Chapter 12

Summary and Future Research Work

12.1 Summary of the Thesis

In this dissertation, some imperfect production inventory models are formulated and solved in crisp, stochastic, fuzzy and fuzzy stochastic environments. Major emphasis in this thesis has been given on the realistic model formation in crisp, stochastic, fuzzy and fuzzy stochastic environments. Here, nine virgin imperfect production inventory models have been presented. The models are solved applying new/modified methods and these are numerically illustrated with some data.

Part II of the thesis contains Chapter 3 in which an imperfect production inventory model with production rate dependent defective rate and advertisement dependent demand in crisp environments has been developed. In this model we consider different production rate and screening rate.

In Part III, through Chapter 4, 5 & 6 three different types of imperfect production inventory models in stochastic environments have been presented. In Chapter 4, multi item imperfect production inventory model with promotional demand in random planning horizon has been illustrated. In this model, the demand rate depend on both selling price and advertisement. In Chapter 5, a deteriorating manufacturing system is considered with inspection errors. In this model, the demand rate depends on discount and warranty period. In Chapter 6, two layers supply chain in an imperfect production inventory model with two storage facilities under reliability consideration has been described. In this model, the defective rate depends on both production rate and time. Rework of imperfect item has been considered in all models in this part.

In fourth part containing Chapter 7, 8 & 9, there are presented three different types of imperfect production inventory models in fuzzy environments. In Chapter 7, three-layer
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Supply chain in an imperfect production inventory model with two storage facilities under fuzzy rough environment has been developed. Here, the demand of the customers is considered as stock dependent. Chapter 8 discusses an imperfect production inventory model based on fuzzy differential and fuzzy integral method. In Chapter 9, controlling GHG emission from industrial waste in two plant production and reproduction inventory model with interval valued fuzzy pollution parameters has been discussed.

Fifth part contains Chapter 10 & 11 which discuss two different types of imperfect production inventory models in fuzzy stochastic environments. In Chapter 10, multi-item EPQ model with shortages, rework and learning effect on imperfect production over fuzzy-random planning horizon has been developed. In Chapter 11, two layers supply chain imperfect production inventory model with fuzzy credit period, time and production rate dependent imperfectness has been discussed. In this model, the demand rate of the customers is considered as stock dependent and credit period. Rework of imperfect item has been considered all models in this part.

In this thesis, several new techniques or existing techniques in modified forms have been developed and implemented to solve the above mentioned imperfect production inventory models. These methods are: Generalized Reduced Gradient (GRG) technique, Genetic Algorithm (GA), Population Varying Genetic Algorithm (PVGA), Multi-Objective Genetic Algorithm (MOGA), Fuzzy Simulation Based Genetic Algorithm (FSGA), Possibility/ Necessity/ Credibility representation, Solution of Fuzzy Differential Equation (FDE), Fuzzy Programming Technique (FPT).

In this thesis, some statistical tests have been developed and implemented to above mentioned imperfect production inventory models. These test are: ANOVA test for comparison of means in Chapter 4, Fishers 't test for Comparison of two means in Chapter 8.

12.2 Future Research Work

There are lot of scopes to improve the production inventory models of this thesis.

In Chapter 3, the proposed model can be extended in several ways such as. First, one can extend this model for stock dependent demand, probabilistic demand. Second, this model can be generalized by considering two level credit policy. Third, this model can be extended to fuzzy demand rate and fuzzy percentage of defective products.

In Chapter 4, the proposed model investigates a multi-item imperfect production inventory model with promotional effort over random planning horizon and the proposed model is solved via Population Varying Genetic Algorithm (PVGA). This model can be extended in fuzzy and/or fuzzy-stochastic environment instead of stochastic (random)
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planning horizon. Moreover, the randomness of the horizon also can be proposed with other continuous distribution. The items also can be treated as breakable or damageable, etc. Thus, the scope for future work includes rigorous testing of this model with real and simulated data.

In Chapter 5 & 6, the model can be extended further considering the uncertain demand which is the limitation of our model; the stock out situation at each stage of the chain may be incorporated further. Moreover, multi-retailer levels may also be introduced in the model.

In Chapter 8, the proposed work can be extended to the rough, fuzzy-rough, random, fuzzy-random environment taking constant part of screening cost, holding cost, set-up cost, etc.

In Chapter 9, the proposed model investigates GA approach for controlling GHG emission from industrial waste in two plant production and reproduction inventory model with interval valued fuzzy pollution parameters. This model can be extended multi item production inventory model in fuzzy stochastic environment instead of stochastic (random) planning horizon. The items also can be treated as breakable or damageable, etc. Thus, the scope for future work includes rigorous testing of this model with real and simulated data.

In Chapter 10, there are several interesting extensions to research work. First, more general distributions such as normal distribution, standard normal distribution, etc., for random time horizons can be considered. Another direction could be to consider fuzzy dependent demand, probabilistic demand, time-dependent demand, etc. Finally, we can consider the joint optimization of production, maintenance and quality with a two-level credit period policy.

In Chapter 11, we suggest several possible directions for future research. First, one may extend our considered EPQ model to joint optimization of expected total profit and carbon emission (i.e., maximize expected total profit and minimize carbon emission). Second, one immediate possible extension could be allowable shortages, cash discounts, etc. Finally, one can extend the fully trade credit policy to the partial trade credit policy in which a seller requests its credit-risk customers to pay a fraction of the purchase amount at the time of placing an order as a collateral deposit, and then grants a permissible delay on the rest of the purchase amount.

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