

### **1.0 Introduction.**

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Optical fibre is replacing many conventional copper cables in communication systems since its inception into the communication field a few years ago, due to the many advantages optical fibre have to offer over conventional copper cables. Optical fibre communication is perceptibly the superior technology that is believed to be the technology of the twenty first century in this twentieth century which offers many advantages without compromise such as; high capacity, cost effectiveness, high security, low signal attenuation, reliability, immunity to interference and it does not deplete earth's natural resources. Even with all these extremely attractive features, there are still more to be offered and one of the most exciting of them all is the optical fibre amplifier. Optical fibre amplifiers offers repeaterless communication by eliminating various electro-optical repeater currently used in optical fibre communication lines to boost up signals. In an optical fibre amplifier, the fibre is not only used to transmit signals, it is also actively involved in amplifying signals that passes through it.

#### **1.2 Thesis Outline.**

In this thesis we look into various non linear effect commonly occurring in optical fibres with an in-depth study on stimulated Raman scattering and the application of it in an optical fibre amplifier.

Chapter 2 covers the common non linear effects seen in optical fibres and the application of these non linear effects where applicable.

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Chapter 3 covers the theoretical approach to non linear optics which relates the polarisation to the non linear susceptibility and electric field. Also covered were spontaneous Raman scattering and stimulated Raman scattering - the generation of the first and higher order stimulated Raman scattering. The Raman shift for various materials were also given, including common fibre materials i.e. silica dioxide. Finally four photon mixing and its various phase matching conditions in optical fibre were also discussed.

Chapter 4 covers the experimental set-up used to observe forward and backward stimulated Raman scattering in silica fibre. The stimulated Raman scattering threshold for various fibre length was also measured. The lifetime of the stimulated Raman scattering and the characteristics of the fibre - polarisation and dispersion was determined at 532 nm which is a prerequisite of the proceeding chapter on Raman fibre amplifier.

Chapter 5 starts with a preliminary study on the dye laser used to generate the signal at 546 nm. The characteristics study of the Raman fibre amplifier was also carried out. Amplification of the signal was measured and the Raman gain of the fibre was determined both in the forward and backward pump configuration. Pump depletion was also observed and measured both in the forward and backward configuration. Finally a comparative study on both the forward and backward pump configuration was carried out.

Chapter 6 covers the conclusion of the Raman fibre amplifier its advantages and disadvantages. Finally suggestion for further work was also recommended in the last section.