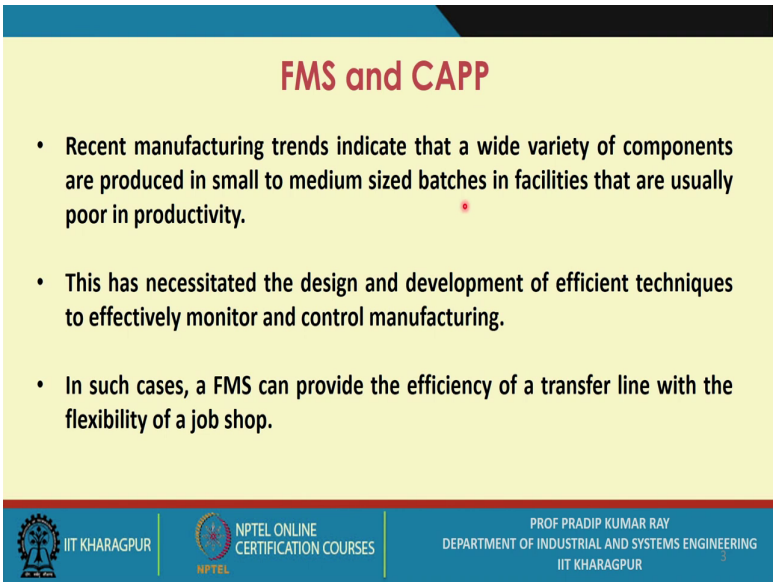
Automation in Production Systems and Management
Prof. Pradip Kumar Ray
Vinod Gupta School of Management
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Automated CAPP (Part-II)
Lecture - 57
FMS and CAPP

In the context of the developing an automated system, we have discussed in detail the FMS a Flexible Manufacturing System and the various types of the parts are required to produce in an FMS. For all these varieties of parts process plan should be known and it will be better that if the CAPP matches with FMS perfectly.

The relationship between FMS and CAPP must be known. During this lecture session, some of the important issues related to this relationship will be discussed.

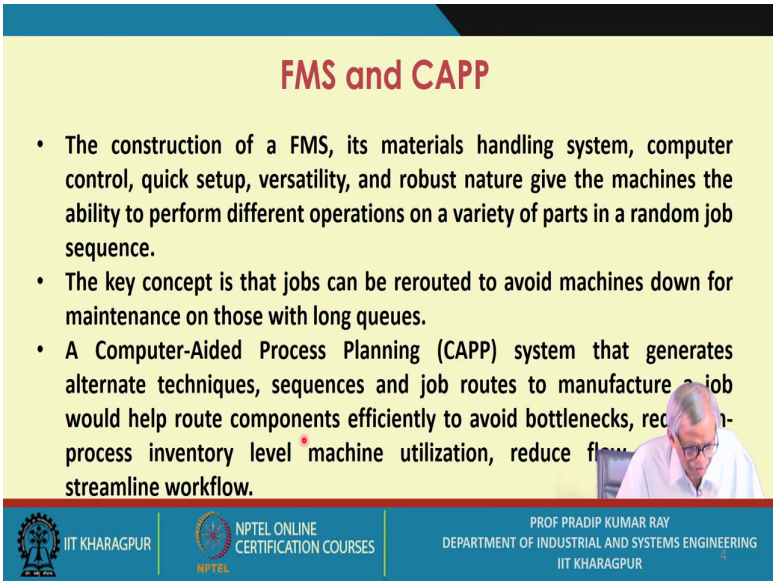
(Refer Slide Time: 04:11)



Recent manufacturing trends indicate that a wide variety of components are produced in small to medium sized batches in facilities that are usually poor in productivity. This has necessitated the design and development of efficient techniques to effectively monitor and

control manufacturing. In such cases, a FMS can provide the efficiency of a transfer line with the flexibility of a job shop.

(Refer Slide Time: 09:18)



The construction of an FMS, the materials handling system could be the automated storage and retrieval system also is part of that. Computer control, quick setup. So, whenever we refer to quick setup sometimes, we refer to one particular Japanese technique, quick setup or accelerated setup.

Accelerated setup aspect means, setup should be as minimum as possible.

The Japanese organizations have developed one particular system which is referred to as related to accelerated setup also as a single minute exchange of dice, SMED. The setup is around 700 hours or 70 hours such cases are there. Can you just reduce it from 7 hours to 7 minutes? A negligible set up.

You will be referring to internal setup, external setup, usually the external setup is spent 90% of the time. Remove the external setup elements as far as possible and then only you will be dealing with the internal setup.

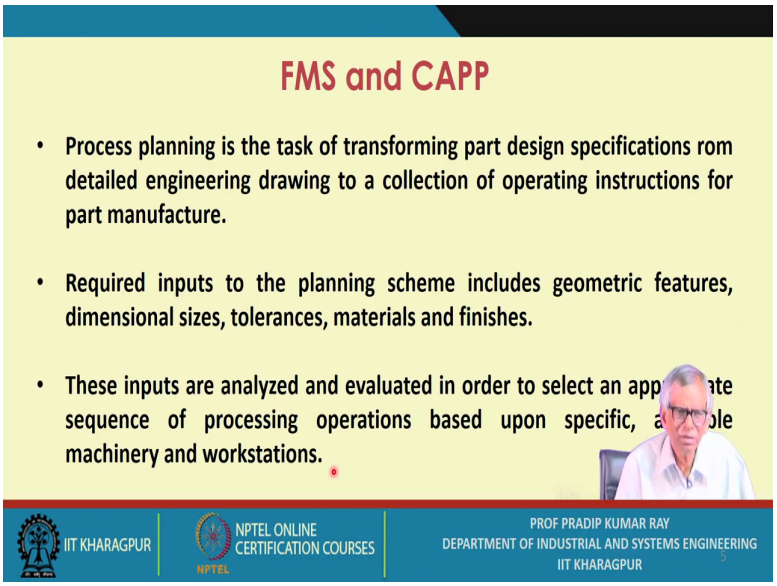
If you remove the external setup you concentrate only on the internal setup and you try to reduce the internal setup elements. The capability to perform different operations on varieties of parts.

The construction of a FMS, its materials handling system, computer control, quick setup, versatility, and robust nature give the machines the ability to perform different operations on a variety of parts in a random job sequence.

The key concept is that jobs can be rerouted to avoid machines down for maintenance on those with long queues.

A Computer-Aided Process Planning (CAPP) system that generates alternate techniques, sequences and job routes to manufacture a job would help route components efficiently to avoid bottlenecks, reduce in-process inventory level machine utilization, reduce flow time and streamline workflow.

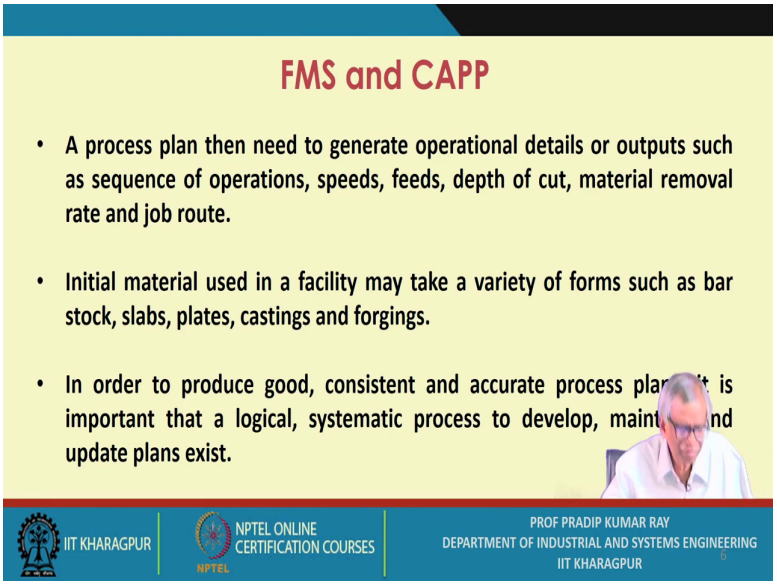
(Refer Slide Time: 17:29)



Process planning is the task of transforming part design specifications rom detailed engineering drawing to a collection of operating instructions for part manufacture. Required inputs to the planning scheme includes geometric features, dimensional sizes, tolerances, materials and finishes. These inputs are analyzed and evaluated in order to select an

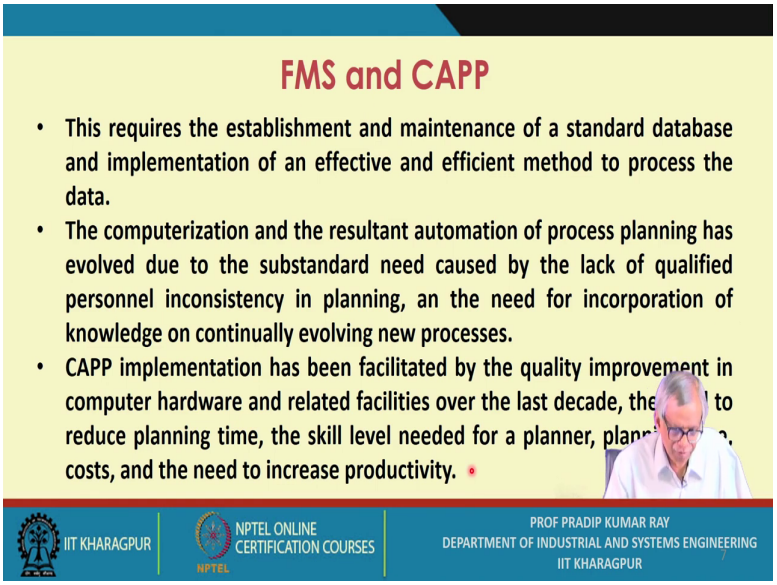
appropriate sequence of processing operations based upon specific, available machinery and workstations.

(Refer Slide Time: 20:24)



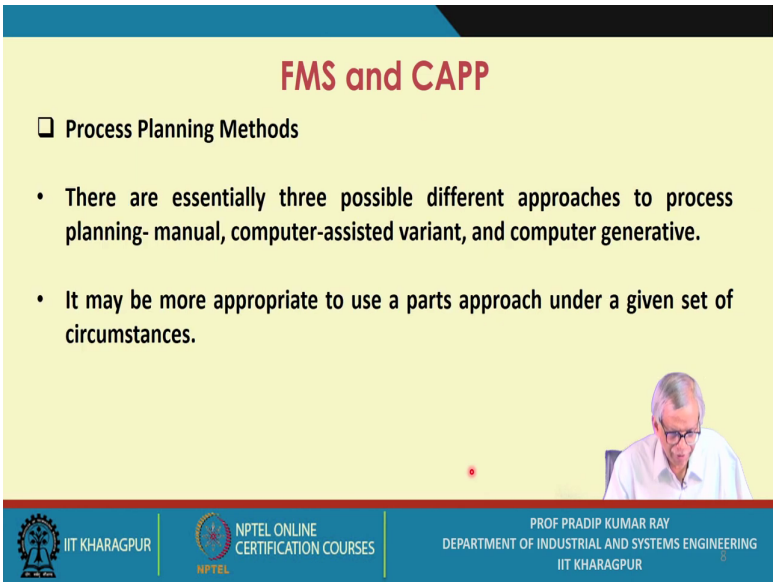
A process plan then need to generate operational details or outputs such as sequence of operations, speeds, feeds, depth of cut, material removal rate and job route. Initial material used in a facility may take a variety of forms such as bar stock, slabs, plates, castings and forgings. In order to produce good, consistent and accurate process plans, it is important that a logical, systematic process to develop, maintain and update plans exist.

(Refer Slide Time: 24:31)



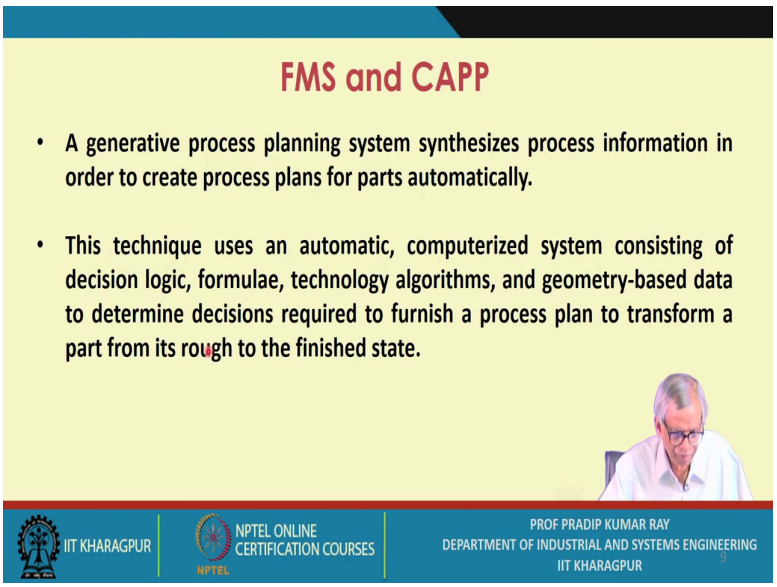
This requires the establishment and maintenance of a standard database and implementation of an effective and efficient method to process the data. The computerization and the resultant automation of process planning has evolved due to the substandard need caused by the lack of qualified personnel inconsistency in planning, the need for incorporation of knowledge on continually evolving new processes. CAPP implementation has been facilitated by the quality improvement in computer hardware and related facilities over the last decade, the need to reduce planning time, the skill level needed for a planner, planning time, costs, and the need to increase productivity.

(Refer Slide Time: 27:23)



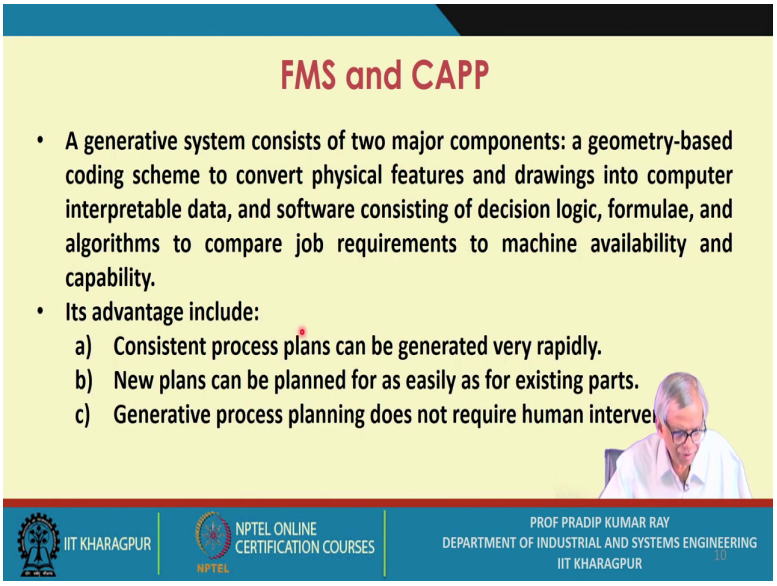
In the process planning methodsThere are essentially three possible different approaches to process planning- manual, computer-assisted variant, and computer generative. It may be more appropriate to use a parts approach under a given set of circumstances.

(Refer Slide Time: 27:52)



A generative process planning system synthesizes process information in order to create process plans for parts automatically. This technique uses an automatic, computerized system consisting of decision logic, formulae, technology algorithms, and geometry-based data to determine decisions required to furnish a process plan to transform a part from its rough to the finished state.

(Refer Slide Time: 28:33)



A generative system consists of two major components: a geometry-based coding scheme to convert physical features and drawings into computer interpretable data, and software

consisting of decision logic, formulae, and algorithms to compare job requirements to machine availability and capability. Its advantage include:

a) Consistent process plans can be generated very rapidly.

b) New plans can be planned for as easily as for existing parts.

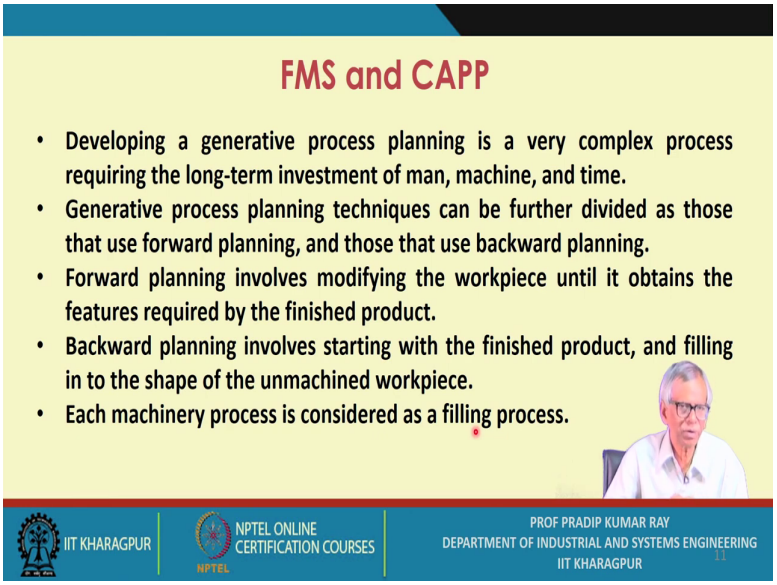
c) Generative process planning does not require human intervention.

(Refer Slide Time: 29:14)

It is 100% automated one; it is a very complex process requiring long term investment of man, machine and time. The generative process planning techniques can be further divided as forward planning.

Forward planning involves modifying the work piece until it obtains the features required by the finished product. Whereas, backward planning involves the starting with the finished product and you go backward and filling in to the shape of the unmachined workpiece. These two approaches may be adopted in certain cases may be forward planning is better. And in certain other cases, a backward planning is better. So, each machinery process is considered as a filling process

(Refer Slide Time: 30:40)



Developing a generative process planning is a very complex process requiring the long-term investment of man, machine, and time. Generative process planning techniques can be further divided as those that use forward planning, and those that use backward planning. Forward planning involves modifying the workpiece until it obtains the features required by the finished product. Backward planning involves starting with the finished product, and filling in to the shape of the unmachined workpiece. Each machinery process is considered as a filling process.