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A NOTE ON INTUITIONISTIC FUZZY π-GENERALIZED SEMI IRRESOLUTE MAPPINGS

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ABSTRACT

In this paper a new class of mapping called intuitionistic fuzzy π-generalized semi irresolute mapping in intuitionistic fuzzy topological space is introduced and some of its properties are studied.

Keywords and Phrases: *Intuitionistic fuzzy topology, intuitionistic fuzzy π-generalized semi closed set, intuitionistic fuzzy π- generalized semi open set, intuitionistic fuzzy π- generalized semi irresolute mapping, intuitionistic fuzzy $_{\pi a}T_{1/2}$ space and intuitionistic fuzzy $_{\pi b}T_{1/2}$ space.*

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1. INTRODUCTION

After the introduction of Fuzzy set (FS) by Zadeh [12] in 1965 and fuzzy topology by Chang [3] in 1967, several researches were worked on the generalizations of the notions of fuzzy sets and fuzzy topology. The concept of intuitionistic fuzzy set (IFS) was introduced by Atanassov in 1983 as a generalization of fuzzy sets. In 1997, Coker [4] introduced the concept of intuitionistic fuzzy topological space. In this paper, we introduce the notion of intuitionistic fuzzy π- generalized semi irresolute mapping in intuitionistic fuzzy topological space and studied some of their properties. We provide some characterizations of intuitionistic fuzzy π- generalized semi irresolute mapping and established the relationships with other classes of early defined forms of intuitionistic fuzzy mappings.

1. PRELIMINARIES

Definition 2.1: [1] Let X be a non empty fixed set. An intuitionistic fuzzy set (IFS in short) A in X is an object having the form $A = \{ \langle x, \mu_A(x), \nu_A(x) \rangle / x \in X \}$ where the functions $\mu_A(x): X \to [0, 1]$ and $\nu_A(x): X \to [0, 1]$ denote the degree of membership (namely $\mu_A(x)$) and the degree of non-membership (namely $\nu_A(x)$) of each element $x \in X$ to the set A respectively and $0 \le \mu_A(x) + \nu_A(x) \le 1$ for each $x \in X$.

Definition 2.2: [1] Let A and B be IFSs of the forms
$A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X\}$ and $B = \{\langle x, \mu_B(x), \nu_B(x) \rangle / x \in X\}$. Then
(1) $A \subseteq B$ if and only if $\mu_A(x) \le \mu_B(x)$ and $\nu_A(x) \ge \nu_B(x)$ for all $x \in X$
(2) $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$
(3) $A^c = \{\langle x, \nu_A(x), \mu_A(x) \rangle / x \in X\}$
(4) $A \cap B = \{\langle x, \mu_A(x) \wedge \mu_B(x), \nu_A(x) \vee \nu_B(x) \rangle / x \in X\}$
(5) $A \cup B = \{\langle x, \mu_A(x) \vee \mu_B(x), \nu_A(x) \wedge \nu_B(x) \rangle / x \in X\}$

For the sake of simplicity, we shall use the notation $A = \langle x, \mu_A, \nu_A \rangle$ instead of $A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X\}$. Also for the sake of simplicity, we shall use the notation $A = \langle x, (\mu_A, \mu_B), (\nu_A, \nu_B) \rangle$ instead of $A = \langle x, (A/\mu_A, B/\mu_B), (A/\nu_A, B/\nu_B) \rangle$. The intuitionistic fuzzy sets $0_\sim = \{ \langle x, 0, 1 \rangle / x \in X \}$ and $1_\sim = \{ \langle x, 1, 0 \rangle / x \in X\}$ are respectively the empty set and the whole set of X.

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Definition 2.3: [4] An intuitionistic fuzzy topology (IFT in short) on a non empty X is a family τ of IFSs in X satisfying the following axioms:

(a) $0_\sim, 1_\sim \in \tau$,
(b) $G_1 \cap G_2 \in \tau$, for any $G_1, G_2 \in \tau$,
(c) $\cup G_i \in \tau$ for any arbitrary family $\{G_i / i \in J\} \subseteq \tau$.

In this case the pair (X, τ) is called an intuitionistic fuzzy topological space (IFTS in short) and any IFS in τ is known as an intuitionistic fuzzy open set (IFOS for short) in X. The complement A^c of an IFOS A in an IFTS (X, τ) is called an intuitionistic fuzzy closed set (IFCS for short) in X.

Definition 2.4: [4] Let (X, τ) be an IFTS and $A = \langle x, \mu_A, \nu_A \rangle$ be an IFS in X. Then, the intuitionistic fuzzy interior and an intuitionistic fuzzy closure are defined by

int(A) = $\cup$ { G / G is an IFOS in X and $G \subseteq A$ },
cl(A) = $\cap$ { K / K is an IFCS in X and $A \subseteq K$ }.

Definition 2.5: [7] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be

(i) An intuitionistic fuzzy closed (IF closed in short) mapping if f(A) is an IFCS A in Y for each IFCS in X
(ii) An intuitionistic fuzzy α-closed (IFα closed in short) mapping if f(A) is an IFαCS in Y for every IFCS A in X
(iii) An intuitionistic fuzzy semiclosed (IFS closed in short) mapping if f(A) is an IFSCS in Y for every IFCS A in X
(iv) An intuitionistic fuzzy preclosed (IFP closed in short) mapping if f(A) is an IFPCS in Y for every IFCS A in X.

Definition 2.6: [7] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be

(i) An intuitionistic fuzzy generalized closed (IFG closed in short) mapping if f(A) is an IFGCS in Y for every IFCS A in X
(ii) An intuitionistic fuzzy pre-regular closed (IFPR closed in short) mapping if f(A) is an IFRCS in Y for every IFRCS A in X .

Definition 2.7:[7] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be an intuitionistic fuzzy almost closed (IFA closed in short) mapping if f(A) is an IFCS in Y for every IFRCS A in X.

Definition 2.8:[8] A subset of A of a space (X, τ) is called:

(i) regular open if A = int (cl(A))
(ii) π open if A is the union of regular open sets.

Definition 2.9: An IFS $A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X\}$ in an IFTS (X,τ) is called an

(a) intuitionistic fuzzy semi closed set [7] (IFSCS) if int(cl (A)) $\subseteq$ A
(b) intuitionistic fuzzy α-closed set [7] (IFαCS) if cl(int(cl(A))) $\subseteq$ A
(c) intuitionistic fuzzy pre-closed set [7] (IFPCS) if cl(int(A)) $\subseteq$ A
(d) intuitionistic fuzzy regular closed set [7] (IFRCS) if cl(int(A)) = A
(e) intuitionistic fuzzy generalized closed set [9] (IFGCS) if cl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFOS
(f) intuitionistic fuzzy generalized semi closed set [8] (IFGSCS) if scl(A) $\subseteq$ U whenever A $\subseteq$ U and U is an IFOS
(g) intuitionistic fuzzy α generalized closed set [8] (IFαGCS) if αcl(A) $\subseteq$ U whenever A$\subseteq$ U and U is an IFOS.
(h) intuitionistic fuzzy π-generalized semi closed set [8] (IFπGSCS) if scl(A) $\subseteq$ U whenever A$\subseteq$ U and U is an IFπOS.

An IFS A is called intuitionistic fuzzy semi open set, intuitionistic fuzzy α-open set, intuitionistic fuzzy pre-open set, intuitionistic fuzzy regular open set, intuitionistic fuzzy generalized open set, intuitionistic fuzzy generalized semi open set, intuitionistic fuzzy α generalized open set and intuitionistic fuzzy π- generalized semi open set(IFSOS, IFαOS, IFPOS, IFROS, IFGOS, IFGSOS , IFαGOS and IFπGSOS) if the complement of A^c is an IFSCS, IFαCS, IFPCS, IFRCS, IFGCS, IFGSCS, IFαGCS and IFπGSCS respectively.

Result 2.10: [8] Every IFCS, IFSCS, IFGCS, IFRCS, IFαCS, IFGSCS is an IFπGSCS but the converses may not be true in general. (Every IFOS, IFSOS, IFGOS, IFROS, IFαOS, IFGSOS is an IFπGSOS but the converses may not be true in general).

Definition 2.11: [5] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y,σ). Then f is said to be intuitionistic fuzzy continuous (IF continuous in short) if $f^{-1}(B) \in$ IFO(X) for every B$\in \sigma$.

Definition 2.12: [7] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y, σ). Then f is said to be
(a) intuitionistic fuzzy semi continuous (IFS continuous in short) if $f^{-1}(B) \in$ IFSO(X) for every $B \in \sigma$
(b) intuitionistic fuzzy α- continuous (IFα continuous in short) if $f^{-1}(B) \in$ IFαO(X) for every $B \in \sigma$
(c) intuitionistic fuzzy pre continuous (IFP continuous in short) if $f^{-1}(B) \in$ IFPO(X) for every $B \in \sigma$
(d) intuitionistic fuzzy completely continuous if $f^{-1}(B) \in$ IFRO(X) for every $B \in \sigma$.

Definition 2.13: [6] A mapping f: (X, τ) → (Y,σ) is called an intuitionistic fuzzy γ continuous (IFγ continuous in short) if $f^{-1}(B)$ is an IFγOS in (X, τ) for every $B \in \sigma$.

Definition 2.14: [12] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y,σ). Then f is said to be an intuitionistic fuzzy generalized continuous (IFG continuous in short) if $f^{-1}(B) \in$ IFGCS(X) for every IFCS B in Y.

Result 2.15: [12] Every IF continuous mapping is an IFG continuous mapping but the converse may not be true in general.

Definition 2.16: [10] A mapping f: (X, τ) → (Y,σ) is called an intuitionistic fuzzy generalized semi continuous (IFGS continuous in short) if $f^{-1}(B)$ is an IFGSCS in (X, τ) for every IFCS B of (Y,σ).

Definition 2.17: [9] A mapping f: (X, τ) → (Y,σ) is called an intuitionistic fuzzy π- generalized continuous (IFπGS continuous in short) if $f^{-1}(B)$ is an IFπGSCS in (X, τ) for every IFCS B of (Y,σ).

Definition 2.18: [12] An IFTS (X, τ) is called an intuitionistic fuzzy $T_{1/2}$ (IF$T_{1/2}$ in short) space if every IFGCS in X is an IFCS in X.

Definition 2.19: [11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y,σ). Then f is said to be an intuitionistic fuzzy irresolute (IF irresolute in short) if $f^{-1}(B) \in$ IFCS(X) for every IFCS B in Y.

Definition 2.20: [11] Let f be a mapping from an IFTS (X, τ) into an IFTS (Y,σ). Then f is said to be an intuitionistic fuzzy generalized irresolute (IFG irresolute in short) if $f^{-1}(B) \in$ IFGCS(X) for every IFGCS B in Y.

Result 2.21: [8] Every IFGSCS is an IFπGSCS but not conversely.

Definition 2.22:[8] An IFTS (X, τ) is said to be an intuitionistic fuzzy $\pi a T_{1/2}$ (IF$\pi a T_{1/2}$ in short) space if every IFπGSCS in X is an IFCS in X.

Definition 2.23:[8] An IFTS (X, τ) is said to be an intuitionistic fuzzy $\pi b T_{1/2}$ (IF$\pi b T_{1/2}$ in short) space if every IFπGSCS in X is an IFGCS in X.

3. INTUITIONISTIC FUZZY π - GENERALIZED SEMI IRRESOLUTE MAPPINGS

In this section, we have introduced intuitionistic fuzzy π- generalized semi irresolute mappings and studied some of their properties.

Definition 3.1: A mapping f: (X, τ) → (Y, σ) is called an intuitionistic fuzzy π- generalized semi irresolute (IFπGS irresolute) mapping if $f^{-1}(A)$ is an IFπGSCS in (X, τ) for every IFπGSCS A of (Y, σ).

Theorem 3.2: If f: (X, τ) → (Y, σ) be an IFπGS irresolute mapping, then f is an IFπGS continuous mapping but not conversely.

Proof: Let A be any IFCS in Y. Since every IFCS is an IFπGSCS, A is an IFπGSCS in Y. Since f is an IFπGS irresolute mapping, $f^{-1}(A)$ is an IFπGSCS in X. Hence f is an IFπGS continuous mapping.

Example 3.3: Let X = { a, b }, Y = { u, v } and $G_1 = \langle x, (0.1_a, 0.2_b), (0.3_a, 0.3_b) \rangle$, $G_2 = \langle x, (0.1_a, 0.1_b), (0.2_a, 0.3_b) \rangle$, $G_3 = \langle x, (0.1_a, 0.2_b), (0.2_a, 0.3_b) \rangle$, $G_4 = \langle x, (0.1_a, 0.1_b), (0.3_a, 0.3_b) \rangle$, $G_5 = \langle x, (0.3_a, 0.3_b), (0.2a, 0.3_b) \rangle$, $G_6 = \langle y, (0.4_u, 0.2b_v), (0.6_u, 0.7_v) \rangle$. Then $\tau = \{ 0_\sim, G_1, G_2, G_3, G_4, G_5, 1_\sim \}$ and $\sigma = \{ 0_\sim, G_6, 1_\sim \}$ are IFTs on X and Y respectively. Define a mapping f: (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFπGS continuous mapping. Let $B = \langle y, (0.1_u, 0.1_v),$

$(0.3_u, 0.3_v)$ ⟩ is an IFπGSCS in Y. But $f^{-1}(B)$ = ⟨ x, $(0.1_a, 0.1_b)$, $(0.3_a, 0.3_b)$ ⟩ is not an IFπGSCS in X. Therefore f is not an IFπGS irresolute mapping.

Theorem 3.4: If f : (X, τ) → (Y, σ) is an IFπGS irresolute mapping, then f is an IFGS continuous mapping but not conversely.

Proof: Let A be an IFCS in Y. Since every IFCS is an IFπGSCS, A is an IFπGSCS in Y. By hypothesis, $f^{-1}(A)$ is an IFπGSCS in X. This implies $f^{-1}(A)$ is an IFGSCS in X. Hence f is an IFGS continuous mapping.

Example 3.5: Let X = { a, b }, Y = { u, v } and G_1 = ⟨ x, $(0.2_a, 0.4_b)$, $(0.5_a, 0.4_b)$ ⟩, G_2 = ⟨ x, $(0.1_a, 0.3_b)$, $(0.3_a, 0.4_b)$ ⟩, G_3 = ⟨ x, $(0.1_a, 0.3_b)$, $(0.5_a, 0.4_b)$ ⟩, G_4 = ⟨ x, $(0.2_a, 0.4_b)$, $(0.3_a, 0.4_b)$ ⟩, G_5 = ⟨ x, $(0.4a, 0.4_b)$, $(0.3_a, 0.4_b)$ ⟩, G_6 = ⟨ y, $(0.4_u, 0.2_v)$, $(0.5_u, 0.5_v)$ ⟩. Then τ = { $0_\sim$,G_1,G_2,G_3,G_4,G_5,$1_\sim$ } and σ = { $0_\sim$, G_6, $1_\sim$ } are IFTs on X and Y respectively. Define a mapping f : (X, τ) → (Y, σ) by f(a) = u and f(b) = v. Then f is an IFGS continuous mapping. Let B = ⟨ y, $(0_u, 0.3_v)$, $(0.5_u, 0.4_v)$ ⟩ is an IFπGSCS in Y. But $f^{-1}(B)$ = ⟨ x, $(0_a, 0.3_b)$, $(0.5_a, 0.4_b)$⟩ is not an IFπGSCS in X. Therefore f is not an IFπGS irresolute mapping.

Theorem 3.6: If f: (X, τ) → (Y, σ) is an IFπGS irresolute mapping, then f is an IF continuous mapping if X is an IF$_{\pi a}T_{1/2}$ space.

Proof: Let A be an IFCS in Y. Then A is an IFπGSCS in Y. Since f is an IFπGS irresolute mapping, $f^{-1}(A)$ is an IFπGSCS in X. Since X is an IF$_{\pi a}T_{1/2}$ space, $f^{-1}(A)$ is an IFCS in X. Hence f is an IF continuous mapping.

Theorem 3.7: Let f : (X, τ) → (Y, σ) and g : (Y, σ) → (Z, η) be any two IFπGS irresolute mappings. Then g ο f: (X, τ) → (Z,η) is an IFπGS irresolute mapping.

Proof: Let A be an IFπGSCS in Z. Then by hypothesis, $g^{-1}(A)$ is an IFπGSCS in Y. Since f is an IFπGSCS irresolute mapping, $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. That is $(g \circ f)^{-1}(A)$ is an IFπGSCS in X. Hence g ο f is an IFπGS irresolute mapping.

Theorem 3.8: Let f: (X, τ) → (Y, σ) be an IFπGS irresolute mapping and g: (Y, σ) → (Z, η) be an IFπGS continuous mapping. Then g ο f : (X, τ) → (Z, η) is an IFπGS continuous mapping.

Proof: Let A be an IFCS in Z. Then by hypothesis, $g^{-1}(A)$ is an IFπGSCS in Y. Since f is an IFπGS irresolute mapping, $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. That is $(g \circ f)^{-1}(A)$ is an IFπGSCS in X. Hence g ο f is an IFπGS continuous mapping.

Theorem 3.9: If f: (X, τ) → (Y, σ) be an IFπGS irresolute mapping, then f is an IFG irresolute mapping if X is an IF$_{\pi b}T_{1/2}$ space.

Proof: Let A be an IFGCS in Y. Then A is an IFπGSCS in Y. Therefore $f^{-1}(A)$ is an IFπGSCS in X, by hypothesis. Since X is an IF$_{\pi b}T_{1/2}$ space, $f^{-1}(A)$ is an IFGCS in X. Hence f is an IFG irresolute mapping.

Theorem 3.10: Let f : (X, τ) → (Y, σ) be a mapping from an IFTS X into an IFTS Y. Then the following conditions are equivalent if X and Y are IF$_{\pi a}T_{1/2}$ spaces:

(i) f is an IFπGS irresolute mapping

(ii) $f^{-1}(B)$ is an IFπGSOS in X for each IFπGSOS B in Y

(iii) $cl(f^{-1}(B)) \subseteq f^{-1}(cl(B))$ for each IFS B of Y.

Proof: (i) ⇒ (ii): Obviously true.

(ii) ⇒ (iii): Let B be any IFS in Y. Clearly $B \subseteq cl(B)$. Then $f^{-1}(B) \subseteq f^{-1}(cl(B))$. Since cl(B) is an IFCS in Y, cl(B) is an IFπGSCS in Y. Therefore $f^{-1}(cl(B))$ is an IFπGSCS in X, by hypothesis. Since X is an IF$_{\pi a}T_{1/2}$ space, $f^{-1}(cl(B))$ is an IFCS in X. Hence $cl(f^{-1}(B)) \subseteq cl(f^{-1}(cl(B))) = f^{-1}(cl(B))$. That is $cl(f^{-1}(B)) \subseteq f^{-1}(cl(B))$.

(iii) ⇒ (i): Let B be an IFπGSCS in Y. Since Y is an IF$_{\pi a}T_{1/2}$ space, B is an IFCS in Y and cl(B) = B.

Hence $f^{-1}(B) = f^{-1}(cl(B)) \supseteq cl(f^{-1}(B))$, by hypothesis. But clearly $f^{-1}(B) \subseteq cl(f^{-1}(B))$. Therefore, $cl(f^{-1}(B)) = f^{-1}(B)$.

This implies $f^{-1}(B)$ is an IFCS in X and hence it is an IFπGSCS in X. Thus f is an IFπGS irresolute mapping.

Theorem 3.11: Let f: $(X, \tau) \to (Y,\sigma)$ be an IF continuous mapping and (Y,σ) is an IF $_{\pi\alpha}T_{1/2}$ space. Then the following statements are equivalent:
(i) f is an IFπGS irresolute mapping
(ii) f is an IFπGS continuous mapping

Proof: (i) ⇒ (ii): Follows from the theorem 3.2.

(ii) ⇒ (i): Let f be an IFπGS continuous mapping . Let A be an IFπGSCS in (Y,σ). Since (Y,σ) is an IF $_{\pi\alpha}T_{1/2}$space, A is an IFCS in (Y,σ) and by hypothesis $f^{-1}(A)$ is an IFπGSCS in (X, τ). Therefore f is an IFπGS irresolute mapping.

Theorem 3.12: Let f: $(X, \tau) \to (Y, \sigma)$ be a mapping from an IFTS X into IFTS Y. Then the following conditions are equivalent
(i) f is an IFπGS irresolute mapping
(ii) $f^{-1}(B)$ is an IFπGSOS in X for every IFπGSOS B in Y.

Proof: (i) ⇒ (ii): Let B be an IFπGSOS in Y, then B^c is an IFπGSCS in Y. Since f is an IFπGS irresolute mapping, $f^{-1}(B^c)$ is an IFπGSCS in X. But $f^{-1}(B^c) = (f^{-1}(B))^c$, implies $f^{-1}(B)$ is an IFπGSOS in X.

(ii) ⇒ (i): Let B be an IFπGSCS in Y. By our assumption $f^{-1}(B^c)$ is an IFπGSOS in X for every IFπGSOS B^c in Y. But $f^{-1}(B^c) = (f^{-1}(B))^c$, which implies $f^{-1}(B)$ is an IFπGSCS in X. Hence f is an IFπGS irresolute mapping.

Theorem 3.13: Let f: $(X, \tau) \to (Y,\sigma)$ be an IFπGS irresolute mapping and g: $(Y,\sigma) \to (Z,\delta)$ is an IFα continuous mapping, then g o f: $(X, \tau) \to (Z, \delta)$ is an IFπGS continuous mapping.

Proof: Let A be an IFCS in Z. Then $g^{-1}(A)$ is an IFαCS in Y, Since g is IFα continuous. Since every IFαCS is an IFπGSCS, $g^{-1}(A)$ is an IFπGSCS in Y. But f is an IFπGS irresolute mapping. Therefore $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence g o f is an IFπGS continuous mapping.

Theorem 3.14: Let f: $(X, \tau) \to (Y,\sigma)$ be an IFπGS irresolute mapping and g: $(Y,\sigma) \to (Z,\delta)$ is an IFαG continuous mapping, then g o f: $(X, \tau) \to (Z, \delta)$ is an IFπGS continuous mapping.

Proof: Let A be an IFCS in Z. By assumption, $g^{-1}(A)$ is an IFαGCS in Y. Since every IFαGCS is an IFπGSCS, $g^{-1}(A)$ is an IFπGSCS in Y. But f is an IFπGS irresolute mapping, implies $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence g o f is an IFπGS continuous mapping.

Theorem 3.15: Let f: $(X, \tau) \to (Y, \sigma)$ be an IFπGS irresolute mapping and g: $(Y, \sigma) \to (Z, \delta)$ is an IFG continuous mapping, then g o f: $(X, \tau) \to (Z,\delta)$ is an IFπGS continuous mapping.

Proof: Let A be an IFCS in Z. By assumption, $g^{-1}(A)$ is an IFGCS in Y. Since every IFGCS is an IFπGSCS, $g^{-1}(A)$ is an IFπGSCS in Y. But f is an IFπGS irresolute mapping. Therefore $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence g o f is an IFπGS continuous mapping.

Theorem 3.16: Let f: $(X, \tau) \to (Y,\sigma)$ be an IFπGS irresolute mapping and g: $(Y,\sigma) \to (Z,\delta)$ is an IFGS continuous mapping, then gof: $(X, \tau) \to (Z,\delta)$ is an IFπGS continuous mapping.

Proof: Let A be an IFCS in Z. Then $g^{-1}(A)$ is an IFGSCS in Y, Since g is an IFGS continuous. Since every IFGSCS is an IFπGSCS, $g^{-1}(A)$ is an IFπGSCS in Y. Since f is an IFπGS irresolute mapping, $f^{-1}(g^{-1}(A))$ is an IFπGSCS in X. Hence gof is an IFπGS continuous mapping.

Definition 3.17: Let A be an IFS in an IFTS (X, τ). Then π-generalized Semi closure of A (πgscl(A) in short) and π- generalized semi interior of A (πgsint(A) in short) are defined by

πgsint(A) = $\cup$ { G / G is an IFπGSOS in X and G $\subseteq$ A }
πgscl(A) = $\cap$ { K / K is an IFπGSCS in X and A $\subseteq$ K }.

Proposition 3.18: If A is an IFS in X, then A $\subseteq$ πgscl(A) $\subseteq$ cl(A).

Proof: The result follows from the definition.

Theorem 3.19: If A is an IFπGSCS in X then πgscl(A) = A.

Proof: Since A is an IFπGSCS, πgscl(A) is the smallest IFπGSCS which contains A, which is nothing but A. Hence πgscl(A) = A.

Theorem 3.20: If A is an IFπGSOS in X then πgsint(A) = A.

Proof: Similar to above theorem**.**

Proposition 3.21: Let (X, τ) be any IFTS. Let A and B be any two intuitionistic fuzzy sets in (X, τ). Then the intuitionistic fuzzy π-generalized Semi closure operator satisfies the following properties.
(i) A $\subseteq$ πgscl(A)
(ii) πgsint(A) $\subseteq$ A
(iii) A $\subseteq$ B $\Rightarrow$ πgscl(A) $\subseteq$ πgscl(B)
(iv) A $\subseteq$ B $\Rightarrow$ πgsint(A) $\subseteq$ πgsint(B)

Theorem 3.22: If f: (X, τ) $\rightarrow$ (Y, σ) is an IFπGS irresolute mapping, then f(πgscl(A)) $\subseteq$ cl(A) for every IFS A of X.

Proof: Let A be an IFCS of X. Then cl(f(A)) is an IFCS of Y. Since every IFCS is an IFπGSCS, cl(f(A)) is an IFπGSCS

in Y. Since f is IFπGS irresolute, f^{-1}(cl(f(A))) is IFπGSCS in X. Clearly A $\subseteq$ f^{-1}(cl(f(A))).

Therefore πgscl(A) $\subseteq$ πgscl(f^{-1}(clf((A)))) = f^{-1}(cl(f(A))). Hence f(πgscl(A)) $\subseteq$ cl(f(A)) for every IFS A of X.

Theorem 3.23: If f: (X, τ) $\rightarrow$ (Y, σ) is IFπGS irresolute, then πgscl(f^{-1}(B)) $\subseteq$ f^{-1}(cl(B)) for every IFS B of Y.

Proof: Let B be an IFS of Y. Then cl(B) is an IFCS of Y. since every IFCS is an IFπGSCS , cl(B) is an IFπGSCS in Y. By hypothesis, f^{-1}(cl(B)) is IFπGSCS in X. Clearly B $\subseteq$ cl(B) implies f^{-1}(B) $\subseteq$ f^{-1}(cl(B)). Therefore,πgscl(f^{-1}(B)) $\subseteq$ πgscl (f^{-1}(cl(B))) = f^{-1}(cl(B)). Hence πgscl(f^{-1}(B)) $\subseteq$ f^{-1}(cl(B)) for every IFS B of Y.

Theorem 3.24: Let f: (X, τ) $\rightarrow$ (Y, σ) be a mapping from an IFTS X into IFTS Y. Then the following conditions are equivalent
(i) f is an IFπGS irresolute mapping
(ii) f^{-1}(B) is an IFπGSOS in X, for each IFπGSOS in Y
(iii) f^{-1}(πgsint (B)) $\subseteq$ πgsint (f^{-1}(B))
(iv) πgscl (f^{-1}(B)) $\subseteq$ f^{-1}(cl(B)) for every IFS B of Y.

Proof:
(i) $\Rightarrow$ (ii): is obviously true.

(ii) $\Rightarrow$ (iii): Let B be an IFπGSCS in Y and πgsint(B) $\subseteq$ B. Then f^{-1}(πgsint(B)) $\subseteq$ f^{-1}(B). Sinc πgsint(B) is an IFπGSOS in Y, f^{-1}(πgsint(B)) is an IFπGSOS in X, by hypothesis. Hence f^{-1}(πgsint(B)) $\subseteq$ πgsint(f^{-1}(B)).

(iii) $\Rightarrow$ (iv): is obvious by taking complement in (iii).

(iv) $\Rightarrow$ (i): Let B be an IFπGSCS in Y and πgscl(B) = B. Hence f^{-1}(B) = f^{-1}(πgscl(B)) $\supseteq$ πgscl(f^{-1}(B)). Therefore, πgscl(f^{-1}(B)) = f^{-1}(B). This implies f^{-1}(B) is an IFπGSCS in X. Thus f is an IFπGS irresolute mapping.

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