International Journal of Mathematical Archive-9(6), 2018, 75-81
Available online through www.ijma.info ISSN 2229 – 5046

NANO REGULAR GENERALIZED STAR STAR b-HOMEOMORPHISM AND CONTRA NANO REGULAR GENERALIZED STAR STAR b-CONTINUOUS IN NANOTOPOLOGICAL SPACES

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(Received On: 30-04-18; Revised & Accepted On: 05-06-18)

ABSTRACT

In this paper, we introduce the concept of nana regular generalized star star b-Homeomorphism and contra nano regular generalized star star b-continuous function in nanotopological spaces. Also we studied the characterizations and several properties in above said. Finally, we introduce the concept of nano regular generalized star star b-irresolute map and contra nano regular generalized star star b- irresolute map in nanotopological spaces.

Key words: *Contra Nrg^{**}b-continuous, Contra Nrg^{**}b-irresolute map, Nrg^{**}b-irresolute map, Nrg^{**}b-Homeomorphism.*

1. INTRODUCTION

Malghan [5] introduced and investigated some properties of generalized closed maps in topological spaces. The concept of nanotopology was introduced by Lellis Thivagar [3] which was defined in terms of approximations and boundary region of a subset of an universe using an equivalence relation on it. He also established the week forms of nano open sets namely nano α-open sets, nano-semi open sets and nano pre-open sets in a nanotopological spaces.

Dhanis Arul Mary and Arockiarani [2] discussed the concept of Nano generalized b- closed maps in Nano topological spaces. Vasanthakannan and Indirani [7] discussed the concepts of Nano regular generalized star star b- closed map, strongly nano regular generalized star star b- closed map, Nano regular generalized star star b-open map and strongly Nano regular generalized star star b- open map in nanotopological spaces.

The concept of generalized homeomorphism was introduced by Sundaram [6]. Lellis Thivagar and Carmel Richard [4] introduced Nano homeomorphism in Nano topological spaces.

In 1994 Dontchev *et al.* [1] introduced the concept of contra-continuity which is stronger form of LC-continuity in general topological spaces. Lellis Thivagar, Saeid Jafari *et al.* [4] introduced the concept of on new classes of contra continuity and contra nano-irresolute map in nanotopological spaces.

In this paper, we have introduced the concepts of Nano regular generalized star star b- homeomorphism and contra nano regular generalized star star b-continuity and study some of its properties. And also we introduced the concept of nano regular generalized star star b-irresolute and contra irresolute map in Nano topological spaces.

2. PRELIMINARIES

Definition 2.1: A function $f:(X,\tau) \to (Y,\sigma)$ is called open if the image of every open set in (X,τ) is open set in (Y,σ).

Definition 2.2: A function $f:(X,\tau) \to (Y,\sigma)$ is called regular-open if the image of every open set in (X,τ) is regular-open in (Y,σ).

Definition 2.3: A function $f:(X,\tau) \to (Y,\sigma)$ is called regular generalized star star b-open (briefly $rg^{**}b$-open)if the image of every open set in (X,τ) is $rg^{**}b$-open in (Y,σ).

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Definition 2.4: A function $f:(X,\tau)\rightarrow(Y,\sigma)$ is called closed if the image of every closed set in (X,τ) is closed in (Y,σ).

Definition 2.5:A function $f:(X,\tau)\rightarrow(Y,\sigma)$ is called regular-closed if the image of every closed set in (X,τ) is regular-closed in (Y,σ).

Definition 2.6: A function $f:(X,\tau)\rightarrow(Y,\sigma)$ is called regular generalized star star b-closed (briefly $rg^{**}b$-closed) if the image of every closed set in (X,τ) is $rg^{**}b$-closed in (Y,σ).

Definition 2.7: A function $f:(X,\tau)\rightarrow(Y,\sigma)$ is called regular generalized star star b-continuous (briefly $rg^{**}b$-continuous) if $f^{-1}(V)$ is $rg^{**}b$-closed set in(X,τ) for every closed set in (Y,σ).

Definition 2.8: A function $f:(X,\tau)\rightarrow(Y,\sigma)$ is called regular generalized star star b-homeomorphism if f is both $rg^{**}b$-open and $rg^{**}b$-continuous.

Definition 2.9: A function $f:(U,\tau_R(X))\rightarrow(V,\tau_{R'}(Y))$ is called nano- regular generalized star star b-closed(briefly $Nrg^{**}b$-closed)if the image of every nano- closed set in $(U,\tau_R(X))$ is $Nrg^{**}b$-closed in $(V,\tau_{R'}(Y))$.

Definition 2.10: A function $f:(U,\tau_R(X))\rightarrow(V,\tau_{R'}(Y))$ is called nano-regular generalized star star b-open(briefly $Nrg^{**}b$-open) if the image of every nano-open set in $(U,\tau_R(X))$ is $Nrg^{**}b$-open in $(V,\tau_{R'}(Y))$.

Definition 2.11: A function $f:(U,\tau_R(X))\rightarrow(V,\tau_{R'}(Y))$ is called nano-regular generalized star star b-continuous(briefly $Nrg^{**}b$-continuous) if $f^{-1}(V)$ is $Nrg^{**}b$-closed set in$(U,\tau_R(X))$ for every nano-closed set in $(V,\tau_{R'}(Y))$.

Definition 2.12: Let U be a non-empty finite set of objects called the universe and R be an equivalence relation on U named as the indiscernibility relation, elements belonging to the same equivalence class are said to be indiscernible with one another. The pair (U,R) is said to be the approximation space. Let $X\subseteq U$.

i) The lower approximation of X with respect to R is the set of all objects, which can be for certain classified as X with respect to R and it is denoted by $L_R(X)$. That is $L_R(X)=\bigcup_{x\in U}\{R(x):R(x)\subseteq X\}$, where $R(x)$ denotes the equivalence class determined by x.
ii) The upper approximation of X with respect to R is the set of all objects, which can be possibly classified as X with respect to R and it is denoted by $U_R(X)$. That is $U_R(X)=\bigcup_{x\in U}\{R(x):R(x)\cap X\neq\emptyset\}$ where $R(x)$ denotes the equivalence class determined by x.
iii) The boundary region of X with respect to R is set of all objects, which can be classified neither as X nor as not X with respect to R and it is denoted by $B_R(X)$.That is $B_R(X)=U_R(X)-L_R(X)$.

Definition 2.13: Let U be the universe, R be an equivalence relation on U and $\tau_R(X)=\{U,\emptyset,L_R(X),U_R(X),B_R(X)\}$ where $X\subseteq U$. Then $\tau_R(X)$ satisfies the following axioms:

1. U and $\emptyset\in\tau_R(X)$.
2. The union of the elements of any sub collection of $\tau_R(X)$ is in $\tau_R(X)$.
3. The intersection of the elements of any finite sub collection of $\tau_R(X)$ is in $\tau_R(X)$.

That is, $\tau_R(X)$ forms a topology on U called as the nanotopology on U with respect to X We call $\left(U,\tau_R(X)\right)$ as the Nanotopological space.

Definition 2.14: Let $(U,\tau_R(X))$ be a nano topological space and $A\subseteq U$. Then A is said to be:

i) Nano semi open if $A\subseteq Ncl(Nint(A))$
ii) Nano pre-open if $A\subseteq Nint(Ncl(A))$
iii) Nano α-open if $A\subseteq Nint(Ncl(Nint(A)))$
iv) Nano semi pre-open if $A\subseteq Ncl(Nint(Ncl(A)))$

Let $(U,\tau_R(X))$ be a nano topological space and $A\subseteq U$. A is said to be nano semi closed, nano pre-closed, nano α-closed, nano semi pre-closed if its complement is respectively nano semi-open, nano pre-open, nano α- open, nano semi pre-open.

3. Nano-regular generalized star star b-Homeomorphism

Definition 3.1: A function $f:(U,\tau_R(X))\rightarrow(V,\tau_{R'}(Y))$ is called nano-regular generalized star star b-homeomorphism if

(i) f is one-one and onto
(ii) f is a $Nrg^{**}b$-continuous
(iii) f is a $Nrg^{**}b$-open

Example 3.2: Let $U = \{\alpha, \beta, \gamma, \delta\}$ with $U/R = \{\{\alpha\}, \{\beta\}, \{\gamma, \delta\}\}$ and $X = \{\alpha, \gamma\} \subseteq U$, $\tau_R(X) = \{U, \phi, \{\alpha\}, \{\alpha, \gamma, \delta\}, \{\gamma, \delta\}\}$. Let $V = \{\alpha', \beta', \gamma', \delta'\}$ with $V/R = \{\{\alpha'\}, \{\beta'\}, \{\gamma', \delta'\}\}$ and $Y = \{\alpha', \beta'\} \subseteq V$, $\tau_{R'}(Y) = \{V, \phi, \{\alpha', \beta'\}, \{\alpha', \beta'\}, \emptyset\}$. Define a function $f: U \to V$ as $f(\alpha) = \alpha', f(\beta) = \delta', f(\gamma) = \gamma', f(\delta) = \beta'$. Then f is bijective, $Nrg^{**}b$-continuous and $Nrg^{**}b$-open. Therefore f is $Nrg^{**}b$-Homeomorphism.

Theorem 3.3: If a function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$is nano homeomorphism, then it is $Nrg^{**}b$-Homeomorphism but not conversely.

Proof: Let $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is nano homeomorphism then f is satisfied by nano-continuous and nano-open. $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is nano-open, the image of every nano-open set in $(U, \tau_R(X))$is nano-open in $(V, \tau_{R'}(Y))$. Since every nano-open set is $Nrg^{**}b$-open. Therefore f is $Nrg^{**}b$-open in $(V, \tau_{R'}(Y))$. Again $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is nano-continuous, the inverse image of every nano-open set in $(V, \tau_{R'}(Y))$ is nano-open set in $(U, \tau_R(X))$ and hence $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is $Nrg^{**}b$-continous Therefore, every nano homeomorphism $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is $Nrg^{**}b$-Homeomorphism.

Example 3.4: Let $U = \{\alpha, \beta, \gamma, \delta\}$ with $U/R = \{\{\alpha\}, \{\beta\}, \{\gamma, \delta\}\}$ and $X = \{\alpha, \gamma\} \subseteq U$, $\tau_R(X) = \{U, \phi, \{\alpha\}, \{\alpha, \gamma, \delta\}, \{\gamma, \delta\}\}$. Let $V = \{\alpha', \beta', \gamma', \delta'\}$ with $V/R = \{\{\alpha'\}, \{\beta'\}, \{\gamma', \delta'\}\}$ and $Y = \{\alpha', \beta'\} \subseteq V$, $\tau_{R'}(Y) = \{V, \phi, \{\alpha'\}, \{\alpha', \beta', \gamma'\}, \{\beta', \gamma'\}\}$. Define a function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ as $f(\alpha) = \beta', f(\beta) = \gamma', f(\gamma) = \alpha', f(\delta) = \delta'$. Then $f$is bijective, $Nrg^{**}b$-continuous and $Nrg^{**}b$-open. Therefore f is $Nrg^{**}b$-Homeomorphism. Now, $f(U) = V, f(\emptyset) = \emptyset, f\{\alpha\} = \{\beta'\}, f\{\alpha, \gamma, \delta\} = \{\beta', \gamma', \delta'\}, f\{\gamma, \delta\} = \{\alpha', \delta'\}$. Since every nano-open sets in $(V, \tau_{R'}(Y))$ are not nano-open set in $(V, \tau_{R'}(Y))$ and hence f is not open. Therefore f is not nano homeomorphism.

Theorem 3.5: If a function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ be an one to one and onto mapping. Then f is $Nrg^{**}b$-Homeomorphism if and only if f is $Nrg^{**}b$-continuous and $Nrg^{**}b$ $-$closed.

Proof: Let $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ is $Nrg^{**}b$-Homeomorphism. Then by definition of f is satisfied by $Nrg^{**}b$-continuous. It is remaining to prove that f is $Nrg^{**}b$ $-$closed. Since every nano-closed set in $(U, \tau_R(X))$ is $Nrg^{**}b$ $-$closed in $(V, \tau_{R'}(Y))$. Let ρ be an arbitrary nano-closed set in $(U, \tau_R(X))$ then $U - \rho$ is nano-open in $(U, \tau_R(X))$. Which implies $f(U - \rho)$ is $Nrg^{**}b$ $-$open in $(V, \tau_{R'}(Y))$. Since f is $Nrg^{**}b$ $-$open. Which implies $V - f(\rho)$ is $Nrg^{**}b$ $-$open in $(V, \tau_{R'}(Y))$. Therefore $f(\rho)$ is $Nrg^{**}b$ $-$closed in $(V, \tau_{R'}(Y))$. Hence f is $Nrg^{**}b$ $-$closed.

Conversely, let f be $Nrg^{**}b$-continuous and $Nrg^{**}b$ $-$closed. Let ρ be nano-open set in $(U, \tau_R(X))$. Then $U - \rho$ is nano-closed in $(U, \tau_R(X))$. Since f is $Nrg^{**}b$ $-$closed, $f(U - \rho)$ is $Nrg^{**}b$-closed in $(V, \tau_{R'}(Y))$. That is $V - f(\rho)$ is $Nrg^{**}b$ $-$closed in $(V, \tau_{R'}(Y))$, $f(\rho)$ is $Nrg^{**}b$ $-$open in $(V, \tau_{R'}(Y))$,for every nano-open set ρ in $(U, \tau_R(X))$. Therefore f is $Nrg^{**}b$ $-$open. Hence $f\ is\ Nrg^{**}b$-Homeomorphism.

Theorem 3.6: A one to one map f of $(U, \tau_R(X))$ onto $(V, \tau_{R'}(Y))$ is $Nrg^{**}b$-Homeomorphism if and only if $f(Nrg^{**}bcl(A)) = Ncl(f(A))$ for every subset A of $(U, \tau_R(X))$.

Proof: Let $f: \left(U, \tau_R(X)\right) \to \left(V, \tau_{R'}(Y)\right)$ is $Nrg^{**}b$-Homeomorphism, then f is $Nrg^{**}b$-continuous and $Nrg^{**}b$ $-$closed. If $A \subseteq U$, it follows that $f\left(Nrg^{**}bcl(A)\right) \subseteq Ncl(f(A))$. Since f is $Nrg^{**}b$-continuous. Since $Nrg^{**}bcl(A)$ is nano-closed in $\left(U, \tau_R(X)\right)$ and f is $Nrg^{**}b$ $-$closed, continuous. $f(Nrg^{**}bcl(A))$ is $Nrg^{**}b$ $-$closed in $(V, \tau_{R'}(Y))$. Also $Nrg^{**}bcl(A)\left(f\left(Nrg^{**}bcl(A)\right)\right) = f\left(Nrg^{**}bcl(A)\right)$. Since $A \subseteq Nrg^{**}bcl(A), f(A) \subseteq f(\ Nrg^{**}bcl(A))$ which implies $Ncl\left(f(A)\right) \subseteq Ncl\left(f\left(Nrg^{**}bcl(A)\right)\right) = f\left(Nrg^{**}bcl(A)\right)$. Which implies $Ncl\left(f(A)\right) \subseteq\ f\left(Nrg^{**}bcl(A)\right)$. Therefore $f\left(Nrg^{**}bcl(A)\right) = Ncl\left(f(A)\right)$.

Conversely if $f\left(Nrg^{**}bcl(A)\right) = Ncl\left(f(A)\right)$ for every subset A of $\left(U, \tau_R(X)\right)$, then f is $Nrg^{**}b$ $-$continuous. If A is nano-closed in $\left(U, \tau_R(X)\right)$ then A is $Nrg^{**}b$ $-$closed in $\left(U, \tau_R(X)\right)$.Then $Nrg^{**}bcl(A) = A \Rightarrow f\left(Nrg^{**}bcl(A)\right) = f(A)$. Hence by the given hypothesis, it follows that $Ncl\left(f(A)\right) = f(A)$. Thus $f(A)$ is nano-closed in $(V, \tau_{R'}(Y))$ and hence $Nrg^{**}b$ $-$closed in $(V, \tau_{R'}(Y))$ for every nano-closed set A in $(V, \tau_{R'}(Y))$. That is f is $Nrg^{**}b$ $-$closed. Hence f is $Nrg^{**}b$-homeomorphism.

Example 3.7: Let $\left(U, \tau_R(X)\right), (V, \tau_{R'}(Y)), (W, \tau_{R''}(Z))$ be three nanotopological spaces and let $U = V = W = \{\alpha, \beta, \gamma, \delta\}$ then the three nano-open sets are $\tau_R(X) = \{U, \phi, \{\alpha\}, \{\alpha, \beta, \delta\}, \{\beta, \delta\}\}$. $\tau_{R'}(Y) = \{V, \phi, \{\beta\}, \{\alpha, \beta, \gamma\}, \{\alpha, \gamma\}\}$ and $\tau_{R''}(Z) = \{W, \phi, \{\gamma\}, \{\alpha, \beta, \gamma\}, \{\alpha, \beta\}\}$ Define two function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ and $g: (V, \tau_{R'}(Y)) \to (W, \tau_{R''}(Z))$ as $f(\alpha) = \gamma, f(\beta) = \beta, f(\gamma) = \alpha, f(\delta) = \delta$ and

$g(\alpha)=\alpha, g(\beta)=\beta, g(\gamma)=\gamma, g(\delta)=\delta$. Then f and g are bijective, $Nrg^{**}b$-continuous and $Nrg^{**}b$ −open. Therefore f and g are $Nrg^{**}b$-Homeomorphism. But their composition $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is not $Nrg^{**}b-$ Homeomorphism, because the nano-open set $f=\{\alpha,\beta\}$ in $(W,\tau_{R''}(Z)), (gof)^{-1}\{\alpha,\beta\}=\{\alpha,\delta\}$ is not $Nrg^{**}b$ −open in $(U,\tau_R(X))$. Hence $g\circ f$ is not a $Nrg^{**}b$-Homeomorphism. Hence the composition of two $Nrg^{**}b$-homeomorphism need not to be a $Nrg^{**}b$-Homeomorphism.

4. Nano regular generalized star star b-irresolute map in nanotopological spaces

Definition 4.1: Let $(U,\tau_R(X))$ and $(V,\tau_{R'}(Y))$ be two nanotopological spaces. Then a function $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ is said to be nano regular generalized star star b-irresolute (briefly $Nrg^{**}b$-Irresolute) if the inverse image of every $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$.

Example 4.2: Let $U=\{\alpha,\beta,\gamma,\delta\}$ with $U/R=\{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X=\{\alpha,\gamma\}\subseteq U$, $\tau_R(X)=\{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$. Let $V=\{\alpha',\beta',\gamma',\delta'\}$ with $V/R=\{\{\alpha'\},\{\beta'\},\{\gamma',\delta'\}\}$ and $Y=\{\alpha',\beta'\}\subseteq V$, $\tau_{R'}(Y)=\{V,\phi,\{\alpha',\beta'\},\{\alpha',\beta'\},\emptyset\}$. Define a function $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ as $f(\alpha)=\alpha', f(\beta)=\delta'$, $f(\gamma)=\gamma', f(\delta)=\beta'$. Then $f$is $Nrg^{**}b$-Irresolute, since the inverse image of every $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$.

Theorem 4.3: If a function $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-Irresolute, then f is $Nrg^{**}b$-continuous.

Proof: Let $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-Irresolute, the inverse image of every $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Since every nano-closed set is $Nrg^{**}b$-closed. Therefore, the inverse image of every nano-closed set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Hence f is $Nrg^{**}b$-continuous.

Example 4.4: The converse of the above theorem need not to be true from the following example.
Let $U=\{\alpha,\beta,\gamma,\delta\}$ with $U/R=\{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X=\{\alpha,\gamma\}\subseteq U$, $\tau_R(X)=\{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$. Let $V=\{\alpha',\beta',\gamma',\delta'\}$ with $V/R=\{\{\alpha'\},\{\beta'\},\{\gamma',\delta'\}\}$ and $Y=\{\alpha',\beta'\}\subseteq V$, $\tau_{R'}(Y)=\{V,\phi,\{\alpha',\beta'\},\{\alpha',\beta'\},\emptyset\}$. Define a function $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ as $f(\alpha)=\alpha', f(\beta)=\delta', f(\gamma)=\gamma', f(\delta)=\beta'$. Then $f$is $Nrg^{**}b$-continuous, but $f$is not $Nrg^{**}b$-Irresolute. Since $f^{-1}\{\gamma'\}=\{\beta\}$ which is not $Nrg^{**}b$-closed set in $(U,\tau_R(X))$ where as $\{\gamma'\}$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$. Hence f is $Nrg^{**}b$-continuous but not $Nrg^{**}b$-Irresolute.

Theorem 4.5: Let $(U,\tau_R(X)),(V,\tau_{R'}(Y)),(W,\tau_{R''}(Z))$ be three nanotopological spaces. If $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ and $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ are $Nrg^{**}b$-Irresolute. Then $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-irresolute.

Proof: Let $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ be $Nrg^{**}b$-Irresolute. Let $\rho\subseteq W$ be $Nrg^{**}b$-closed. Then $g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$. Let $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$be $Nrg^{**}b$-Irresolute. Since $g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$, then $f^{-1}(g^{-1}(\rho))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$ which implies $(g\circ f)^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Therefore $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-irresolute.

Theorem 4.6: If $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ are $Nrg^{**}b$-continuous then $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

Proof: Let $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ are $Nrg^{**}b$-continuous. Let $\rho\subseteq W$ be nano-closed. Then $g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$. Let $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute. Since $g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$. Then $f^{-1}(g^{-1}(\rho))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$ which implies $(g\circ f)^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Therefore $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous in $(U,\tau_R(X))$.

Theorem 4.7: If $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ are nano g-continuous then $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

Proof: Let $g:(V,\tau_{R'}(Y))\to(W,\tau_{R''}(Z))$ are nano g-continuous. Let $\rho\subseteq W$ be nano-closed. Then $g^{-1}(\rho)$ is g-nano closed set in $(V,\tau_{R'}(Y))$. Since every nano-g closed is $Nrg^{**}b$-closed. Let $f:(U,\tau_R(X))\to(V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute. Since $g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V,\tau_{R'}(Y))$. Then $f^{-1}(g^{-1}(\rho))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$which implies $(g\circ f)^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Therefore $g\circ f:(U,\tau_R(X))\to(W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous in $(U,\tau_R(X))$.

Similarly we can prove that,

i) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano -continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

ii) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and$g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano g^*-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

iii) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano α-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

iv) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano semi-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

v) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano pre-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

vi) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano gp-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

vii) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano $g\alpha$-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

viii) If $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be $Nrg^{**}b$-Irresolute and $g:(V,\tau_{R'}(Y)) \to (W,\tau_{R''}(Z))$ is nano regular-continuous then $g \circ f:(U,\tau_R(X)) \to (W,\tau_{R''}(Z))$ is $Nrg^{**}b$-continuous.

5. **Contra Nano Regular Generalized Star Star b- Continuous Function in Nano topological Spaces**

Definition 5.1: A map $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ is Contra nano regular generalized star star b-continuous(briefly $CNrg^{**}b$-continuous) on $(U,\tau_R(X))$ if the inverse image of every nano-open set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$.

Example 5.2: Let $U=\{\alpha,\beta,\gamma,\delta\}$ with $U/R=\{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X=\{\alpha,\beta\}\subseteq U$, $\tau_R(X)=\{U,\phi,\{\alpha,\beta\},\{\alpha,\beta\},\emptyset\}$. Let $V=\{\alpha',\beta',\gamma',\delta'\}$ with $V/R'=\{\{\alpha'\},\{\beta'\},\{\gamma',\delta'\}\}$ and $Y=\{\alpha',\gamma'\}\subseteq V$, $\tau_{R'}(Y)=\{V,\phi,\{\alpha'\},\{\alpha',\gamma',\delta'\},\{\gamma',\delta'\}\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(\alpha)=\alpha', f(\beta)=\beta', f(\gamma)=\gamma', f(\delta)=\delta'$. Then $f$is $CNrg^{**}b$-continuous function.

Theorem 5.3: Every contra nano continuous function is contra $Nrg^{**}b$-continuous.

Proof: Let $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ be contra nano continuous function. Let ρ be nano-open set in $(V,\tau_{R'}(Y))$. Then $f^{-1}(\rho)$ is nano-closed set in$(U,\tau_R(X))$. Since every nano-closed set is $Nrg^{**}b$-closed set. Therefore $f^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$. Hence f is contra $Nrg^{**}b$-continuous.

Example 5.4: Let $U=V=\{1,2,3,4\}$, $R=\{(x,y): x \text{ and } y \text{ are have the same remainder when divided by } 3, x,y\epsilon U\}$ with $U/R=\{\{1,4\},\{2\},\{3\}\}$ and $X=\{1,2,3\}\subseteq U$ then the nanotopology is $\tau_R(X)=\{U,\phi,\{2,3\},\{1,2,3,4\},\{1,4\}\}$. Let $R'=\{(x,y): x\equiv y(mod\ 4\ x,y\epsilon V\}$ with $V/R'=\{\{1,3\},\{2,4\}\}$ and $Y=\{1,2,3\}\subseteq V$, $\tau_{R'}(Y)=\{V,\phi,\{1,3\},\{1,2,3,4\},\{2,4\}\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(1)=1$, $f(2)=3, f(3)=2, f(4)=4$. Then $f$is $CNrg^{**}b$-continuous function but not contra nano continuous function. Since $f^{-1}(\{2,4\})$ is $Nrg^{**}b$-closed set but not nano-closed set in $(U,\tau_R(X))$ where as $\{2,4\}$ is nano open set in $(V,\tau_{R'}(Y))$.

Theorem 5.5: Let $(U,\tau_R(X))$ *and* $(V,\tau_{R'}(Y))$ be nanotopological mappings and a mapping $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$. Then every contra semi-continuous, every contra α-continuous, every contra pre-continuous, every contra regular-continuous, every contra g-continuous , every contra g^*-continuous , every contra $g\alpha$-continuous, every contra gp-continuous functions are contra $Nrg^{**}b$-continuous.

Remark 5.6: Reverse implications of the above theorem need not to be true as seen from the following example.

Example 5.7: Let $U=V=\{1,2,3\}$, $R=\{(x,y): x \text{ and } y \text{ are have the same remainder when divided by } 3, x,y\epsilon U\}$ with $U/R=\{\{1\},\{2\},\{3\}\}$ and $X=\{1,2\}\subseteq U$ then the nanotopology is $\tau_R(X)=\{U,\phi,\{1,2\},\{1,2\},\emptyset\}$. Let $R'=\{(x,y): x\equiv y(mod\ 2)\ x,y\epsilon V\}$ with $V/R'=\{\{1,3\},\{2\}\}$ and $Y=\{1,3\}\subseteq V$, $\tau_{R'}(Y)=\{V,\phi,\{1,3\},\{1,3\},\emptyset\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(1)=1, f(2)=2, f(3)=3$. Then $f$is $CNrg^{**}b$-continuous function but not contra nano semi- continuous function, contra nano α-continuous and contra nano-regular continuous. Since $f^{-1}(\{1,3\})$ =$\{1,3\}$ is $Nrg^{**}b$-closed set but not in nano semi-closed set, nano α-closed set and nano-regular closed set, where as $\{1,3\}$ is nano open set in $(V,\tau_{R'}(Y))$.

Example 5.8: Let $U = V = \{1,2,3\}$, $R = \{(x,y): x\ and\ y\ are\ have\ the\ same\ remainder\ when\ divided\ by\ 3, x,y\epsilon U\}$ with $U/R = \{\{1\},\{2\},\{3\}\}$ and $X = \{1,2\} \subseteq U$ then the nanotopology is $\tau_R(X) = \{U,\phi,\{1,2\},\{1,2\},\emptyset\}$. Let $R' = \{(x,y): x \equiv y(mod\ 2)\ x,y\epsilon V\}$ with $V/R' = \{\{1,3\},\{2\}\}$ and $Y = \{1,3\} \subseteq V$, $\tau_{R'}(Y) = \{V,\phi,\{1,3\},\{1,3\},\emptyset\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(1) = 1, f(2) = 3, f(3) = 2$. Then $f$is $CNrg^{**}b$-continuous function but not contra nano pre- continuous function, contra nano $g\alpha$-continuous and contra nano g- continuous, contra nanog^*-continuous, contra nano gp-continuous. Since $f^{-1}(\{1,3\})$ =$\{1,2\}$ is $Nrg^{**}b$-closed set but not in nano pre-closed set, nano $g\alpha$-closed set and nano g-closed set, nano g^*-closed set, nano gp-closed set.

Example 5.9: Let $U = V = \{1,2,3\}$, $R = \{(x,y): x\ and\ y\ are\ have\ the\ same\ remainder\ when\ divided\ by\ 3, x,y\epsilon U\}$ with $U/R = \{\{1\},\{2\},\{3\}\}$ and $X = \{1,2\} \subseteq U$ then the nanotopology is $\tau_R(X) = \{U,\phi,\{1,2\},\{1,2\},\emptyset\}$. Let $R' = \{(x,y): x \equiv y(mod\ 2)\ x,y\epsilon V\}$ with $V/R' = \{\{1,3\},\{2\}\}$ and $Y = \{1,3\} \subseteq V$, $\tau_{R'}(Y) = \{V,\phi,\{1,3\},\{1,3\},\emptyset\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(1) = 1, f(2) = 3, f(3) = 2$. Then $f$is $CNrg^{**}b$-continuous function but not contra rg- continuous function. Since $f^{-1}(\{2\})$ =$\{3\}$ is $Nrg^{**}b$-closed set but not in nano rg-closed set where as $\{2\}$ is nano open set in $(V,\tau_{R'}(Y))$.

Remark 5.10: Composition of two contra $Nrg^{**}b$-continuous function need not to be contra $Nrg^{**}b$-continuous function as shown in the example.

Example 5.11: Let $U = \{\alpha,\beta,\gamma,\delta\}$ with $U/R = \{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X = \{\alpha,\beta\} \subseteq U$, $\tau_R(X) = \{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$. Let $V = \{\alpha,\beta,\gamma,\delta\}$ with $V/R' = \{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $Y = \{\alpha,\beta\} \subseteq V$, $\tau_{R'}(Y) = \{V,\phi,\{\alpha,\beta\},\{\alpha,\beta\},\emptyset\}$. Let $W = \{\alpha,\beta,\gamma,\delta\}$ with $W/R'' = \{\{\alpha,\delta\},\{\beta\},\{\gamma\}\}$ and $Z = \{\alpha,\beta,\gamma\} \subseteq W$, $\tau_{R''}(Z) = \{W,\phi,\{\beta,\gamma\},\{\alpha,\beta,\gamma,\delta\},\{\alpha,\delta\}\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(\alpha) = \alpha, f(\beta) = \beta$, $f(\gamma) = \gamma, f(\delta) = \delta$ and $g(\alpha) = \alpha, g(\beta) = \gamma, g(\gamma) = \beta, g(\delta) = \delta$. Here f and g are $CNrg^{**}b$-continuous function but the composition is not $CNrg^{**}b$-continuous. Since $(f^{-1}(g^{-1}\{\alpha,\delta\})) = f^{-1}(\{\alpha,\delta\}) = \{\alpha,\delta\}$ is not $Nrg^{**}b$-closed set.

Remark 5.12: Contra $Nrg^{**}b$-continuous function and $Nrg^{**}b$-continuous function are independent.

Example 5.13: Let $U = \{\alpha,\beta,\gamma,\delta\}$ with $U/R = \{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X = \{\alpha,\gamma\} \subseteq U$, $\tau_R(X) = \{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$. Let $V = \{\alpha,\beta,\gamma,\delta\}$ with $V/R' = \{\{\alpha,\delta\},\{\beta\},\{\gamma\}\}$ and $Y = \{\alpha,\beta,\gamma\} \subseteq V$, $\tau_{R'}(Y) = \{V,\phi,\{\alpha,\beta\},\{\alpha,\beta\},\emptyset\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(\alpha) = \alpha, f(\beta) = \delta, f(\gamma) = \gamma$, $f(\delta) = \beta$. Here f is $Nrg^{**}b$-continuous function. Since $f^{-1}(\{\alpha,\beta\}) = \{\alpha,\beta\}$ is not $Nrg^{**}b$-closed set in $(U,\tau_R(X))$, where as $\{\alpha,\beta\}$ nano-open in $(V,\tau_{R'}(Y))$ Hence f is not Contra $Nrg^{**}b$-continuous function.

Example 5.14: Let $U = \{\alpha,\beta,\gamma,\delta\}$ with $U/R = \{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X = \{\alpha,\gamma\} \subseteq U$, $\tau_R(X) = \{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$. Let $V = \{\alpha,\beta,\gamma,\delta\}$ with $V/R' = \{\{\alpha,\delta\},\{\beta\},\{\gamma\}\}$ and $Y = \{\alpha,\beta,\gamma\} \subseteq V$, $\tau_{R'}(Y) = \{V,\phi,\{\alpha,\beta\},\{\alpha,\beta\},\emptyset\}$. Define a function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ as $f(\alpha) = \delta, f(\beta) = \alpha, f(\gamma) = \gamma$, $f(\delta) = \beta$. Here f is contra $Nrg^{**}b$-continuous function. Since $f^{-1}(\{\gamma,\delta\}) = \{\gamma,\delta\}$ is not $Nrg^{**}b$-closed set in $(U,\tau_R(X))$, where as $\{\gamma,\delta\}$ is nano-closed in $(V,\tau_{R'}(Y))$. Hence f is not $Nrg^{**}b$-continuous function

6. CONTRA NANO REGULAR GENERALIZED STAR STAR B-IRRESOLUTE MAP IN NANOTOPOLOGICAL SPACES

Definition 6.1: A map $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ is Contra nano regular generalized star star b- irresolute (briefly $CNrg^{**}b$-irreseloute) on $(U,\tau_R(X))$ if the inverse image of every nano $rg^{**}b$-open set in $(V,\tau_{R'}(Y))$ is $Nrg^{**}b$-closed set in $(U,\tau_R(X))$.

Example 6.2: Let $U = \{\alpha,\beta,\gamma,\delta\}$ with $U/R = \{\{\alpha\},\{\beta\},\{\gamma,\delta\}\}$ and $X = \{\alpha,\gamma\} \subseteq U$, $\tau_R(X) = \{U,\phi,\{\alpha\},\{\alpha,\gamma,\delta\},\{\gamma,\delta\}\}$ and $R' = \{(x,y): x\ and\ y\ are\ have\ the\ same\ remainder\ when\ divided\ by\ 3, x,y\epsilon U\}$ with $V/R' = \{\{1\},\{2\},\{3\}\}$ and $Y = \{1,2\} \subseteq V$ then the nanotopology is $\tau_R(X) = \{U,\phi,\{1,2\},\{1,2\},\emptyset\}$. Define the function $f:(U,\tau_R(X)) \to (V,\tau_{R'}(Y))$ defined as $f(\alpha) = 1, f(\beta) = 1, f(\gamma) = 2, f(\delta) = 3$ then f is $CNrg^{**}b$-irreseloute function.

Remark 6.3: Composition of two contra $Nrg^{**}b$-irresolute function need not to be contra $Nrg^{**}b$-irresolute function as shown in the example.

Example 6.4: Let $U = \{\alpha, \beta, \gamma, \delta\}$ with $U/R = \{\{\alpha\}, \{\beta\}, \{\gamma, \delta\}\}$ and $X = \{\alpha, \beta\} \subseteq U$, $\tau_R(X) = \{U, \phi, \{\alpha\}, \{\alpha, \gamma, \delta\}, \{\gamma, \delta\}\}$. Let $V = \{1,2,3\}, R' = \{(x, y): x\ and\ y\ are\ have\ the\ same\ remainder\ when\ divided\ by\ 3, x, y \epsilon U\}$ with $V/R' = \{\{1\}, \{2\}, \{3\}\}$ and $Y = \{1,2\} \subseteq V$ then the nanotopology is $\tau_R(X) = \{U, \phi, \{1,2\}, \{1,2\}, \emptyset\}$. Let $W = \{1,2,3\}, R'' = \{(x, y): x \equiv y(mod\ 2)\}$ with $W/R'' = \{\{1,3\}, \{2\}\}$ and $Z = \{1,3\} \subseteq W, \tau_{R''}(Z) = \{W, \phi, \{1,3\}, \{1,3\}, \emptyset\}$. Define a function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ as $f(\alpha) = 1, f(\beta) = 1, f(\gamma) = 2, f(\delta) = 3$ and $g: (V, \tau_{R'}(X)) \to (W, \tau_{R''}(Y)), g(1) = 1, g(2) = 3, g(3) = 2$. Here f and g are $CNrg^{**}b$-irresolute function but the composition is not $CNrg^{**}b$-irresolute. Since $(f^{-1}(g^{-1}\{2,3\})) = f^{-1}(\{2,3) = \{\alpha, \beta\}$ is not $Nrg^{**}b$-open set in $(U, \tau_R(X))$.

Theorem 6.5: Let $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$, $g: (V, \tau_{R'}(X)) \to (W, \tau_{R''}(Y))$ be two contra $Nrg^{**}b$-irresolute functions then their composition is $Nrg^{**}b$-irresolute function.

Proof: Let ρ be $Nrg^{**}b$-open set in $(W, \tau_{R''}(Y)), g^{-1}(\rho)$ is $Nrg^{**}b$-closed set in $(V, \tau_{R'}(Y))$.
Since g is $CNrg^{**}b$-irresolute function. $f^{-1}(g^{-1}(\rho))$ is $Nrg^{**}b$-open set in $(U, \tau_R(X))$, f is contra $Nrg^{**}b$-irresolute function. Which implies ρ is $Nrg^{**}b$-open set in $(W, \tau_{R''}(Y))$ and $f^{-1}(g^{-1}(\rho)) = (g \circ f)^{-1}(\rho)$ is $Nrg^{**}b$-open set in $(U, \tau_R(X))$. Hence $g \circ f$ is $Nrg^{**}b$-irresolute function.

Theorem 6.6: Every contra $Nrg^{**}b$-irresolute function is contra $Nrg^{**}b$-continuous functions.

Proof: Let $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ be a contra $Nrg^{**}b$-irresolute function. That is inverse image of $Nrg^{**}b$-closed in $(V, \tau_{R'}(Y))$ is $Nrg^{**}b$-open set in $(U, \tau_R(X))$. Let ρ be nano-closed in $(V, \tau_{R'}(Y))$. Since every nano-closed set is $Nrg^{**}b$-closed. Which implies ρ is $Nrg^{**}b$-closed in $(V, \tau_{R'}(Y))$. Then $f^{-1}(\rho)$ is $Nrg^{**}b$-open set in $(U, \tau_R(X))$. Therefore f is contra $Nrg^{**}b$-continuous functions.

Remark 6.7: Every contra $Nrg^{**}b$-continuous function need not to be contra $Nrg^{**}b$-irrsolute function as shown in the example.

Example 6.8: Let $U = \{\alpha, \beta, \gamma, \delta\}$ with $U/R = \{\{\alpha\}, \{\beta\}, \{\gamma, \delta\}\}$ and $X = \{\alpha, \gamma\} \subseteq U$, $\tau_R(X) = \{U, \phi, \{\alpha\}, \{\alpha, \gamma, \delta\}, \{\gamma, \delta\}\}$. Let $V = \{\alpha, \beta, \gamma, \delta\}$ with $V/R' = \{\{\alpha\}, \{\beta\}, \{\gamma, \delta\}\}$ and $Y = \{\alpha, \beta\} \subseteq V$, $\tau_{R'}(Y) = \{V, \phi, \{\alpha, \beta\}, \{\alpha, \beta\}, \emptyset\}$. Define the function $f: (U, \tau_R(X)) \to (V, \tau_{R'}(Y))$ defined as $f(\alpha) = \alpha, f(\beta) = \beta, f(\gamma) = \gamma, f(\delta) = \delta$ then f is $CNrg^{**}b$-irreseloute function but f is not contra $Nrg^{**}b$-continuous function. Since $f^{-1}\{\alpha, \beta\} = \{\alpha, \gamma, \delta\}$ is not $Nrg^{**}b$-closed set in $(U, \tau_R(X))$ where as $\{\alpha, \beta\}$ is not nano-open in $(V, \tau_{R'}(Y))$.

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Source of support: Nil, Conflict of interest: None Declared.