SUPPLY CHAIN MANAGEMENT is critically important in producing and delivering goods and services in a cost-effective, timely manner. Inventory has been and continues to be the lifeblood of supply chains. An inventory problem is a problem in making optimal decisions with respect to inventory systems. In other words, an inventory problem is concerned in making decisions that minimize the total cost of an inventory system. The approach in this thesis is based on modeling of the inventory problems and finding out the optimal replenishment policy by using optimization techniques. In this thesis, number of inventory models are developed under static and dynamic environments. The demand is assumed to be static or stock dependent or time dependent or sensitive to selling price. Inventory models with finite and infinite planning horizon under inflation are developed. The concept of deterioration plays a vital role and is taken into account. Deteriorating items and non-instantaneous deteriorating items with shortages or without shortages are considered. When shortages occur, they are partially backlogged and this backlogging rate may be waiting time-dependent. The necessary and sufficient conditions for the existence and uniqueness of the optimal solutions are also provided. An inventory model with variable holding cost, with setup cost reduced through additional capital investments is developed. Capital investment to develop the quality level of the product is also considered. Further, we also develop an inventory model by employing postponement strategy with trade credit period to prove that postponement system can outperform independent system. Suppliers
usually offer permissible delay period to their customers. To be more realistic, this concept is also taken into account while framing the models. A two stage integrated vendor-buyer supply chain model is framed in which the supplier offers freight rate discounts and trade credit period. In this model, the trade credit and freight rate are simultaneously linked to the order quantity. In general, algorithms and solution procedures are designed for all the developed models to find the optimal solutions. Numerical illustrations aid in demonstrating theoretical results and solution procedure.