Automation in Production Systems And Management
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Introduction to Manufacturing and Production Systems
Lecture - 05
Definitions and Design Criteria for Production Systems

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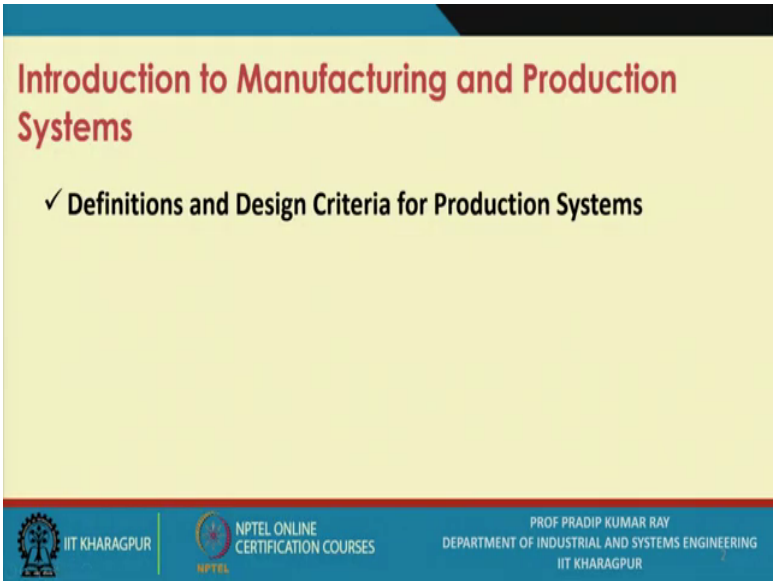

This will be my last lecture session in the first week and I will be referring to the Definitions and Design Criteria for Production Systems.

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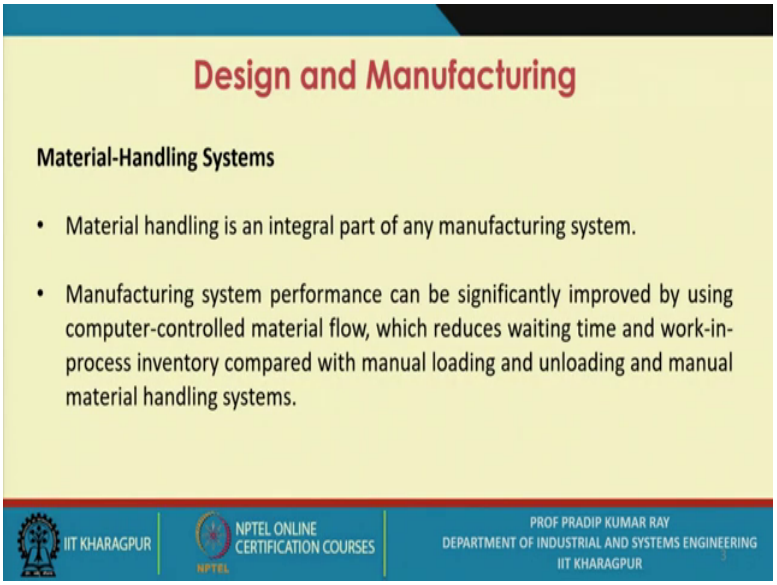

when we refer to the production system, we not only refer to the manufacturing, we also refer to other activities like material handling systems.

when we refer to the processing part, there is a chance that we may not give equal importance to the other activities like transferring or material handling activities etc.

In material handling system, so many varieties of Powered Industrial Trucks PITs we use. The material handling system is an integral part of any manufacturing system. Can it be made automated one? So, can material handing robot be used? Manufacturing system performance can be significantly improved by using computer-controlled material flow which reduces waiting time and work-in-process inventory compared with manual loading and unloading.

Usually they are manual, but when you opt for FMS, when the material handling system is made automated one, even the storage one, temporary storage, the storing system transferring, and the storing system,

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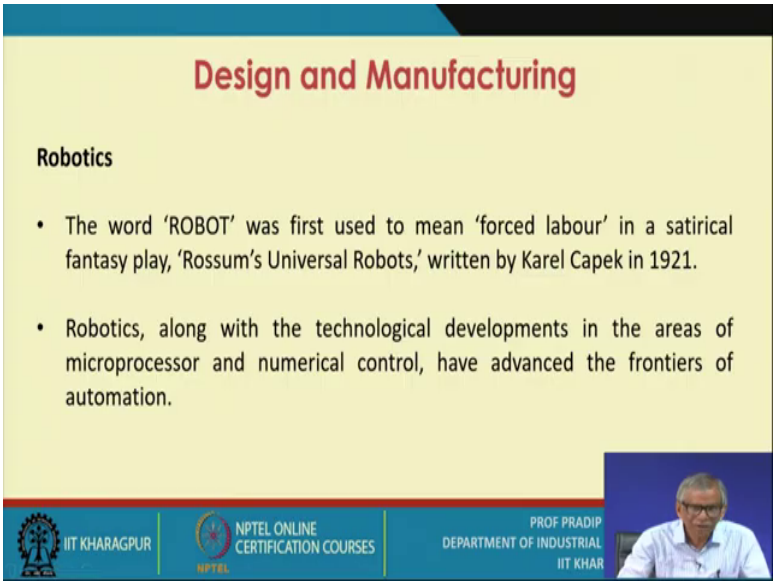

all these are made automated and manual. The details must be known and what are the activities you carry out in a particular material handling systems, Can they be eliminated? For automation in production systems, first you have to thoroughly study or analyze production systems and have to identify all the activities, their interrelationships and all. And once the flow patterns is known, you try to simplify the system. Simplification means reducing the number of activities.

once the system becomes simplified, then it becomes easier for automating the system. No complex systems can be automated and human being is the best automated system. The robotics is used in many different kinds of the manufacturing systems these days. 'ROBOT' was first used to mean 'forced labour' way back in 1921, this term was used in a satirical fantasy play, 'Rossum's Universal Robots, written by Karel Capek in 1921.

Robotics, along with the technological developments in the areas of microprocessor and numerical control, have advanced the frontiers of automation, .

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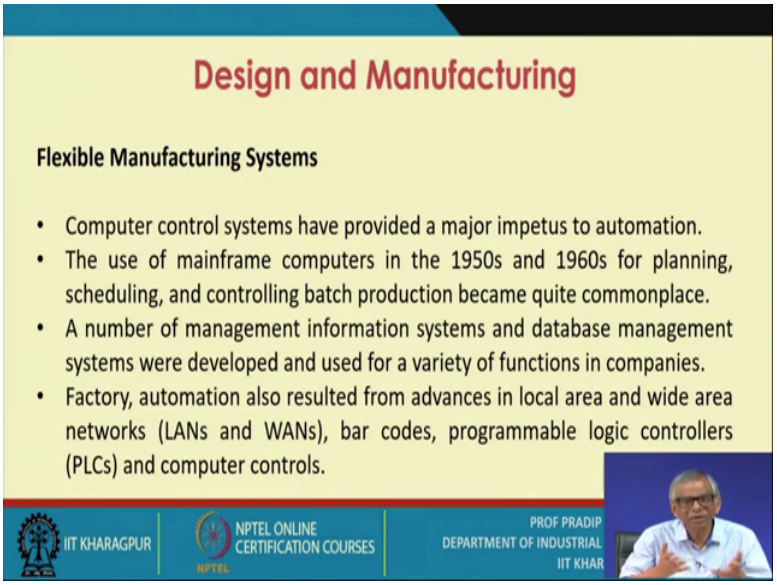

Robot maybe a part of FMS, when we refer to the layout for FMS, entire layout of the flexible manufacturing system or sometimes, refer to as a flexible production system is dependent on what kind of material handling system you use. The layout could be a rectangular, the square or circular. depending on the layout, you have to use assembly robot.

Computer control systems have provided a major impetus to automation. The mainframe computers in the 1950s was used for planning, scheduling and controlling batch production.

The next development was a number of management information systems and database management systems, which was used for a variety of functions in companies Factory, automation also resulted from advances in local area and wide area networks, bar coding, programmable logic controller, PLCs and computer controls

The technological developments in CNC, DNC, PLC, robotics, automated guided vehicles AGVs, are widely used. Automated storage and retrieval system ASRs, automatic tool changes, tool magazines, modular fixturing are a part of FMS.

Local area networks and associated technologies such as group technology laid foundations for automated manufacturing of a high to medium variety of parts having low to medium levels of demand.

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What is the system? Why we are referring to this particular term called system? A system is a collection of components in which individual components are constrained by connecting interrelationships such that the system as a whole fulfils some specific functions in response to varying demands.

what matters is overall performance of the product during its life cycle. Therefore, the product life-cycle approach provides a logical framework for understanding and analysis.

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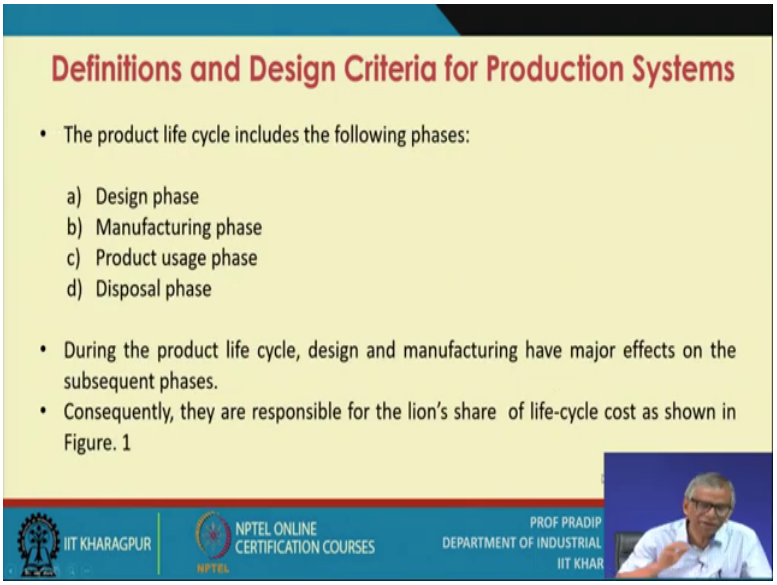

The product life cycle has four specific stages, first one is a design phase, second one is the manufacturing phase, third one is a product usage phase and last one is the disposal phase. The product life cycle design and manufacturing have major effects on the subsequent phases.

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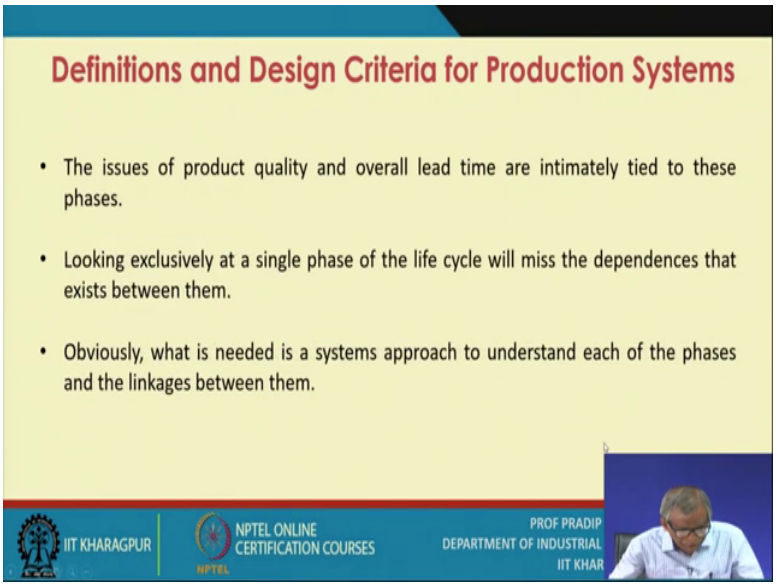

The product quality and overall lead time are intimately tied to these phases, lead time means basically the lead time or we use the term basically the throughput time.

That means, you have a starting point and ending point in the process; there could be 'n' number of stages. For example, you will be producing 1000 units of a particular product, the starting time at the first stage of the first unit that you note down and the ending time of the n^{th} unit at the last stage, the time difference is referred to as the total the throughput and suppose, there are 'n' number of stages, at each stage, you have throughput. To individual throughput you add 'n' number of times, you get the total throughput. Once the configuration of your production system is done, then, only you will have this measure configuration, or the layout.

Looking exclusively at a single phase of the life cycle will means the dependences that exists between them. Obviously, what is needed is a systems approach to understand each of the phases and the linkage between them.

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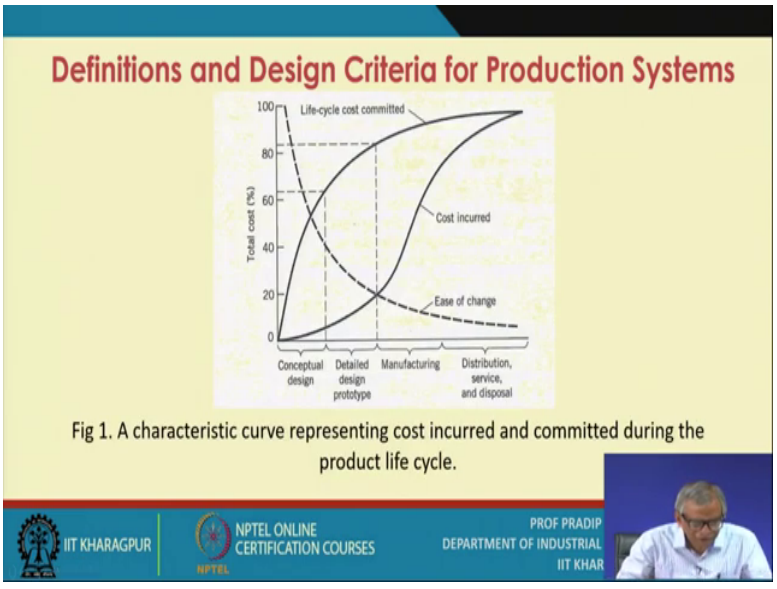

The definitions and design criteria for production systems. Any activity you carry out, there is a cost associated with it.

when we refer to the product development process; the conceptual design is assessed first and then detail design followed by prototyping. These days, before you go for physical

prototyping you can go for the computer-based or simulation prototype. There are different kinds of software's you can assess for design and then physical prototyping is done by assessing all the basic criteria of manufacturing such as cost, quality, performance, serviceability, maintainability etc. and at last the product is ready for commercial production.

This particular product prototype or model is send for manufacturing and once it is manufactured, then, you go for distribution, service and disposal. The 'y' axis represents a cost the total cost. Once the detailed design is reached which means when the design is frozen you will find there is a cost incurred and if there are certain deficiencies in design, it is very difficult to remove or change the design. That is why determination of the committed cost is very important. In empirical studies, it was found that more than 80 percent of the cost is already committed when prototyped design is send for manufacturing which means only 20 percent design is controllable.

I have referred to one particular term called total life cycle costing, given a particular production system, what is total life cycle cost, can you develop it? And when you go for automation to what extent it is affecting your total life cycle costing. This is a very rigorous exercise but once you have this relationship established, then what you find that your automated system is time tested.

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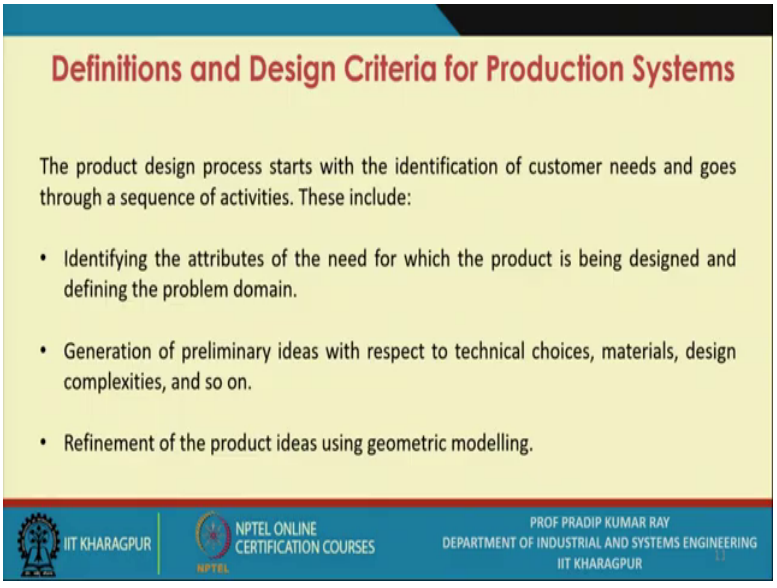

The product design process starts with the identification of customer needs and goes through a sequence of activities, identifying attributes of the need for which the product is being designed and defining the problem domain. In marketing sale, one document called product brief will give the list of customer requirements in customers languages and as soon as it reaches to your design department or product development cell (also referred to as the engineering cell), it is to be converted into engineering specification..

And while you opt for the design, cost, budget for the design, time period given for designing a new product, its manufacturability, producibility, its testability should be known and should be tested for automated system otherwise it will become unreliable. If the reliability is more, ultimately the whole system in all likelihood will become very expensive.

The generation of preliminary ideas with respect to technical choice or say which particular so the technology you will opt for, materials selection, the design complexities and so on and the refinement of the product ideas using geometric modelling.

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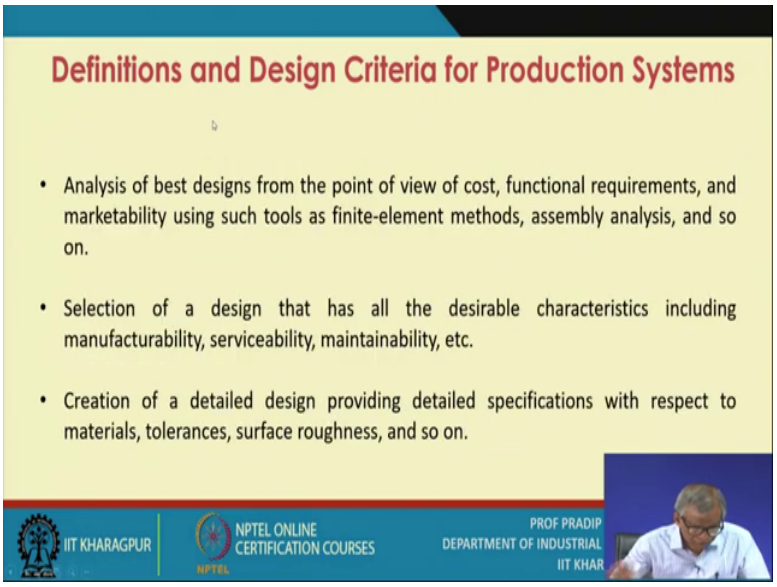

Analysis of best designs from the point of view of cost, functional requirements and marketability using such tools as finite-element methods, assembly analysis, and so on. These are the tools and techniques used for design purposes.

Selection of a design that has all the desirable characteristics including manufacturability, serviceability, maintainability etc. The creation of a detailed design providing detailed specifications with respect to materials, tolerances, surface roughness, and so on.

Before introducing or implementing an automated system in production, in manufacturing, manufacturing details must be known.

And in a total systems approach, focus should be on processing, loading, unloading, material handling or transferring, automated tool changing systems, automated storage systems, automated inspection systems.

A total systems approach is a must. But many times, we focus only on the processing part, the set up part or the transferring part or material handling part are ignored which should also be given importance.

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