Product Design and Manufacturing
Prof. J. Ramkumar
Dr. Amandeep Singh Oberoi
Department of Mechanical & Design Program
Department of Industrial and Production Engineering
Indian Institute of Technology, Kanpur
National Institute of Technology, Jalandhar

Lecture – 02 Continued.
Fundamentals of Manufacturing Towards Product Development

Welcome back friends. So, we will continue with our lecture 2 lecture two started with fundamentals of manufacturing towards product design.

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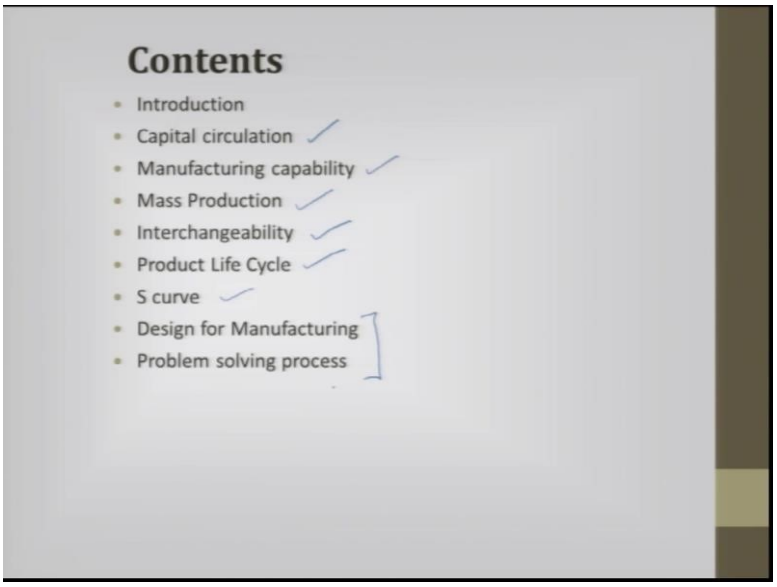

So, we were trying to cover the contents of this lecture. So, we have covered capital circulation, manufacturing capability, mass production, interchangeability product life cycle and S curve. S curve we ended with a example of Nokia phones saying a feature based phone then a smart phone we saw that s curve. So, in the S curve we also saw embryonic period, then technology development period or technology reiteration period then maturity period and then aging period. So, we are left with two more topics to be discussed one is design for manufacturing, and the last one is going to be problem solving processes.

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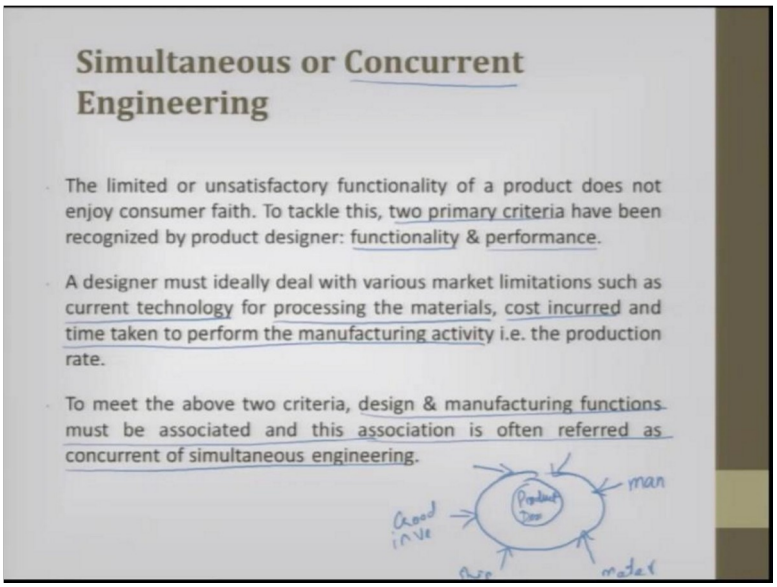


So, here we would first look into simultaneous or concurrent engineering, what is concurrent? Concurrent means involving many people together or trying to work at the latest technology or the recent happenings. So, when you talk about any product there are two primary criteria's which a product designer has to always keep it in mind. One is the functionality the other one is the performance. So, a designer must ideally deal with various market limitations, such as the current technology. There are several places were even the current technology has lot of limitations.

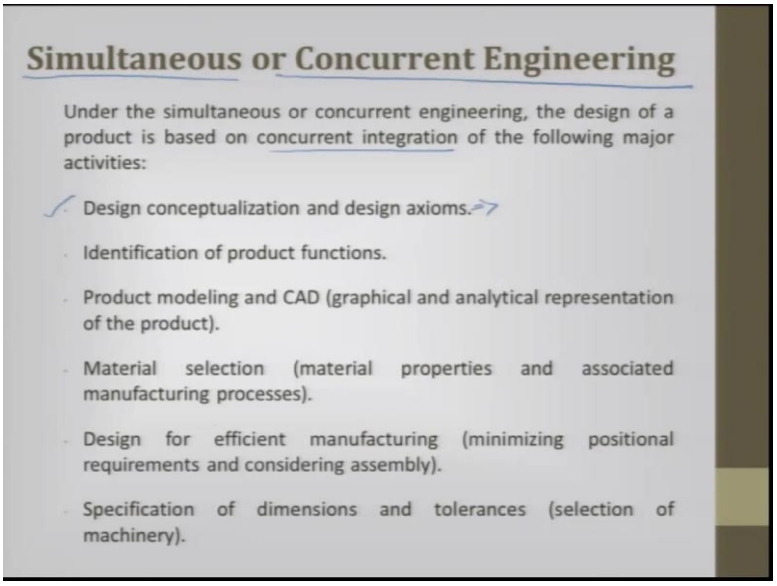
For example when we try to use GPS we say it is very good, but still we have problems when there is zero visibility in the airstrip. So, take off and landing is always a problem still we need technology ah. So, current technology there are lot of limitations for the processing of materials and when we talk about processing of the material, there are materials today which are which are brittle and as far also there are highly high strength brittle, and they have lot of factor toughness. So, you have combinational mechanical properties and when we start processing those things, we have a lot of limitation in manufacturing technology. The other way what I gave an example of airstrip takeoff and landing is the other technology where in which vision based is pr problem.

The third thing currently what we have limitation and technologies is the fog. Trains run come winter train runs 12hours 16 hours late, 8 hours late its because of the fog the driver engine driver is having almost zero visibility, he has to he has to move along the track. So, there is a lot of limitation though we say technology has gone way high, but

still there is lot of technological limitations even available today, in terms of performance as well as in terms of manufacturing.

The cost incurred and the time taken to perform a manufacturing activity all these things put lot of limitation in making a product, which is functional which has lot of functions and which good does a very good performance. To meet out the above two criteria that the design and manufacturer functions must be associated and this association is often referred as concurrent or simultaneous engineering. So; that means, to say you have a team in this team you have so, many members who try to participate when a product is getting developed.

So, here we have just taken an example of manufacturing engineer. So, we have we can also have materials, we can have a have a shipping engineer, we can have a goods inward engineer. So, all these peoples sit together to have a common objective which is to produce a product, which meets all the functionality and does a wonderful performance. So, this is called as concurrent engineering. There can be a technology limitation, there can be a material limitation, there can be a cost limitation; that means, to say the cost which can be given to a particular product. So, that. So, all these peoples sit together look forward in developing a product and this is also very important when a product is getting designed, the product engineer must keep back of his mind. (Refer Slide Time: 04:45)



So, the design of the product is based on concurrent integration of the following major activity, one is design conceptualization and design axioms. We will see what is axiom

later in our course then identification of product functions, then product modeling and cad. The next one is material selection design for efficient manufacturing and specification of dimension and tolerance for selecting the proper machines.

So, all these people are part of concurrent engineering or in other words it is called as simultaneous engineering. So, when we develop a product new product, we should try to keep in mind that we follow concurrent engineering. So, what is that? This is what is concurrent engineering I was talking to about this is these are the arrows are nothing, but the experts what have given in the next slide.

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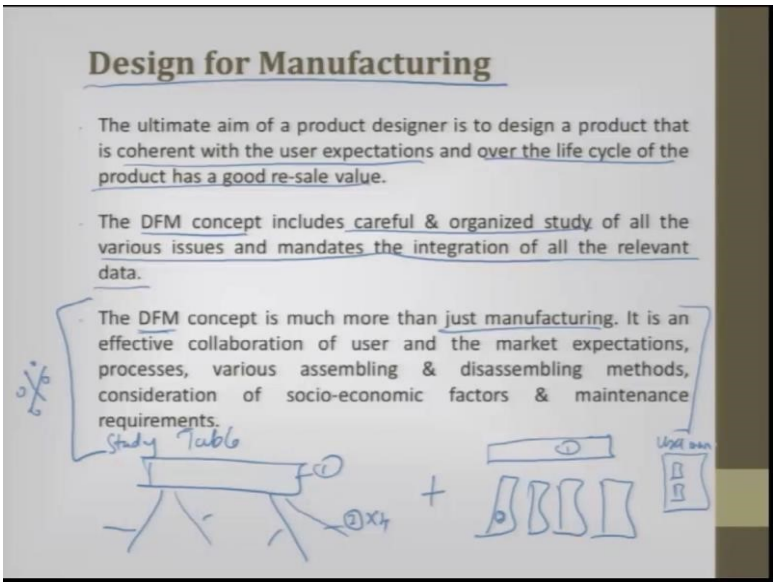

Design for manufacturing which I have already hinted earlier. So, I will just quickly work through the slide. The ultimate aim of a product designer is to design a product that is that is coherent with the user expectations and over the life cycle of the product and has a good re sale value. So, this is a important thing which a product designer should think at the design stage.

So, DFM is a concept which includes careful and organized study of various issues and mandates the integration of all relevant data. So, design for manufacturing concept is much more than just manufacturing. It is an effective collaboration of user and the

market expectation processes various assemblies, disassembling methods considering of socio economical factors and maintenance requirements this is very important.

DFM concept is much more than just manufacturing, it is an effect to collaboration of user and the market and the market expectation processes various assemblies dis-assemblies because today you see let me take an example of a simple table a table let us take its a study table. A study table has 4 legs it has four legs and a top whatever it is it has a top on top. So, let us take this as one piece and this as two piece; that means, 2x2=4 pieces you have. So, people what they have done today is, if you if you completely make a table in your in your factory and try to transport this table to the customer, it occupies lot of volumes space it occupies lot of volume.

So, what people have come out is, they have come out with something called as design for manufacturing they try to sell a table as disassembled parts. So, now, with a given same space the table is divided into 2 and it is packed separately, now table can be moved from one place to the other or from the manufacturer to the to the customer without getting damage and here the customer is asked to assemble and not assembled table is sold. So, this is part of DFM.

So, what they have done is they have kept their mind and also concurrent engineering they have kept their mind transportation is going to be costly for this table. So, let us do it disassembled and let us ask the customer to assemble wherein which there is a user manual given, which is more pictorial and user manual which is more pictorial, and just by looking at it the customer is able to understand what it has to be done and he does it by himself. Many a times this is also said as customer delight or customer is over thrilled when he assembles and he sees a product that he has assembled and which he is using.

So, for this thing this is now also a part of DFM. So, these are some small concepts which are used same for example, today computers are also sold in piece meal. So, they have they have run separate hard disk is separate, and they also give you a user manual they ask you to assemble and try to make a full product.

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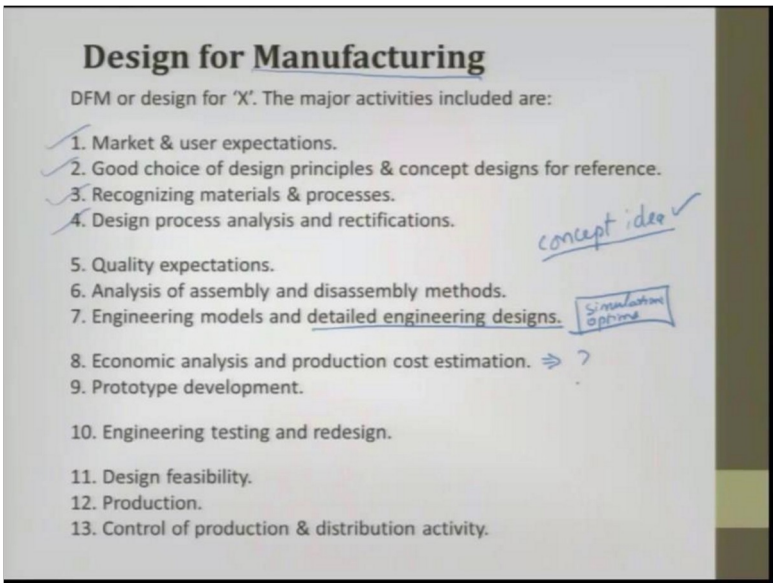

when we talk about design for manufacturing in little more details, the major activity includes marketing goods good choice of design principles, concept design for reference then recognizing materials and processes, design process analysis and rectification. The next one is quality expectation analysis of assembly disassembly method engineering models and detailed engineering.

So, here what happens the boundary conditions are say for example, here the con the initial concept idea is approved and functionality is all integrated into it and now what they do is now they look for how fixing a boundary conditions, look for simulation, or look for optimization in terms of space cost whatever it is and then you come out with the detailed engineering design. Till this conceptual idea you do not you do not worry about how what should be the size what should be the shape and all you just put all functionality together and then integrated and look at it this is what is a product we are supposed to make.

And once everything is cleared by the customer, then you start optimizing and reducing space choice of material and all those things. Economic analysis and production cost estimation this is very important, as I told you a product is always develop keeping economics into it prototype development engineering testing and redesign. So, this is an iterative process, product development is never single step process. It is iterative it goes back and then you reiterate, come back again and then show it to the customer and then improvise your product. Design feasibility production and control of production and

distribution activities these are some of the activities or some of the major activities for design for manufacturing.

If a company says I am following design for manufacturing; that means, to say they have done a thorough job in in the product design stage itself to develop a product. And if a company follows this design for manufacturing, it is pretty sure their product is going to be sustainable, the product is going to be of high quality and the costing to a large extent is reduced.

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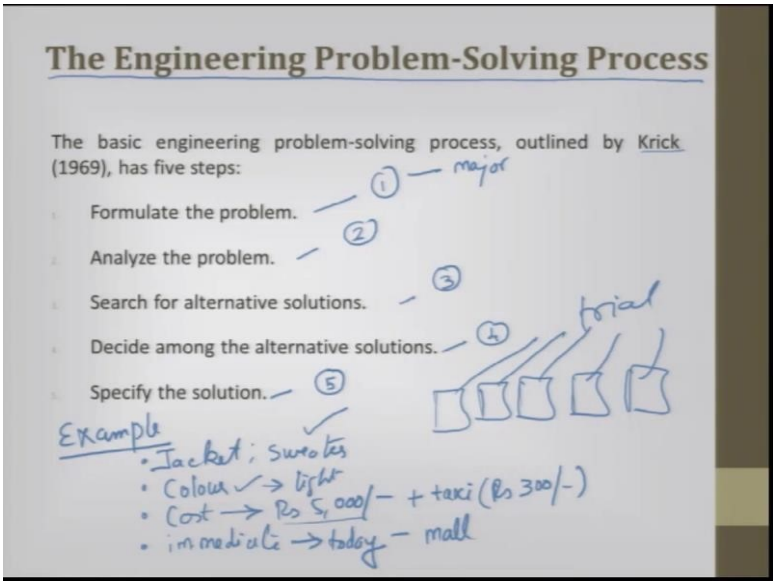

So, the last topic in this lecture is going to be the engineering problem solving processes. The basic engineering problem solving process outlined by Krick has 5 steps; first you have to formulate a problem, second you have to analyze the problem, third you have to look for alternative solutions, fourth you have to look among the alternative solution the best solution and start working on it finally, you choose the best solution ok. So, these are the specification of the solution.

Now, let us take an example; I feel it is pretty cold outside ok. So, now, I have to decide how should I protect myself from the cold; one I and the other thing is am also moving. So, buying a heater is not a solution. So, I have decided that I will buy a protecting cloth

which can cover my body wrap around my body. So, then it comes as should I buy a jacket should I buy a sweater.
So, now I have to decide which one to buy, next one is what is the color and next one is what is the cost, the next one is should I think for cost and then next one is should I buy it immediate or should I postpone it for a week. So, these are all statements in front of me. So, then what do I do I try to keep all those things, I try to now fix what is to be I try to buy a sweater, what I have done? I have now formulated the problem I will try to buy a color which is which is light I would try to give a cost of rupees 5000 and I would like to go immediate today.

So, what I have done? I have decided that I will I have formulated a problem to solve the solution that I am feeling cold, then what do? I do see look at it I have fixed my prices 5000. So, since I have fixed it as 5000, I do not mind travelling by a taxi to some place for which I can give you up to 300 rupees to a place where I can shop where I can go and then get and get since I have decided it today I would like to go to a mall right and ah. So, now, you see the problem is formulated and now what I do is, I have to analyze and then I have to look for solutions. So, in the next what do I do with this problem, I try to analyze the problem whatever I have chosen, and then I would look for alternative solutions.

When I walk through the mall I pick some 6 or 7 different types of sweaters for me in front of me 5 and then what do I do is I go to a trial room, I wear all five which can suit my color, my size, my shape everything and then what I do? I do I pick up the right one and then come to the billing part then pay. The engineering problem solving technique also goes by this, but this is the major challenge, how do I understand the situation and formulate a problem this is very very important.

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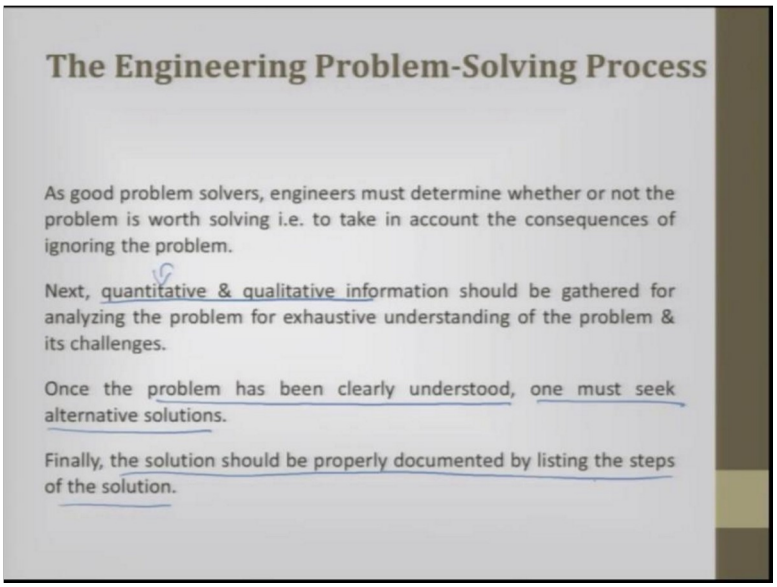

A good problem solver in engineer must determine whether or not the problem is worth solving. Many a times what happens you try to solve a problem, which is only one time and which is rarest of the rare kind. So, then you cannot develop a product for it you just have to live it and get out ok. So, so please do not look at those things look at problems where it is genuine and where it is occurring regularly, and there are lot of customers who are been affected by the problem. So, it is first you have to choose a problem exactly. If you choose a small problem then a product designer might develop a product which does not have a long product life or the number of product sold will be very less ok.

Next is quant quantitatively qualitative information should be gathered for analyzing the problem for exhaustive understanding of the problem and its challenge what is qualitative and quantitative? Qualitative is O soft O hard it has to be it has to be very high strength, but you do not tell any values. When you talk about quality these are all qualities read great all these things, but when you talk to quantitative you try to give a number to it. So, then that is very important. So, quantitative and qualitative information should be gathered first and then you should look at the problem challenge.

Once the problem has been clearly understood if you do not understand the problem, it is good that you go back reiterate at this stage itself to understand the problem. And once you have understood the problem very clearly understood what a customer wants and everything then one should start looking at alternative solutions. Many a times a

customer tries to give his requirements in qualitative; the biggest challenge for a designer is to convert the qualitative information into quantitative and then he should start working out.

For example I would like to have a cell phone, which does which needs no charging for 10 days. You have not specified what are all the apps you have you have not specified; what is the time you use your mobile phone. So, once you have to understand all those things convert those number and come out with the number of this is the total time he is going to work on a mobile phone, this many apps he is going to use for this what should be the consumption of power, and for that power what should be the battery and then we decide what should be the recharge cycle time.

So, like that we have to go ahead converting a qualitative into quantitative data has to be done. And once after doing it then you have to look at alternative batteries which are available in the market pick one which tries to be cost effect to and gives high quality and come out with the solution. Finally, the solution should be properly documented by listing the steps of solution and a product designer should always keep in mind he should always move with the diary.

Let it be hard or let it be digital, he has to keep recording informations and keep making notes. And regularly he has keep iterating the notes such that he keep, he put, he converts this data into information and this information has to be recorded somewhere. So, that whenever he needs any clarification, he can go back to the information and start doing it back and forth he does then he should finally, write down the systematic solution, how did he come to this particular to end of the product. That means, to say why did he choose this particular shape size, what is the logic behind it has to be properly documented which will help hence forth when he does it he need not do right from scratch he can use this information and then start proceeding further.

So, with this we come to an end of lecture 2. So, till now we have covered what is all basics of product design and different manufacturing concepts, which are involved keeping product design as the back end so.

Thank you very much.