# On Fuzzy Contra $g^* \alpha$-Continuous Functions

Madhulika Shukla
Department of Applied Mathematics,
Gayan Ganga Insitude of Technology and Sciences
Jabalpur (M.P.) 482011 India

## ABSTRACT
In this paper we introduce and study the new class of functions called fuzzy contra $g^*\alpha$-continuous and fuzzy almost contra $g^*\alpha$-continuous mappings on fuzzy topological spaces. We investigate some of their properties. Also we provide the relation between fuzzy contra $g^*\alpha$-continuous mappings and fuzzy almost contra $g^*\alpha$-continuous mappings.

**General Terms** Fuzzy topology, fuzzy generalized closed set, fuzzy $g\alpha$-closed, fuzzy $g^*\alpha$-closed set, fuzzy contra $\alpha$-continuous function fuzzy $g^*\alpha$-continuous.

## Keywords
Fuzzy contra $g^*\alpha$-continuous function, fuzzy Contra $g^*\alpha$-irresolute function, fuzzy almost contra $g^*\alpha$-continuous functions.

## 1. INTRODUCTION
The fuzzy $\alpha$-open and fuzzy $\alpha$-continuous mappings were introduced and generalized by Bin Shahana [4]. N. Levine [8] introduced the concepts of generalized closed sets in general topology in the year 1970. Veera kumar [13] introduced and study the concept of $g^*$-closed set and $g^*$-continuity in topological space. In 2006, Eradal and Etienne [5] introduced the notation of fuzzy contra continuous mapping. S. S. Benchalli and G. P. Siddapur [3] introduced the notation of generalized pre-closed sets in fuzzy topological space in 2011. Recently M. Shukla introduced the concept of fuzzy contra $g^*p$-continuous [11] and fuzzy contra $g^*s$- continuous [12] in fuzzy topological space.

In this paper we introduce and study the new class of mappings called fuzzy contra $g^*\alpha$-continuous and fuzzy almost contra $g^*\alpha$-continuous functions in fuzzy topological spaces. Also we define the relation between of fuzzy contra $g^*\alpha$ -continuous and fuzzy almost contra $g^*\alpha$-continuous spaces and study some of their properties.

## 2. PRELIMINARY
Let $X$ be a non empty set. A collection $\tau$ of fuzzy sets in $X$ is called a fuzzy topology on $X$ if the whole fuzzy set 1 and the empty fuzzy set 0 is the members of $\tau$ and $\tau$ is closed with respect to any union and finite intersection. The members of $\tau$ are called fuzzy open sets and the complement of a fuzzy open set is called fuzzy closed set.

The **closure** of a fuzzy set $\lambda$ (denoted by $cl(\lambda)$ ) is the intersection of all fuzzy closed which contains $\lambda$. The **interior** of a fuzzy set $\lambda$ (denoted by $int(\lambda)$) is the union of all fuzzy open subsets of $\lambda$. A fuzzy set $\lambda$ in $X$ is fuzzy open (resp. fuzzy closed) if and only $int(\lambda) = \lambda$ (resp. $cl(\lambda) = \lambda$).

**Definition 2.1:** Let $(X, \tau)$ be a fuzzy topological space. A fuzzy set $\lambda$ in the space $X$ is called:

(i) semi-open fuzzy set [1] if $\lambda \leq cl(int(\lambda))$ and semi-closed fuzzy set if $int(cl(\lambda)) \leq \lambda$.
(ii) pre-open fuzzy set [4] if $\lambda \leq int(cl(\lambda))$ and pre-closed fuzzy set if $cl(int(\lambda)) \leq \lambda$.
(iii) $\alpha$-open fuzzy set [4] if $\lambda \leq int\left(cl(int(\lambda))\right)$ and $\alpha$-closed fuzzy set if $cl\left(int(cl(\lambda))\right) \leq \lambda$.
(iv) regular open fuzzy set [1] if $\lambda = int(cl(\lambda))$ and regular closed fuzzy set if $\lambda = cl(int(\lambda))$.

The $\alpha$-closure (resp. semi-closure, pre-closuer) of a fuzzy set $\lambda$ in fuzzy topological space $(X, \tau)$ is intersection of all $\alpha$-closed (resp. semi-closed, preclosed) fuzzy sets in $X$ containing $\lambda$ and is denoted by $\alpha - cl(\lambda)$ (resp. $scl(\lambda), pcl(\lambda)$ ).

**Definition 2.2:** Let $(X, \tau)$ be a fuzzy topological space. A fuzzy set $\lambda$ in the space $X$ is called:

(i) generalized closed fuzzy set ($g$-closed) fuzzy set [2] if $cl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is open fuzzy set in$(X, \tau)$.
(ii) generalized $\alpha$-closed fuzzy set ($g\alpha$-closed) fuzzy set [2] if $\alpha cl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is open fuzzy set in$(X, \tau)$.
(iii) $g^*$- closed fuzzy set ($g^*$-closed) fuzzy set [8] if $cl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is $g$-open fuzzy set in$(X, \tau)$.
(iv) $g^*$-preclosed fuzzy set ($g^*p$-closed) fuzzy set [3] if $pcl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is $g$-open fuzzy set in$(X, \tau)$.
(v) $g^*$-semiclosed fuzzy set ($g^*$s-closed) fuzzy set [3] if $scl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is $g$-open fuzzy set in $(X, \tau)$.
(vi) $g^*$-alphaclosed fuzzy set ($g^*\alpha$-closed) fuzzy set [3] if $\alpha cl(\lambda) \leq \eta$ whenever $\lambda \leq \eta$ and $\eta$ is $g$-open fuzzy set in$(X, \tau)$.

The complement of $g$-closed (resp. $gp$-closed, $g^*$-closed and $g^*p$-closed, $g^*s$-closed, $g^*\alpha$-closed) fuzzy sets are called fuzzy $g$-open (resp. $gp$-open, $g^*$-open and $g^*p$-open, $g^*s$-open, $g^*\alpha$-open) sets in fuzzy topological spaces.

**Definition 2.3:** A fuzzy topological space $(X, \tau)$ is called $T_\alpha^*$ -space [6] if every $g^*\alpha$-closed fuzzy set is a closed fuzzy set in $X$.

**Definition 2.4:** A function $f$ from a fuzzy topological space $(X, \tau)$ to fuzzy topological space $(Y, \sigma)$ is called:

(i) fuzzy-contra continuous if $f^{-1}(\lambda)$ is fuzzy closed in $X$ for every fuzzy open set $\lambda$ of $Y$ [5].

(ii) fuzzy contra pre-continuous (fuzzy contra $\alpha$-continuous [7], fuzzy contra semi-continuous) if $f^{-1}(\lambda)$ is fuzzy pre-closed (fuzzy $\alpha$-closed, fuzzy semi-closed resp.) in $X$ for every fuzzy open set $\lambda$ of $Y$ .
(iii) fuzzy $g$-continuous if $f^{-1}(\lambda)$ is fuzzy $g$-closed in $X$ for every fuzzy closed set $\lambda$ of $Y$ [2].
(iv) fuzzy $g$ pre- continuous (fuzzy $g\alpha$-continuous, fuzzy $g$semi-contonuous) if $f^{-1}(\lambda)$ is fuzzy $gp$-closed (fuzzy $g\alpha$-closed, fuzzy $gs$-closed resp.) in $X$ for every fuzzy closed set $\lambda$ of $Y$ [6,].
(v) fuzzy $g^*$- continuous if $f^{-1}(\lambda)$ is fuzzy $g^*$-open in $X$ for every fuzzy open set $\lambda$ of $Y$ [8].
(vi) fuzzy $g^*p$-continuous (fuzzy $g^*\alpha$-continuous, fuzzy $g^*s$emi-continuous) if $f^{-1}(\lambda)$ is fuzzy $g^*p$ –open (fuzzy $g\alpha^*$-open, fuzzy $g^*s$-open ) in $X$ for every fuzzy open set $\lambda$ of $Y$ [3,].
(vii) A function $f: X \to Y$ is called fuzzy contra $g^*p$-continuous (fuzzy contra $g^*s$-continuous) if $f^{-1}(\lambda)$ is fuzzy $g^*p$-closed (fuzzy $g^*s$-closed) set in $X$ for every open set $\lambda$ in $Y$ [11].
(viii) fuzzy almost continuous if $f^{-1}(\lambda)$ is fuzzy open in $X$ for every fuzzy regular open set $\lambda$ of $Y$ [1].

## 3. FUZZY CONTRA $g^*\alpha$-CONTINUOUS FUNCTION

**Definition 3.1.** A function $f: X \to Y$ is called **fuzzy contra $g^*\alpha$-continuous** if $f^{-1}(\lambda)$ is fuzzy $g^*\alpha$-closed set in $X$ for every open set $\lambda$ in $Y$.

**Theorem 3.2.** Every fuzzy contra continuous function is fuzzy contra $g^*\alpha$-continuous function.

**Proof:** It follows from the fact that every fuzzy closed set is $g^*\alpha$-closed set.

The converse of the above theorem need not be true as seen from the following example.

**Example 3.3:** Let $X = \{x_1, x_2\}$, $Y = \{y_1, y_2\}$ and $\mu, \lambda$ be fuzzy sets in $X$ and $Y$, defined as $\mu(x_1) = 0.5$, $\mu(x_2) = 0.5$, $\lambda(y_1) = 0.4$, and $\lambda(y_2) = 0.3$. Let $\tau = \{0, \mu, 1\}$ and $\tau' = \{0, \lambda, 1\}$ be fuzzy topologies on sets $X$ and $Y$ respectively. We see that map $f : X \to Y$ defined as $f(x_1) = y_1$ and $f(x_2) = y_2$ Then $f$ is fuzzy contra $g^*\alpha$-continuous but not fuzzy contra continuous.

**Theorem 3.4.** Every fuzzy contra $\alpha$-continuous mapping is fuzzy contra $g^*\alpha$-continuous function.

**Proof.** Straight forward and follows from the definitions.

The converse of the above theorem need not be true as seen from Example 3.2.

**Theorem 3.5.** Every fuzzy contra $g^*\alpha$ -continuous mapping is fuzzy contra $g^*s$-continuous function as well as fuzzy $g^*p$-continuous.

**Proof:** Straight forward and follows from the definitions.

The converse of the above theorem need not be true as seen from Example 3.6 and Example 3.7.

**Example 3.6:** Let $X = \{x_1, x_2\}$, and $Y = \{y_1, y_2\}$. Let $\eta_1, \eta_2, \eta_3$ be fuzzy sets in $X$, $\mu$ be a fuzzy set in $Y$, defined as $\eta_1(x_1) = 0.2$, $\eta_1(x_2) = 0.3$, $\eta_2(x_1) = 0.3$, $\eta_2(x_2) = 0.5$, $\eta_3(x_1) = 0.6$, $\eta_3(x_2) = 0.7$, $\mu(y_1) = 0.5$, and $\mu(y_2) = 0.6$. Let $\tau_X = \{0, \eta_1, \eta_2, \eta_3, 1\}$ and $\tau_Y = \{0, \mu, 1\}$ be fuzzy topologies on sets $X$ and $Y$ respectively. Let $f: X \to Y$ defined as $f(x_i) = y_i$ , i = 1, 2. Then $f$ is fuzzy contra $g^*s$-continuous but not fuzzy contra $g^*\alpha$-continuous.

**Example 3.7:** Let $X = \{x_1, x_2\}$, and $Y = \{y_1, y_2\}$. Let $\eta_1$ an, $\eta_3$ be fuzzy sets in $X$, $\mu$ be a fuzzy set in $Y$, defined as $\eta_1(x_1) = 0.1$, $\eta_1(x_2) = 0.2$, $\eta_2(x_1) = 0.4$, $\eta_2(x_2) = 0.6$, $\eta_3(x_1) = 0.7$, $\eta_3(x_2) = 0.7$, $\mu(y_1) = 0.2$ and $\mu(y_2) = 0.5$. Let $\tau_X = \{0, \eta_1, \eta_2, \eta_3, 1\}$ and $\tau_Y = \{0, \mu, 1\}$ be fuzzy topologies on sets $X$ and $Y$ respectively. Let $f: X \to Y$ defined as $f(x_i) = y_i$ , i = 1, 2. Then $f$ is fuzzy contra $g^*p$-continuous but not fuzzy contra $g^*\alpha$-continuous.

**Theorem 3.8.** If a function $f: (X, \tau) \to (Y, \sigma)$ is fuzzy contra $g^*\alpha$ –continuous and $(X, \tau)$ is fuzzy $T_\alpha^*$-space, than $f$ is fuzzy contra continuous.

**Proof.** Let $\lambda$ be open fuzzy set in $Y$. Then $f^{-1}(\lambda)$ is $g^*\alpha$-closed fuzzy set in $X$. Since $X$ is fuzzy $T_\alpha^*$ -space. $f^{-1}(\lambda)$ is closed fuzzy set in $X$. Thus $f$ is fuzzy contra continuous function.

**Theorem 3.9.** If a function $f: (X, \tau) \to (Y, \sigma)$ is fuzzy contra $\alpha$ -continuous and $(X, \tau)$ is fuzzy $T_\alpha^*$-space, than $f$ is fuzzy contra $g^*\alpha$-continuous.

**Proof.** Let $\lambda$ be open fuzzy set in $Y$. Then $f^{-1}(\lambda)$ is $\alpha$ -closed fuzzy set in $X$. Since $X$ is fuzzy $T_\alpha^*$ -space. $f^{-1}(\lambda)$ is $g^*\alpha$-closed fuzzy set in $X$. Thus $f$ is fuzzy contra $g^*\alpha$-continuous function.

**Theorem 3.10.** If a function $f: (X, \tau) \to (Y, \sigma)$ is fuzzy contra $g^*\alpha$ –continuous and $(X, \tau)$ is fuzzy $T_\alpha^*$-space, than $f$ is fuzzy contra $\alpha$ -continuous.

**Proof.** Let $\lambda$ be open fuzzy set in $Y$. Then $f^{-1}(\lambda)$ is $g^*\alpha$-closed fuzzy set in $X$. Since $X$ is fuzzy $T_\alpha^*$ -space. $f^{-1}(\lambda)$ is closed fuzzy set in $X$. And every closed fuzzy set is$\alpha$ -closed fuzzy set. Thus $f$ is fuzzy contra $\alpha$ -continuous function.

**Theorem 3.11** Let $(X, \tau)$ and $(Y, \sigma)$ be two fuzzy topological spaces. The following statement are equivalent for a function $f: X \to Y$.
(i) $f$ is fuzzy contra $g^*\alpha$- continuous.
(ii) $f^{-1}(\lambda)$ is $g^*\alpha$-open fuzzy set in $X$ for each closed fuzzy set $\lambda$ in $Y$.
(iii) for each $x \in X$ and each closed fuzzy set $\lambda$ in Y containing $f(x)$. there exist a $g^*\alpha$-open fuzzy set $\eta$ in $X$ containing $x$ such that $f(\eta) \leq \lambda$.
(iv) for each $x \in X$ and open fuzzy set $\mu$ in $Y$ non-containing $f(x)$, there exists a $g^*\alpha$-closed fuzzy set $\vartheta$ in $X$ non-containing $x$ such that $f^{-1}(\mu) \leq \vartheta$.

**Proof.** (i)$\Rightarrow (ii)$. Let $\lambda$ be a closed fuzzy set in $(Y, \sigma)$. Then 1- $\lambda$ is fuzzy open. By (i), $f^{-1}(1-\lambda) = 1 - f^{-1}(\lambda)$ is $g^*\alpha$-closed fuzzy set in $X$. So $f^{-1}(\lambda)$ is $g^*\alpha$ –open fuzzy set in $X$.
(ii) $\Rightarrow (i)$. proof as above.
(ii) $\Rightarrow (iii)$. Let $\lambda$ be any closed fuzzy set in $Y$ containing $f(x)$. By (ii). $f^{-1}(\lambda)$ is $g^*\alpha$-open fuzzy set in $(X, \tau)$ and $x \in f^{-1}(\lambda)$. Take $\eta = f^{-1}(\lambda)$. Then $f(\eta) \leq \lambda$.
(iii) $\Rightarrow (ii)$. Let $\lambda$ be a closed fuzzy set in $Y$ and $x \in f^{-1}(\lambda)$. From (iii), there exists a $g^*\alpha$-open fuzzy set $\eta$ in $X$ containing $x$ such that $\eta \leq f^{-1}(\lambda)$. We have $f^{-1}(\lambda) = \cup_{x \in f^{-1}(\lambda)} \eta$. Thus $f^{-1}(\lambda)$ is $g^*\alpha$-open fuzzy set in $(X, \tau)$.
(iii) $\Rightarrow (iv)$. Let $\mu$ be any open fuzzy set in $Y$ non-containing $f(x)$. Then 1-$\mu$ is a closed fuzzy set containing $f(x)$. By (iii) there exists a $g^*\alpha$-open fuzzy set $\eta$ in $X$ containing $x$ such that $f(\eta) \leq 1 - \mu$. Hence $\eta \leq f^{-1}(1-\mu) \leq 1 - f^{-1}(\mu)$ and then $f^{-1}(\mu) \leq 1 - \eta$.

Take $\vartheta = 1 - \eta$. We obtain that $\vartheta$ is a $g^*\alpha$-closed fuzzy set in $X$ non-containing $x$.
The converse can be shown easily.

**Definition 3.12.** A function $f:(X,\tau) \to (Y,\sigma)$ is called **Fuzzy Contra $g^*\alpha$–irresolute** if $f^{-1}(\lambda)$ is $g^*\alpha$-closed fuzzy set in $X$ for every $g^*\alpha$-open fuzzy set $\lambda$ in $Y$.

**Theorem 3.13.** A function $f:(X,\tau) \to (Y,\sigma)$is fuzzy contra $g^*\alpha$-continuous if and only if $f^{-1}(\lambda)$ is $g^*\alpha$-open fuzzy set in $X$ for every $g^*\alpha$-closed fuzzy set $\lambda$ in $Y$.

**Theorem 3.14.** Every fuzzy contra $g^*\alpha$-irresolute mapping is fuzzy contra $g^*\alpha$-continuous.

**Proof.** Let $f:X \to Y$ is fuzzy contra $g^*\alpha$-irresolute function. Let $\lambda$ be a fuzzy open set in $Y$. Then $\lambda$ is $g^*\alpha$-open fuzzy set in $Y$. Since $f$ is fuzzy contra $g^*\alpha$-irresolute. $f^{-1}(\lambda)$ is $g^*\alpha$- fuzzy closed set in $X$. Hence $f$ is fuzzy contra $g^*\alpha$-continuous function.

**Theorem 3.15.** Let $f:X \to Y$, $g:Y \to Z$ be two functions then

(i) $gof:X \to Z$ is fuzzy contra $g^*\alpha$-continuous, if $f$ is fuzzy contra $g^*\alpha$-continuous and $g$ are fuzzy continuous.
(ii) $gof:X \to Z$ is fuzzy contra $g^*\alpha$-continuous if $f$ is fuzzy contra $g^*\alpha$-irresolute and $g$ is fuzzy $g^*\alpha$-continuous.

# 4. FUZZY ALMOST CONTRA $g^*\alpha$-CONTINUOUS FUNCTION

**Definition 4.1.** A function $f:(X,\tau) \to (Y,\sigma)$ is called **Fuzzy almost contra $g^*\alpha$–Continuous** if $f^{-1}(\lambda)$ is fuzzy $g^*\alpha$-closed set in $X$ for every regular open set $\lambda$ in $Y$.

**Theorem 4.2.** Every fuzzy contra $g^*\alpha$-continuous function is fuzzy almost contra $g^*\alpha$-continuous.

**Proof.** Since every regular fuzzy open set is open fuzzy set, such that every fuzzy contra $g^*\alpha$-continuous mappings is fuzzy almost contra $g^*\alpha$-continuous.
The converse of the above theorem need not be true as seen from the following example.

**Example 4.3:** Let $X = \{x_1, x_2\}, Y = \{y_1, y_2\}$ $\lambda$, and $\mu$ be a fuzzy set in $X$ and $Y$ defined as $\lambda(x_1) = 0.5$, $\lambda(x_2) = 0.5$, $\mu(y_1) = 0.3$, $\mu(y_2) = 0.5$. Let $\tau = \{0, \lambda, 1\}$ and $\tau' = \{0, \mu, 1\}$ be fuzzy topologies on sets $X$ and $Y$ respectively. The map $f:(X,\tau) \to (Y,\tau')$ defined as $f(x_i) = y_i, i = 1,2$ is fuzzy almost contra $g^*\alpha$-continuous map but not fuzzy contra $g^*\alpha$-continuous.

**Definition 4.4.** A function $f:X \to Y$ is said to be fuzzy regular set connected if $f^{-1}(\lambda)$ is fuzzy clopen in $X$ for every fuzzy regular open set $\lambda$ of $Y$.

**Theorem 4.5.** If a function $f:X \to Y$ is fuzzy almost contra $g^*\alpha$-continuous and fuzzy almost continuous, then $f$ is fuzzy regular set connected.

**Proof.** Let $\lambda$ be a fuzzy regular open set in $(Y,\sigma)$. Since $f$ is fuzzy almost contra $g^*\alpha$-continuous and fuzzy almost continuous, $f^{-1}(\lambda)$ is fuzzy $g^*\alpha$-closed and open. Hence $f^{-1}(\lambda)$ is fuzzy clopen. Therefore $f$ is fuzzy regular set connected.

**Definition 4.6.** A fuzzy topological spaces $(X,\tau)$ is called fuzzy $g^*\alpha$-connected if $X$ cannot be written as the disjoint union of two non-empty fuzzy $g^*\alpha$-open sets.

**Theorem 4.7.** Let $(X,\tau)$ and $(Y,\sigma)$ be two fuzzy topological spaces. The following statement are equivalent for a function $f:X \to Y$.

(i) $f$ is fuzzy almost contra $g^*\alpha$- continuous.
(ii) $f^{-1}(\lambda)$ is fuzzy $g^*\alpha$-open set in $X$ for every regular closed set $\lambda$ in $Y$.
(iii) for each $x \in X$ and each fuzzy regular closed set $\lambda$ in Y containing $f(x)$. there exist a fuzzy $g^*\alpha$-open set $\eta$ in $X$ containing $x$ such that $f(\eta) \leq \lambda$.
(iv) for each $x \in X$ and fuzzy regular open set $\mu$ in $Y$ non-containing $f(x)$, there exists a fuzzy $g^*\alpha$-closed set $\vartheta$ in $X$ non-containing $x$ such that $f^{-1}(\mu) \leq \vartheta$.

**Proof.** As theorem 3.8.

**Theorem 4.8:** Let $X$, $Y$ and $Z$ be fuzzy topological spaces and let $f:X \to Y$ and $g:Y \to Z$ be maps. If $f$ is fuzzy contra $g^*\alpha$-continuous and $g$ is fuzzy almost continuous then $gof:X \to Z$ is fuzzy almost contra $g^*\alpha$-continuous.

# 5. CONCLUSION

(i) We have introduced and studied new kind of map fuzzy contra $g * \alpha$ -continuous maps on fuzzy topological spaces.
(ii) We defined the relation between fuzzy contra $\alpha$continuous and fuzzy contra $g * \alpha$-continuous map. We investigated some of their properties.
(iii) We proved that every fuzzy contra $g * \alpha$ -continuous map is fuzzy contra $g * p$ –precontinuos as well as fuzzy $g * s$-continuous mapping but converse may not be true by use of example.
(iv) We have established some significant properties of fuzzy contra $g * \alpha$- continuous maps.
(v) We introduce and study new kind of fuzzy almost contra $g * \alpha$-continuous map.

# 6. REFERENCES

[1] Azad, K. K. 1981 On fuzzy semi-continuity, fuzzy almost continuity and fuzzy weakly continuity, J. Math Apl. 82 , 14-32.

[2] Balasubramanian, G. and Sundaram, p. 1997 On some generalization of fuzzy continuous, Fuzzy Sets and Systems, 86 , 93-100.

[3] Benchalli, S. S. and Siddapur, G. P. 2011 Fuzzy $g^*$pre-continuous maps in Fuzzy topological Spaces, Int. J. of Computer Appl. (0975-8887), Vol. 16- No. 2.

[4] Bin Shahana, A. S. 1991 On fuzzy strong semi-continuity and fuzzy pre continuity. *Fuzzy Sets and Systems.* **44** , 303-308.

[5] Erdal, Ekici and Etienne E. 2006 Kerre, On Fuzzy Contra-Continuities, Advanced in Fuzzy Mathematics, Vol. 1 No. 1 , pp. 35-44.

[6] Fukutake, T., Saraf, R. K., Caldas, M. and Mishra, S. 2003 Mappings Fgp-closed sets, Bull. of Fukuoka Univ. of Edu. Vol. 52, Part III , 11-20.

[7] Jafari, S. and Nori, T.2002 On contra- precontinuous functions, Bull. Malays Math. Sci. Soc. (2), 25(2), 115-128.

[8] Levine, N. 1970 Generalized closed sets in topology, Rend. Circ. Mat. Palermo 19 (2) , 89-96.

[9] Malghan, S. R. and Benchali, S.S. 1984 Open maps, closed maps and local compactness in Fuzzy Topological spaces, JI MATh. Anal.. Appl. 99No 2 , 74-79.

[10] Mukherjee, M.N. and Ghosh, B. 1990 Some stronger forms of fuzzy continuous mappings on fuzzy topological spaces, Fuzzy Sets and Systems, 38 , 375-387.

[11] Shukla, M. 2012 On Fuzzy Contra $g^{*}p$-continuous mapping, Advance in Fuzzy Mathematics, Vol 7, No 2 91-97.

[12] Shukla, M. 2013 On Fuzzy Contra $g^{*}$ semi-continuous mapping, Int.J. Sci.& Engg. Research, Vol 4, No. 10 , 529-536.

[13] Veerakumar, M. K. R.S. 2002 $g^{\#}$-semi-closed setsd in topology, Acta Ciencia Indica, Vol.xxix M, No. 1. 081.

[14] Yaidynathaswamy, R. 1960 Set Topology Chelsea New York.

[15] Yuksel,, S., G., Caylak and Acikgoz, A. 2010 On fuzzy S-I open sets and decomposition of fuzzy $\alpha$-I continuity SDU journal of SCI. 5(1) 147-153.

[16] Yuksel,, S., G., Caylak and Acikgoz, A. 2009 On fuzzy $\alpha$-I Continuous and fuzzy $\alpha$-I open function Chaos Solitions Fractals 41(4) 1691-1696.

[17] Zadeh L.A. 1965 *Fuzzy Sets, Inform. and control*, **8** , 338-353.