Topology plays an important role in many branches of modern mathematics which elucidates the concepts of continuity and nearness within the framework of Mathematics. This thesis is a study of a new type of generalized closed set in a topological space called $g$-$\delta$-$s$-closed set by utilizing semi closure operator and followed by the properties of $g$-$\delta$-$s$-nhd, $g$-$\delta$-$s$-interior, $g$-$\delta$-$s$-exterior, $g$-$\delta$-$s$-boundary, $g$-$\delta$-$s$-frontier, strongly $g$-$\delta$-$s$-continuous, $g$-$\delta$-$s$-closed functions, $g$-$\delta$-$s$-homeomorphisms, $g$-$\delta$-$s$-compactness, $g$-$\delta$-$s$-connected-ness, $g$-$\delta$-$s$-regular spaces, $g$-$\delta$-$s$-normal spaces, totally $g$-$\delta$-$s$-continuous functions via $g$-$\delta$-$s$-open and $g$-$\delta$-$s$-closed sets.

The thesis contains seven chapters that deal with weaker forms of closed sets, namely $g$-$\delta$-$s$-closed sets in topological spaces. The idea of N. Levine motivated to take up the study on the concept of $g$-$\delta$-$s$-closed sets using $\delta$-open sets.

Chapter 1 is introductory in nature and contains preliminaries that are required for further work presented in the subsequent chapters.

Chapter 2 deals with the generalized $\delta$-semi closed (briefly $g$-$\delta$-$s$-closed) sets, $g$-$\delta$-$s$-open sets, $g$-$\delta$-$s$-neighbourhoods, $g$-$\delta$-$s$-limit points, $g$-$\delta$-$s$-derived sets, $g$-$\delta$-$s$-closure, $g$-$\delta$-$s$-interior, $g$-$\delta$-$s$-exterior, $g$-$\delta$-$s$-boundary of a set and some of their properties. Using $g$-$\delta$-$s$-closed sets, two new spaces namely, $gT_{3/4}$ and $gT_{1/2}$ spaces are introduced and some basic results are obtained.

A subset $A$ of a topological space $X$ is said to be $g$-$\delta$-$s$-closed set if $sCl(A) \subseteq U$ whenever $A \subseteq U$ and $U$ is $\delta$-open in $X$. The family of all $g$-$\delta$-$s$-closed sets is denoted by $G\delta SC(X)$. It is observed that the intersection of $g$-$\delta$-$s$-closed sets is again a $g$-$\delta$-$s$-closed set, but the union of $g$-$\delta$-$s$-closed sets need not be a $g$-$\delta$-$s$-closed set in general: It is shown that if a subset $A$ of $X$ is $g$-$\delta$-$s$-closed in $X$, then $sCl(A) - A$ does not contain any nonempty $\delta$-closed set in $X$. The complement of a $g$-$\delta$-$s$-closed set is called a $g$-$\delta$-$s$-open set. Some of its properties are investigated. Also it is proved that a subset $A$ of $X$ is...
\(g\delta s\)-open if and only if \(F \subset s\text{Int}(A)\) whenever \(F \subset A\) and \(F\) is a \(\delta\)-closed set. It is also observed that, if \(s\text{Int}(A) \subset B \subset A\) and \(A\) is a \(g\delta s\)-open set, then \(B\) is a \(g\delta s\)-open set. Further for \(A, B \subset X\), \(B\) is \(g\delta s\)-open and if \(s\text{Int}(B) \subset A\) then \(A \cap B\) is a \(g\delta s\)-open set.

Among many other results, it is observed that, for a subset \(A\) of \(X\) it is \(g\delta s\)-closed if and only if \(g\delta s\text{-Cl}(A) = A\) and \(g\delta s\)-open if and only if \(g\delta s\text{-Int}(A) = A\). Further, it is shown that if \(A\) is \(g\delta s\)-closed in \(X\) and \(x \in X - A\), then there exists a \(g\delta s\)-nhd \(N\) of \(x\) such that \(N \cap A = \emptyset\). A set is \(g\delta s\)-open if and only if it is \(g\delta s\)-nhd of each of its points and it is \(g\delta s\)-closed if and only if \(g\delta s\text{-D}(A) \subset A\). A point \(x \in g\delta s\text{-Cl}(A)\) if and only if every \(g\delta s\)-open set \(G\) contains points of \(A\) other than \(x\). For a set \(A\) of \(X\), \(g\delta s\text{-Int}(A)\) equals to the set of all those points which are not \(g\delta s\)-limit points of \((X - A)\). A point \(x \in X\) is called \(g\delta s\)-exterior point of \(A\) if \(x\) is \(g\delta s\)-interior of \((X - A)\). Further, \(g\delta s\text{-Int}(A)\), \(g\delta s\text{-Ext}(A)\) and \(g\delta s\text{-Fr}(A)\) are pairwise disjoint and \(X = g\delta s\text{-Int}(A) \cup g\delta s\text{-Ext}(A) \cup g\delta s\text{-Fr}(A)\). It is observed that every \(gT_{3/4}\) space is \(g\delta sT_{1/2}\) space and every \(g\delta sT_{1/2}\) space is semi-\(T_{1/2}\) space.

Chapter 3 deals with stronger forms of continuous functions namely, strongly \(g\delta s\)-continuous, perfectly \(g\delta s\)-continuous and completely \(g\delta s\)-continuous functions in topological spaces and obtain some of their properties.

A function is called strongly \(g\delta s\)-continuous if the inverse image of every \(g\delta s\)-closed set is a closed set. It is proved that every strongly \(g\delta s\)-continuous function is continuous, \(g\delta s\)-irresolute but not conversely and a function is strongly \(g\delta s\)-continuous, if and only if for each point \(x\) of \(X\) and each \(g\delta s\)-open set \(V\) in \(Y\) containing \(f(x)\), there is an open set \(U\) in \(X\) such that \(x \in U\) and \(f(U) \subset V\). A function is said to be strongly semi-\(g\delta s\)-continuous, if the inverse image of every \(g\delta s\)-closed set is semiclosed set. Every strongly semi-\(g\delta s\)-continuous function is semi continuous, \(g\delta s\)-irresolute but not conversely. A function is strongly semi-\(g\delta s\)-continuous, if and only if for each point \(x\) of \(X\) and each \(g\delta s\)-open set \(V\) in \(Y\) containing \(f(x)\), there is a
semiopen set $U$ in $X$ such that $x \in U$ and $f(U) \subset V$. Among many other results, it is observed that the composition of two strongly $g\delta s$-continuous functions is strongly $g\delta s$-continuous function. It is also observed that every perfectly $g\delta s$-continuous and completely $g\delta s$-continuous function is strongly $g\delta s$-continuous function but not conversely.

Chapter 4 deals with $g\delta s$-closed, $pg\delta s$-closed, regular $g\delta s$-closed, strongly $g\delta s$-closed, quasi $g\delta s$-closed and respective open functions and obtain some of their properties.

A function is $g\delta s$-closed, if the image of each closed set is $g\delta s$-closed and the composition of two $g\delta s$-closed functions need not be $g\delta s$-closed in general. It is proved that a function is $g\delta s$-open, if and only if the image of every nhd of a point $x$ of $X$ is $g\delta s$-nhd of $f(x)$. It is also observed that every closed function is $g\delta s$-closed. A function is $pg\delta s$-closed if the image of each semiclosed set is $g\delta s$-closed and it is observed that every semiopen function is $pg\delta s$-closed and every $pg\delta s$-closed function is $g\delta s$-closed, but the converse need not be true in general. It is proved that the image of $g\delta s$-closed set is $g\delta s$-closed under $\delta$-continuous, $pg\delta s$-closed function. A function is strongly $g\delta s$-closed, if the image of each $g\delta s$-closed set is $g\delta s$-closed and the composition of two strongly $g\delta s$-closed functions is strongly $g\delta s$-closed. Also it is observed that every quasi closed function is strongly $g\delta s$-closed, every strongly $g\delta s$-closed function is $pg\delta s$-closed and every $pg\delta s$-closed function is $g\delta s$-closed, but not conversely. Also some preservation theorems are proved.

Chapter 5 deals with $g\delta s$-regular and $g\delta s$-normal spaces and also weaker separation axioms via $g\delta s$-closed sets such as $g\delta s-T_0$, $g\delta s-T_1$ and $g\delta s-T_2$ spaces and obtain some of their properties and characterizations.

A topological space $X$ is said to be $g\delta s$-regular if for each closed set $F$ and each point $x \notin F$, there exist disjoint $g\delta s$-open sets $U$ and $V$ such that $x \in U$ and $F \subset V$. Every regular space is $g\delta s$-regular space, but not conversely. It is proved that every $g\delta s$-regular $T_0$ space is $g\delta s-T_2$ space and
a space $X$ is $g\delta s$-regular if and only if for every point $x \in X$ and an open set $V$ containing $x$ there exists a $g\delta s$-open set $U$ such that $x \in U \subset g\delta s-\text{Cl}(U) \subset V$. It is observed that the image of a $g\delta s$-regular space is $g\delta s$-regular under strongly $g\delta s$-open continuous surjective function. It is proved that every normal space is $g\delta s$-normal but not conversely. Also it is proved that a space $X$ is $g\delta s$-normal if and only if for each closed set $A$ and each open set $U$ such that $A \subset U$, there exists a $g\delta s$-open set $V$ containing $A$ such that $g\delta s-\text{Cl}(V) \subset U$. It is observed that the image of a $g\delta s$-normal space is $g\delta s$-normal under strongly $g\delta s$-open continuous bijective function. Among many other results, it is observed that the image of $g\delta s$-$T_0$ space is $g\delta s$-$T_0$, under injective $g\delta s$-irresolute function. It is proved that a space $X$ is $g\delta s$-$T_1$ if and only if every singleton subset $\{x\}$ of $X$ is $g\delta s$-closed. Also it is proved that $X$ is a $g\delta s$-$T_2$ space if and only if for each $x \neq y$ there exists a $g\delta s$-open set $U$ such that $x \in U$ and $y \notin g\delta s-\text{Cl}(U)$.

The concept of a new class of homeomorphisms, namely $g\delta s$-homeomorphisms, strongly $g\delta s$-homeomorphisms in topological spaces, $g\delta s$-compact, countably $g\delta s$-compact and $g\delta s$-Lindelöf and $g\delta s$-connectedness in topological spaces are dealt with, in chapter 6, and some of their characterizations and properties are studied.

It is observed that every homeomorphism, strongly $g\delta s$-homeomorphism and $g$-homeomorphism is $g\delta s$-homeomorphism. Among other results it is observed that the composition of two $g\delta s$-homeomorphisms need not be a $g\delta s$-homeomorphism in general. But the composition of two strongly $g\delta s$-homeomorphisms is again a strongly $g\delta s$-homeomorphism. Also $g\delta s$-quotient function is defined and it is observed that every homeomorphism is a $g\delta s$-quotient function.

A topological space $X$ is called $g\delta s$-compact if every $g\delta s$-open cover has a finite subcover. It is shown that every $g\delta s$-compact space is compact (resp. countably $g\delta s$-compact and $g\delta s$-Lindelöf) space. It is proved that a
$g\delta s$-closed subset of $g\delta s$-compact space is $g\delta s$-compact relative to $X$ and the image of a $g\delta s$-compact space under a $g\delta s$-irresolute function is $g\delta s$-compact and the image of a countably $g\delta s$-compact space under a $g\delta s$-irresolute function is countably $g\delta s$-compact. It is observed that if a space $X$ is both $g\delta s$-Lindelöf and countably $g\delta s$-compact, then $X$ is $g\delta s$-compact. Also it is proved that the image of a $g\delta s$-Lindelöf space under a $g\delta s$-irresolute function is $g\delta s$-Lindelöf space.

A topological space $X$ is said to be $g\delta s$-connected if $X$ cannot be written as the union of two nonempty disjoint $g\delta s$-open sets. It is observed that every $g\delta s$-connected space is connected but not conversely. It is proved that $X$ is $g\delta s$-connected if and only if the only subsets of $X$ which are both $g\delta s$-open and $g\delta s$-closed are the empty set $\emptyset$ and $X$. Also the image of a $g\delta s$-connected space is $g\delta s$-connected under a $g\delta s$-irresolute surjection.

Chapter 7 deals with another new type of function known as semi total continuity and obtain some basic properties of these functions. Further preservation theorems of semi totally continuous functions and relationships between semi totally continuous functions and graphs are investigated. Also semi totally open functions in topological spaces are introduced and studied.

A function is said to be semi totally continuous if the inverse image of every semiopen subset is clopen. It is proved that every strongly continuous function is semi totally continuous and every semi totally continuous function is total continuous, totally semi continuous and semi continuous. The composition two semi totally continuous functions is semi totally continuous. Also it is proved that a surjective function $f : X \to Y$ is semi totally open if and only if for each subset $B$ of $Y$ and for each semiclosed set $U$ containing $f^{-1}(B)$ there is a clopen set $V$ of $Y$ such that $B \subset V$ and $f^{-1}(V) \subset U$. The composition of two semi totally open functions is again semi totally open.