A facility layout is an arrangement of everything needed for production of goods or delivery of services. For a medium scale manufacturing system, the most important component is design of plant layout. Cellular type layout reduces material handling, movement time and waiting time.

The current research work is carried out in a medium scale organization which is engaged in manufacturing of planetary gear boxes. To cope up with the increasing demand, the company tried to increase its production rate by expanding its infrastructure. Still they are unable to satisfy the demand. Hence, the current work is devoted to find the causes and remedies of the problem. The identified problems are Poor Inventory Management, Unorganized flow of material and inefficient assembly shop layout.

Considering these problems, the main objective of the research is defined as reduction in manufacturing cost and increase in productivity and production with separation of assembly process from manufacturing processes, effective inventory management, smooth flow of material, reduction in material handling cost and time and optimization of the utilization of all available resources.

The problems, their solutions and the problem solving methodology are discussed in the thesis through 8 chapters.

Chapter 1 introduces identification and selection of the problem with detailed objectives. It also provides a brief introduction of the company where the current work is carried out and the company’s current working practices. The chapter also throws some light on the expected outcomes.

Chapter 2 presents up to date information regarding the existing literature spread over a period of nearly last three decades. About 100 papers
published in national and international journals are studied. The literature review involves study of selective inventory control techniques, inventory management techniques, clustering algorithms, layout generation techniques, methods of comparison of layouts and optimization techniques.

Chapter 3 discusses scientific classification of inventory items and inventory management. The company needs hundreds of components to be fitted in a gear box. The unit price, demand, availability of each component is different. Observations of existing inventory system show that sometimes items are ordered in excess while sometimes there is scarcity. This situation may lead to severe loss of business. This necessitates installation of scientific inventory control system which starts with classification of inventory items.

As the organization is mainly interested in reducing inventory cost, the items are classified using A-B-C analysis. At the same time, the demand of items is not uniform. Hence they are classified according to X-Y-Z analysis also. Six lot sizing techniques viz. lot for lot, Economic Order Quantity, Period order quantity, Least Unit Cost, Least Total Cost, Least Period Cost and Wagner Whitin algorithm are applied to all the classes. The Wagner Whitin algorithm returns minimum inventory cost in majority of the cases. For remaining items, existing method is giving minimum total inventory cost. Hence W-W algorithm is applied to all the items and thus total inventory cost is reduced by nearly 33%.

Chapter 4 reveals development of new clustering algorithm. A simple yet effective algorithm for formation of manufacturing cells is explained step by step. The algorithm is validated by applying it to numerous benchmark problems presented in literature. The results are compared using widely accepted performance measures. The performance measures used for comparison are number of exceptional elements, machine utilization, grouping efficiency and grouping efficacy. The results are way better than the existing cell formation algorithm.

In current research work, the cellular manufacturing concept is applied in nontraditional way. Instead of forming cells within a plant, each company location is treated as a cell. Chapter 5 presents application of the validated algorithm to existing situation which involves three parameters: components, locations and processes. All grouping options are considered and 26 components are grouped to form three groups. Using assignment problem, these
three groups are allocated to three locations. The results show that proposed algorithm reduces the transportation by nearly 30%.

The components get processed through three locations and three vendors and come to assembly shop for assembly work. The redesign of the assembly shop layout using systematic layout planning and other techniques is discussed in chapter 6. Total 7 layouts are generated using layout generation techniques such as flow process chart, relationship chart, simulated annealing algorithm, minimum spanning tree algorithm and different flow patterns.

Chapter 7 discusses simulation. The layouts generated are simulated for one week using WITNESS simulation software. Best layout is found out using the statistics returned by the software. The statistical parameter used for comparison are % idle time, % busy time, total distance traveled and cycle time.

These layouts are compared using combined AHP-TOPSIS in chapter 8. Qualitative as well as quantitative criteria are identified. The hierarchy of criteria is developed using AHP and the layouts are ranked using TOPSIS. The simulation results are in line with the results obtained through AHP-TOPSIS.

Chapter 9 discusses the results qualitatively as well as quantitatively along with concluding remarks. Chapter 10 briefs about research contributions and future scope. The references at the end show the literature used.

Thus redesign of a plant layout for increasing the productivity is achieved through integrating key areas of inventory management, cellular manufacturing, layout planning, simulation and optimization.