In the present thesis, the settling and rheological behaviour of magnetite ore suspensions are studied in aqueous CMC and guar gum solutions to investigate the effects of different parameters on them. The data obtained from experimentation are suitably tailored to build data-driven mathematical models for drag coefficient-particle Reynolds number relationship \( (C_D-\text{Re}_P) \), suspension rheological behaviour, concentration effects on suspension viscosity and artificial neural network (ANN) models to approximate shear stress-shear rate relationship and the relative viscosity of the suspensions. This thesis is structured as follows:

Chapter 1 provides a brief overview of the solid-liquid suspensions, their settling and rheological behaviours and parameters which govern them. Introduction of ANN is given and objectives of the thesis and thesis outline are stated in this chapter.

The chapter 2 is the discussion of the previous work by other researchers. In this chapter earlier studies of the effects of solids concentration and wall effects on the settling behaviour of suspensions are described. The \( C_D-\text{Re}_P \) relationships proposed by earlier workers are presented. Investigations of other workers and their recommendations are discussed. This chapter includes discussion on rheological properties of the suspensions, the rheological behaviours and different rheological models. Further effects of system parameters like solids concentration, particle size and temperature on suspension viscosity are discussed. Different dispersants are also discussed. The chapter concludes with the discussion on applications of artificial neural networks in various fields of chemical engineering.

The third chapter gives the overview of the theory of different forces acting the particles, settling velocity and the \( C_D-\text{Re}_P \) relationships for the suspensions. The rheological behaviour of suspensions and various mathematical equations used to describe the suspension behaviour are presented in this chapter. Here ANN structure and its development, main components, training and practical aspects of neural computing are introduced.
Chapter 4 gives detail information of the materials and methods used for experimental work of this thesis. Here the properties of the material, experimental set-up and procedure are discussed.

Chapter 5 is the discussion on findings of experimental investigations, its analysis and various models used to fit the experimental data. Effects of dispersant concentration, solids concentration and particle size on the settling of the suspensions are discussed here. The mathematical formulation to calculate particle Reynolds number and drag coefficient of settling particles and the $C_D$-$Re_P$ relationship obtained are presented. The rheological nature of the suspensions under consideration, effect of particle size and solids concentration on suspension rheology is discussed and effect of temperature on suspension viscosity is also presented in this chapter.

Model fitting for suspension rheology and concentration effects on suspension viscosity is presented in the last part of the chapter. Reported constants of different models used to fit the data are obtained by curve fitting and using the Mathematica-4.1 software. The development of artificial neural network model for the prediction of the suspension rheology and relative viscosity their results and comparison with other models is discussed in last section of this chapter.

Finally, the sixth chapter of this thesis provides a summary of important results and conclusions drawn from the experimental investigations and model fitting.