ABSTRACT

In the present scenario, manufacturing is done through Cellular manufacturing. Cellular manufacturing is an application of group technology, in which dissimilar machines or process has been aggregated into cells, each of which is dedicated to the production of a part or part family. In this thesis, the basic manufacturing concept is proposed for a struggling manufacturer with limited conventional resources, providing an alternative solution to cell formation by implementing Nagare cell concept. It is a Japanese concept with more objectives than cellular manufacturing system. It combines manual and semiautomatic machine layout as cells, and results maximum output flexibility for all kind of low to medium and medium to high volume productions. The solution adopted is to create a dedicated group of conventional machines, all but one of which is already available on the shop floor. It provides the advantages like the flexible output, with one or more operators working simultaneously to gain low capital expenditure, high labor productivity, minimal work in progress, and shorter lead time. The development of Nagare cell design attempts to bring out man, machine and materials into a product with the aim of eliminating the intercellular movements and maximizing the operator efficiency via continuous improvement to meet the customer demand per day.
This thesis focuses on the development of modified Shortest Processing Time (SPT) heuristic scheduling algorithm with the objective of minimizing makespan and idle time of machine. In this proposed algorithm, summation of processing time of all products in each machine is calculated. Then the sum of processing time is sorted by shortest processing time rule to get the assignment schedule. Based on the resultant assignment schedule Nagare Cell layout is arranged for the manufacturing. This algorithm also provides steps to determine the product ready time, machine idle time and product idle time. Conventional methods of solving scheduling problems based on priority rules still result new schedules, sometimes, with significant idle times. To optimize the proposed work, industrial problems of Nagare cell manufacturing system are consequently compared with scheduling heuristics of Gupta’s heuristics, RA heuristics, Palmer’s heuristics and, CDS heuristics. Gantt charts are also generated to verify the effectiveness of the proposed approach.

The simulation part for the proposed scheduling problem is carried out in two ways by visual basic model and ARENA simulation package. Firstly a deterministic visual basic model has been developed for Nagare cell scheduling problem. The execution of deterministic visual basic model allows computing, performance measures starting from initial global state and going into a desirable final state(s) of the product flow. A visual basic simulator with graphical user interface to monitor execution of the sequence of tasks on
machines is dynamically designed too. Further this deterministic visual basic model has been developed and implemented for Nagare cell manufacturing systems. Secondly ARENA simulation helps to take right decisions at appropriate time of production by predicting the production bottlenecks, work in-process inventory, resource utilization and feasible schedules. In addition, simulation offers flexibility in the production planning and scheduling and also offers visualization of activities through dynamic graphs, plots, tables etc. Additions or modifications of resources could be incorporated and effect the production system through animation and graphics before introducing them in the real production system with the objective of minimizing the cycle time, NVA time, WIP, and total time. Further this work explains the use of simulation technique for helping the decision maker to have all details about resource analysis and make scientific decisions.