Automation in Production Systems and Management
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Lecture - 11
Product Development Process: Approaches and Stages

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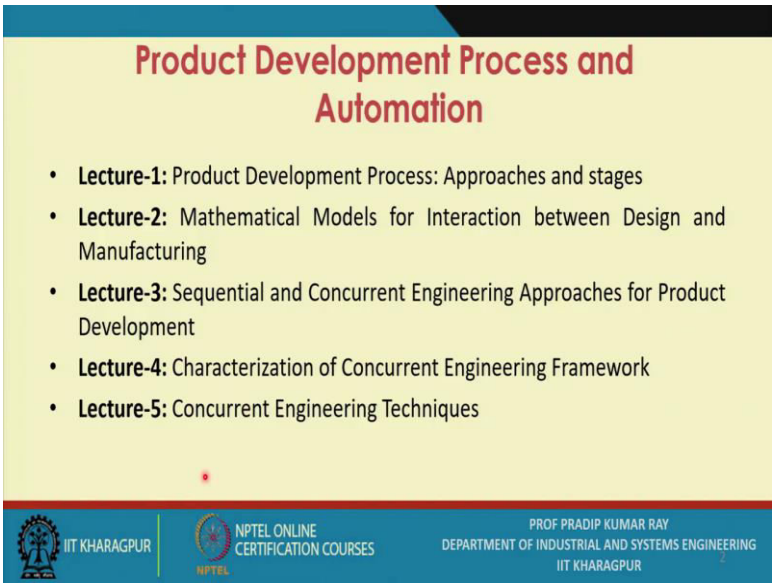

Now, during the current week we are going to discuss Product Development Process and Automation.

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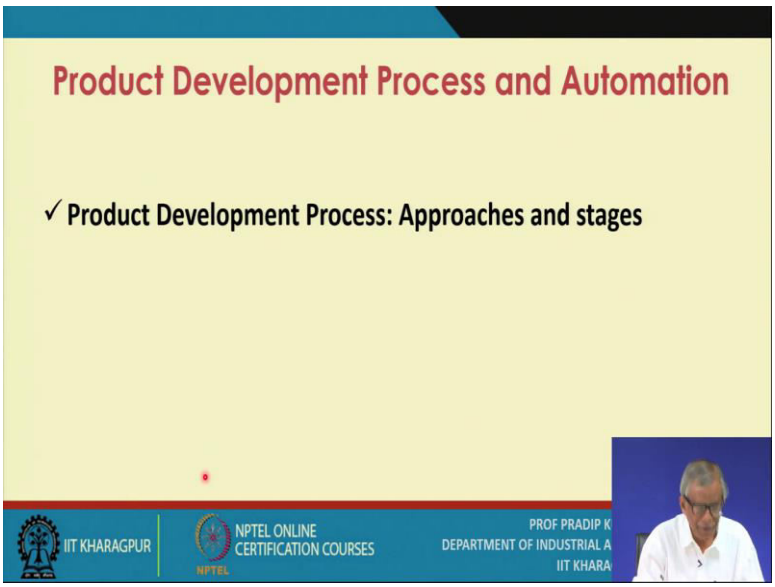

let us discuss the product development process and its approaches and its stages.

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Product development or product development process has three important stages or three important activities, first is product design, second is process design and third is manufacturing.

The product development process in a company is one of the important activities that is primarily responsible for its long-term survival and sustainability in the market. The entire process of product development consists of several steps to be followed in sequence in traditional approaches. What are these stages?

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This process typically requires the persons involved may be able to communicate freely and effectively among themselves, for product development process to be effective you need to have team and it is a group activity, which means related to several activities or related to different processes involved in product development, that we emphasise on data collection, problem solving and suggestions for improvement in products, processes and manufacturing.

The main objective is to improve communication between manufacturing top management group, the designers, the suppliers and the customers on a continuous basis. To become successful in product development in the long term, the company is required to establish a collaborative and multidisciplinary approach for product development.

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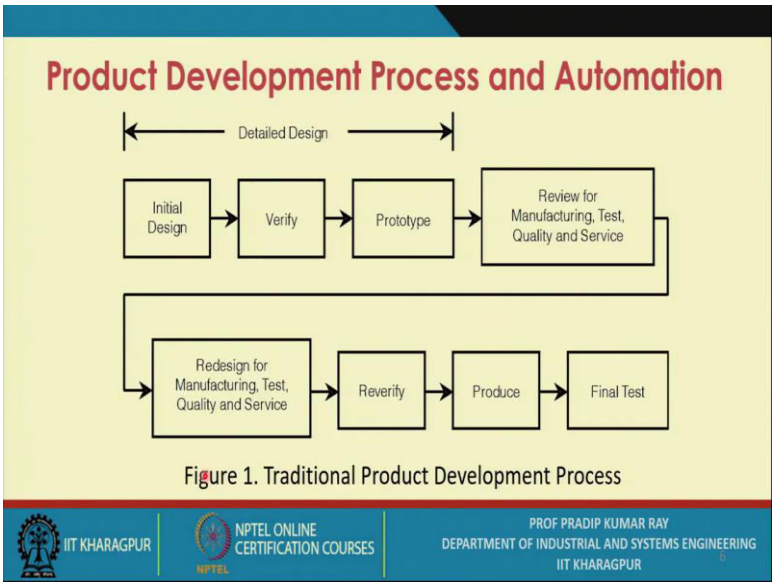

Figure 1. Traditional Product Development Process

This particular figure 1. is trying to highlight all the important activities related to product development process and this is a traditional approach.

There should be initial design and once the initial design of the product is accepted then, you need to verify the design and for verification of design, after that you must go for prototype or prototyping.

Once prototype is made and then there should be testing of the prototype. During this stage, you review its manufacturability, testability, quality and serviceability. These are the four main important issues.

Now once you go for reviewing, in majority of cases you need to redesign the product. Then once the changes are made in the design then again you have to reverify.

Once the verification results are accepted, now actual production of the product is done, final testing of product is done at last. This is the traditional product development process.

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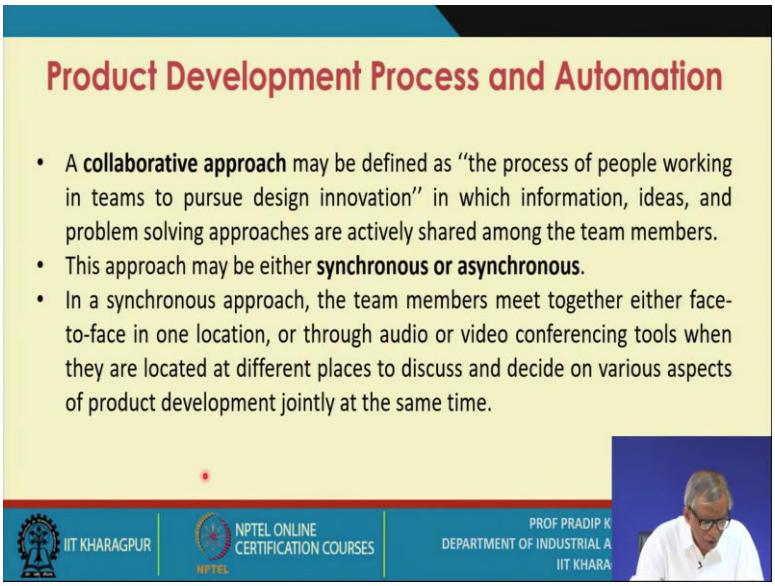

There must be a collaborative approach, because whenever we talk about the automation, one important condition that you have to fulfil is called integration followed by automation.

A **collaborative approach** may be defined as ‘‘the process of people working in teams to pursue design innovation’’ in which information, ideas, and problem-solving approaches are actively shared among the team members. This approach may be either **synchronous or asynchronous**. In a synchronous approach, the team members meet together either face-to-face in one location, or through audio or video conferencing tools when they are located at different places to discuss and decide on various aspects of product development jointly at the same time.

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An asynchronous approach is where team members separately contribute to the respective aspects of product development at different stages and times. Usually this is a traditional approach and many times you will observe that the traditional approach is nothing but the sequential approach.

The coordinator of the team becomes responsible for decision making at different stages of the product development process. This is basically referred to as asynchronous approach.

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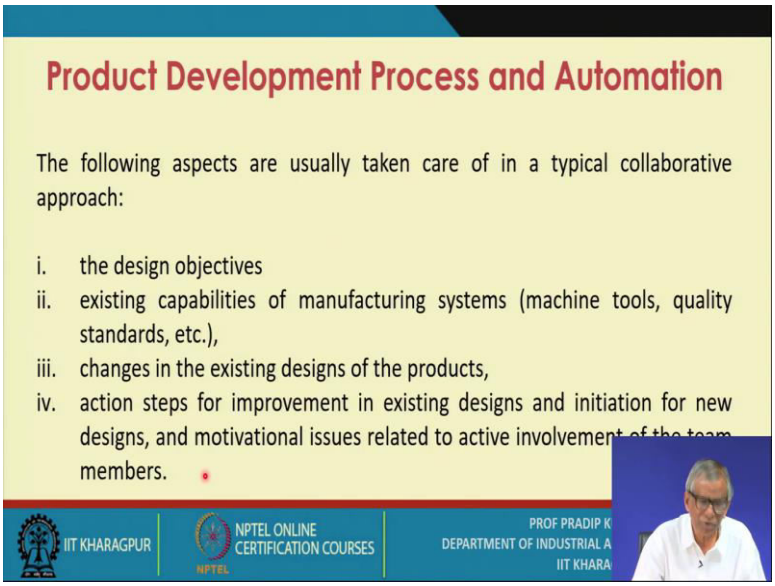

what are the important issues to be considered in a typical collaborative approach? First one is design objective that is number 1. Number 2 is existing capabilities of manufacturing systems.

What is capability? The ability to produce as per the specifications. The third important issue is changes in the existing design of the products. No design is referred to as a perfect design, that means, design improvement is always a possibility and that is why we never say the design has become fully matured.

The changes in the existing designs of the products will help the design become better and the performance of the product improves.

Action steps for improvement in existing designs, means what actually you are supposed to do for improving the design, what are the activities and initiation for new designs and motivational issues related to active involvement of the team members.

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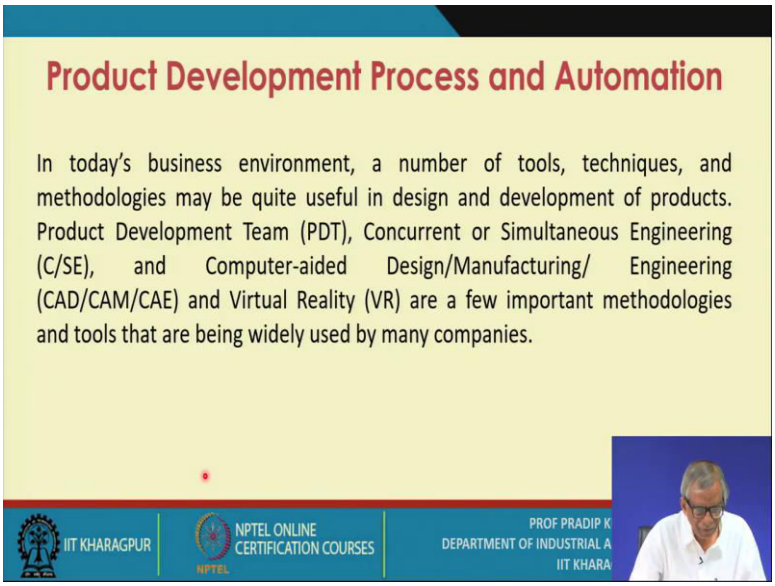

In today's context a number of tools, techniques and methodologies may be quite useful in design and development of products.

The Product Development Team that is one particular approach (PDT), Concurrent or Simultaneous Engineering and Computer Aided Design, Manufacturing, Engineering, the Computer Aided Design CAD, Computer Aided Manufacturing CAM and Computer Aided Engineering CAE and Virtual Reality are a few important methodologies and tools that are being widely used by many companies.

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What is this product development team? The objective of this approach is to organize the resources of a company into an integrated team for product development and is called integrated team and this team is responsible for designing, producing and delivering a product or a number of products to the existing or new customers.

The team is also accountable for delivering a quality product. And this quality product must be developed in such a way that its performance is acceptable to the customers, and the profitability of the company is also assured.

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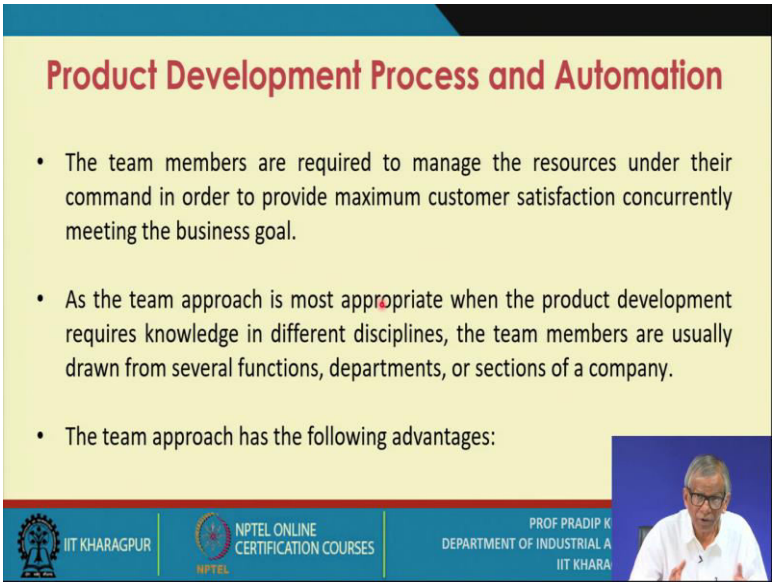

The team members are required to manage the resources under their command in order to provide maximum customer satisfaction concurrently meeting the business goal.

As the team approach is most appropriate when the product development requires knowledge in different disciplines, the team members are usually drawn from several functions, departments, or sections of a company.

The team approach has the following advantages:

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1. It ensures that the product design is compatible with manufacturing or service capabilities, and life cycle requirements are most likely marketable with a competitive price.

2. It helps speed up the whole design process including its delivery and service as an integrated approach through team work.

3. It enables communication and collaboration between personnel in different organizations, functional areas, disciplines, and locations at different phases of the product development.

4. There may be significant control on the external product cost.

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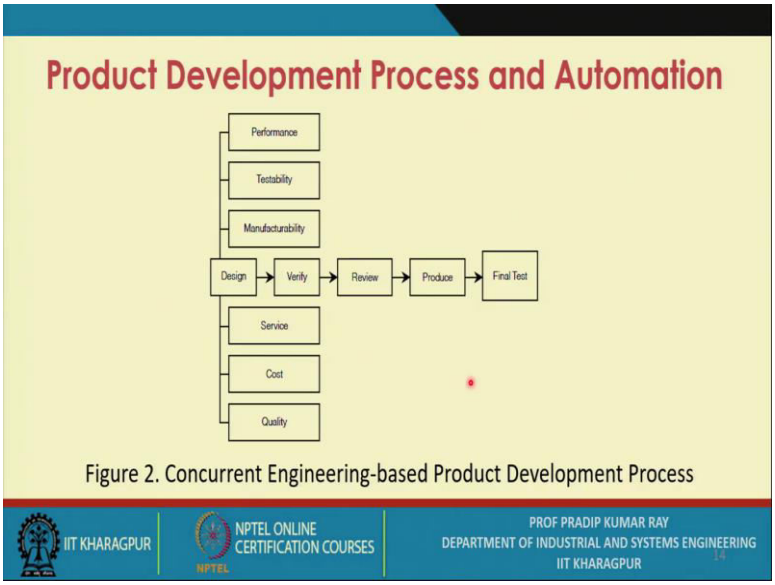

Now as an alternative to the traditional approach issue, opt for the concurrent engineering-based product development process. While you carry out the design related activities and you will be always verifying your design.

Now, during the design phase, you must be able to estimate or measure the performance of the product, its testability, manufacturability are to be measured.

once you have all these information related to the product, then again you review your design and then you go for its production, when you get the finished goods and the finished goods is finally tested.

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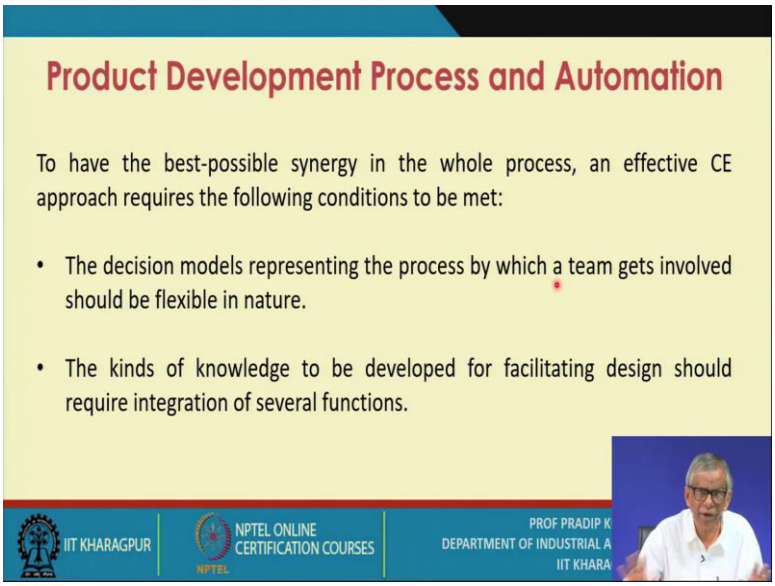

To have the best-possible synergy in the whole process, an effective CE approach requires the following conditions to be met:

The decision models representing the process by which a team gets involved should be flexible in nature.

The kinds of knowledge to be developed for facilitating design should require integration of several functions.

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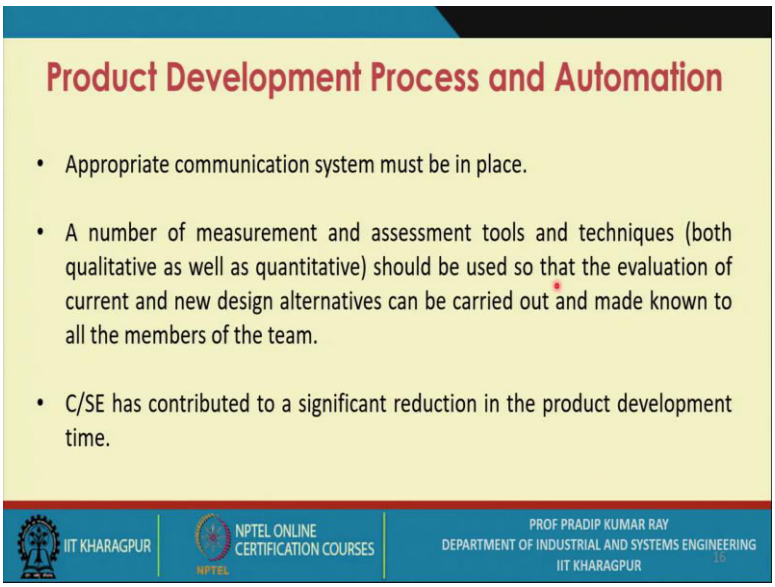

Appropriate communication system must be in place. A number of measurement and assessment tools and techniques (both qualitative as well as quantitative) should be used so that the evaluation of current and new design alternatives can be carried out and made known to all the members of the team. C/SE has contributed to a significant reduction in the product development time.

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What are the stages in product development process?

First is identification of customer requirements and setting up of design objectives. It is basically the process of identifying, defining, and documenting specific needs for the development of a new product. The main objective at this stage is to identify, consolidate, and document all the features that the system may have in feasible, realistic, and complete specifications of product requirements.During this phase, a large number of new ideas for the product to be developed are converted into practical requirements and specifications.

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What is the next stage? Next stage is identification of the design alternatives.

At this stage, identification of several design approaches or alternatives meeting the defined requirements, prior to identifying the best design to be used, is the main purpose. This process begins as and when a need for a new product is defined and explained in concrete terms, and ends only when the best design approach is recommended in order to meet the requirements from the new product. For this, responsibility should be shared among the members of the design team.

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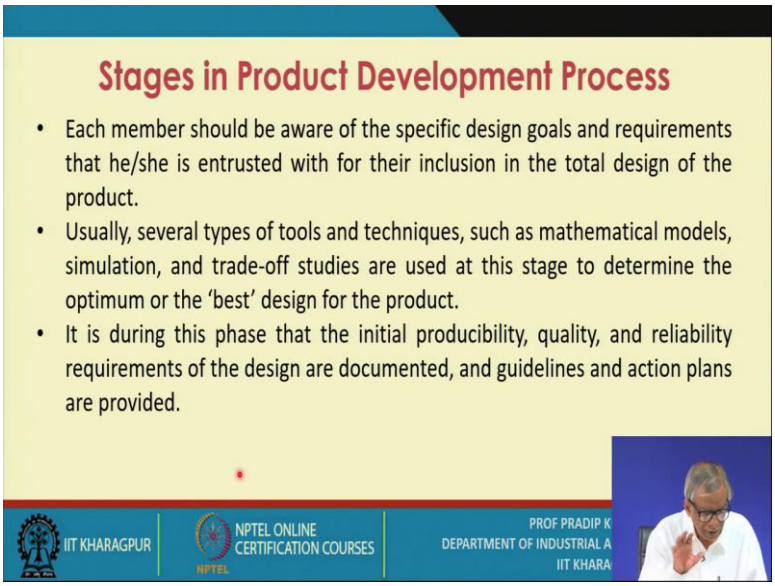

Each member should be aware of the specific design goals and requirements that he/she is entrusted with for their inclusion in the total design of the product. Usually, several types of tools and techniques, such as mathematical models, simulation, and trade-off studies are used at this stage to determine the optimum or the 'best' design for the product. It is during this phase that the initial producibility, quality, and reliability requirements of the design are documented, and guidelines and action plans are provided.

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Third stage is selection of appropriate design and its detailing. It is the process of finalizing a product's design which meets the requirements and design approach defined in the early phases.

During this stage, the product development team may construct prototypes or laboratory working models of the design for testing and evaluation to verify performance results.

At this phase, the interactions among many disciplines and design professionals take place, and these interactions should be effective.

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Fourth stage is Assessment of product design:

Assessment of the improved design is done through a series of test and evaluation of the prescribed design resulting in a set of quality features and improved performance meeting the requirements. The main goal of this assessment is to identify areas for design improvement for the product, keeping the issues like improved manufacturability and reliability in mind. The acceptable levels of the design parameters must also ensure minimum technical risk for the product.

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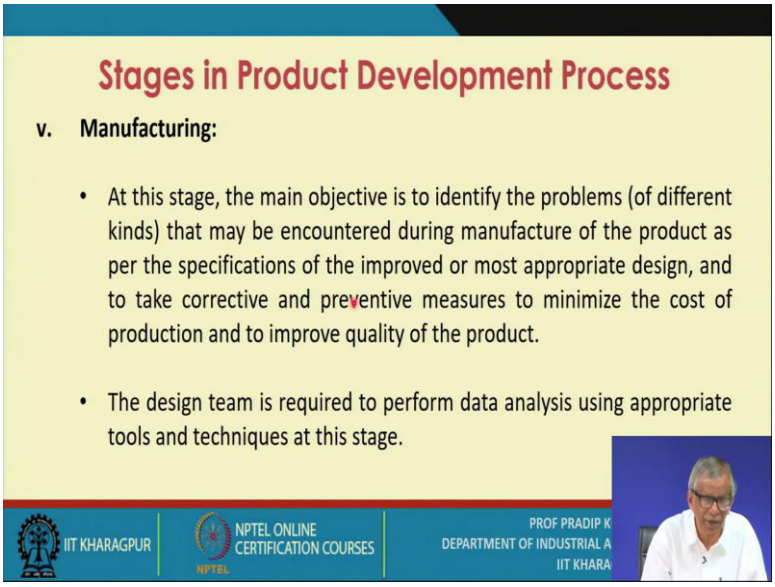

Fifth stage is manufacturing, At this stage, the main objective is to identify the problems (of different kinds) that may be encountered during manufacture of the product as per the specifications of the improved or most appropriate design, and to take corrective and preventive measures to minimize the cost of production and to improve quality of the product. The design team is required to perform data analysis using appropriate tools and techniques at this stage.

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