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ON INTUITIONISTIC FUZZY REGULAR GENERALIZED b CLOSED SETS

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ABSTRACT

The purpose of this paper is to introduce and study the concepts of intuitionistic fuzzy regular generalized b closed sets and intuitionistic fuzzy regular generalized b open sets in intuitionistic fuzzy topological space. We investigate some of their properties. Further the notion of intuitionistic fuzzy $_{rgb}T_{1/2}$ spaces and intuitionistic fuzzy $_{rgb}T_b$ spaces are introduced and studied.

Keywords: *Intuitionistic fuzzy topology, intuitionistic fuzzy regular generalized b closed sets, intuitionistic fuzzy regular generalized b open sets, intuitionistic fuzzy $_{rgb}T_{1/2}$ spaces and intuitionistic fuzzy $_{rgb}T_b$ spaces.*

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1. INTRODUCTION

Fuzzy set (FS) as proposed by Zadeh [12] in 1965 is a framework to encounter uncertainty, vagueness and partial truth and it represents a degree of membership for each member of the universe of discourse to a subset of it. After the introduction of fuzzy topology by Chang [2] in 1968, there have been several generalizations of notions of fuzzy set and fuzzy topology. By adding the degree of non-membership to FS, Atanassov [1] proposed intuitionistic fuzzy set (IFS) in 1986 which looks more accurate to uncertainty quantification and provides the opportunity to precisely model the problem based on the existing knowledge and observations. In 1997, Coker [3] introduced the concept of intuitionistic fuzzy topological space. In the present paper, we extend the concept of regular generalized b closed sets due to Mariappa and Sekar [6] in intuitionistic fuzzy topology and study some of the basic properties regarding it. We also introduce the applications of intuitionistic fuzzy regular generalized b closed sets namely intuitionistic fuzzy $_{rgb}T_{1/2}$ spaces, intuitionistic fuzzy $_{rgb}T_b$ spaces and obtained some characterizations and several preservation theorems of such spaces.

2. 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

(a) $A \subseteq B$ if and only if $\mu_A(x) \le \mu_B(x)$ and $\nu_A(x) \ge \nu_B(x)$ for all $x \in X$,
(b) $A = B$ if and only if $A \subseteq B$ and $B \subseteq A$,
(c) $A^c = \{\langle x, \nu_A(x), \mu_A(x) \rangle / x \in X\}$,
(d) $A \cap B = \{\langle x, \mu_A(x) \wedge \mu_B(x), \nu_A(x) \vee \nu_B(x) \rangle / x \in X\}$,
(e) $A \cup B = \{\langle x, \mu_A(x) \vee \mu_B(x), \nu_A(x) \wedge \nu_B(x) \rangle / x \in X\}$.

For the sake of simplicity, the notation $A = \langle x, \mu_A, \nu_A\rangle$ shall be used 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 the *empty set* and the *whole set* of X, respectively.

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Definition 2.3: [3] An *intuitionistic fuzzy topology* (IFT in short) on a non empty set 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 in short) in X.

The complement A^c of an IFOS A in an IFTS (X, τ) is called an *intuitionistic fuzzy closed set* (IFCS in short) in X.

Result 2.4: [3] Let A and B be any two intuitionistic fuzzy sets of an intuitionistic fuzzy topological space (X, τ). Then
(a) A is an intuitionistic fuzzy closed set in X $\Leftrightarrow$ cl(A) = A,
(b) A is an intuitionistic fuzzy open set in X $\Leftrightarrow$ int(A) = A,
(c) $cl(A^c) = (int(A))^c$,
(d) $int(A^c) = (cl(A))^c$,
(e) $A \subseteq B \Rightarrow int(A) \subseteq int(B)$,
(f) $A \subseteq B \Rightarrow cl(A) \subseteq cl(B)$,
(g) $cl(A \cup B) = cl(A) \cup cl(B)$,
(h) $int(A \cap B) = int(A) \cap int(B)$.

Definition 2.5: [3] 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 2.6: An IFS $A = \{\langle x, \mu_A(x), \nu_A(x) \rangle / x \in X\}$ in an IFTS (X, τ) is said to be
(a) *intuitionistic fuzzy b closed set* [5] (IFbCS in short) if $cl(int(A)) \cap int(cl(A)) \subseteq A$,
(b) *intuitionistic fuzzy α-closed set* [4] (IFαCS in short) if $cl(int(cl(A))) \subseteq A$,
(c) *intuitionistic fuzzy pre-closed set* [4] (IFPCS in short) if $cl(int(A)) \subseteq A$,
(d) *intuitionistic fuzzy regular closed set* [4] (IFRCS in short) if $cl(int(A)) = A$,
(e) *intuitionistic fuzzy semi closed set* [4] (IFSCS in short) if $int(cl(A)) \subseteq A$,
(f) *intuitionistic fuzzy generalized closed set* [11] (IFGCS in short) if $cl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS,
(g) *intuitionistic fuzzy generalized pre closed set* [8] (IFGPCS in short) if $pcl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS,
(h) *intuitionistic fuzzy α generalized closed set* [10] (IFαGCS in short) if $\alpha cl(A) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS,
(i) *intuitionistic fuzzy weakly generalized closed set* [7] (IFWGCS in short) if $cl(int(A)) \subseteq U$ whenever $A \subseteq U$ and U is an IFOS.

An IFS A is called *intuitionistic fuzzy b open set, intuitionistic fuzzy α-open set, intuitionistic fuzzy pre-open set, intuitionistic fuzzy regular open set, intuitionistic fuzzy semi open set, intuitionistic fuzzy generalized open set, intuitionistic fuzzy generalized pre open set, intuitionistic fuzzy α generalized open set* and *intuitionistic fuzzy weakly generalized open set* (IFbOS, IFαOS, IFPOS, IFROS, IFSOS, IFGOS, IFGPOS, IFαGOS and IFWGOS) if the complement of A^c is an IFbCS, IFαCS, IFPCS, IFRCS, IFSCS, IFGCS, IFGPCS, IFαGCS and IFWGCS respectively.

Definition 2.7: [9] Let (X, τ) be an IFTS and $A = \langle x, \mu_A, \nu_A \rangle$ be an IFS in X. Then the *intuitionistic fuzzy b closure* of A (bcl(A) in short) and *intuitionistic fuzzy b interior* of A (bint(A) in short) are defined as
$bint(A) = \cup\{G / G$ is an IFbOS in X and $G \subseteq A\}$,
$bcl(A) = \cap\{K / K$ is an IFbCS in X and $A \subseteq K\}$.

Proposition 2.8: [9] Let (X, τ) be any IFTS. Let A and B be any two intuitionistic fuzzy sets in (X, τ). Then the intuitionistic fuzzy generalized b closure operator satisfies the following properties.
(a) $bcl(0_{\sim}) = 0_{\sim}$ and $bcl(1_{\sim}) = 1_{\sim}$,
(b) $A \subseteq bcl(A)$,
(c) $bint(A) \subseteq A$,
(d) If A is an IFbCS then $A = bcl(bcl(A))$,
(e) $A \subseteq B \Rightarrow bcl(A) \subseteq bcl(B)$,
(f) $A \subseteq B \Rightarrow bint(A) \subseteq bint(B)$.

3. INTUITIONISTIC FUZZY REGULAR GENERALI ZED b CLOSED SETS

In this section, we introduce intuitionistic fuzzy regular generalized b closed sets in intuitionistic fuzzy topological space and study some of their properties.

Definition 3.1: An IFS A in an IFTS (X, τ) is said to be an *intuitionistic fuzzy regular generalized b closed set* (IFRGbCS in short) if bcl(A) ⊆ U whenever A ⊆ U and U is an IFROS in (X, τ).

The family of all IFRGbCSs of an IFTS (X, τ) is denoted by IFRGbC(X).

Example 3.2: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨x, (0.2, 0.3), (0.8, 0.7)⟩. Then the IFS A = ⟨ x, (0.7, 0.6), (0.3, 0.4) ⟩ is an IFRGbCS in X.

Theorem 3.3: Every IFCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFCS and bcl(A) ⊆ cl(A), bcl(A) ⊆ cl(A) = A ⊆ U. Therefore A is an IFRGbCS in X.

Example 3.4: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.3, 0.2), (0.6, 0.7)⟩. Then the IFS A = ⟨ x, (0.5, 0.6), (0.4, 0.3) ⟩ is an IFRGbCS but not an IFCS in X, since cl(A) = T ≠ A.

Theorem 3.5: Every IFαCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFαCS, αcl(A) = A. Therefore bcl(A) ⊆ αcl(A) = A ⊆ U. Hence A is an IFRGbCS in X.

Example 3.6: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.3, 0.2), (0.6, 0.8) ⟩. Then the IFS A = ⟨ x, (0.5, 0.6), (0.3, 0.3) ⟩ is an IFRGbCS but not an IFαCS in X, since cl(int(cl(A))) = T^c ⊄ A.

Theorem 3.7: Every IFPCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFPCS, cl(int(A)) ⊆ A. Therefore cl(int(A)) ∩ int(cl(A)) ⊆ cl(A) ∩ cl(int(A)) ⊆ A. This implies bcl(A) ⊆ U. Hence A is an IFRGbCS in X.

Example 3.8: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.2, 0.3), (0.8, 0.7)⟩. Then the IFS A = ⟨ x, (0.4, 0.5), (0.6, 0.5) ⟩ is an IFRGbCS but not an IFPCS in X, since cl(int(A)) = T^c ⊄ A.

Theorem 3.9: Every IFbCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFbCS, bcl(A) = A. Therefore bcl(A) = A ⊆ U. Hence A is an IFRGbCS in X.

Example 3.10: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0, 0.2), (0.3, 0.4) ⟩. Then the IFS A = ⟨ x, (0, 0.5), (0.2, 0) ⟩ is an IFRGbCS but not an IFbCS in X, since cl(int(A)) ∩ int(cl(A)) = 1~ ⊄ A.

Theorem 3.11: Every IFRCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFRCS, cl(int(A)) = A. This implies cl(A) = cl(int(A)). Therefore cl(A) = A. Hence A is an IFCS in X. By theorem 3.3, A is an IFRGbCS in X.

Example 3.12: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.2, 0.4), (0.8, 0.6) ⟩. Then the IFS A = ⟨ x, (0.7, 0.5), (0.3, 0.5) ⟩ is an IFRGbCS but not an IFRCS in X, since cl(int(A)) = T^c ≠ A.

Theorem 3.13: Every IFGCS is an IFRGbCS but not conversely.

Proof: Let A ⊆ U and U is an IFROS in (X, τ). Since A is an IFGCS, cl(A) ⊆ U. Therefore bcl(A) ⊆ cl(A), bcl(A) ⊆ U.

Hence A is an IFRGbCS in X.

Example 3.14: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.2, 0.4), (0.8, 0.6) ⟩. Then the IFS A = ⟨ x, (0.1, 0.3), (0.8, 0.7) ⟩ is an IFRGbCS but not an IFGCS in X, since cl(A) = T^c ⊄ T.

Theorem 3.15: Every IFαGCS is an IFRGbCS but not conversely.

Proof: Let $A \subseteq U$ and U is an IFROS in (X, τ). Since A is an IFαGCS, $\alpha cl(A) \subseteq U$. Therefore $bcl(A) \subseteq \alpha cl(A)$, $bcl(A) \subseteq U$. Hence A is an IFRGbCS in X.

Example 3.16: Let X = {a, b} and let $\tau = \{0_\sim, T, 1_\sim\}$ be an IFT on X where T = ⟨ x, (0.3, 0.3), (0.4, 0.4) ⟩. Then the IFS A = ⟨ x, (0.1, 0.1), (0.5, 0.6) ⟩ is an IFRGbCS but not an IFαGCS in X, since $\alpha cl(A) = 1_\sim \not\subseteq T$.

Theorem 3.17: Every IFGPCS is an IFRGbCS but not conversely.

Proof: Let $A \subseteq U$ and U is an IFROS in (X, τ). Since A is an IFGPCS, $pcl(A) \subseteq U$. Therefore $bcl(A) \subseteq pcl(A)$, $bcl(A) \subseteq U$. Hence A is an IFRGbCS in X.

Example 3.18: Let X = {a, b} and let $\tau = \{0_\sim, T_1, T_2, 1_\sim\}$ be an IFT on X where T_1 = ⟨ x, (0.2, 0.3), (0.8, 0.7) ⟩ and T_2 =⟨ x, (0.4, 0.5), (0.6, 0.5)⟩. Then the IFS A = ⟨ x, (0.4, 0.5), (0.6, 0.5) ⟩ is an IFRGbCS but not an IFGPCS in X, since $pcl(A) = T_2^c \not\subseteq T_2$.

Theorem 3.19: Every IFWGCS is an IFRGbCS but not conversely.

Proof: Let $A \subseteq U$ and U is an IFROS in (X, τ). Since A is an IFWGCS, $cl(int(A)) \subseteq U$. This implies A is an IFPCS in X. By theorem 3.7, A is an IFRGbCS in X.

Example 3.20 Let X = {a, b} and let $\tau = \{0_\sim, T, 1_\sim\}$ be an IFT on X where T = ⟨ x, (0.4, 0.3), (0.6, 0.7)⟩. Then the IFS A = ⟨ x, (0.4, 0.3), (0.6, 0.7) ⟩ is an IFRGbCS but not an IFWGCS in X, since $cl(int(A)) = T^c \not\subseteq T$.

The following implications are true:

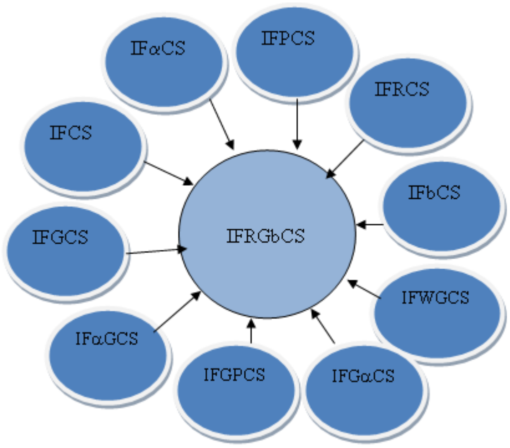

Fig.1 Relation between intuitionistic fuzzy regular generalized b closed set and other existing intuitionistic fuzzy closed sets.

In this diagram by "A $\rightarrow$ B" we mean A implies B but not conversely.

None of them is reversible.

Theorem 3.21: Every IFGαCS is an IFRGbCS but not conversely.

Proof: Let $A \subseteq U$ and U is an IFROS in (X, τ). Since every regular open set are open sets and A is an IFGαCS, $bcl(A) \subseteq \alpha cl(A) \subseteq U$. Therefore A is an IFRGbCS in X.

Example 3.22: Let X = {a, b} and let $\tau = \{0_\sim, T, 1_\sim\}$ be an IFT on X where T = ⟨ x, (0.3, 0.3), (0.4, 0.4) ⟩. Then the IFS A = ⟨ x, (0.1, 0.1), (0.5, 0.6) ⟩ is an IFRGbCS but not an IFGαCS in X, since $\alpha cl(A) = T^c \not\subseteq T$.

Remark 3.23: The union of any two IFRGbCSs need not be an IFRGbCS in general as seen from the following example.

Example 3.24: Let X = {a, b} and let $\tau = \{0_\sim, T_1, T_2, 1_\sim\}$ be an IFT on X where T_1 = ⟨ x, (0.4, 0.4), (0.6, 0.6) ⟩ and T_2 =⟨ x, (0.4, 0.3), (0.6, 0.7)⟩. Then the IFSs A = ⟨ x, (0.4, 0.2), (0.6, 0.8) ⟩ and B = ⟨ x, (0.3, 0.3), (0.6, 0.7) ⟩ are IFRGbCSs but $A \cup B$ is not an IFRGbCS in X, since $bcl(A \cup B) = T_1 \not\subseteq T_2$.

Theorem 3.25: If A is an IFRGbCS in (X, τ) such that $A \subseteq B \subseteq bcl(A)$ then B is an IFRGbCS in (X, τ).

Proof: Let B be an IFS in an IFTS (X, τ) such that B ⊆ U and U is an IFROS in X. This implies A ⊆ U. Since A is an IFRGbCS, bcl(A) ⊆ U. By hypothesis, we have bcl(B) ⊆ bcl(bcl(A)) = bcl(A) ⊆ U. Hence B is an IFRGbCS in X.

Theorem 3.26: If A is both intuitionistic fuzzy b open and intuitionistic fuzzy regular generalized b closed in an IFTS (X, τ) then A is intuitionistic fuzzy b closed in (X, τ).

Proof: Since A is intuitionistic fuzzy b open and intuitionistic fuzzy regular generalized b closed in (X, τ), bcl(A) ⊆ A. But A ⊆ bcl(A). Thus bcl(A) = A and hence A is intuitionistic fuzzy b closed in (X, τ).

4. INTUITIONISTIC FUZZY REGULAR GENERALIZED b OPEN SETS

In this section, we introduce intuitionistic fuzzy regular generalized b open sets in intuitionistic fuzzy topological space and study some of their properties.

Definition 4.1: An IFS A is said to be an *intuitionistic fuzzy regular generalized b open set* (IFRGbOS in short) in (X, τ) if the complement A^c is an IFRGbCS in X.

The family of all IFRGbOSs of an IFTS (X, τ) is denoted by IFRGbO(X).

Example 4.2: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.3, 0.4), (0.7, 0.6)⟩. Then the IFS A = ⟨ x, (0.4, 0.5), (0.6, 0.5) ⟩ is an IFRGbOS in X.

Theorem 4.3: For any IFTS (X, τ), we have the following:
(a) Every IFOS is an IFRGbOS.
(b) Every IFbOS is an IFRGbOS.
(c) Every IFαOS is an IFRGbOS.
(d) Every IFGOS is an IFRGbOS.
(e) Every IFGPOS is an IFRGbOS.

Proof: Straight forward.

The converse of the above statements need not be true in general as seen from the following examples.

Example 4.4: Let X = {a, b} and let τ = {0~, T, 1~} be an IFTS on X where T = ⟨ x, (0.4, 0.3), (0.5, 0.4)⟩. Then IFS A = ⟨ x, (0.4, 0.4), (0.6, 0.5) ⟩ is an IFRGbOS but not an IFOS in X.

Example 4.5: Let X = {a, b} and let τ = {0~, T, 1~} be an IFTS on X where T = ⟨ x, (0, 0.2), (0.3, 0.4)⟩. Then IFS A = ⟨ x, (0.2, 0.1), (0.8, 0.9) ⟩ is an IFRGbOS but not an IFbOS in X.

Example 4.6: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.3, 0.2), (0.6, 0.8)⟩. Then the IFS A = ⟨ x, (0.3, 0.3), (0.5, 0.6) ⟩ is an IFRGbOS but not an IFαOS in X.

Example 4.7: Let X = {a, b} and let τ = {0~, T, 1~} be an IFT on X where T = ⟨ x, (0.2, 0.4), (0.7, 0.6)⟩. Then the IFS A = ⟨ x, (0.8, 0.7), (0, 0.3) ⟩ is an IFRGbOS but not an IFGOS in X.

Example 4.8: Let X = {a, b} and let τ = {0~, T_1, T_2, 1~} be an IFT on X where T_1 = ⟨ x, (0.2, 0.3), (0.8, 0.7) ⟩ and T_2 =⟨ x, (0.4, 0.5), (0.6, 0.5)⟩. Then the IFS A = ⟨ x, (0.6, 0.5), (0.4, 0.5) ⟩ is an IFRGbOS but not an IFGPOS in X.

Theorem 4.9: An IFS A of an IFTS (X, τ) is an IFRGbOS if and only if F ⊆ bint(A) whenever F is an IFRCS and F ⊆ A.

Proof: Necessity: Suppose A is an IFRGbOS in X. Let F be an IFRCS and F ⊆ A. Then F^c is an IFROS in X such that $A^c \subseteq F^c$. Since A^c is an IFRGbCS, bcl(A^c) ⊆ F^c. Hence $(\text{bint}(A))^c \subseteq F^c$. This implies F ⊆ bint(A).

Sufficiency: Let A be any IFS of X and let F ⊆ bint(A) whenever F is an IFRCS and F ⊆ A. Then $A^c \subseteq F^c$ and F^c is an IFROS. By hypothesis, $(\text{bint}(A))^c \subseteq F^c$. Hence bcl($A^c$) ⊆ F^c . Hence A is an IFRGbOS in X.

Theorem 4.10: If A is an IFRGbOS in (X, τ) such that bint(A) ⊆ B ⊆ A then B is an IFRGbOS in (X, τ).

Proof: By hypothesis, we have bint(A) ⊆ B ⊆ A. This implies $A^c \subseteq B^c \subseteq (\text{bint}(A))^c$. That is, $A^c \subseteq B^c \subseteq \text{bcl}(A^c)$. Since A^c is an IFRGbCS, by theorem 3.25, B^c is an IFRGbCS. Hence B is an IFRGbOS in X.

5. APPLICATIONS OF INTUITIONISTIC FUZZY REGULAR GENERALIZED b CLOSED SETS

In this section, we introduce intuitionistic fuzzy $_{rgb}T_{1/2}$ spaces and intuitionistic fuzzy $_{rgb}T_b$ spaces in intuitionistic fuzzy topological space and study some of their properties.

Definition 5.1: An IFTS (X, τ) is called an *intuitionistic fuzzy* $_{rgb}T_{1/2}$ *space* ($IF_{rgb}T_{1/2}$ space in short) if every IFRGbCS in X is an IFCS in X.

Definition 5.2: An IFTS (X, τ) is called an *intuitionistic fuzzy* $_{rgb}T_b$ *space* ($IF_{rgb}T_b$ space in short) if every IFRGbCS in X is an IFbCS in X.

Theorem 5.3: Let (X, τ) be an IFTS where (X, τ) is an $IF_{rgb}T_{1/2}$ space. Then the following statements hold.
(i) Any union of IFRGbCS is an IFRGbCS.
(ii) Any intersection of IFRGbOS is an IFRGbOS.

Proof:
(i): Let $\{A_i\}_{i\in J}$ be a collection of IFRGbCS in an $IF_{rgb}T_{1/2}$ space (X, τ). Therefore every IFRGbCS is an IFCS. But the union of IFCS is an IFCS. Hence the union of IFRGbCS is an IFRGbCS in X.
(ii): It can be proved by taking complement in (i).

Theorem 5.4: An IFTS (X, τ) is an $IF_{rgb}T_b$ space if and only if IFRGbO(X) = IFbO(X).

Proof: Necessity: Let A be an IFRGbOS in X. Then A^c is an IFRGbCS in X. By hypothesis, A^c is an IFbCS in X. Therefore A is an IFbOS in X. Hence IFRGbO(X) = IFbO(X).

Sufficiency: Let A be an IFRGbCS in X. Then A^c is an IFRGbOS in X. By hypothesis, A^c is an IFbOS in X. Therefore A is an IFbCS in X. Hence (X, τ) is an $IF_{rgb}T_b$ space.

Theorem 5.5: An IFTS (X, τ) is an $IF_{rgb}T_{1/2}$ space if and only if IFRGbO(X) = IFO(X).

Proof: Necessity: Let A be an IFRGbOS in X. Then A^c is an IFRGbCS in X. By hypothesis, A^c is an IFCS in X. Therefore A is an IFOS in X. Hence IFRGbO(X) = IFO(X).

Sufficiency: Let A be an IFRGbCS in X. Then A^c is an IFRGbOS in X. By hypothesis, A^c is an IFOS in X. Therefore A is an IFCS in X. Hence (X, τ) is an $IF_{rgb}T_{1/2}$ space.

6. CONCLUSION

The theory of g-closed sets plays an important role in the general topology. Since its inception many weak forms of g-closed sets have been introduced in general topology as well as in fuzzy topology and intuitionistic fuzzy topology. The present paper investigated in new weak form of intuitionistic fuzzy g closed sets namely intuitionistic fuzzy regular generalized b closed sets which contain the classes of intuitionistic fuzzy b closed sets and intuitionistic fuzzy regular generalized closed sets. Several properties and applications of intuitionistic fuzzy regular generalized b closed sets are studied. Many examples are given to justify the results.

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