CHAPTER VI

SUMMARY AND CONCLUSION
The present thesis deals with the investigations on the electrical, optical and structural properties of the transparent conducting oxides – indium oxide, tin oxide and indium tin oxide thin films. The results of the investigations and conclusions derived are summarized here. The scope of future work is also indicated.

The electrical, optical and structural studies of transparent conducting oxide thin films are reviewed in the first chapter. The apparatus and experimental techniques used are presented in Chapter II. Thermal evaporation method of preparation of thin films are also given. The vacuum coating system is also described. Optical method of thickness measurement is given. Different measuring instruments such as Keithly programmable electrometer, electrical conductivity cell, UV – Visible Spectrophotometer and X-ray diffractometer are also described.

The measurement of sheet resistance, electrical conductivity and determination of the activation energy of indium oxide, tin oxide and indium tin oxide thin films are given in Chapter III. It is found that the resistivity of the films are strongly dependent on substrate temperature and post deposition annealing treatments. Activation energy is found to be thickness dependent and substrate temperature dependent.

In Chapter IV, the direct band gap, the indirect band gap, refractive index and the extinction coefficient of indium oxide, tin oxide and indium
tin oxide films have been determined and compared with the results obtained by others.

Structural studies on indium oxide, tin oxide and indium tin oxide are given in Chapter V. The obtained X-ray diffractograms are compared with the ASTM standard data. For all the three materials, the peaks obtained are sharp indicating the high crystalline nature of the samples. The grain size evaluation has been done for indium oxide, tin oxide and indium tin oxide thin films. The grain size is found to increase with increase in substrate temperature and annealing temperature.

There is considerable scope for extending the work to low temperature region down to liquid nitrogen temperatures. With suitable doping, superconductivity measurement may be made in these films. This work can be extended to other transparent conducting films also. These films can be used for fabrication of new devices. Applications of these films in industry, science and technology for solar cells will make drastic changes in the near future.