International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

On Soft Semi Weakly Generalized Closed Set in Soft TopologicalSpaces

Sasikala V.E, Sivaraj .D ,Ponraj A.P

Abstract—Soft sets has helped the development of soft topological space and it was also applied in the field of life science, Social science and Engineering. Many researchers developed various ideas based on the properties of soft topology. The article deals with study of properties in soft topological space based on soft semi weakly generalized closed set.

Keywords—Soft swg-closed set, Softswg-open set, Soft swg-closure set, Soft swg-interior.

Subject Classification:*06D72,54A05*

I. INTRODUCTION

Intheyear1999,the idea of soft set theory was introduced by Molodstov[2]tofindanswerstoseveral problemsinlifescience,engineering,and in practical life situationetc.,Later theresults wereapplied indifferent fieldsoft study viz., operations research, gametheoryetc.,. C¸aˇgmanN[1]introduced softtopologyfromwhich manyresearchers applieditas abase toworkon softtopologicalspaceanditwasthe beginningforsoftmathematicalconcepts.Here we introduced the idea of soft topological space in the basis of soft semi weakly generalized closed set.Thecollectionof soft sets overF_A was stuided by Shabir M and Naz M, [7] and denotedfewnotionsofttopologicalspace. Thepropertiesofsofttopologicalspaces werestudiedbythe authors [3-8] LetU be an universal set and E set of parameters; P(U)the power set of U. The collection of all soft sets over Uand Eis denoted by S(U). If A$\subseteq$ E, then the pair(F, A)is said to be the soft set over U and it is denoted by$F_A$or F_E where F is a mapping of A ontoP(U). Note that for e$\notin$A,F(e) $= F_\emptyset$ [2].Let F_B and G_C be the soft sets in a universe set Uand B, C $\subseteq$E. *Soft subset* of G_C represented F_B, symbolizedby $F_B \tilde{\subseteq} G_C$, when (i) B$\subseteq$C and (ii) $\forall$ e$\in$B, F(e)=G(e).The *relative complement* of a soft set F_A, denoted by F_A^c, is being represented by thefunction $f_{A^c}(e) = f_A^c(e)$, that is $f_A^c(e) = U - f_A(e) \forall$ e$\in$E. In other words$(F_A^c)^c = F_A$,$F_\phi^c = F_E$and $F_E^c = F_\phi$[1]. Let $F_A \in S(U)$.

A *soft topology* on $(F_A, \tilde{\tau})$, which is a group of soft subsets of $F_A$has the following properties(i) F_ϕ, $F_A \in \tilde{\tau}$.(ii)$\{F_{A_i} \tilde{\subseteq} F_A : i \in I\} \tilde{\subseteq} \tilde{\tau} \Rightarrow \tilde{\cup}_{i\in I} F_{A_i} \in \tilde{\tau}$. (iii)$\{F_{A_i} \tilde{\subseteq} F_A : 1 \le i \le n,\ n \in N\} \tilde{\subseteq} \tilde{\tau} \Rightarrow \tilde{\cap}_{i=1}^{n} F_{A_i} \in \tilde{\tau}$.The pair $(F_A, \tilde{\tau})$ is known as*soft topological spaces* [7].Let$(F_A, \tilde{\tau})$be a soft topological space and F_B be a soft set overF_A. (i) S*oft interior* of F_B is the soft set *int*$(F_B) = \tilde{\cup}\{F_C$: $F_C$is soft open set and $F_B \tilde{\subseteq} F_C\}$. (ii) S*oft closure* of $F_B$is the soft set *cl*$(F_B)=\tilde{\cap}\{F_C$: $F_C$is soft closed set and $F_C \tilde{\subseteq} F_B\}$ [7]. (i) Soft α-closed set, when *cl*(*int*(*cl*(F_B)))$\tilde{\subseteq} F_B$ [3]. (ii) Soft β −closed set (or) Soft semi-pre closed set, when *int*(*cl*(*int*(F_B)))$\tilde{\subseteq} F_B$ [3]. (iii) Soft semi-closed set, when *int*(*cl*(F_B))$\tilde{\subseteq} F_B$ [5]. (iv) Soft pre-closed set, when *cl*(*int*(F_B))$\tilde{\subseteq} F_B$ [6]. (v) Soft regular closed set, when *cl*(*int*(F_B))= F_B [8]. (vi) Soft generalized closed set, when *cl*$(F_B) \tilde{\subseteq} F_C$, whenever $F_B \tilde{\subseteq} F_C$and $F_C$is a soft open set and Soft weakly closed set, if every *cl*$(F_B) \tilde{\subseteq} F_C$, whenever $F_B \tilde{\subseteq} F_C$ and $F_C$is a soft semi-open set [8].

II. SOFT SEMI WEAKLY GENERALIZED CLOSED SET AND SOFT SEMI WEAKLYGENERALIZED CLOSED SETS IN THEIR PROPERTIES

Definition 2.1.Let $(F_A, \tilde{\tau})$ is a soft topological space and $F_B \tilde{\subseteq} F_A$,$F_B$ is identified to be a *Soft Semi Weakly Generalized closed set*(briefly,*soft swg-closed set*) if every *cl*(*int*(F_B))$\tilde{\subseteq} F_C$, whenever $F_B \tilde{\subseteq} F_C$and F_C (soft semi-open set).

Example 2.2.Let U = {*a*,b,c}, E = $\{e_1, e_2, e_3\}$, A = $\{e_1, e_2\} \tilde{\subseteq}$ E.

$F_A = \{(e_1, \{a,b,c\}), (e_2, \{a,b,c\})\}$,

$F_1 = \{(e_1, \{b,c\}), (e_2, \{b,c\})\}$, $F_2 = \{(e_1, \{c\}), (e_2, \{a,b\})\}$, $F_3 = \{(e_1, \{a,c\}), (e_2, \{b\})\}$, $F_4 = \{(e_1, \{c\}), (e_2, \{b\})\}$,$F_5 = \{(e_1, \{b,c\}), (e_2, \{a,b,c\})\}$,$F_6=\{(e_1, \{a,b,c\}), (e_2, \{b,c\})\}$,$F_7 = \{(e_1, \{a,c\}), (e_2, \{a,b\})\}$, $F_8 = \{(e_1, \{a\}), (e_2, \{a\})\}$, $F_9 = \{(e_1, \{a,b\}), (e_2, \{c\})\}$, $F_{10}=\{(e_1,\{b\}), (e_2, \{a,c\})\}$,$F_{11}=\{(e_1, \{a,b\}), (e_2, \{a,c\})\}$,$F_{12}= \{(e_1, \{a\})\}$, $F_{13}= \{(e_2, \{a\})\}$, $F_{14}=\{(e_1, \{b\}), (e_2, \{c\})\}$,$F_{15} = F_A$, $F_{16}= F_\phi$. Let $\tilde{\tau}= \{F_\phi, F_A, F_1, F_2, F_3, F_4, F_5, F_6, F_7\}$. Then $(F_A, \tilde{\tau})$is a soft topological space. Soft open set are $\{F_A, F_\phi, F_1, F_2, F_3, F_4, F_5, F_6, F_7\}$. Soft closed set are $\{F_A, F_\phi, F_8, F_9, F_{10}, F_{11}, F_{12}, F_{13}, F_{14}\}$.

(i) Let us consider $F_B = F_8= \{(e_1, \{a\}), (e_2, \{a\})\}$,$F_8 \tilde{\subseteq} F_A$and $F_C= \{(e_1, \{a\}), (e_2, \{a,b\})\}$where$F_C$is soft semi-open set, then*int*$(F_B) = F_\phi$, *cl*(*int*(F_B)) $= F_\phi$. So *cl*(*int*(F_B))$\tilde{\subseteq} F_C$.$F_B$issoft semi weakly generalized closedset (soft *swg*-closed set) but not soft semi-open set.

Revised Manuscript Received on October 30, 2019.
* Correspondence Author
Sasikala V.E*, Research Scholar, Vels Instituteof Science, Technology and Advanced Studies, Chennai, Tamil nadu, India. (E-mail: sasikala.rupesh@gmail.com)
Sivaraj .D, Meenakshi Academy of Higher Education and Research, Chennai ,Tamil Nadu, India.
Ponraj A.P, Meenakshi Academy of Higher Education and Research, Chennai ,Tamil Nadu, India.

(ii) Let us consider$F_B = \{(e_1, \{c\}), (e_2, \{b, c\})\}$ and $F_C = \{(e_1, \{a, b, c\}), (e_2, \{b, c\})\}$where$F_C$ is a soft semi-open set,then*int*$(F_B) = F_4$, *cl*(*int*$(F_B)) = F_A$. So,*cl*(*int*$(F_B)) \tilde{\nsubseteq} F_C$. $F_B$is a soft semi-open set but it is neither a soft semiweakly generalized closed set(soft *swg*-closed set) nor soft closed set orsoft open set.

Theorem 2.3.All soft closed sets represent soft *swg*-closed set.

Proof.Let$F_B$be a soft closed set in$(F_A, \tilde{\tau})$. Now *int*$(F_B)\tilde{\subseteq}F_BandF_B\tilde{\subseteq}F_C$always, if $F_B$is a soft closed set and soft open set. So, if $F_B\tilde{\subseteq}F_C$, where F_C is a soft semi-open set in F_A, then *cl*(*int*$(F_B))\tilde{\subseteq}$*cl*$(F_B)\tilde{\subseteq}F_C$. Thus *cl*(*int*$(F_B))\tilde{\subseteq}F_C$, whenever $F_B\tilde{\subseteq}F_C$, whereF_C denotes soft semi-open set. Therefore, $F_B$is a soft *swg*-closed set.□

Example 2.4.We have following example 2.2., LetF_B= $\{(e_1, \{c\}), (e_2, \{a, b, c\})\}$ and $F_C = \{(e_1, \{a, c\}), (e_2, \{a, b, c\})\}$, where $F_C$is a soft semi-open set, then *int*(F_B)= F_ϕ,*cl*(*int*$(F_B)) = F_\phi$, so, *cl*(*int*$(F_B))\tilde{\subseteq}F_C$. Now$F_B$ is soft *swg*-closed set but it is not a soft closed set.

Theorem 2.5.All soft *g*-closed sets represent soft *swg*-closed set.

Proof.Let $F_B$stands soft *g*-closed set, then *cl*$(F_B)\tilde{\subseteq}F_C$whenever $F_B\tilde{\subseteq}F_C$and$F_C$remains a soft open set. Each soft open set denotes soft semi-openset. *int*$(F_B)\tilde{\subseteq}F_B$, if $F_B$is a soft open set. Now *cl*(*int*$(F_B))\tilde{\subseteq}$*cl*$(F_B)\tilde{\subseteq}F_C$. Therefore, $F_B$refers asasoft *swg*-closedset.□

Example 2.6.We have following example 2.2., LetF_B= $\{(e_1, \{c\}),(e_2, \{a\})\}$,$F_C = \{(e_1, \{c\}), (e_2, \{a, b\})\}$ and $F_B\tilde{\subseteq}F_C$ where $F_C$represents soft open set and soft semi-open set.Then*int*(F_B)= F_ϕ,*cl*(*int*$(F_B))$ = F_ϕ, *cl*(*int*$(F_B))\tilde{\subseteq}F_C$. Therefore,$F_B$ be a soft *swg*-closed set but it is not a soft *g*-closed set.

Theorem 2.7.All soft regular closed set represent soft *swg*-closed set.

Proof.Let $F_B$refer to a soft regular closed set, if *cl*(*int*(F_B)) = F_B. Since$F_B\tilde{\subseteq}F_C$, where $F_C$remains soft semi-openset. Now *cl*(*int*$(F_B)) = F_B\tilde{\subseteq}F_C$.Therefore, $F_B$refers as a soft *swg*-closed set.

Example 2.8.We have following example 2.2., LetF_B= $\{(e_1, \{a\}), (e_2, \{b\})\}$,$F_C = \{(e_1, \{a\}), (e_2, \{b, c\})\}$ and $F_B\tilde{\subseteq}F_C$ where $F_C$is soft semi-open set, then *int*(F_B)= F_ϕ,*cl*(*int*$(F_B))$ = F_ϕ,*cl*(*int*$(F_B))\tilde{\subseteq}F_C$. Therefore,$F_B$ refers as asoft *swg*-closed set but it is not a soft regular closed set

Theorem 2.9.The intersection of two soft *swg*-closed sets gives another soft *swg*-closed set.

Proof.LetF_B and $F_C$stay any two soft *swg*-closed sets and F_D remains any soft semi-open set comprise$F_B$and F_C. By definition of soft *swg*-closed set,*cl*(*int*$(F_B)\tilde{\subseteq}F_D$ and *cl*(*int*$(F_C))\tilde{\subseteq}F_D$. Hence *cl*(*int*$(F_B\tilde{\cap}F_C))\tilde{\subseteq}$*cl*(*int*$(F_B))\tilde{\cap}$*cl*(*int*$(F_C))\tilde{\subseteq}F_D$. Therefore, *cl*(*int*$(F_B\tilde{\cap}F_C))\tilde{\subseteq}F_D$. Therefore, $F_B\tilde{\cap}F_C$refers assoft *swg*-closed set inF_A.□

Remark2.10.If F_B and F_C are soft *swg*-closed sets the $F_B \tilde{\cup} F_C$ does not need be a soft *swg*-closed set.

Example 2.11.From 2.2., LetF_B= $\{(e_1, \{c\})\}$ andF_C = $\{(e_2, \{b\})\}$, then F_B and $F_C$are soft *swg*-closed sets.$F_B \tilde{\cup} F_C$ =$\{(e_1, \{c\}), (e_2, \{b\})\}$ is not a soft *swg*-closed set

Theorem 2.12.Let $(F_A, \tilde{\tau})$ be a soft topological space. Then a soft subset F_B ofF_A is soft *swg*-closed set in $(F_A, \tilde{\tau})$ iff*cl*(*int*$(F_B)) - F_B$ contains empty soft semi-closed set

Proof.LetF_C be a non empty soft semi-closed set subset of*cl*(*int*$(F_B)) - F_B$. Now$F_C\tilde{\subseteq}$*cl*(*int*$(F_B)) - F_B$. Which implies that$F_C\tilde{\subseteq}$*cl*(*int*$(F_B)) \tilde{\cap} F_B^c$. Since *cl*(*int*$(F_B)) - F_B$=*cl*(*int*$(F_B)) \tilde{\cap} F_B^c$. Thus $F_C\tilde{\subseteq}$*cl*(*int*$(F_B))$. Now $F_C\tilde{\subseteq}F_B^c$which implies that $F_B\tilde{\subseteq}F_C^c$.When$F_C^c$representssoft semi-open set and $F_B$represents soft *swg*-closed set,we have *cl*(*int*$(F_B))\tilde{\subseteq}F_C^c$ which implies that $($*cl*(*int*$(F_B)))^c\tilde{\subseteq}(F_C^c)^c$ which implies that $F_C\tilde{\subseteq}($*cl*(*int*$(F_B)))^c$which implies that $F_C\tilde{\subseteq}$*cl*(*int*$(F_B))$ $\tilde{\cap}($*cl*(*int*$(F_B)))^c = F_\phi$ which is a contradiction. Therefore, $F_C = F_\phi$.Therefore, *cl*(*int*$(F_B)) - F_B$ contains empty soft semi-closed set. Conversely, Assume *cl*(*int*$(F_B)) - F_B$ containsempty soft semi-closed sets. Let $F_B\tilde{\subseteq}F_C$, where F_C is a soft semi-open set. Presume,*cl*(*int*$(F_B))$ is not contained in F_C. Then *cl*(*int*$(F_B)) \tilde{\nsubseteq} F_C$, then *cl*(*int*$(F_B)) \tilde{\cap} F_C^c$ is a non empty soft semi-closed set of *cl*(*int*$(F_B)) - F_B$, which is a contradiction. Then *cl*(*int*$(F_B))\tilde{\subseteq}F_C$ whenever $F_B\tilde{\subseteq}F_C$. Therefore, $F_B$is a soft *swg*-closed set. □

Theorem 2.13.Thesoft *swg*-closed sets be a soft regular closed set, ⟺*cl*(*int*$(F_B)) - F_B$ softsemi-closed set.

Proof.Presume that $F_B$be soft regular closed set. Since *cl*(*int*$(F_B)) = F_B$. Since *cl*(*int*$(F_B)) - F_B = F_\phi$ besoft regular closed set and it is soft semi-closed set. Conversely, Assume *cl*(*int*$(F_B)) - F_B$is a soft semi-closed set [From Theorem 2.12]. Since, *cl*(*int*$(F_B)) - F_B = F_\phi$contains empty soft semi-closed set. Thus F_B proved as soft regular closed set.□

Theorem 2.14.Soft topological space$(F_A, \tilde{\tau})$ and $F_C\tilde{\subseteq}F_B\tilde{\subseteq}F_A$.If$F_C$ is a soft *swg*-closed set in F_A, then F_C is a soft *swg*-closed set in relation to$F_B$and mutually soft open set and soft *swg*-closed are subset of F_A, then F_C, soft*swg*-closed set relative to F_A

Proof. Assume$F_C\tilde{\subseteq}F_D$ and $F_D$be the soft open set overF_A. From the known result$F_C\tilde{\subseteq}F_B\tilde{\subseteq}F_A$.Then $F_C\tilde{\subseteq}F_B$ and$F_C\tilde{\subseteq}F_D$which implies that$F_C\tilde{\subseteq}F_B\tilde{\cap}F_D$. Since F_C denoted as a soft *swg*-closed set relative to F_B, *cl*(*int*$(F_C)\tilde{\subseteq}F_B\tilde{\cap}F_D$ which implies that $F_B\tilde{\cap}$*cl*(*int*$(F_C))\tilde{\subseteq}F_B\tilde{\cap}F_D$which implies that $F_B\tilde{\cap}($*cl*(*int*$(F_C)))\tilde{\subseteq}F_D$. Thus$F_B\tilde{\cap}$*cl*(*int*$(F_C))\tilde{\cup}($*cl*(*int*$(F_C)))^c\tilde{\subseteq}F_D$ $\tilde{\cup}($*cl*(*int*$(F_C)))^c$which implies that F_B $\tilde{\cup}($*cl*(*int*$(F_C)))^c\tilde{\subseteq}F_D$ $\tilde{\cup}($*cl*(*int*$(F_C)))^c$. Since F_B is a soft *swg*-closed set in F_A.We have *cl*(*int*$(F_B)\tilde{\subseteq}F_D$ $\tilde{\cup}($*cl*(*int*$(F_C)))^c$. Also, $F_C\tilde{\subseteq}F_B$which implies that *cl*(*int*$(F_C))\tilde{\subseteq}$*cl*(*int*$(F_B))$. Thus *cl*(*int*$(F_C))\tilde{\subseteq}$*cl*(*int*$(F_B))\tilde{\subseteq}$ F_D $\tilde{\cup}($*cl*(*int*$(F_C)))^c$. Hence,F_C proved as soft *swg*-closed set in relationto F_A

Theorem 2.15.When soft topological space$(F_A, \tilde{\tau})$and $F_C\tilde{\subseteq}F_B\tilde{\subseteq}F_A$. If$F_C$ is soft *swg*-closed set relative to $F_B$and F_B is soft *swg*-closed set$(F_A, \tilde{\tau})$.Then F_C, soft *swg*-closed set in relation to $(F_A, \tilde{\tau})$

Proof.Let $F_C\tilde{\subseteq}F_D$, where$F_D$is soft semi-open set in F_A. Then $F_C\tilde{\subseteq}F_B\tilde{\cap}F_D$. Since F_C is soft*swg*-closed set relative toF_B, then *cl*(*int*$(F_C))\tilde{\subseteq}F_B\tilde{\cap}F_D$. ie.,$F_B\tilde{\cap}$*cl*(*int*$(F_C))\tilde{\subseteq}F_B\tilde{\cap}F_D$.

International Journal of Innovative Technology and Exploring Engineering (IJITEE)
ISSN: 2278-3075 (Online), Volume-8 Issue-12, October 2019

We have $F_B \tilde{\cap} cl(int(F_C)) \tilde{\subseteq} F_D$ and then $F_B \tilde{\cap} cl(int(F_C)) \tilde{\cup} (cl(int(F_C)))^c \tilde{\subseteq} F_D \tilde{\cup} (cl(int(F_C)))^c$. Since F_B is a soft *swg*-closed set in F_A, we obtain $cl(int(F_B)) \tilde{\subseteq} F_D \tilde{\cup} (cl(int(F_C)))^c$. Also, $F_C \tilde{\subseteq} F_B$ which implies that $cl(int(F_C)) \tilde{\subseteq} cl(int(F_B))$, therefore $cl(int(F_C)) \tilde{\subseteq} F_D$. Since $cl(int(F_C))$ is not contained in $(cl(int(F_C)))^c$. Hence, F_C proved as soft *swg*-closed set in F_A.

Theorem 2.16. Let $(F_A, \tilde{\tau})$ considered as soft topological space, then a soft subset F_B inside F_A is soft nowhere dense, then F_B, soft *swg*-closed set in F_A

Proof. When a soft subset F_B of F_A is soft nowhere dense, then $int(F_B) = F_\phi$. Let $F_B \tilde{\subseteq} F_C$ where F_C represent soft semi-open set, which denotes that $cl(int(F_B)) = cl(F_\phi) = F_\phi \tilde{\subseteq} F_C$. Therefore, F_B proved as soft *swg*-closed set in F_A.

Theorem 2.17. Let $(F_A, \tilde{\tau})$ be a soft topological space. For every soft subset $f_A \in F_A$, either $\{f_A\}$ refers as soft semi-closed set, or $\{f_A\}^c$, soft *swg*-closed set in $(F_A, \tilde{\tau})$

Proof. Assume that $\{f_A\}$ does not belongs to soft semi-closed set of $(F_A, \tilde{\tau})$. Then $\{f_A\}^c$ is a soft semi-open set and the only soft semi-open set containing in F_A itself. Therefore, $cl(int(\{f_A\}^c)) \tilde{\subseteq} F_A$ and so $\{f_A\}^c$ proved as soft *swg*-closed set in $(F_A, \tilde{\tau})$

Theorem 2.18. If F_B state soft semi-open set and soft *swg*-closed set in F_A, both these constitute soft *g*-closed set

Proof. Let F_B be both soft *swg*-closed set and soft semi-open set. Let $F_B \tilde{\subseteq} F_C$ where F_C is soft open set. Then by definition of soft *swg*-closed set, $cl(int(F_B)) \tilde{\subseteq} F_C$. Since F_B is soft semi-open set $cl(F_B)) \tilde{\subseteq} cl(int(F_B)) \tilde{\subseteq} F_C$. Which implies that $cl(F_B) \tilde{\subseteq} F_C$, where F_C shows as soft open set. Hence F_B proved as soft *g*-closed set.

Theorem 2.19. Let F_B be soft *swg*-closed set and F_D is soft closed set, then $F_B \tilde{\cap} F_D$ is soft *swg*-closed set

Proof. Let F_B be a soft *swg*-closed set and F_D is soft closed set. Now, show that $F_B \tilde{\cap} F_D$ is soft *swg*-closed set. Let $F_B \tilde{\cap} F_D \tilde{\subseteq} F_C$ where F_C is soft semi-open set. Since F_D is soft closed set, $F_B \tilde{\cap} F_D$ is soft closed set in F_B which implies that $F_B \tilde{\cap} F_D \tilde{\subseteq} F_B$. It implies that $cl(int(F_B \tilde{\cap} F_D)) \tilde{\subseteq} cl(F_B \tilde{\cap} F_D) = F_B \tilde{\cap} F_D \tilde{\subseteq} F_C$. It implies that $cl(int(F_B \tilde{\cap} F_D)) \tilde{\subseteq} F_C$. Therefore, $F_B \tilde{\cap} F_D$ proved as soft *swg*-closed set.

Theorem 2.20. Let $(F_A, \tilde{\tau})$ be soft topological space. If F_B is soft *swg*- closed set in $(F_A, \tilde{\tau})$ and $F_B \tilde{\subseteq} F_C \tilde{\subseteq} cl(int(F_B))$, then F_C is soft *swg*-closed set in $(F_A, \tilde{\tau})$.

Proof. Given that: $F_C \tilde{\subseteq} cl(int(F_B))$, then $cl(int(F_C)) \tilde{\subseteq} cl(int(F_B))$.

Which implies that $cl(int(F_C)) - F_C \tilde{\subseteq} cl(int(F_B)) - F_B$. Since $F_B \tilde{\subseteq} F_C$ and F_B is soft *swg*-closed set in $(F_A, \tilde{\tau})$ [From Theorem 2.12]. Let $cl(int(F_B)) - F_B$ contains empty soft semi-closed set and $cl(int(F_C)) - F_C$ contains no non empty soft semi-closed set. Therefore, F_C proved as soft *swg*-closed set.

III. SOFT SEMI WEAKLY GENERALIZED OPEN SET AND SOFT SEMI WEAKLY GENERALIZED OPEN SETS IN THEIR PROPERTIES

Definition 3.1. A soft subset F_B of $(F_A, \tilde{\tau})$ refers as *soft semi weakly generalized open set* (briefly, *soft swg-open set*), if its compliment is soft *swg*-closed set in $(F_A, \tilde{\tau})$.

Theorem 3.2. A soft subset F_B of $(F_A, \tilde{\tau})$ is soft regular open set, then it is soft *swg*-open set.

Proof. Let F_B be a soft regular open set in $\tilde{\tau}$, then F_B^c is soft regular closed set. It implies $F_B^c = cl(int(F_B^c))$. Let $F_B^c \tilde{\subseteq} F_C$, since F_C is soft semi-open set in $\tilde{\tau}$. It implies that $cl(int(F_B^c)) \tilde{\subseteq} F_C$ where F_C represent soft semi-open set. Since F_B^c represent soft *swg*-closed set. Therefore, F_B proved as soft *swg*-open set.

Theorem 3.3. A soft subset F_B of a soft topological space $(F_A, \tilde{\tau})$ is soft *swg*-open set iff $F_C \tilde{\subseteq} int(cl(F_B))$ when $F_C \tilde{\subseteq} F_B$ and F_C is a soft semi-closed set.

Proof. Presume that F_B is a soft *swg*-open set in F_A, then F_B^c represent soft *swg*-closed set. Let F_C be a soft semi-closed set in $(F_A, \tilde{\tau})$ contained in F_B. Then F_C^c is soft semi-open set containing F_B^c. i.e., $F_B^c \tilde{\subseteq} F_C^c$. It implies $cl(int(F_B^c)) \tilde{\subseteq} F_C^c$. Since F_B^c is soft *swg*-closed set. $\therefore F_C \tilde{\subseteq} int(cl(F_B))$. Conversely, suppose $F_C \tilde{\subseteq} int(cl(F_B))$ when $F_C \tilde{\subseteq} F_B$ and F_C is a soft semi-closed set. Then F_C^c is soft semi-open set containing F_B^c and $F_C^c \tilde{\supseteq} (int(cl(F_B)))^c$. It follows $F_C^c \tilde{\supseteq} (cl(int(F_B^c)))$. F_B^c is soft *swg*-closed set and so, F_B proved as soft *swg*-open set.□

Theorem 3.4. If $int(cl(F_B)) \tilde{\subseteq} F_C \tilde{\subseteq} F_B$ and F_B is soft *swg*-open set in F_A, then F_C is soft *swg*-open set

Proof. Let $int(cl(F_B)) \tilde{\subseteq} F_C \tilde{\subseteq} F_B$ it implies $(F_B)^c \tilde{\subseteq} (F_C)^c \tilde{\subseteq} (int(cl(F_B)))^c$ which implies that $(F_B)^c \tilde{\subseteq} (F_C)^c \tilde{\subseteq} (cl(int(F_B^c)))$ where F_B^c is soft *swg*-closed set in F_A and also F_C^c is soft *swg*-closed set. Therefore, F_C proved as soft *swg*-open set in F_A.

Theorem 3.5. While F_B and F_C are soft *swg*-open sets in F_A. Let F_B, $F_C \tilde{\subseteq} F_A$. If F_C is soft *swg*-open set and $int(cl(F_C)) \tilde{\subseteq} F_B$, then $F_B \tilde{\cap} F_C$ is soft *swg*-open set

Proof. Let F_B and F_C are soft *swg*-open sets in F_A and F_B^c and F_C^c are soft *swg*-closed sets in F_A. Since $F_B \tilde{\supseteq} int(cl(F_C))$ it implies $int(cl(F_C)) \tilde{\subseteq} F_B \tilde{\cap} F_C \tilde{\subseteq} F_B$ [By Theorem 3.4], then $F_B \tilde{\cap} F_C$ proved as soft *swg*-open set

Theorem 3.6. A soft set F_B is a soft *swg*-open sets in F_A, $\Leftrightarrow F_C = F_A$, when F_C is soft semi-open set and $int(cl(F_B)) \tilde{\cup} F_B^c \tilde{\subseteq} F_C$

Proof. Let F_B be soft *swg*-open set. F_C be soft semi-open set and $int(cl(F_B)) \tilde{\cup} F_B^c \tilde{\subseteq} F_C$. Which implies that $(F_C)^c \tilde{\subseteq} (int(cl(F_B)) \tilde{\cup} F_B^c)^c = (int(cl(F_B)))^c \tilde{\cap} F_B = (int(cl(F_B)))^c - F_B^c = cl(int(F_B^c)) - F_B^c$. Which implies that $F_C^c \tilde{\subseteq} cl(int(F_B^c)) - F_B^c$. Since F_B^c represent soft *swg*-closed set and F_C^c represent soft semi-closed set, based on that $F_C^c = F_\phi$. Therefore, $F_C = F_A$. Conversely, assume that F_D is a soft semi-closed set in F_A and $F_D \tilde{\subseteq} F_B$. Then $int(cl(F_B)) \tilde{\cup} F_B^c \tilde{\subseteq} int(cl(F_B)) \tilde{\cup} F_D^c$. Since both $int(cl(F_B))$ and F_D^c are soft semi-open set, their union $int(cl(F_B)) \tilde{\cup} F_D^c$ is also a soft semi-open set. It follows by hypothesis that $int(cl(F_B)) \tilde{\cup} F_D^c = F_A$ and hence $F_D \tilde{\subseteq} int(cl(F_B))$.

Therefore, $F_B$proved as soft *swg*-open sets in F_A

Theorem 3.7.If $F_B \tilde{\subseteq} F_C \tilde{\subseteq} F_A$, where $F_B$is soft *swg*-open set isin relation to F_C and F_C is soft *swg*-open set is in relation to F_A, then F_B is a soft*swg*-open set is in relation to F_A.

Proof.Let F_D be a soft semi-closed set and suppose$F_D \tilde{\subseteq} F_B$.Then F_D, a soft semi-closed isin relation to $F_C$and hence $F_D \tilde{\subseteq} int(cl(F_B))$. Therefore, a soft semi-open set $F_E$exists such that $F_D \tilde{\subseteq} F_E \tilde{\cap} F_C \tilde{\subseteq} F_B$. But$F_D \tilde{\subseteq} F_E^* \tilde{\subseteq} F_C$for soft semi-open set F_E^*, since F_C is soft *swg*-open set in F_A. Thus $F_D \tilde{\subseteq} F_E^* \tilde{\cap} F_E \tilde{\subseteq} F_C \tilde{\cap} F_E \tilde{\subseteq} F_B$. It follows that $F_D \tilde{\subseteq} int(cl(F_B))$.Because soft set $F_B$is soft *swg*-open set. It implies $F_D \tilde{\subseteq} int(cl(F_B))$ whenever$F_D$is a soft semi-closed set and $F_D \tilde{\subseteq} F_B$. Therefore, $F_B$is soft *swg*-openset in F_A.

IV. SOFT SWG-CLOSURE And SOFT SWG-INTERIOR& RESULTS

Definition 4.1.Let $(F_A, \tilde{\tau})$be soft topological space,$F_B \tilde{\subseteq} F_A$. The soft *swg*-closure of F_B(briefly, *swg-cl*(F_B)) to be the intersection of all soft*swg*-closed subsets containing F_B. In symbols, *swg-cl*(F_B) = {F_C:$F_B \tilde{\subseteq} F_C$and $F_C$is a soft *swg*-closed set in F_A}

Theorem 4.2.While any soft subset $F_B$of soft topological space F_A, $F_B \tilde{\subseteq}$swg-*cl*$(F_B)\tilde{\subseteq}$*cl*(*int*(F_B))

Proof.It is based on Theorem 2.3.

Example 4.3.We have following example 2.2., F_B = {(e_1, {c}), (e_2, {*a*, b})},then *swg-cl*(F_B) = {(e_1, {b, c}), (e_2, {*a*, b})} and *int*$(F_B) = F_2$, *cl*(*int*(F_B))= F_A. Therefore, $F_B \tilde{\subseteq}$*swg-cl*$(F_B)\tilde{\subseteq}$*cl*(F_B) in F_A .

Theorem 4.4.Thesoft *swg*-closure operator is soft Kuratowski closure operator on F_A.

Proof.(i) *swg-cl*$(F_\phi) = F_\phi$.

(ii) $F_B \tilde{\subseteq}$*swg-cl*(F_B) by Theorem 4.2.,

(iii) Let $F_{B_1} \tilde{\cup} F_{B_2} \tilde{\subseteq} F_C$and $F_C$belongs to soft*swg*-closed set in F_A,then$F_{B_i} \tilde{\subseteq} F_C$and by Definition 3.1. *swg-cl*$(F_{B_i}) \tilde{\subseteq} F_C$for each i=1, 2. Therefore,*swg-cl*$(F_{B_1})\tilde{\cup}$*swg-cl*$(F_{B_2}) \tilde{\subseteq} \cap$ {F_C: $F_{B_1} \tilde{\cup} F_{B_2} \tilde{\subseteq} F_C$ and $F_C$issoft *swg*-closed set in F_A}=*swg-cl*$(F_{B_1} \tilde{\cup} F_{B_2})$. For the reverse insertion,let $f_A \in$swg-*cl*$(F_{B_1} \tilde{\cup} F_{B_2})$ and suppose that$f_A \notin$*swg-cl*$(F_{B_1})\tilde{\cup}$*swg-cl*(F_{B_2}). Then there exist soft *swg*-closed sets $F_{C_1}$and $F_{C_2}$with $F_{B_1} \tilde{\subseteq} F_{C_1}$,$f_A \notin F_{C_1}$ and $F_{B_2} \tilde{\subseteq} F_{C_2}$, $f_A \notin F_{C_2}$. We have $F_{B_1} \tilde{\cup} F_{B_2} \tilde{\subseteq} F_{C_1} \tilde{\cup} F_{C_2}$ and$F_{C_1} \tilde{\cup} F_{C_2}$is a soft *swg*-closed set such that $f_A \notin F_{C_1} \tilde{\cup} F_{C_2}$. Thus $f_A \notin$*swg-cl*$(F_{B_1} \tilde{\cup} F_{B_2})$. Which is a contradiction to $f_A \in$ *swg-cl*$(F_{B_1} \tilde{\cup} F_{B_2})$.Hence*swg-cl*$(F_{B_1})\tilde{\cup}$*swg-cl*$(F_{B_2})$=*swg-*cl$(F_{B_1} \tilde{\cup} F_{B_2})$.

(iv) Let $F_B \tilde{\subseteq} F_C$and $F_C$is soft *swg*-closed set withinF_A. Then byDefinition 3.1.*swg-cl*$(F_B) \tilde{\subseteq} F_C$and *swg-cl*(*swg-cl*$(F_B)$)$\tilde{\subseteq} F_C$, we have*swg-cl*(*swg-cl*(F_B))$\tilde{\subseteq} \cap$ {F_C: $F_B \tilde{\subseteq} F_C$and $F_C$is a soft *swg*-closed set inF_A}= *swg-cl*(F_B). [By Theorem 3.2.], *swg-cl*$(F_B) \tilde{\subseteq}$*swg-cl*(*swg-cl*(F_B))and therefore, *swg-*cl(F_B) = *swg-cl*(*swg-cl*(F_B)). Hence soft*swg*-closure operator is a soft Kuratowski closure operator on F_A

Theorem 4.5.While any soft subset $F_B$of soft topological space in F_A.

(i) *swg-cl*(F_B) is smallest soft *swg*-closed set containing F_B.

(ii) $F_B$issoft *swg*-closed set⟺*swg-cl*$(F_B) = F_B$.

Proposition4.6.While two soft subsets $F_{B_1}$and $F_{B_2}$of soft topological space in F_A.

(i) $F_{B_1} \tilde{\subseteq} F_{B_2}$,then *swg-cl*$(F_{B_1}) \tilde{\subseteq}$*swg-cl*$(F_{B_2})$.

(ii) *swg-cl*$(F_{B_1} \tilde{\cap} F_{B_2}) \tilde{\subseteq}$*swg-cl*$(F_{B_1})\tilde{\cap}$*swg-cl*$(F_{B_2})$.

Theorem 4.7.For any $f_A \in F_A$, $f_A \in$*swg-cl*(F_B),⟺$F_C \tilde{\cap} F_B \neq F_\phi$for every soft *swg*-open set $F_C$containing f_A.

Proof.Let $f_A \in$*swg-cl*(F_B) for any $f_A \in F_A$. Suppose there exists a soft*swg*-open set F_C containing f_A such that $F_C \tilde{\cap} F_B = F_\phi$. Then$F_B \tilde{\subseteq} F_C^c$.Since $F_C^c$is a soft *swg*-closed set containing F_B, we obtain*cl*(*int*(F_B))$\tilde{\subseteq} F_C^c$which implies that $f_A \notin$*swg-cl*(F_B), which is a contradiction. On the contrary,assume that$f_A \notin$*swg-cl*(F_B). From Definition 4.1.there exists a soft*swg*-closed set $F_D$containing $F_B$such that $f_A \notin F_D$. Thereafter $f_A \in F_D^c$and F_D^c is a soft*swg*-open set in F_A. Also, $F_D^c \tilde{\cap} F_B = F_\phi$which is acontradiction to the hypothesis. Therefore,$f_A \in$*swg-cl*(F_B).

Theorem 4.8.For any$F_B \tilde{\subseteq} F_A$, soft *swg*-interior of F_B (briefly, *swg-int*(F_B)) is illustrated as the union of the entire soft *swg*-open sets containing in F_B.In symbols, *swg-int*(F_B)=∪{ F_C : $F_C \tilde{\subseteq} F_B$ and F_C is a soft *swg*-openset in F_A}

Remark 4.9.For any soft subset $F_B$of soft topological space F_A,

(i)*swg-int*(F_B) is soft *swg*-open set in F_A, Since arbitrary union of every soft *swg*-open sets in $F_A$is in factsoft *swg*-open sets inF_A.

(ii) *swg-int*(F_B) is the largest soft swg-open set in F_A contained in F_B.

Theorem 4.10.Let $F_B$representsoft *swg*-open set in F_A, ⟺F_B=*swg-int*(F_B).

Proof.Let$F_B$is soft *swg*-open set. Now, $F_B$being soft *swg*-open set in F_A, $F_B$is the largest soft *swg*-open set in F_A. Therefore, F_B=*swg-int*(F_B). Conversely, let *swg-int*$(F_B) = F_B$ and by definition, *swg-int*(F_B) is a soft *swg*-open set. Then it follows that, $F_B$is also a soft *swg*-open set.

Proposition 4.11.For the two soft subset F_B and $F_C$of soft topological space F_A, then the following holds.

(i) *int*(*cl*(F_B))$\tilde{\subseteq}$*swg-int*$(F_B) \tilde{\subseteq} F_B$.

(ii) If $F_B \tilde{\subseteq} F_C$, then *swg-int*$(F_B) \tilde{\subseteq}$*swg-int*$(F_C)$.

(iii) *swg-int*$(F_B \tilde{\cap} F_C) \tilde{\subseteq}$*swg-int*$(F_B)\tilde{\cap}$*swg-int*$(F_C)$.

(iv) *swg-int*$(F_B \tilde{\cup} F_C) \tilde{\subseteq}$*swg-int*$(F_B)\tilde{\cup}$*swg-int*$(F_C)$.

(v) *swg-int*$(F_A) = F_A$.

(iv) *swg-int*$(F_\phi) = F_\phi$.

Remark 4.12.In any soft topological space F_A, if *swg-int*(F_B) = *swg-int*(F_C) for subsets $F_B$and F_C of F_A, then it does not imply that $F_B = F_C$.

Example 4.13.We have following example 2.2., Let F_B = {(e_1, {c})}, F_C={(e_2, {b})},then *swg-cl*$(F_B) = F_\phi$ and *swg-cl*$(F_C) = F_\phi$. Therefore,*swg-int*(F_B) = *swg-int*(F_C) but $F_B \neq F_C$.

Theorem 4.14.While soft subset $F_B$of soft topological spaceF_A, then the following holds.

(i) (*swg-int*(F_B))^c = *swg-cl*(F_B^c).

(ii) *swg-int*(F_B) = (*swg-cl*(F_B^c))^c.

(iii) *swg-cl*(F_B) = (*swg-cl*(F_B^c))^c.

Proof. Let $f_A \in (swg\text{-}int(F_B))^c$. Then $f_A \notin swg\text{-}int(F_B)$ and so every soft *swg*-open set F_C containing f_A is such that $F_C \tilde{\nsubseteq} F_B$. That is every soft *swg*-open set F_C containing f_A is such that $F_C \tilde{\cap} F_B^c = F_\phi$ [By Theorem 4.7.], $f_A \in swg\text{-}cl(F_B^c)$ and therefore, $(swg\text{-}int(F_B))^c \tilde{\subseteq} swg\text{-}cl(F_B^c)$. Conversely, let $f_A \in swg\text{-}cl(F_B^c)$. Then [by Theorem 3.4]., every soft *swg*-open set F_D containing f_A is such that $F_D \tilde{\cap} F_B^c \neq F_\phi$ and so every soft *swg*-open set F_D containing f_A is such that $F_D \tilde{\nsubseteq} F_B$. This implies by definition 4.8., $f_A \notin swg\text{-}int(F_B)$ implies $f_A \in (swg\text{-}int(F_B))^c$ and $swg\text{-}cl(F_B^c) \tilde{\subseteq} (swg\text{-}int(F_B))^c$. Thus $(swg\text{-}int(F_B))^c = swg\text{-}cl(F_B^c)$. (ii) and (iii) follows from (i).

REFERENCES

1. Naim C¸aˇgman, Serkan Karata¸s, and Serdar Enginoglu, Soft topology, Computers and Mathematics with Applications, 62(1)(2011),351-358.Doi. 10.1016/j.camwa.2011.05.016.
2. D. Molodtsov, Soft set theory-first results, Computers and Mathematics with Applications, 37(4-5), (1999), 19-31.doi.10.1016/S0898-1221(99)00056-5.
3. Sasikala V E*, Sivaraj D, On soft β-open sets, International Journal ofFuzzy Mathematics and systems,7(1), (2017), 25-36.
4. Shabir M and Naz M, On soft topological spaces, Computers and Mathematics with Applications, 61(7), (2011), 1786-1799.
5. Sasikala V E*, Sivaraj D, On Soft Semi-Open Sets, International Journal of Scientific and Engineering Research, 7(12), (2016), 31-35.
6. Sasikala V E*, Sivaraj D, A Study on Soft Pre-open Sets, InternationalJournals of Mathematical Archive-8(3), (2017), 138-143.
7. Zorlutuna I, Akdag M, Min W K, and Atmaca S, Remarks on soft topological spaces, Annals of Fuzzy Mathematics and Informatics, 3(2), (2012), 171-185.
8. Nirmala Rebecca Paul, Remarks on soft ω -closed sets in soft topological spaces,Bol. Soc. Paran. Mat., 33(1), (2015), 181-190.