Electron Paramagnetic Resonance (EPR) is a very powerful tool of investigation which finds a wide variety of applications in the fields of Physics, Chemistry, Geology, Biology, etc. In Physics, the work is mainly centred around the investigation of position and symmetry of the environments of paramagnetic ions doped in diamagnetic hosts.

Crystals doped with iron-group ions have been extensively studied by EPR. At the time of beginning of this work only a few papers based on EPR studies of formates of alkaline earth elements had been published. A survey of literature did not reveal any EPR work on formates of second group elements (Ca, Sr, and Ba). Therefore, EPR studies of transition metal ions doped in formates of calcium, strontium, and barium were carried out and the results are reported in this thesis.

This thesis describes the results of the investigations by the author on the EPR spectra of vanadyl ion doped calcium formate and barium formate, and copper(II) doped strontium
formate dihydrate and barium formate.

Chapter I describes in brief, an introduction to EPR. This chapter contains the historical background of EPR and the origin of paramagnetism. A brief mention of scope of EPR in various branches has been outlined.

Chapter II deals with theory related to EPR, crystal field effects, spin-Hamiltonian and its parameters. This chapter also include the Kramers' theorem and the Jahn-Teller effect. Zero-field splitting, forbidden transitions, and the relaxation processes are discussed.

In Chapter III the theory related to vanadyl ion (\(\text{VO}^{2+}\)) and copper(II) ion (\(\text{Cu}^{2+}\)) are given. Electronic structure, and molecular orbital description of \(\text{VO}^{2+}\) ion is discussed. In the case of \(\text{Cu}^{2+}\) ion, the low symmetry effects are discussed. The methods for determination of spin-Hamiltonian parameters are described in detail.

Chapter IV and VII present the EPR studies of \(\text{VO}^{2+}\) ions in calcium formate [\(\text{Ca(HCOO)}_2\)] and barium formate [\(\text{Ba(HCOO)}_2\)] respectively. The optical studies of \(\text{VO}^{2+}\) ion in these hosts are also made. The EPR and optical data are correlated and the ground state wave functions are calculated and discussed. Spin-Hamiltonian parameters are determined.
In Chapter V and VI the EPR studies of Cu$^{2+}$ ions in strontium formate dihydrate [Sr(HCOO)$_2$·2H$_2$O] and barium formate are given. The low symmetry effects are observed in both cases. The spin-Hamiltonian parameters are calculated and the ground state wave functions are formulated.

In all cases, the impurities are found to occupy both substitutional and interstitial sites. Absence of water of crystallization from the samples was confirmed by recording their infrared spectra.

Each chapter has been written in a manner to be more or less self-contained; repetition of some statements has been, therefore, unavoidable.