CHAPTER 7

GENERAL CONCLUSIONS

The work presented in this thesis is the design, fabrication and parametric studies of a high power nitrogen laser system and its use to study the fluorescence characteristics of certain doped phosphors.

NITROGEN LASER: We observed significantly improved discharge uniformity and suppression of arcs over a wide pressure range, improved reproducibility of both spatial distribution and intensity of the laser output and increase in permissible operating pressures.

In general, the following conclusions were made from the present studies:

1. In order to obtain uniform and reproducible discharge, it is advisable to use the combination of cylindrical cathode and plane anode, as reported in the present work.

2. Sufficiently uniform gas flow is achieved with the holes distributed along each electrode and located in such a way that they do not face each other.

3. In order to achieve a shorter rise time, the inductance of
the cavity and spark gap are minimized by reducing their physical sizes.

(4) For effective heat dissipation black painted fins are provided for cooling the laser cavity and spark gap.

(5) The double-Blumlein circuit has been found to give higher output peak power and better efficiency than the single-Blumlein circuit.

(6) The maximum peak power obtained for the double-Blumlein circuit was 700 kW at a charging voltage of 9.3 kV and the maximum efficiency obtained was 0.51%. The pulse width at FWHM was 3 ns.

(7) For obtaining better stability in repetition rate, triggered spark gap switch may be used.

(8) The additive gases $\text{CH}_2\text{Cl}_2\text{-CH}_2\text{Cl}$, $\text{CCl}_4$, and $\text{SOCl}_2$ enhances the emission intensity appreciably.

In conclusion, $\text{N}_2$ laser with transverse discharge geometry shows promise as a simple and ideal source for fluorescence analysis. It is compact, less divergent, and powerful. Its voltage requirements are comparable to those used with low pressure $\text{N}_2$ lasers. The $\text{N}_2$ laser described here
has been operating for several months in this laboratory giving satisfactory performance. With further parametric optimization, the performance can be improved.

**FLUORESCENCE IN PHOSPHORS** : The detailed preparation and fluorescence emission analysis of SrS phosphors doped with Ce, Eu, Sm, Dy and Er were discussed with accompanying energy level diagrams for each rare earth ions in SrS lattice. The fluorescence emission from Sm, Dy and Er were analysed in detail using a parametrized model. The crystal field parameters were calculated and the splitting pattern of the energy levels in SrS lattice were evaluated.

**FUTURE SCOPE:**

We believe on the basis of the parametric studies, that it should be possible by using preionization together with higher voltages and shaping the electrodes to achieve atmospheric or higher pressure operation with pure $N_2$ or possibly with a mixture of $N_2$ and a buffer gas suitable for collisional quenching of the lower levels. The recent trend to $N_2$ laser fabrication is towards making compact and reliable
lasers. Studies on the coherence properties of the laser radiation and the effects of additives enabled a better understanding of the laser action in $N_2$. $N_2$ laser has varied applications which make this system equally popular among the scientists working in physical and life sciences.

The fluorescence measurements at low temperature is to be carried out, since UV excited fluorescence at low temperature will give more informations about the crystalline effects on the rare earth ions. It is certain that continued progress in the device field will yield major changes in the techniques of display devices necessitating the development and characterisation of different phosphor materials.