Abstract

In the present day economy, most of the people are conscious about the expenditure of their daily needs. They usually try to apply the science in their daily life as far possible and try to get a financial benefit. Though the inventory management had come to meet up the special needs of Second World War, but nowadays, its necessity is felt almost everywhere in all the branches of science as well as human society. Using inventory management science one can run a business in a more profitable manner. With this view point, many research papers have been published. But in this thesis, we are trying to give some modern views instead of traditional view of characterizing different inventory models. Some of the traditional views about inventory management are: different cost-coefficients are constant, all the parameters involved in the inventory system are deterministic etc. and even any inventory system can be predictable properly without the loss of total information that is captured over it. But the modern views over it are: different cost coefficients may not be constant, all the parameters involved in the inventory system may not be deterministic and even some inventory system can not be predictable properly without the loss of total information. The inventory management system which focuses the modern view is called Fuzzy Inventory Management. Keeping this idea in mind, we have discussed some inventory models using some parameters as fuzzy numbers. Throughout the thesis, we have discussed various inventory models using the deterioration rate, demand rate, production rate, the cost coefficients, lead time etc. as fuzzy parameters. The defuzzification is made using the extension principle, or the signed distance method or the concept of graded mean integration representation method based on fuzzy numbers. The first chapter of the thesis is devoted to discuss the inventory management system, a historic overview of literature survey and a simple idea of fuzzy sets and systems.

In chapter 2, we investigate an economic production quantity (EPQ) inventory model with finite production rate, fuzzy demand rate and fuzzy deterioration rate. The effect of loss of production quantity due to old/faulty machines, manufacturing defect etc. have also been taken into consideration. Three different fuzzy models

have been proposed. To derive the estimate of the fuzzy total cost, we have used the concept of signed distance method. Numerical examples are provided to illustrate the computational procedure. The effect of changes in different parameters on the decision variables have been analyzed.

Chapter 3 deals with problem of determining the economic order quantity (EOQ) in the fuzzy sense. The imprecise parameters of demand, lead-time and inventory costs are expressed through linear/non-linear membership functions. These are represented by different types of membership functions, linear or quadratic, depending upon the prevailing supply condition and marketing environment. These fuzzy parameters are then converted into appropriate interval numbers and using the interval mathematics, the objective function for average cost is changed into equivalent multi-objective functions. To obtain the solution of this equivalent problem, we have used fuzzy programming technique. Solution procedure is demonstrated with the help of numerical examples. Lastly, to study the effect of decision variables on changes of different parameters, a sensitivity analysis is also presented.

In Chapter 4, we investigate a group of computing schemas for joint economic lot size as fuzzy values of the economic lot size model for purchaser and vendor. We express the fuzzy order quantity / production lot size for the purchaser / vendor as the normal triangular fuzzy number (q_1, q_0, q_2) and then we solve the aforementioned optimization problem under the condition $0 < q_1 < q_0 < q_2$. We find that, after defuzzification, the joint total relevant cost is slightly higher than in the crisp model.

In chapter 5, a fuzzy production lot-size inventory model with a permissible delay in payments is developed by assuming that the demand rate and the production rate are triangular fuzzy numbers and the items deteriorate at a constant rate θ. The expressions for the average inventory cost both in the crisp sense and fuzzy sense are derived. The fuzzy model is defuzzified using fuzzy extension principle and its optimization with respect to the decision variables is carried out. The computation procedure is explained with the help of a numerical example. Sensitivity of the optimal solution to changes in parameter values is examined.

Chapter 6 deals with the problem of determining the economic order quantity for deteriorating items in the fuzzy sense where delay in payments for retailer and customer are permissible and generalizes the earlier published results in this direction. The demand rate, holding cost, ordering cost and purchasing cost are taken as fuzzy numbers. It is also assumed that the supplier would offer the retailer a delay period for payment and the retailer would also offer the trade credit period to the customer. The total variable cost in fuzzy sense is defuzzified using Graded Mean Integration Representation method. Then we have proved that the defuzzified total variable cost is convex, that is, unique solution exists. For determination of optimal ordering policies, we have developed some algorithms. Finally, the theorems and the algorithms are illustrated with the help of numerical examples.

In chapter 7, a production lot-size inventory model for deteriorating items with a permissible delay in payments for retailer and customer is developed by assuming that the cost coefficients are triangular fuzzy numbers. We also assume that the supplier would offer the retailer a delay period for payment and the retailer would also offer the trade credit period to the customer. The expressions for the average inventory cost both in the crisp sense and fuzzy sense are derived. The total variable cost in fuzzy sense is defuzzified using Graded Mean Integration Representation method and it has been proved that there exists a unique optimal cycle time to minimize the total variable cost per unit time. Then, a theorem is presented to determine the optimal ordering policies. For easy determination of optimal ordering policies, we have proposed three algorithms. Some previously published results of other authors are special cases of our model discussed in this chapter. Finally, the theorem and the algorithms have been explained with the help of numerical examples.

In chapter 8, an effort has been made to analyse an EOQ model for deteriorating items with shortage under inflation where the demand rate is a ramp type function of time. In this chapter, we have introduced fuzzy multi-objective mathematical programming technique with triangular fuzzy number as cost coefficients. Pareto optimal solution of this multi-objective mathematical programming is established. Numerical example has been provided to illustrate the problem. Sensitivity analysis is carried out to identify the most sensitive parameters in the system.

Lastly, chapter 9 is devoted to give conclusion of the thesis along with a scope of future works in the context of the present study.

Keywords: Fuzzy inventory model, Signed distance, Fuzzy demand rate, Fuzzy deterioration rate, Membership function, Extension principle, Fuzzy order quantity / production lot size, Trade credit, Permissible delay period, Graded mean integration representation, Generalized fuzzy number, Fuzzy cost coefficients, Ramp type demand, Multi-objective programming, Fuzzy programming technique.