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On wgrα-Closed Sets in Topological Spaces

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ABSTRACT

In this paper, a new class of sets called wgrα-closed set is introduced and their properties are studied. Moreover the notions of wgrα-continuity and wgrα-irresoluteness are introduced.

Mathematics Subject Classification: *54C10, 54A05.*

Keywords: *wgrα-closed sets, wgrα-open sets, wgrα-continuous and wgrα-irresolute.*

1. Introduction

N. Levine [11] introduced generalized closed sets in general topology as a generalization of closed sets. Stone [21] introduced regular open sets. N. Levine [10,11], Cameron [5], Sundaram and Sheik john [20], Bhattacharyya and lahiri [4], Nagaveni [16], Palaniappan and Rao [18], Maki, Devi and Balachandran [12], J.K Park and J.H Park [19], S.S. Benchalli and R.S. Wali [3] introduced and investigated semi-open sets, generalized closed sets, weakly closed sets, semi generalized closed sets, weakly generalized closed sets, generalized pre-regular closed sets, generalized α-closed sets, α-generalized closed sets, mildly generalized closed sets and regular ω-closed sets respectively. Regular α-open sets and regular generalized α-closed sets have been introduced and investigated by A. Vadivel and K. Vairamanickam [22]. In this paper, we define and study the properties of wgrα-closed sets.

Throughout this paper, space (X, τ) (or simply X) always means a topological space on which no separation axioms are assumed unless explicitly stated. For a subset A of a space X, cl(A), int(A) and A^c denote the closure of A,the interior of A and the complement of A in X respectively.

2. Preliminaries

Definition 2.1: A subset A of a space (X, τ) is called
(i) regular open [21] if A= int(cl(A)) and regular closed if A= cl(int(A)).
(ii) pre-open [14] if A $\subset$ int(cl(A)) and pre-closed if cl(int(A)) $\subset$ A.
(iii) semi-open [10] if A $\subset$ cl(int(A)) and semiclosed if int(cl(A)) $\subset$ A.
(iv) α-open [17] if A $\subset$ int(cl(int(A))) and α-closed if cl(int(cl(A))) $\subset$ A.
(v) semi-pre open [2, 7] if A $\subset$ cl(int(cl(A))) and a semi-preclosed if int(cl(int(A))) $\subset$ A.
(vi) regular α-open [22] if there is a regular open set U such that U $\subset$ A $\subset$ αcl(U).
(vii) regular semi open [5]if there is a regular open set U such that U $\subset$ A $\subset$ cl(U).

Definition 2.2: A subset A of a space (X, τ) is called

(i) generalized closed set (briefly, g-closed) [11] if cl(A) $\subset$ U whenever A $\subset$ U and U is open in X.

(ii) generalized α-closed set (briefly, gα-closed) [12] if αcl(A) $\subset$ U whenever A $\subset$ U and U is α-open in X.

(iii) α-generalized closed set (briefly, αg-closed) [13] if αcl(A) $\subset$ U whenever A $\subset$ U and U is open in X.

(iv) regular generalized closed set (briefly, rg-closed) [18] if cl(A) $\subset$ U whenever A $\subset$ U and U is regular open in X.

(v) generalized pre -regular closed set (briefly, gpr-closed) [19] if pcl(A) $\subset$ U whenever A $\subset$ U and U is regular open in X.

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(vi) weakly generalized closed set (briefly, ωg-closed) [15,16] if clint(A)$\subset$U whenever A$\subset$U and U is open in X.

(vii) weakly closed sets (briefly, ω-closed) [1,3] if cl(A)$\subset$U whenever A$\subset$U and U is semi open in X.

(viii) semi weakly generalized closed set (briefly, sωg-closed) [16] if cl(int(A))$\subset$U whenever A$\subset$U and U is semi-open in X.

(ix) regular weakly generalized closed set (briefly, rωg-closed) [16] if cl(int(A))$\subset$U whenever A$\subset$U and U is regular open in X.

(x) regular generalized α-closed set (briefly, rgα-closed) [22] if αcl(A)$\subset$U whenever A$\subset$U and U is regular α- open n X.

(xi) Semi-generalized closed (briefly, sg-closed) [4,6,8] if scl(A)$\subset$U whenever A$\subset$U and U is semi open in X.

(xii) regular ω-closed (briefly, rω-closed) [3] if cl(A)$\subset$U whenever A$\subset$U and U is regular semi open in X.

(xiii) mildly generalized closed sets (briefly, mildly g-closed) [19] if cl(int(A))$\subset$U, whenever A$\subset$U and U is g-open in X.

Definitions 2.3: A map f :(X, τ)$\rightarrow$(Y, σ) is said to be
(i) continuous [9] if f^{-1}(V) is closed in X, for every closed set V in Y.
(ii) ω-continuous [16] if f^{-1}(V) is ω-closed in X, for every closed set V in Y.
(iii) α-continuous [3] if f^{-1}(V) is α-closed in X, for every closed set V in Y.
(iv) gα-continuous [12] if f^{-1}(V) is gα-closed in X, for every closed set V in Y.
(v) rgα-continuous [22] if f^{-1}(V) is rgα-closed in X, for every closed set V in Y.
(vi) sωg-continuous [3] if f^{-1}(V) is sωg-closed in X, for every closed set V in Y.
(vii) rωg-continuous [3] if f^{-1}(V) is rωg-closed in X, for every closed set V in Y.

3. wgrα-closed sets in topological spaces

Definition 3.1: A subset A of a space (X, τ) is called wgrα-closed if cl(int(A))$\subset$U whenever A$\subset$U and U is regular α-open in (X, τ).

The complement of the wgrα-closed set is wgrα-open set.

We denote the set of all wgrα-closed sets in (X, τ) by WGRαC(X) and wgrα-open sets in (X, τ) by WGRαO(X)

Theorem 3.2:
1.Every ω-closed set is wgrα-closed
2.Every α-closed set is wgrα-closed
3.Every gα-closed set is wgrα-closed
4.Every rgα-closed set is wgrα-closed
5.Every sωg-closed set is wgrα-closed
6.Every wgrα-closed set is rωg- closed

Proof: straight forward.

Remark 3.3: Converse of the above need not be true as shown in the following examples.

Example 3.4: Consider X= {a, b, c, d, e} and τ={X, ϕ, {a}, {d}, {e}, {a, d}, {d, e}, {a, e}, {a, d, e}}
Let A= {b}. A is wgrα-closed, but it is not ω-closed.

Example 3.5: Consider X= {a, b, c, d, e} and τ ={X, ϕ, {a}, {d}, {e}, {a, d}, {d, e}, {a, e}, {a, d, e}}
Let A= {a, d, e}. A is wgrα-closed, but it is not α-closed.

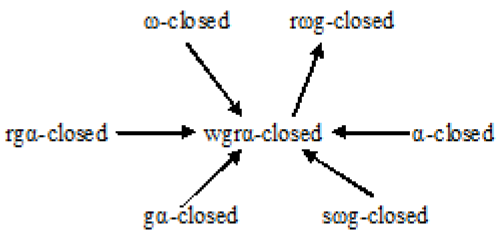
Example 3.6: Consider X= {a, b, c, d} and τ ={X, ϕ, {a}, {b}, {a, b}, {a, b, c}}. Let A= {a, b, d}.A is wgrα-closed, but it is not gα-closed.

Example 3.7: Consider X= {a, b, c, d} and τ ={X, ϕ, {a}, {c, d}, {a, c, d}}. Let A={c}.A is wgrα-closed, but it is not rgα-closed.

Example 3.8: Consider X= {a, b, c, d} and τ ={X, ϕ, {a}, {b}, {a, b}, {a, b, c}}. Let A= {a, b, c}.A is wgrα-closed, but it is not sωg-closed.

Example 3.9: Consider X= {a, b, c, d} and τ={X, ϕ, {a}, {b}, {a, b},{a, b, c}}. Let A= {b, c}. A is rωg-closed, but it is not wgrα-closed.

Remark 3.10: The above discussions are summarized in the following diagram.



Remark 3.11: Union of two wgrα-closed sets need not be wgrα- closed.

Example 3.12: Let X={a, b, c, d},τ = {X, ϕ,{a},{c, d},{a, c, d}}. A={c} and B={d} are wgrα- closed sets. But $A \bigcup B$ is not wgrα-closed.

Remark 3.13: Intersection of two wgrα-closed sets need not be wgrα-closed.

Example 3.14: Let X= {a, b, c, d},τ = {X, ϕ,{a},{c, d},{a, c, d}}. A= {a, b} and B= {a, d} are wgrα-closed. But $A \bigcap B$ is not wgrα-closed.

Remark 3.15: The following example shows that wgrα-closed sets are independent of mildly g-closed sets, generalized closed sets, ωg-closed sets, semi closed sets, αg-closed sets, sg-closed sets and rω-closed sets.

Example 3.16: Let X= {a, b, c, d} and τ ={X, ϕ, {a}, {b}, {a, b}, {a, b, c}}. Then

(i) wgrα-closed sets in (X, τ) are
{X, ϕ, {c}, {d}, {c, d}, {a, b, c}, {a, b, d}, {a, c, d}, {b, c, d}}

(ii) mildly g-closed sets in (X, τ) are
{X, ϕ, {d}, {c, d}, {a, d},{b, d}, {a, b, d}, {b, c, d}, {a, c, d}}

(iii) generalized closed sets in (X, τ) are
{X, ϕ, {d}, {c, d}, {a, d}, {b, d}, {a, b, d}, {a, c, d}, {b, c, d}}

(iv) ωg-closed sets in (X, τ) are
{X, ϕ, {c}, {d}, {c, d}, {a, d}, {b, d}, {a, c}, {a, b, d}, {a, c, d}, {b, c, d}}

(v) semi-closed sets in (X, τ) are
{X, ϕ,{a},{b},{c}, {d}, {a, d}, {b, d}, {c, d}, {a, c},{b, c}, {a, c, d}, {b, c, d}}

(vi) αg-closed sets in (X, τ) are
{X, ϕ, {c}, {d}, {c, d}, {a, d}, {b, d}, {a, b, d}, {a, c, d}, {b, c, d}}

(vii) sg-closed sets in (X, τ) are
{X, ϕ, {a}, {b}, {c}, {d}, {c, d}, {b, c}, {a, d}, {b, d}, {a, c}, {a, c, d}, {b, c, d}}

(viii) rω-closed sets in (X, τ) are
{X, ϕ, {d}, {a, b}, {c, d}, {a, b, c}, {a, b, d}, {a, c, d}, {b, c, d}}

Theorem 3.17: Let A be wgrα-closed in (X, τ), then cl(int(A))−A does not contain any non-empty regular α-open set.

Proof: Let F be a non-empty regular-α open set such that $F \subset cl(int(A)) - A$. Then $F \subset X - A \Rightarrow A \subset X - F$, X−F is regular α-open. Since A is wgrα-closed, $cl(int(A)) \subset X - F$. Therefore $F \subset cl(int(A)) \cap X - cl(int(A))$,which implies F= ϕ, which is a contradiction. Hence cl(int(A)) −A does not contain any non-empty regular α-open set.

Remark 3.18: Converse of the above theorem need not be true as shown in the following example.

Example 3.19: Let X= {a, b, c, d, e}, τ={X, ϕ, {a}, {d}, {e}, {a, d}, {a, e}, {d, e}, {a, d, e}}. Let A= {a, b}. cl(int(A))−A={c},which is not regular α-open. But A= {a, b} is not wgrα-closed.

Corollary 3.20: A subset A of X is wgrα-closed set in X, then cl(int(A))−A does not contain any non-empty regular open set in X, but not conversely.

Proof: Follows from theorem 3.17 and the fact that every regular open set is regular α-open.

Example 3.21: Let X= {a, b, c, d}, τ={X, ϕ,{a} ,{c, d},{a, c, d}}.Let A={a}.cl(int(A))−A ={b} , which is not regular open set. But A is not wgrα-closed.

Corollary 3.22: A subset A of X is wgrα-closed set in X, then cl(int(A))−A does not contain any non-empty regular closed set in X, but not conversely.

Proof: Follows from theorem 3.17 and the fact that every regular open set is regular α-open.

Example 3.23: Let X= {a, b, c, d}, τ={X, ϕ, {a}, {c, d}, {a, c, d}}. Let A ={c, d}, cl(int(A)) –A ={b} , which is not regular closed. But A is not wgrα-closed.

Theorem 3.24: For an element $x \in X$, then the set X−{x} is wgrα-closed or regular α-open.

Proof: Suppose X−{x} is not regular α-open set. Then X is the only regular α-open set containing X−{x} $\Rightarrow$ cl(int({X−{x}})) $\subset$ X. Therefore X−{x} is wgrα-closed.

Theorem 3.25: A is wgrα-closed subset of X such that $A \subset B \subset$ cl(int(A)),then B is wgrα-closed set in X.

Proof: If A is wgrα-closed subset of X such that $A \subset B \subset$ cl(int(A)). Let U be regular α-open set of X such that $B \subset U$, then $A \subset U$. Since A is wgrα-closed, cl(int(A)) $\subset$ U. Now cl(int(B)) $\subset$ cl(int(cl(int(A))))=cl(int(A)) $\subset$ U. Thus B is wgrα-closed set in X.

Remark 3.26: Converse of the above theorem need not be true.

Example 3.27: Let X={a, b, c}, τ={X, ϕ,{a},{b},{a, b}}. Here A={a} ,B={a,c}with $A \subset B \subset$ cl(int(A)), B is wgrα-closed in X, but A is not wgrα-closed in X.

Theorem 3.28: If A is wgrα-closed and regular open, then A is rg-closed.

Proof: Let $A \subset U$ and U be regular open. By hypothesis, cl(A) $\subset$ U. Therefore A is rg-closed.

Theorem 3.29: Let A be wgrα-closed in (X, τ), then A is regular closed set iff cl(int(A)) −A is regular α-open .

Proof: Suppose A is regular closed in X. Then cl(int(A)) = A and so cl(int(A))−A=φ, which is regular α-open in X. Conversely, Suppose cl(int(A))−A is a regular α-open in X. Then cl(int(A)) −A = φ. Hence A is regular closed set in X.

4. wgrα-open sets

Theorem 4.1: A subset A of a topological space X is wgrα-open iff $F \subset$ int(cl(A)),whenever F is regular α-open and $F \subset A$.

Proof: Assume A is wgrα- open, A^c is wgrα- closed. Let F be a regular α-open set in X contained in A. F^c is a regular α-open set in X containing A^c .Since A^c is wgrα-closed, cl(int(A^c) $\subset F^c$.Therefore $F \subset$ int(cl(A)).

Conversely, let $F \subset$ int(cl(A)),whenever $F \subset A$ and F is regular α-open in X. Let G be a regular α-open set containing A^c ,then $G^c \subset$ int(cl(A)).Thus cl(int(A^c)) $\subset G \Rightarrow A^c$ is wgrα-closed $\Rightarrow$ A is wgrα -open.

Theorem 4.2: If $A \subset X$ is wgrα-closed, then cl(int(A))−A is wgrα-open.

Proof: Let A be wgrα-closed and F be regular α-open. $F \subset$ cl(int(A))−A, then int(cl((cl(int(A)) −A)))=φ. Thus $F \subset$ int(cl((cl (int(A))−A))).Therefore cl(int(A))−A is wgrα-open.

Remark 4.3: Converse of the above theorem need not be true as shown in the following example.

Example 4.4: Let $X = \{a, b, c, d\}$, $\tau = \{X, \varphi, \{a\}, \{b\}, \{a, b\}, \{a, b, c\}\}$. Let $A = \{a, c\}$. $cl(int(A)) - A = \{d\}$ is wgrα-open. But A is not wgrα-closed.

Theorem 4.5: If $int(cl(A)) \subset B \subset A$ and A is wgrα-open, then B is wgrα-open.

Proof: Let $int(cl(A)) \subset B \subset A$. Thus $X-A \subset X-B \subset cl(int(X-A))$.Since $X-A$ is wgrα-closed, by theorem 3.25, $X-B$ is wgrα-closed.

Theorem 4.6: If A is both regular open and wgrα-closed then it is clopen.

Proof: straight forward.

5. wgrα-continuous and irresolute mappings.

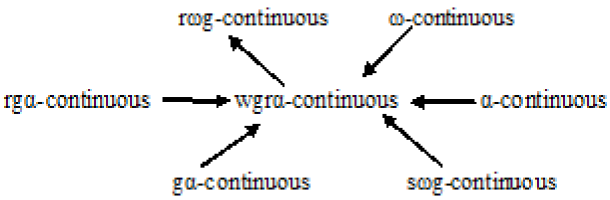
Definition 5.1: A map $f:(X, \tau) \to (Y, \sigma)$ is said to be wgrα-continuous if $f^{-1}(V)$ is wgrα-closed in X, for every closed set V in Y.

Example 5.2: Let $X=\{a, b\}$,$\tau=\{ X, \phi, \{a\}, \{b\}\}$and $\sigma=\{ X, \phi, \{a\}\}$.Define $f:(X,\tau) \to (X, \sigma)$ by $f(a)=b$ and $f(b)=a$. Since every subset of (X, τ) is wgrα-closed, f is wgrα-continuous.

Definition 5.3: A map $f:(X, \tau) \to (Y, \sigma)$ is said to be wgrα-irresolute if $f^{-1}(V)$ is wgrα-closed in X, for every wgrα-closed set V in Y.

Example 5.4: Let $X= \{a, b, c\}$, $\tau=\{X, \phi, \{a, b\}\}$ and $\sigma=\{X, \phi, \{a, b\}, \{c\}\}$. Define $f :(X, \tau) \to (X, \sigma)$ by $f(a)=c$, $f(c)=a$ and $f(b)=b$. f is wgrα-irresolute.

The above results are summarized in the following diagram.



Remark 5.5: Every wgrα-irresolute function is wgrα-continuous, but not conversely.

Example 5.6: Let $X= \{a, b, c\}$, $\tau =\{X, \phi, \{a\}, \{b\}, \{a, b\}\}$ and $\sigma =\{X, \phi, \{a\}\}$. Define $f: (X, \tau) \to (X, \sigma)$ by $f(a)=a$, $f(b)=b$ and $f(c)=c$. Here f is wgrα-continuous, but not wgrα-irresolute.

Theorem 5.7:
1.Every ω-continuous is wgrα-continuous
2.Every gα-continuous is wgrα-continuous
3.Every α-continuous is wgrα-continuous
4.Every sωg-continuous is wgrα-continuous
5.Every rgα-continuous is wgrα-continuous
6.Every wgrα-continuous is rωg- continuous

Proof: straight forward.

Remark 5.8: Converse of the above need not be true.

Example 5.9: Let $X= \{a, b, c, d\}$, $\tau =\{X, \phi, \{a\}, \{b\}, \{a, b\}, \{a, b, c\}\}$ and $\sigma=\{X, \phi,\{b\},\{c\},\{b, c\}\}$
Define $f :(X, \tau) \to (X, \sigma)$ by $f(a) = b$, $f(b) = c$, $f(c) = d$, $f(d) = a$. f is wgrα-continuous, but it is not ω-continuous.

Example 5.10: Let $X= \{a, b, c, d, e\}$,$\tau=\{X, \phi, \{a\}, \{d\}, \{e\}, \{a, d\}, \{a, e\}, \{d, e\}\}$ and $\sigma=\{X, \phi,\{c\},\{c, d\}\}$. Define $f:(X, \tau) \to (X, \sigma)$ by $f(a)=b$, $f(b)=c$, $f(c)=d$, $f(d)=e$, $f(e)=a$. f is wgrα-continuous, but it is not gα-continuous.

Example 5.11: Let X={a, b, c},τ ={X, ϕ, {a}, {c}, {a, c}} and σ ={X, ϕ,{c},{b, c}}.Define f:(X, τ)→(X, σ) by f(a)=a , f(b)=b, f(c)=c. f is wgrα-continuous, but it is not α-continuous.

Example 5.12: Let X={a, b, c, d},τ ={X ,ϕ, {a}, {b}, {a, b}, {a, b, c}} and σ={X, ϕ,{d},{a, c, d}}
Define f :(X, τ)→(X, σ) by f(a) = a , f(b) = c, f(c) = b, f(d)=d. f is wgrα-continuous, but it is not sωg-continuous.

Example 5.13: Let X={a, b, c, d},τ ={X, ϕ, {a}, {c, d}, {a, c, d}} and σ ={X, ϕ,{a, d},{a, b, d}}.Define f:(X, τ)→(X, σ) by f(a) = b , f(b) = a, f(c) = c, f(d) = d. f is wgrα-continuous, but it is not rgα-continuous.

Example 5.14: Let x = {a, b, c, d}, τ = {ϕ, x, {a}, {b}, {a, b}, {a, b, c}} and σ= {ϕ, x, {a, c}, {a, c, d}}. Define f:(X, τ)→(X, σ) by f(a) , f(b)=c, f(c)=b, f(d)=d. f is rωg-continuous, but it is not ωgrα-continuous.

Remark 5.15: The composition of two ωgrα-continuous functions need not be ωgrα-continuous.

Example 5.16: Let X={a, b, c},τ={X, ϕ,{a},{b},{a, b}}, σ ={X, ϕ,{a},{a, b}} and η = {X, ϕ,{a},{a, c},{a, b}}. Define f:(X, τ)→(X, σ) by f(a)=b, f(b)=a, f(c)=c. Define g:(X, σ)→(X, η) by g(a)=a, g(b)=c, g(c)=b, f and g are ωgrα-continuous, but g∘f is not ωgrα-continuous.

Theorem 5.17: Let f:(X, τ)→(Y, σ) and g:(Y, σ)→(Z, η) be any two maps . Then
(i) g∘f is wgrα-continuous, if g is continuous and f is wgrα-continuous
(ii) g∘f is wgrα-irresolute, if g is wgrα-irresolute and f is wgrα-irresolute
(iii) g∘f is wgrα-continuous, if g is wgrα-continuous and f is wgrα-irresolute

Proof:
(i) Let V be any closed set in (Z, η).Then $g^{-1}(V)$ is closed in (Y, σ),since g is continuous. By hypothesis, $f^{-1}(g^{-1}(V))$ is wgrα-closed in (X, τ). Hence g∘f is wgrα-continuous.

(ii) Let V be wgrα-closed set in (Z, η).Since g is wgrα-irresolute,$g^{-1}(V)$ is wgrα-closed in (Y, σ).As f is wgrα-irresolute, $f^{-1}(g^{-1}(V))=(g\circ f)^{-1}(V)$ is wgrα-closed in (X, τ).Hence g∘f is wgrα-irresolute.

(iii) Let V be closed in (Z, η). Since g is wgrα-continuous,$g^{-1}(V)$ is wgrα-closed in (Y, σ).As f is wgrα-irresolute, $f^{-1}(g^{-1}(V))=(g\circ f)^{-1}(V)$ is wgrα-closed in (X, τ).Hence g∘f is wgrα-continuous.

References

[1] Ahmad Al-Omari and Salmi Md Noorani, Regular generalized ω-closed sets, International ournal of Mathematics and Mathematical Sciences, Volume 2007, article(ID),16292.

[2] D. Andrijevic, Semi-preopen sets, Mat. Vesnik 38(1986), 24-32.

[3] S.S.Benchalli and R.S.Wali, On rw-closed sets in topological spaces, Bull. Malays. Math. Sci. Soc.(2) 30(2) (2007), 99-110

[4] P. Bhattacharya and B.K. lahiri, Semi-generalized closed sets in topology, Indian J. Math. 29 (1987), 376-382.

[5] D. E. Cameron, Properties of S-closed spaces, Proc. Amer Math. Soc. 72(1978), 581-586

[6] G. Di Maio and Noiri, On S-closed spaces, Indian J. Pure Appl. Math. 18(3)(1987), 226-233.

[7] J. Dontchev,On generalizing semi-preopen sets, Mem. Fac Sci. Kochi. Univ. Ser. A. Math. 16 1995), 35-48.

[8] J. Dontchev and H.maki, On sg-closed sets semi-λ closed sets, Questions and Answers Gen. Topology, 15(1997), 253-266.

[9] Y. Gnanambal, On generalized preregular closed sets in topological spaces, Indian j. pure App. Math.28 (1997), 351-360.

[10] N. Levine, Semi-open sets and semi-continuity in topological spaces, Amer .Math. Monthly, 70(1963), 36-41.

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

[12] H. Maki, R. Devi and K. Balachandran, Associated topologies of generalized α-closed sets and α-generalized closed sets, Mem. Sci. Kochi Univ. Ser. A. Math. 15(1994), 51-63.

[13] H. Maki, R. Devi and K. Balachandran, Generalized α-closed sets in topology, Bull. Fukuoka Unv. Ed. Part-III 42(1993), 13-21.

[14] A.S.Mashhour, M.E.Abd. El-Monsef and S. NEl-Deeb, On pre continuous mappings and weak pre-continuous mappings, proc. Math. Phys. Soc. Egypt 53(1982), 47-53.

[15] C. Mukundhan and N. Nagaveni, A Weaker Form of a Generalized closed set, Int. J. Contemp. Math. Sciences, Vol. 6, 2011, no.20, 949-961.

[16] N. Nagaveni, studies on generalizations of Homeomorphisms in topological spaces, Ph.D. Thesis, Bharathiar University, Coimbatore, 1999.

[17] O.Njastad, On some classes of nearly open sets, Pacific J. Math. 15(1965), 961-970.

[18] N.Palaniappan and K.C.Rao, Regular generalized closed sets, Kyungpook Math. J. 33 (1993), 211-219.

[19] J. K. Park and J.H. Park, Mildly generalized closed sets, almost normal and mildly normal spaces, Chaos, Solitions and Fractals 20(2004), 1103-1111.

[20] P. Sundaram and M. Sheik John, On w-closed sets in topology, Acta Ciencia Indica 4(2000), 389-392

[21] M.Stone, Applications of the theory of Boolean rings to general topology, Trans. Amer. Math. Soc , 41(1937),374-481.

[22] A. Vadivel and K. Vairamanickam, rgα-closed sets and rgα-open sets in topological spaces, Int. Journal of Math. Analysis, Vol.3, 2009, no.37, 1803-1819.

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