Conclusion and Future work:

EPR and optical studies of Mn$^{2+}$ doped crystals have been done. The spin Hamiltonian parameters $g$, $a$, $A$, $B$, $D$ and $E$ have been determined. Our study indicates that there exist fine and hyperfine structures due to four sites and the Mn$^{2+}$ ion enters the lattice interstitially. From the optical study, the observed bands are assigned to transitions from the $^6A_{1g}(S)$ ground state to the various excited quartet levels of Mn$^{2+}$ ions. The Racah parameters (B and C) and the crystal field parameter ($D_q$) have also been evaluated. The values of B and C are considerably decreased from their free-ion values, which show that there is a covalent bonding between the central metal ion and the ligands. The zero field splitting parameters have also been calculated with the help of perturbation theory and crystal field parameters obtained from superposition model. Theoretical results agree well with the experimental ones.

The calculated ZFS parameters for Mn$^{2+}$ ion at the interstitial site in ZLT single crystal fairly match with the experimental values. The calculated optical energy levels using CFA package are in reasonable agreement with the experimental values. This suggests that the Mn$^{2+}$ ion occupies an interstitial site in ZLT, which is consistent with the experimental result obtained earlier.

Zero-field splitting parameter D for Mn$^{2+}$ doped CAPH and PTS in axial symmetry has been calculated with the help of superposition model and perturbation formulae. Better agreement with the experimental value is obtained when small distortion is taken into account. The investigation indicates that Mn$^{2+}$ ion enters the host lattice substitutionally, which supports the experimental EPR analysis.

In future, EPR and optical study of single crystals doped with transition and lanthanide ions in different diamagnetic lattices related with polyamino acids and nucleic acid derivatives will be done. The spin Hamiltonian parameters will be determined. These parameters together with the data obtained from optical absorption study will be used to obtain different bonding parameters of the metal ion with its ligands. The doped single crystals of VO$^{2+}$, Mn$^{2+}$, Cu$^{2+}$ and Gd$^{3+}$ will be used and the results obtained will be discussed. The effect of symmetry of the crystalline field about the metal ion will also be discussed.

Apart from this EPR and optical study of nano materials doped with Mn$^{2+}$ and Cr$^{3+}$ will also be undertaken. On the basis of results obtained the characterization of the material will be done. To interpret the results properly and nicely a comprehensive theoretical development of the subject and literature collection will be done. EPR
spectra will be recorded as a function of temperature to see whether there is any change of phase. If there is change of phase, the spectra will be recorded and interpreted properly. If superhyperfine structure is observed in any system, it will be studied in detail to interpret electron delocalization i.e. fraction of unpaired electron spin transferred to an orbital on a ligand and $\sigma$, $\pi$, and $s$ contributions. While variations in spectroscopic splitting factor and metal hyperfine tensors can often be explained by a covalent bonding model for the electronic structure of a complex, they are rather indirect evidence for delocalization. However, when the spectra show ligand hyperfine splitting one can study the bonding in more detail and obtain cross checks on the evaluated molecular orbital parameters. The characterization of nano materials using EPR and optical absorption techniques will be useful in finding such materials of industrial and commercial applications.