Schedule optimization plays an important role in well designed and efficient manufacturing systems to fulfill global business needs. Intelligent utilization of resources to improve efficiency of the manufacturing system is a complex combinatorial job shop scheduling problem. For each job in a job shop scheduling problem, there is a sequence of operations, which needs to be processed without interruption on a given machine for a given period of time. More than one operation of the same job cannot be processed concurrently. The objective of job shop scheduling problem is to find a feasible schedule that minimizes the makespan, i.e. completion time required to get the finished product. Job shop scheduling problem is one of the hard combinatorial optimization problems. Hence, techniques to efficiently solve job shop scheduling problems are an important area of research.

In recent years, much attention has been given to solve combinatorial optimization problems like job shop scheduling using meta-heuristic approaches and in most domains, no single meta-heuristic method dominates. Hence, it is desirable to gain the collective power of a set of meta-heuristics like ant colony optimization and tabu search. This thesis proposes algorithms based on ant colony optimization, tabu search and a hybrid algorithm comprising the abilities of the first two algorithms. Algorithm, based on ant colony optimization, analyzes various priority rules and tunes up
different parameters used in the approach of ant colony optimization. The algorithm also analyzes new and different pheromone updating strategies employing a step interval value to decide updating and finds a strategy that generates far superior results among others.

Algorithm, based on tabu search, analyzes different neighborhood structures and finds the best one. The algorithm introduces new dynamic tabu length strategy that divides total iterations into several ranges and employs different control variables to change the length of tabu list. The main objective of this thesis is to propose an algorithm as a hybrid version, which employs parameters and strategies tuned up and found in the first two algorithms. The hybrid algorithm selects a neighborhood solution using a state transition rule that employs better heuristic information available in start and end operations of a neighbor. The hybrid algorithm uses reinforcement-learning approach that records past performance of a neighbor in terms of pheromone level. Computational results have shown that the proposed hybrid approach, using tabu search with strategies of ant colony optimization, can produce superior solutions compared with existing approaches.