

Manufacturing Guidelines for Product Design
Prof. Inderdeep Singh
Department of Mechanical and Industrial Engineering
Indian Institute of Technology-Roorkee

Lecture-01
Product Design: Basics

Namaskar friends, so today we are going to start our discussion on a very very important topic that is manufacturing guidelines for product design. Friends the basic ideology the basic concept before starting this course is that although we study independent courses such as the manufacturing courses like basic manufacturing processes, theory of production processes, machining science, welding.

So we learn about the various processes in our UG curriculum. Similarly we takes certain industrial engineering courses. For example production planning and control operations management, method and time study, industrial management, value engineering. So friends we take independent courses in which we learn about the hard aspects of production engineering and the soft aspects of industrial engineering.

But usually in actual practice when we want to practice engineering, when we want to develop product or combined knowledge which must complement each other. So we must be good in manufacturing or manufacturing subject where we have studied conversion processes from raw material to the final product such as casting may be welding, machining, joining. So we may have learn different types of manufacturing processes.

On the other hand we know about the product design, we know about method and times study, but when we have to combine that 2 together there is no interface between the hard aspect and the soft aspects of production engineering. And therefore we have conceptualize this course so the basic theory behind this course is that we want to complement the information that has been developed independently as separate stream of courses.

So therefore as you all know the title of the course is manufacturing guideline for product design. So we must know the 2 things one are the manufacturing guideline, and on the other side we have the product design. So in today's session our target is to just revise what we have covered in product design. All the undergraduate colleges or all the engineering

institutes across the country focus on product design as one of the chapters in one of the courses.

So we usually teach in production planning and control. So we have one product design and development. But basically we will revise today we will try to summarize the product design and development into one important session that is the introductory session for this course. Then we will focus our attention in the next week on revising that concept of manufacturing, trying to learn the process capability of the most important manufacturing processes.

It will be a kind of revision a very very concise revision, brief revision of almost the courses that you have studied in engineering. After going through the manufacturing may be for 2 and half weeks, 2 and half hours sorry for 1 week we will focus on manufacturing, then on 1 week we will focus on materials why because when we are designing the product we will be required to have information related to design.

Information related to manufacturing, information related to materials and then only we can ensure quality of the product. So that is what we are going to focus on in the third week of our discussion sorry the second of our discussion. We will focus may be today we will start with product design basics, then may be in the next sessions of our focus will be on manufacturing.

After that our focus will be on materials and then once we have made or revised our basics related to manufacturing, related to materials we know that this particular set of material can be processed by this particular set of manufacturing processes or for this family of materials or particular family of manufacturing processes is applicable, understanding a process capabilities of the various processes.

Understanding the physical, chemical, mechanical properties of the engineering materials. We will try to move forward and try or frame or understand or discuss or concretize the various guidelines for the various manufacturing processes. We will focus on sand casting, die casting, injection molding, compression molding, then we will focus also on machining, we will focus on the various joining strategies.

Such as welding, riveting, fastening using the screw fastener, adhesive joining, microwave joining, so our target will be to understand the guidelines that must be kept in mind when we are designing a product. So while designing the product sometimes we are not able to give due emphasis to the manufacturing processes that are going to be used for manufacturing the product. And that leads to an iterative type of design.

We make a design, we pass it on to the next stage to the manufacturing shop floor and from there sometimes the product is sent back for modification as a faulty design why because the infrastructure facilities that we have the facilities that are required to produce the kind of specifications that we have taken forward in our design are not available on the shop floor.

And therefore we need to revise our design, we need to revisit our design, we need to modify our design, we need to update our design in order to have a mapping with the kind of infrastructural support in the form of manufacturing facilities that we have. So therefore in order to avoid this kind of iterative or iterations in that design it is always better that we keep in mind or we take into account the various guidelines that do exist in literature.

Many a times I have observed the learners are not aware about the kind of guidelines that are available which have been documented very good books have been written they are available in our course of this session you will see I will share references of very good book in which certain set of tables are available, certain set of principles are available, guidelines are available which can be used by the designers when they are designing the product in order to avoid the various throw backs or iteration in the product design.

Due to noncompliance of the manufacturing regarding the specifications which I have been set by the product designer. So when they are noncompliant automatically the product design needs to be modified or updated. So with this background basically we here start the today's session in because this is a 20 our course, we have to finish the discussion of all the processes whatever we can do.

Then we have to further learn certain advanced topics like design for environment and rapid prototyping. So therefore the time to be taking into account the time constraint I will not stretch the discussion too much in introducing the course I will directly start the course may be with the product design basics. So basically we need to understand that 2 terms the

manufacturing guidelines and the product design. Let us try to understand product design today in our subsequent lectures in this week, our focus will be on manufacturing.

We will try to classify the manufacturing processes, we will try to find out the process capability for the manufacturing processes, we will try to find the advantages and limitations of the processes, we will try to look at the applications of the various important manufacturing processes, followed by discussion on engineering materials and followed by discussion on the important aspects that must be taken into account while designing the products.

But most importantly our focus will be on manufacturing processes that what are the standard guidelines that must be taken into account when the product designer are making the specifications for manufacturing a particular product. So what basically we can call a product design, so what is the product design concept.

(Refer Slide Time: 09:17)

Product Design Concept

- Product design is conceptualization of an idea about a product and transformation of the idea into a reality.

To transform the idea into reality, a specification about the product is prepared.

- This specification is prepared by considering different constraints such as production process, customer expectation, etc.

So we can see the product design concept on your screen the product design is conceptualization of an idea about a product and transformation of the idea into the reality. So we can breakdown this sentence into 2 broad parts, so product design is conceptualization of an idea, so we must have an idea and then that idea needs to be converted into a tangible product. So about the idea must be about the product.

And the product will definitely satisfy the need or requirement which do exist. So the need and requirement maybe an industrial need or requirement and it may be customer based or it

may be a societal need or requirement. So basically the product is going to satisfy a need or requirement. So basically we need to conceptualize a idea to satisfy the needs and requirements in the form of a product.

And this ideal has to be done transformed into the reality and the reality will lead us to the product. So we need to generate lots and lots of ideas because many of the ideas do not pass the test of screening. So the ideas are screened at various levels using the technical competence, the financial viability of the idea, the environmental viability of the idea. So at different level the ideas are scrutinized they are screened.

And very few ideas finally lead to the products. So we must be very very liberal in generation of ideas and we must have large number of ideas and then only we will be able to produce may be a few final product. So to transform the idea into reality, so in order to do now this is related to the first sentence is related to the concept that what basically product design is all about.

And this is related to the process now how to convert to transform the idea into reality or specification about the product is prepared. So we must prepare the specifications which may be the initially the specifications can be broad specification and finally we go to the detailed specifications. So maybe we can try to understand this with that example of a 4 wheeler car.

So basically in the initial stage the conceptualization of an idea we can conceptualize that they are must be a source of transport which must be able to transport goods as well as the passengers from one place to another place. So that is basically an idea. Now how this idea can be converted into a tangible product or into reality for that we need to do the further analysis.

We need to find out that how what type of mode of transport or what type of source we must develop which is able to transport goods as well as passengers from one place to another place. So that is one idea which we need to transform into a reality and for that we need the specifications. Now specifications can be that we are specifying a family which means that it must be able to transport 4 to 6 people at a time.

It must be a 4 wheeler or a 3 wheeler, it must be run on diesel or petrol. So that are those are the broad specifications though that are develop in order to in order to convert our idea into a tangible product and the final product can be a car which are all of us are using these days. So to transform the idea into reality a specification about the product is prepared. This specification is prepared by considering different constituents such as production process.

Now we can see when we make a detailed design we have to give due importance to the production process that is being going to be used for converting our idea into reality, that is the most important point of course, why because we are going to focus on the various manufacturing processes and what are the associated guidelines that must be taken into account by the designer when he or she is designing a particular product.

And we are not only going to focus on the processes that are going to be used for processing or production of metallic component, our target will be to focus on processes that can be used for production of fabrication of plastic components, we will be focusing on joining of parts also, we will be focusing on machining of parts also. So there is going to be a wide variety of processing that we are going to cover in our discussion in this course.

So this specification is prepared by considering different constrained such as production process, customer expectation as I have already highlighted here, the needs and requirements will be generated from the customer expectation and there are number of other parameters that need to be taken into account when we are making the detailed specifications of our product. So that is the basic idea about product design.

(Refer Slide Time: 14:38)

Product Design Concept cont.....

- In product design stage all aspects of the product are analyzed. *Marketing* *Economic*
- Final decision regarding the product is taken on the basis of the analysis.
- This decision can be any aspect related to the product, e.g. dimension and tolerances, type of material for each component.

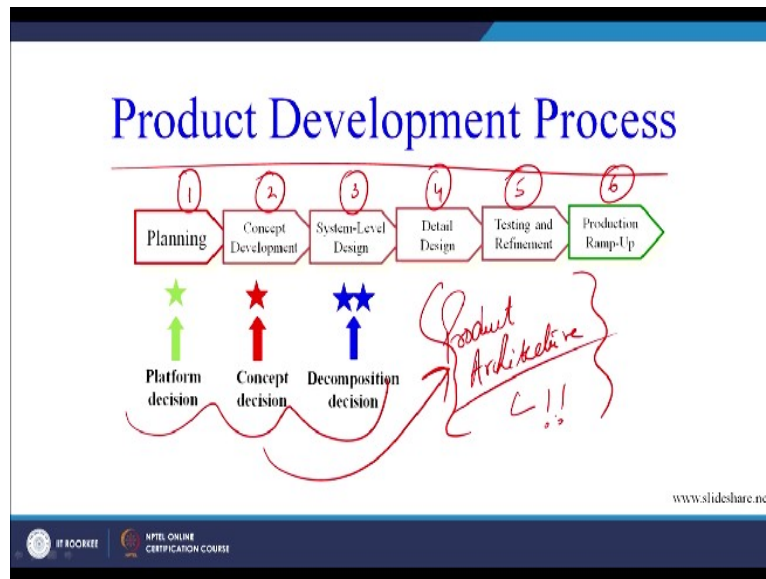
IPR ONLINE CERTIFICATION COURSE

Now in product design stage all aspects of product are analysed. Now we will see what are the various aspects. So these can be the marketing aspects, we are going to come to this towards the end of today's session and these can be the economic aspects and already we have seen in the previous point the production aspects we have to take into account. Final decision regarding the product is taken on the basis of the analysis.

So whatever we analyse the ideas based on the final decision about the product is taken because we consider the economic aspect, we consider the production aspect, we considered the product characteristics, functional aspects, operational durability aspect. So considering all these aspects of final product specification is laid out or the final decision about the product is taken.

This decision can be any aspect related to the product for example the dimensions and tolerances type of material for each component, type of assembly operation that we are going to use. So this detailed specification can lead to or these type of finalization of the values for all these parameters which are mentioned here.

(Refer Slide Time: 15:52)



Now product development process this diagram again we will come to during the course of our session, we will try to understand it in a much more clearer manner in the course of our discussion. So basically for product development process we can see first is we undertake the planning then concept development, then system level design, the overall detailed design, then detailed already I have told detail design.

Then testing and refinement and finally the production ramp-up. So basically we have to decide on the product architecture also and that we will cover in our 8th week of discussion when we have learnt about all the processes that are used or that can be used for making the product and what are the various guidelines that we must take care. So here we can see that initial stage only the product architectural place a very important role.

That in how many modules we must produce our product, how the modules can be classified, all that will be covered in product architecture, we will see try to take an example and try to understand that when we look at a product it can be divided into the various modules and how the modules can be classified or how the modules can be made may be based on the geometric layout or based on the commonality in the functions.

So we will divide the product into different modules and these modules will make up the complete product. So this gives us a overall summary of the process from planning to concept development detailed design to testing and refinement to final production. Now what are the various steps involved quickly we can go through we have already recorded a course which is a 10 hour course on product design and development.

And which has been drawn successfully for 2 consecutive semesters may be in the coming semester or next to next semester the course may again we offer for learners who are really interested to have a just a brief review of the product design process and the various tools and techniques that must be used during the product design process can register for that course and get benefited.

(Refer Slide Time: 18:13)

Product Design : Steps

1. **Synthesis:** Try to develop different alternatives. *ideas*
2. **Sketching:** Draw sketches in exact scale for different alternatives
3. **Analysis:** Analysis ~~of~~ different alternatives with respect to operability, maintainability, inspection, assembling and dismantling issues, cost parameters, production methods, etc.
4. **Selection:** Select the best alternative.

NPTEL ONLINE CERTIFICATION COURSE

So here we are just going to summarise the product design steps. So we can see synthesis which means try to develop the different alternatives. So as I have already told lot of ideas or alternatives must be there because we have to further do the screening out based on various criteria and finally we must be able to come up with the idea which is done which can be converted into a tangible product or which has the potential to be commercially converted into a final product.

So first thing is synthesis we have large number of alternatives there, there is sketching draw sketches in exact scale for different alternatives analysis, analysis we can say analyse different alternatives with respect to operability, we will see operational aspects, maintainability, inspection, assembling and dismantling issues, cost parameters, production methods again the production methods are coming here.

Assembling is again coming here, so these are the 2 aspects with which we have designed and conceptualize this course. So basic and we will see the operability. So we will see analyse the different alternatives based on all these parameters. So we may have 5 different processes

which can be used to produce the product. Now which one we must choose. So it is a multi this is multi criteria decision making process.

Because we have to satisfy the cost parameters also, we have to select the production method also, it must be easy to operate, it must be easy to maintain. Now they are can be a production process which is very easy, which is cost effective, but when we use that process we are not able to maintain. So dismantling becomes very very difficult. So we have to see that how this combination of parameters, we have to analyse that how this combination of parameters must be selected which production method must be selected.

So that the product is easy to operate, product to easy to maintain, product is cost effective, product is easy to assemble, it is easy to inspect. So that all things are analysed and based on this analysis the selection is made, we select the best alternative.

(Refer Slide Time: 20:28)

Product Design : Steps cont..

5. Basic engineering: Prepare layout in exact scale, calculate strength of components, select proper cost effective material.

6. Detail design: Prepare detail engineering drawing for each component.

7. Prototype: If option is there, then prepare prototype and test it.

DFG
L2
8 weeks
Rapid Prototyping - 8 weeks

IF A COREE NPTEL ONLINE CERTIFICATION COURSE

Then the basic engineering is done prepare a layout in exact scale, calculate strength of components, select proper cost effective material. So this cost effective material we will see the importance of this when we talk about design for environment that what is the focus in today's scenario which type of material we must select in order to make our product a sustainable product or green product or environment friendly product.

So we will have 2 sessions on design for environment in the flag end of our course in the 8th week of our discussion. Once we have done the basic engineering for the product we go to the detailed design, we prepare the detailed engineering drawing for the component. After

that we go to the prototype, if option is there then prepare the prototype and test it. And for the prototyping we will have a discussion on the rapid prototyping technology in the 8th week again of our discussion, 8th week we will again come to rapid prototyping.

That what is the concept of rapid prototyping and why you should do rapid prototyping, what are the various technologies that has been developed under the board umbrella of rapid prototyping.

(Refer Slide Time: 21:44)

The slide is titled "Product Design :Steps cont.." and lists three steps:

- 8. Manufacturing:** If prototype is not made, then follow manufacturing steps and solve manufacturing problems and assembly problems, if any. Handwritten notes include "Minimize" and "Eliminate" with arrows pointing to the text.
- 9. Operation:** Collect feedback during actual operation of the new product. If any problem exists, try to provide design based solution. Also, implement lessons in the future design.
- 10. Product development:** If any modification can be done, implement the same in the next generation product. Handwritten note "Subanishic" is written above the text.

The slide footer includes logos for IIT COOBE and NPTEL ONLINE CERTIFICATION COURSE.

Then the manufacturing is a prototype is not made then follow manufacturing steps and solve the manufacturing problems and assembly problems, you know this is very very important, solve the manufacturing problems and the assembly problem. So if somebody has gone through this course a learner of this course we successfully completed this discussion will never face this problem at the manufacturing stage.

Because while designing the product only the designer will take into account all the manufacturing problems that can come. He will take into account all the manufacturing guidelines that are there for a specific manufacturing process therefore there will be no problem when the product is going to the manufacturing stage. Similarly for assembly also there will be no problems.

Because during rapid prototyping we can make different types of parts and then try to assemble them before the products goes for the final assembly or the final manufacturing. So rapid prototyping stage only we will be able to iron out all the problem, we will be able to

remove all the problems. So that whatever design is finally been passed on to the manufacturing state is fully well set design fully inspected design.

So that there is no problem, so the overall objective of our course is to minimise I think I can go to the extent of saying eliminate all these problems that creep up during the manufacturing stage and once the product has been made successfully we will go to operation, collect the feedback during actual operation of the new product. If any problem exists try to provide design based solution also implement lessons in the future design.

So then the product development if any modification can be done implement the same in the next generation product that is may be a futuristic aspect that once the product has been lost it is being operated, it is being used, it is being consumed by the consumer, we must always strive for continuous improvement in our product design. So basically we have seen that these are the various steps for any generic product development cycle.

(Refer Slide Time: 24:11)



Product Analysis

- Many factors have to be analyzed in connection with development and design.
- Factors varying in character and complexity.
- Factors affiliated with different fields in production and industrial engineering.

IIT BOMBAY NPTEL ONLINE CERTIFICATION COURSE

Now coming on to the product analysis which is also an important point manufactures have to be analysed in connection with the development and design of a product, factors varying in character and complexity. Now what are these factors subsequently we will see, factors are few little bit different fields in production and industrial engineering. So we will see industrial engineering aspects are also important when we are talking of product design.

Production engineering aspects are also important and the beginning of today's session only I have told that our course basically is going to provide the interface between the 2, we are

trying to design a product which is a soft engineering, we can say it is majorly taught in the industrial engineering topics, we are trying to use the manufacturing guidelines that are established in production engineering courses.

So basically it is trying to complement each other, we are trying to design the product, keeping in mind all the knowledge that has been developed in the manufacturing engineering or production engineering courses. Now these are the some of the important factor that has to be taken into account.

(Refer Slide Time: 25:10)

Some of these factors may be grouped as follows:

1. Marketing aspect
2. Product characteristics
 - Functional aspect
 - Operational aspect
 - Durability and dependability aspect
 - Aesthetic aspect
3. Economic analysis
 - The profit consideration
 - The effect of standardization, simplification and specialization
 - The break-even analysis
4. Production aspect

Analysing the Product ←

IPROBEE | NPTEL ONLINE CERTIFICATION COURSE

These are very well explained in a book written by Samuel Eilon that is elements of production planning and control. So first are the marketing aspects, product characteristics, economic analysis and the production aspects. So our major focus is on the production aspects that when we are analysing our products we must take into account the production aspects that how it is going to be manufactured.

What are the processes that are going to be used for manufacturing the product. So this is the focus area of our product, but we must also know the overall product design cycles. So let us quickly focus on these 4 aspects.

(Refer Slide Time: 26:00)

1. Marketing aspect

- Once the product is selected, then it is very important to know the marketability of the product.
- All further steps are dependent upon the demand for the proposed product and customer acceptability of the product.
- If there is no potential market, then it is a wasteful exercise to design and manufacture the product.
- It give the answer of following questions:
 - What will be the expected demand for the product both short-term and long-term?
 - Whether the functions that are offered by the product are desirable and acceptable to the customers?

Now in marketing aspects once the product is selected then this very important to know the marketability of the product, all further steps are dependent upon the demand for the proposed product and customer acceptability of the product. If there is no potential market then it is a wasteful exercise to design and manufacture product, it give the answer to the following questions.

Before going to the course let us now try to understand what we try to do in the marketing aspect, in marketing aspects need analysis is done, we try to figure out that the product that we are trying to develop who are going to be the users of these product, what is the market segment that we are targeting, how many user we target over the next 1 year, what is going to be the demand for this product.

What is going to be the customer acceptability of this product. So all these things are finalized in the marketing stage only and then we try to find out the answers to your questions like what will be the expected demand for the product both the short term and the long term, whether the functions that are offered by the product are desirable and acceptable to the customers that is basically a judgement about the customer acceptability of the product.

Once it is established that yes we have an idea and there is a need and requirement of this product in the market we must be the first company to launch this product in the market and thereby then we focus on the product characteristics. So the first thing is finding out that we are moving in the right direction or not, if we launch this product this product is going to be successful, it is given to the game changer, it is certainly required in the market.

(Refer Slide Time: 27:46)

2. Product characteristics
-Functional aspect

Value engineering
 $f = \frac{\text{verb} + \text{noun}}{\text{show} + \text{time}}$

- When the marketing possibilities have been explored, the functional scope of the product has to be carefully analyzed and properly defined.
- The definition of the objective itself rarely tells us much about the predicted functional scope.

IPROOEEE | NPTEL ONLINE CERTIFICATION COURSE

Once that is established then we go to next stage product characteristics, in functional aspects when the marketing possibilities have been explored and it has been established that the product is required, the functional scope as the product has to be carefully analysed and properly define. So I have already told normally in functional analysis we focus on the concept of value engineering.

And if it is possible we will try to have a course may be 10 hour course on value engineering also it is quite important course and is the need of the hour. So in value engineering we define the function of the product with the combination of the verb and noun. So in verb and noun normally we say that if we are say talking about the watch we say we can say the functional definition of the watch is show time.

So verb may be show+noun may be time, so we say show time for maybe for engineering component point of view if we talk about the function of our shaft, so we can say transmit torque. So that is in that way you can have if you talk about the function of a fan we can just circulate air. So based on that we try to do the functional analysis of the product, that the product that we are designing and developing.

What is going to be the functional scope of the product, what is going to be achieved by the product. When the marketing possibilities have been explored, the functional scope of the product has to be carefully analyzed and properly defined. However we are going to define that with the

help of the verb and noun type of definition very crisp definition. The definition of the objective itself rarely tells us much about the predicted functional scope.

And therefore we need to very very crisp, precise, brief in defining the functional scope of our products. Then we go to the let us take an example of washing machine, objective to wash cloth.

(Refer Slide Time: 29:48)

Example : A washing machine

- **Objective :** To wash clothes. 2???
- This does not state, however, how the washing should be carried out, whether the machine should be capable of heating the water prior to washing, whether rinsing or drying, or both, are to be done by the machine, and if so by what method, and what should the proportion be between automatic functioning and manual supervision.
- A functional analysis of this kind obviously affects the design of the machine, its complexity, its appearance, and its price.

NPTEL ONLINE CERTIFICATION COURSE

This does not state however how the washing should be carried out, whether the washing machine should to be capable of heating the water prior to washing, weathering rinsing or drawing or both are to be done by the machine and if so by what method and what should be the proportion be between automatic functioning and the manual supervision. So basically we can see that only the objective is specified to wash clothes.

But these other parameter there is a question mark and there is no clarity, so functional analysis of this kind obviously affects the design of the machine, its complexity, its appearance and its price. So in functional analysis we will try to establish the complete scope of the product that what is the complete functional scope of the product and what all function we are targeting, what are the functions we do not want to include in our product.

(Refer Slide Time: 30:44)

2. Product characteristics

-Operational aspect

- The product is not only expected to perform its functions satisfactorily but it should be easy to handle and operate at the customers end.
- The product is used at different operational conditions and the customers vary with respect to skill and knowledge and the designer's problem becomes complicated with addition of more functions.

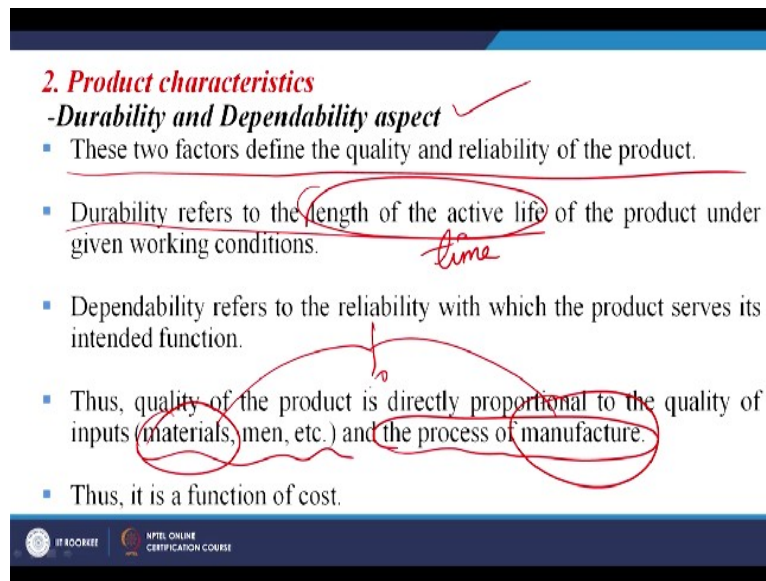
And accordingly we will take the design to the next stage, now product characteristics the second point once we have identified the functions in the functional analysis that what we want our product to provide to the customer why the customer is going to buy our product, what functions for the customer our product is going to satisfy. Once all that is known to us we go to the operational aspects.

Why you because suppose we take the example of a washing machine in a fully automatic machine some of the homemakers may not be able to upgrade it, my not because of the limited knowledge but because of the complexity of the operation. So when the function become too large the operations become too complex. So therefore we have to do a trade of between the functional aspects and the operational aspects.

We need to include more and more functions in our product, but at the same time we have to ensure that the operation of these functions also is easy it is not difficult, it is not complicated. So the product is not only expected to perform its function very clearly it is written satisfactorily, but it should be easy to handle and operate at a customer's end only and I have already taken an example of washing machine.

That it may be very very functional it may give us lot of function but sometimes we may not be able to use it because of the complexity that this functions bring along with them. So the product is used at different operational conditions and the customers vary with respect to skill and knowledge and designer problem problems becomes complicated with the addition of more functions.

(Refer Slide Time: 32:30)



2. Product characteristics
-Durability and Dependability aspect ✓

- These two factors define the quality and reliability of the product.
- Durability refers to the length of the active life of the product under given working conditions. *time*
- Dependability refers to the reliability with which the product serves its intended function.
- Thus, quality of the product is directly proportional to the quality of inputs (materials, men, etc.) and the process of manufacture.
- Thus, it is a function of cost.

IF ROOKEET | NPTEL ONLINE CERTIFICATION COURSE

So this is something which has to be addressed by the product designers they have to do a trade-off between the functional and the operational aspects of the product. Then we talk about the durability and dependability aspects, so as the words are very very self-explanatory when we are designing a product we need to look at these 2 factor because these define the quality and reliability of the product.

Durability refers to the length of the active life very very important it is usually in terms of time but durability refers to a time of the product under the given conditions or under the given conditions that length if active life means the point up to which it perform its desired function satisfactorily. Dependability refers to the reliable with which the product serves it intended function. Thus quality of the product is directly proportional to the quality of the inputs, materials, men, etc. and the process of the manufacture.

So again the importance of materials and manufacturing is coming into picture in defining the quality of the product, defining the dependability and reliability of our product, defining the durability of our product and therefore our target is on these 2 important aspects related to the product design process. Thus it is a function of cost. So basically the cost is also going to be affected when we are putting a certain degree of durability and dependability in our product.

So these also has to be analysed during the product design process. Then coming onto the aesthetic aspect we have seen functional aspects, we have seen operational aspects, we have seen durability and dependability.

(Refer Slide Time: 34:08)

2. Product characteristics

-Aesthetic aspect

- It refers to the 'external look good' aspect of the product and it is concerned with molding the final shape around the basic skeleton.
- It helps the sales function of the product by attracting the customers and creating the first impression about the product.
- Designers use variety of tools to build aesthetic characteristics into the products such as:
 - Use of special material
 - Use of colour
 - Texture
 - Packaging

<http://www.filesproject.org/wp-content/uploads/2011/10/Flower-pot-design-ideas-with-Unique-Design.jpg>

IIT BOMBAY NPTEL ONLINE CERTIFICATION COURSE

And the last are the aesthetic aspects or the aesthetic characteristics, it refers to the external look good aspect of the product and it is concerned with molding the final shape around the basic skeleton. So the basic skeleton is what, basic skeleton is going to satisfy the functional requirement and then the product must look good also, and for that we are going to incorporate certain degree of aesthetic aspects in the product.

It helps the sales function of the product by attracting the customers and creating the first impression about the product, it is self-explanatory and good looking product will automatically we sort for by the customers, designers use variety of tools to build aesthetic characteristics into the products such as use of special material, use of colour, texture, packaging.

So all these are important factors that affect the statistics of a product. So basically we have seen that there are at the initial stage marketing aspects taken into account, then the product characteristics, product characteristics further include the function aspects they include the operational aspect, they include the durability and dependability aspects, they include the aesthetic aspects.

(Refer Slide Time: 35:22)

3. Economic analysis

- An economic analysis is the key to the management decision in product design policy.
- It answer the following questions:
 - Input What will be the amount of investment needed to manufacture the new product?
 - What are the estimated production costs per piece?
 - What will be the expected profit margin?
 - Whether the prices proposed to be offered by the company are competitive?

IF I COOEEI NPTEL ONLINE CERTIFICATION COURSE

And then we come to the economic analysis, the third important category of product analysis. In economic analysis is the key to the management decision in the product design policy. Now economic was the companies doing business to make profit, so they have to ensure that the profit is accrued when the business is accomplished or a new product is loosed in the market.

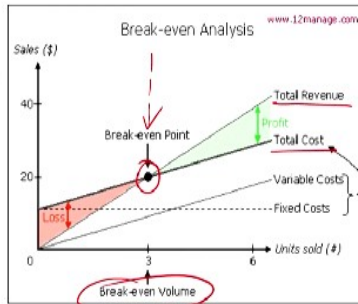
So in economic analysis answers to the following are find out what will be the amount of investment needed to manufacture the new product means what will be the financial input required. then what are the estimated production cost, what will be the expected profit margin, whether the prices proposed to be offered by the company are competitive in reference to the other products of the products of the other companies.

So from economic analysis point of view our focus will be to find out whether we will be able to make the profit what are our inputs in terms of our expenditure on investment and what is the output that we desire in terms of revenue.

(Refer Slide Time: 36:23)

Tools in economic analysis

- The three S's (standardization, simplification and specialization)
- The break-even analysis



http://www.12manage.com/images/picture_break_even_chart.gif

So tools in economic analysis we can think of the break-even analysis, we can see here, this is the break-even point which is mentioned here where the total revenue curve is cutting the total cost curve, this is the point and this is a break even volume or break-even quantity. So three S's is that is the standardization, simplification and specialisation must be taken into account.

We cannot go into the details of these 3 aspects but the basically we must try to use the standard material, standard processes if we want to be competitive and if we want to be profit making. So the break-even analysis will help us to fine tune our decision making, so that when we will start to make profit we can very easily established from the break-even analysis.

(Refer Slide Time: 37:14)

4. Production aspect → MOST IMPo

- The design will be converted in the production shop where it will be transformed into a physical product to be offered to the customers
- Successful transformation of design into a saleable product is a challenge to the organization.

Designing

Tools in production aspect

- DFM ✓
- DFA ✓
- DFX ✓

R, C, MA, P

+ Profitable

This is the most important aspect that is relevant to our course maybe I will again write here as the most important aspect because our target is manufacturing guidelines for product design and this is what we are going to talk about in our subsequent sessions. So design will be converted into the production shop. In the production shop where it will be transformed into a physical product.

So our transformation and what are the product design guidelines that we must take into account when we are designing our product especially with the manufacturing perspective that is what is a target of our course to be offered to the customer. So this physical product that is to be offered to the customer when we are designing this product, what are the production aspects that must be taken into account that is our target.

So successful transformation of design into a saleable product is a challenge to the organisation. In order to saleable I would like to add profitable also it may be sold in the market but if it is not giving proper to the organisation I think it is of no use. So the product that we are designing we must try to design it in such a way that it is easy to manufacture, it is easy to assemble.

And it turns out to be a profitable product in the market and for that we some time use the design for manufacturing, design for assembly and DFX, so X can be changed by the reliability, it can we change the cost also, then it can be changed to manufacturing and assembly, it can be changed to production. So our target basically is to focus on the production aspects during the product design process.

And learn about the various production guidelines for the various processes that must be kept in mind while we are designing the products. So we have to analyse a product from various perspectives, we have to analyse the product from the marketing perspective, we have to analyse the product from the economic perspective, we have to analyse the products from the functional perspective, operational perspective.

But most importantly we have to analyse the product from the manufacturing perspective that when the product is going to be converted into the final form or when the raw materials are going to be converted into the final products or they have to be joined together or the product

have to be assembled, what are the various guidelines that we must keep in mind and that is the target of course.

So with this I conclude the today's session, I think the first session has been slightly stretch but the basic concept was to highlight the importance of the course as well as to highlight the importance of product design and to learn about the various steps involved in the product design process as well as the product analysis.

In our subsequent sessions during the first week we will try to focus on the basic aspects of the other catch word or the key word in our title that is the manufacturing guidelines. So the title is manufacturing guidelines for product design. So product design we have covered today manufacturing guidelines we will try to cover up maybe in the subsequent sessions in this week.

Thank you.