S.p.38. RAMACHANDRAN, T. – Development of a nitroigen laser pumped dye laser with a single stage amplifier and studies on energy transfer dye laser systems – 1988 – Dr. K. Sathianandan

Pulsed uv lasers and tunable dye lasers pumpd by them find important applications as sources for various experiments in spectroscopy, solid state physics, chemical physics and medicine. As the experiments advance to higher sophistication, the demands on the laser characteristics such as power, pulse width, stability and repetition rate become more stringent. The present thesis reports the work carried out by the author on the design, fabrication and optimisation of a high power nitrogen laser and a tunable dye laser with an oscillator-amplifier configuration. The studies also include applications of the above lasers to the investigations on solvent effects of Rhodamine 6G dye laser, energy transfer studies on mixed dye systems and radiative decay characteristics of Ho^{+}_{3} ions in CaF_2 lattice. The above problems have direct applications on laser physics itself; since studies on solvents and mixed dye systems can lead to better designs of active media for dye lasers. Also, since CaF_2. Ho^{3+} is one of the few solid state materials having laser transitions in green region, considerable importance is attached to its detailed study. The investigations outlined above are presented in seven chapters.

The first chapter begins with a historical survey on the various designs of nitrogen lasers followed by a brief analysis of the theoretical considerations for laser action in nitrogen gas. It is shown that a very fast excitation of nitrogen molecules is a pre-requisite for population inversion. This is accomplished by a fast electrical discharge which dictates a very low impedence pulse circuit. A Blumlein circuit with transverse excitation is ideal for this, since with a moderate voltage it is possible to excite the gas at high pressures. Details of how a Blumlein circuit can be incorporated into a nitrogen laser is given. A comparison with other types of discharge circuits is also presented.

mixtures in place of a single dye, the efficiency is enhanced. The donor and acceptor concentration ratio at which there is maximum efficiency is identified. An attempt has also been made to analyse the exact nature of the energy transfer mechanism in mixed dye systems.

Chapter seven presents the results on the calculation of relative values of non-radiative transfer efficiencies from different upper levels to the 5 S_2 level of Ho^{3+} green emission (551.2 nm) in $CaF_2.Ho^{3+}$. The calculation is made using the data available from the excitation, absorption and fluorescence spectra.

S.P.39. – RAVISANKAR, M. Fabrication and Parametric Studies of a Triggered Nitrogen Laser and Investigations on the Influence of Dissolved Constituents of Sea water on the Optical Attenuation Using the Nitrogen Laser Pumped Dye Laser – 1989 – Dr. K. Sathianandan.

Optical attenuation study in sea water has assumed renewed interest because of its importance in the emerging areas of underwater applications such as optical communication, imaging, target finding and ranging. In recent years, many workers have carried out optical attenuation studies in clear water, "artificial" sea water and natural sea water by laboratory and in situ methods. A careful examination of the available information on sea water reveal that reliable data are not available. In addition, there are major disagreements among the results that are reported. The reasons for such discrepancies can be attributed to the differences in the composition of the sea water and to the experimental methods and procedures adopted by the various investigators. Therefore, to get reliable data, a systematic analysis of the effect of the dissolved constituents of sea water on optical attenuation has to be carried out using an experimental technique which takes care of all the possible errors. The present thesis contains the details of the work done by the author in this direction.

The material presented in the thesis can be broadly divided into two sections. The first section covers the fabrication details of a nitrogen laser which is used to pump a dye laser. The second section gives the optical attenuation studies of different solutions containing the constituents of sea water.

Chapter one is a general introduction to the nitrogen laser, nitrogen laser pumped dye laser and optical attenuation studies in sea water. A comprehensive review of the work on optical attenuation studies is presented here as a necessary introduction to the detailed investigations undertaken.

A continuously tunable dye laser has to be used for the determination of optical attenuation in the entire visible region. In order to get nanosecond pulses, which is required in the present experimental technique, the dye laser has to be pumped by a nitrogen laser. A pulsed nitrogen laser of about 500 kW and a repetition rate of 50 pps (maximum) is fabricated to suit the requirements. Design and fabrication details of this nitrogen laser are included in the second chapter of the thesis. Efficiency of the nitrogen laser has been improved by using a modified design of the spark gap and the trigger circuit. Trigger repetition rate can be selected as 10, 25 and 50 pps.

Parametric studies of the nitrogen laser were carried out and presented in the third chapter of the thesis. Pulse width, pulse energy and power were measured as a function of input voltage and nitrogen pressure. The optimum condition for