[5] I. Altun, M. Imdad, Some fixed point theorems on ordered uniform spaces, Filomat, 23 (3) (2009) 15-22.

[6] A. H.Ansari,Note on" $\varphi-\psi$-contractive type mappings and related fixed point",The 2nd Regional Conference on Mathematics And Applications,PNU,September (2014) 377-380.

[7] A. H. Ansari, S. Chandok, C. Ionescu, Fixed point theorems on $b$-metric spaces for weak contractions with auxiliary functions,Journal of Inequalities and Applications 2014 (2014) Article ID 429.

[8] A.O. Bosede, On some common fixed point theorems in uniform spaces, General Mathematics 19 (2) (2011) 41–48.

[9] L.J. Ćirić, N. Cakić, M. Rajović, J.S. Ume, Monotone generalized nonlinear contractions in partially ordered metric spaces, Fixed Point Theory Appl. 2008 (2008) Article ID 131294.

[10] R. Chugh, M. Aggarwal, Fixed points of intimate mappings in uniform spaces, Int. Journal of Math. Analysis 6 (9) (2012) 429 - 436.

[11] V.B. Dhagat, V. Singh, S. Nath, Fixed point theorems in uniform spaces, Int. Journal of Math. Analysis 3 (4) (2009) 197 - 202.

[12] Z. M. Fadail, A. G. Bin Ahmad, A. H. Ansari, S. Radenović , M. Rajović, Some common fixed point results of mappings in $0-\sigma-$complete metric-like spaces via new function, Applied Mathematical Sciences, 9 (83) (2015) 4109 - 4127

[13] J. Harjani, K. Sadarangani, Fixed point theorems for weakly contractive mappings in partially ordered sets, Nonlinear Anal. 71 (2009) 3403-3410.

[14] E. Hoxha, A. H.Ansari, K. Zoto, Some common fixed point results through generalized altering distances on dislocated metric spaces, Proceedings of EIIC, september 1-5 (2014) 403-409.

[15] M.S. Khan, M. Swaleh, S. Sessa, Fixed point theorems by altering distances between the points, Bulletin of the Australian Mathematical Society 30 (1) (1984) 1–9.

[16] H.K. Nashine, B. Samet, Fixed point results for mappings satisfying $(\psi,\varphi)-$ weakly contractive condition in partially ordered metric spaces, Nonlinear Anal. 74 (6) (2011) 2201-2209.

[17] J.J. Nieto, R.R. Lopez, Contractive mapping theorems in partially ordered sets applications to ordinary differantial equations, Order. 22 (2005) 223-239.

[18] M.O. Olatinwo, On some common fixed point theorems of Aamri and El Moutawakil in uniform spaces, Applied Mathematics E-Notes 8 (2008) 254-262.

[19] M.O. Olatinwo, Some common fixed point theorems for self-mappings in uniform space, Acta Mathematica Academiae Peadegogicae Nyiregyhaziensis 23 (2007) 47-54.

[20] V. Ozturk, D. Turkoglu, Common fixed point for $(\psi,\varphi)$-weak contractions on ordered gauge spaces and applications, Journal Of Nonlinear Sci. Appl. 16(3) (2015) 473-483

[21] A.C.M. Ran, M.C.B. Reurings, A fixed point theorem in partially ordered sets and some applications to matrix equations, Proc. Amer. Math. Soc. 132 (2004) 1435-1443.

[22] S. Sedghi, N. Shobkolaei, S. Firouzian, I. Altun, Cyclic $\phi-$contractions on $S-$complete Hausdorff uniform spaces, Kuwait J. Sci., 42 (1) (2015) 55-63.

[23] D. Turkoglu, V. Ozturk, $(\psi,\varphi)$-weak contraction on ordered uniform spaces, Filomat 28:6 (2014) 1265–1269.

[24] S. Willard, General Topology, Addison-Wesley Publishing, 1970.