The chemistry of copper (II), nickel (II) and cobalt (II) is of interest to the scientist’s in view of the variety of structural types which are possible in their complexes with various ligands. A survey of literature shows that the inorganic salts of these metals have been extensively studied but their organic derivatives have not been given much attention. The present work has been, therefore, undertaken in order to study the coordination complexes formed by copper (II), nickel (II) and cobalt (II) 5,5-diethyl-2,4,6 (1H) pyrimidinetrione, phthalimide, phthalate, succinate, benzoate with imidazole, 2-methylimidazole and benzimidazole to establish their structures and to determine the effect of anion on the coordination number, colour and stability of the complexes. The anion 5,5-diethyl-2,4,6 (1H) pyrimidinetrione is of special interest which belongs to an important drug barbiturate.

The present investigations have been mainly carried out with a view to correlate the structures of the complexes with the symmetry and base strength of the ligands. The result of these investigations which were started in December, 1988 are presented in this thesis entitled "Synthesis and characterisation of some coordination complexes of copper(II), nickel(II) and cobalt(II) with nitrogen containing ligands" consisting of four chapters.
The first chapter of the thesis gives some introductory ideas about the coordination complexes and a variety of physicochemical methods like elemental analysis, conductance, infrared, magnetic susceptibility measurements, electronic spectra and thermogravimetric analysis which have been used for elucidating the structures of the complexes.

The second chapter outlines in detail the existing literature on the nitrogen donor ligands complexes of copper(II), nickel(II), and cobalt(II). An attempt has been made to list all the complexes relevant to this work, which have been studied during the years 1945-92.

Third chapter is mainly devoted for describing the general methods used for the synthesis of complexes and details of the data collected on each complex is listed.

The structural discussion is given in chapter fourth. The complexes possess the general formulae:

\[ [M(\text{barb})_2(L)_m] \cdot nH_2O \]
\[ [M(\text{phthali})_2(L)_m] \cdot nH_2O \]
\[ [M(\text{phth})(L)_m] \cdot nH_2O \]
\[ [M(\text{succ})(L)_m(H_2O)_n] \cdot nH_2O \]
\[ [M(\text{benzo})_2(L)_m(H_2O)_n] \cdot nH_2O \]
where,

$M = \text{Cu(II)}, \text{Ni(II)} \text{ or Co(II)}$

$\text{barb} = 5,5\text{-diethyl-2,4,6(1H) pyrimidinetrione}$

$\text{phthali} = \text{Phthalimide}$

$\text{phth} = \text{Phthalate}$

$\text{succ} = \text{succinate}$

$\text{benzo} = \text{benzoate}$

$L = \text{imidazole, 2-methylimidazole or benzimidazole}$

And

$m = 1, 2 \text{ or } 4$

$n = 0, 1, 2, 4 \text{ or } 7$

All the complexes are blue, green, chocolate, mauve coloured crystalline solid, soluble to a limited extent in nitrobenzene.

The molar conductance of the complexes have been measured in nitrobenzene at a concentration of $10^{-3}$ to $10^{-4}\text{M}$. The values obtained are close to the values reported for nonelectrolytes and indicate that all the anions $5,5\text{-diethyl-2,4,6(1H) pyrimidinetrione}$, phthalimide, phthalate, succinate and benzoate are also coordinated to the metal(II). This has also been confirmed by infrared data.

The infrared spectra of the complexes have been recorded in the region $4000-400 \text{ cm}^{-1}$. The comparison of the
spectra of free ligands and their complexes show shifts as well as splitting in some of the important ligand bands which have been taken to indicate coordination.

The magnetic measurements have been made by Gouy's method and all the complexes are found to be paramagnetic, their paramagnetism falling in the usual range of one, two and three unpaired electrons as expected for high spin complexes of copper(II), nickel(II) and cobalt(II) respectively.

Electronic spectra of copper(II) complexes usually show one broad band which has been taken to be equal to 10 Dq. Nickel(II) and cobalt(II) complexes show two bands which are $\tilde{\nu}_1$, $\tilde{\nu}_2$ or $\tilde{\nu}_3$ transitions.

The thermogravimetric studies show that the decomposition pattern of the complexes are of three types.

Category I - complexes decompose in one step.
Category II - complexes decompose in two step.
Category III - complexes decompose in three step.

The lattice water is lost around 125°C while coordinated water is lost around 240°C. The loss of organic anions and ligands occur between 250-850°C. Around 850°C the curve becomes a straight line and the metal oxide is formed.