8. SUMMARY

The structure, dielectric, conduction, breakdown and laser damage properties of solution grown pure and iodine doped polyvinyl alcohol (PVA) and polymethyl methacrylate (PMMA) films have been investigated in detail in the present study. The important results are summarized below.

The structures of both polyvinyl alcohol and polymethyl methacrylate films (pure and doped) have been found to be amorphous. Optical absorption study reveals the presence of iodine in doped polyvinyl alcohol and polymethyl methacrylate films. Also RBS technique confirms the presence of iodine in both the films.

The studies on the dielectric properties have been carried out at different frequencies and temperatures with a view to study their effects on capacitance, dielectric constant and dielectric loss. Annealing studies have been found to have a stabilizing effect on the dielectric properties of these films. The increase in capacitance with decrease of frequency is observed in both the PVA and PMMA films (pure and doped). In 0.5% and 2% iodine doped PVA and PMMA films the doping increases the capacitance value. This increase in capacitance with doping was explained on the basis of formation of charge transfer complexes between the materials. The effect of frequency on loss factor shows loss peaks for both the films, indicating relaxation effect in these films.
Cole-Cole plots are drawn to estimate the dielectric relaxation time in both the PVA and PMMA films. The temperature coefficients of capacitance, relative permittivity and linear expansion coefficient values of pure and doped PVA and PMMA films have been estimated.

The a.c. and d.c. conduction studies have given an idea of the conduction mechanism in pure and doped PVA and PMMA films. The a.c. conductivity is found to follow a $\sigma_{ac} \propto \omega^n$ relation in PVA films. The increase in conductivity at high temperatures (> 343) is due to the increase of crystallinity in the films. The values of a.c. activation energy of both the polymer film materials have been estimated. In the PMMA films a strong frequency dependence of conduction tending towards square law at higher frequencies has been observed. This dependence indicates that the electron hopping mechanism is responsible for the a.c. conduction. The increase of activation energy values with increase of iodine doping is observed in both the PVA and PMMA films.

A Poole-Frenkel type of conduction mechanism is identified as the dominating conduction mechanism in pure, and 0.5% doped PVA and PMMA films. In the case of 2% doped films the Schottky conduction mechanism is observed at temperatures above 343 K. The activation energy, zero field activation energy and metal insulator work function of both the PVA and PMMA films (pure and doped) have also been evaluated.

The breakdown studies show that the thickness and temperature dependence of onset breakdown field follow the Forlani - Minnaja theory in the pure, 0.5% and 2% iodine doped PVA and PMMA films.
Laser damage threshold studies carried out on these films of different thicknesses reveal that the laser damage mechanism is an impurity dominated one.

Thus, the present investigation provides valuable data on dielectric, electrical conduction, breakdown and laser induced damage of solution grown pure, 0.5% and 2% iodine doped PVA and PMMA films. It is believed that data presented in this thesis, along with the other data available in the literature, will be very much useful for the exploitation of these films in a variety of applications.