## ABSTRACT

The present decade has witnessed a dramatic explosion in the wealth of information in device technology, component development, system architechtures and application areas in the field of lightwave communication. The success so far attained in both the terrestrial lightwave communication and in free space / deep-space optical communication is overwhelming. However, it is fair to say that there exists an enormous scope of further research in lightwave communication to attain the ultimate goal of fastest and farthest, communication than what is so far far

The present thesis is based on the investigations on the behaviour of some plausible modulation schemes that may be appropriate for direct detection and coherent detection lightwave. systems for both free-space and terrestrial optical communication.

In particular, M-ary pulse position modulation with direct and coherent detection for free-space optical linkS and coherent amplitude shift keying and frequency shift keying modulations for terrestrial coherent optical links are considered. A new form of hybrid modulation technique known as MSK-FM (which is a heterodyne FM with MSK subcarrier modulation) is also suggested and multichannel MSK-FM and multichannel FSK systems are also studied in detail.

(iv)

The present work also embodies in-depth studies of the effect of phase noise, usefulness of error correction coding to reduce the influence of phase noise, effect of nonuniform FM response of DFB lasers and the use of appropriate linecoding to reduce the adverse effect of nonuniformity in the FM response. The present investigations provide the theoretical as well as over simulation results of the relevant modulation schemes in both direct detection and coherent optical receiver. It is hoped that these results will be of sufficient value to those who desire to implement such schemes in practice.

(v)