**Chapter I** deals with the introductory aspects on surfactant-metal complexes and various types of electron transfer reactions involving metal complexes in acidic aqueous solution as well as in microheterogenous systems.

**Chapter II** explains the aim and scope of the work.

**Chapter III** explains the synthesis of some new type of surfactant-cobalt(III) complex ions of the type, cis-[Co(X)\(_2\)(C\(_{14}\)H\(_{29}\)NH\(_2\))\(_2\)]\(^{3+}\) where X= ethylenediamine or 2,2’ bipyridine or 1,10-phenanthroline and cis-\(\alpha\)-[Co(trien)(C\(_{14}\)H\(_{29}\)NH\(_2\))\(_2\)]\(^{3+}\) (trien: triethylenetetramine) and characterized by IR, NMR, UV-Visible electronic absorption spectra, elemental analysis and metal analysis. The critical micelle concentration (CMC) values of these surfactant-cobalt(III) complexes in aqueous solution were obtained from conductance measurements. Specific conductivity data (at 298, 308 and 318 K) served for the evaluation of temperature-dependent CMC and the thermodynamics of micellization (\(\Delta G_m^0, \Delta H_m^0, \Delta S_m^0\)).

**Chapter IV** describes the kinetics of outer-sphere electron transfer reaction between the following known surfactant-cobalt(III) complex ions and Fe\(^{2+}\)\(_{aq}\) ion at various temperatures.

- cis-[Co(en)\(_2\)(C\(_{12}\)H\(_{25}\)NH\(_2\))\(_2\)]\(^{3+}\)
- cis-\(\alpha\)-[Co(trien)(C\(_{12}\)H\(_{25}\)NH\(_2\))\(_2\)]\(^{3+}\)
- cis-[Co(bpy)\(_2\)(C\(_{12}\)H\(_{25}\)NH\(_2\))\(_2\)]\(^{3+}\)
- cis-[Co(phen)\(_2\)(C\(_{12}\)H\(_{25}\)NH\(_2\))\(_2\)]\(^{3+}\)
Chapter VI

The rate constant for each complex ion increases with initial concentration of one of the reactants (namely surfactant-cobalt(III) complexes) which shows that self-micelles formed by the surfactant-cobalt(III) complex itself influenced these reactions. The activation parameters were obtained. The electron transfer reaction of the surfactant-cobalt(III) complex ions was also carried out in the medium of various concentration of β-cyclodextrin. β-cyclodextrin retarded the rate of the reaction for phenantroline and bipyridine substituted complexes by the inclusion of long chain amine of the complexes into its cavity.

Chapter V explains the outer-sphere electron transfer reaction between Fe(CN)$_6^{4-}$ and the following surfactant-cobalt(III) complex ions in the self-micelles formed from these surfactant-cobalt(III) complex molecules themselves.

- cis-[Co(en)$_2$(C$_{12}$H$_{25}$NH$_2$)$_2$]$^{3+}$
- cis-α-[Co(trien)(C$_{12}$H$_{25}$NH$_2$)$_2$]$^{3+}$
- cis-[Co(bpy)$_2$(C$_{12}$H$_{25}$NH$_2$)$_2$]$^{3+}$
- cis-[Co(phen)$_2$(C$_{12}$H$_{25}$NH$_2$)$_2$]$^{3+}$

The rate constant of the outer-sphere electron transfer reaction increases with increase in initial concentration of these surfactant complexes. This can be due to the aggregation of these metal complexes in their own self-micelles. With increase in initial concentration of the surfactant-cobalt(III) complexes the number of micelles present in the medium also increases. In these micelles the reactants are
encountered in a small volume of Stern-layer of the micelles leading to enhancement of concentration of reactants at the microlevel leading to higher rate and lower activation energy. The reaction has also been carried out in the presence of β-cyclodextrin. We have observed that the second order rate constant decreased with increase in the concentration of cyclodextrin in the medium. This is attributed to the inclusion of the long aliphatic chain present in one of the ligands of our complexes into the cavity of cyclodextrin thereby breaking of micelles leading to lowering of rate constant.