SUMMARY OF THE THESIS

The research work presented in this thesis deals with the study of "Geometry of Indefinite Manifolds and their Related Structures". Actually, manifolds are everywhere. These are the generalizations of curves and surfaces to arbitrarily many dimensional space and provide the mathematical context for understanding space in all of its manifestations. Today, the tools of manifold theory are indispensable in most major subfields of pure mathematics. Apart from its own intrinsic interest, a knowledge of differentiable manifold is useful and even essential, in a number of areas of mathematics and its applications. Indeed topics such as time and surface integrals, curl and divergence of vector fields and Stoke’s and Green’s theorems find their most natural setting in manifold theory. Differentiable manifolds are the underlying objects of study in much of advanced calculus and analysis. Thus, the study of differentiable manifolds is the study of chief discussion in geometry.

The brief chapter wise description of the work presented in this thesis is given in the following paragraphs.

Chapter 1 deals with preliminaries. In this chapter a brief resume of the results in the differential geometry and their allied structures have been given. Most of the results presented in this chapter are available in review articles, research papers and books, even then we have collected them to fix up our terminology and to make the thesis self contained.

Since sectional curvature offers a lot of information concerning the intrinsic geometry of Riemannian manifolds and manifolds with constant sectional curvature are great source of study. Therefore, in Chapter 2 constancy of $\phi$-
holomorphic sectional curvature of indefinite Sasakian manifolds has been discussed. After the brief introduction of Sasakian and indefinite Sasakian manifolds, a condition for the characterization of constancy of $\phi$-holomorphic sectional curvature has been proved for indefinite Sasakian manifolds. Same condition for an $\epsilon$-Sasakian manifold has also been obtained.

The theory of submanifolds of Riemannian or semi-Riemannian manifolds is well known but its counter part of lightlike submanifolds is relatively new and in the developing stage. The primary difference between the classical theory of Riemannian or semi-Riemannian submanifolds and the theory of lightlike submanifolds arises due to the fact that in the second case, the normal vector bundle intersects with the tangent bundle of the submanifold. Thus, one fails to use, in the usual way, the theory of non-degenerate submanifolds (Classical theory) to define the induced geometric objects on the lightlike submanifolds. Moreover, the growing importance of lightlike hypersurfaces and submanifolds in mathematical physics, in particular, their extensive use in relativity and very limited information available on the general theory of lightlike submanifolds are the motivating factors to do research on this subject matter. Chapter 3 deals with the axiom of planes and spheres in semi-Riemannian geometry with lightlike submanifolds. In this chapter, it has been proved that a lightlike submanifold of a semi-Riemannian manifold is real space form if it satisfies axiom of planes or spheres.

Chapter 4 deals study of some properties of lightlike submanifolds of semi-Riemannian manifolds. In this chapter necessary and sufficient condition for the integrability of screen distribution of a lightlike submanifold has been established. A Necessary and sufficient condition for a lightlike submanifold to be
a totally geodesic has also been discussed.

**Chapter 5** elaborates the concept of contact $CR$-lightlike submanifolds of indefinite Sasakian manifolds. Condition for an invariant lightlike submanifold of indefinite Sasakian space form to be of constant $\phi$-sectional curvature has been established. The integrability conditions of various distributions of contact $CR$-lightlike submanifolds of $(\epsilon)$-Sasakian manifolds have been studied. Totally contact umbilical $CR$-lightlike submanifolds of $(\epsilon)$-Sasakian manifolds are also discussed.

In the end of the thesis, a bibliography has been given which by no means is an exhaustive one but lists only those research papers and books which have been referred to in the main text of the thesis.