Product Design and Manufacturing
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Lecture – 10
Value Engineering Methodology (Part 1 of 3)

Good morning. Welcome back to the course product design and manufacturing; wherein, we are trying to study the systematic way to design the product and to develop the product, then to manufacture the product; manufacturing concerns as well.

So, I am taking the topic value engineering this week. So, in this lecture, we will discuss value engineering methodology.

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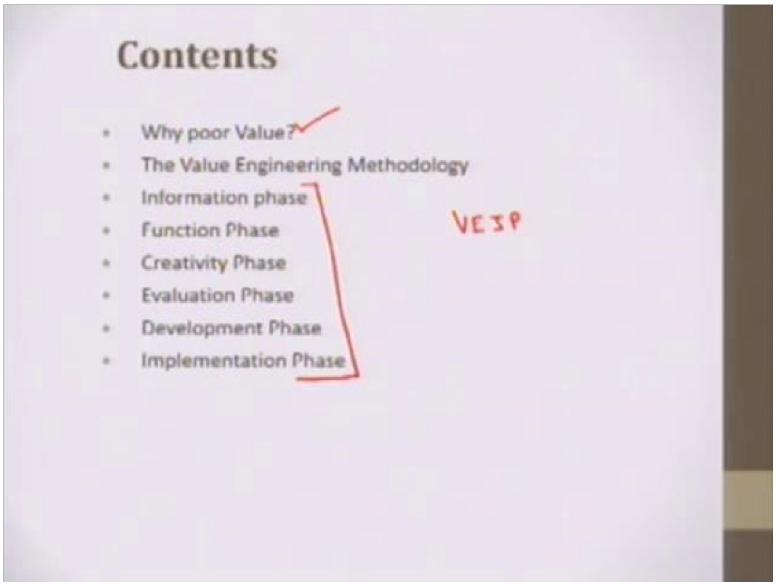

So, the contents would go like this. Will see, why the products have poor value. Then we will see these phases of value engineering, which is also known as value engineering job plan.

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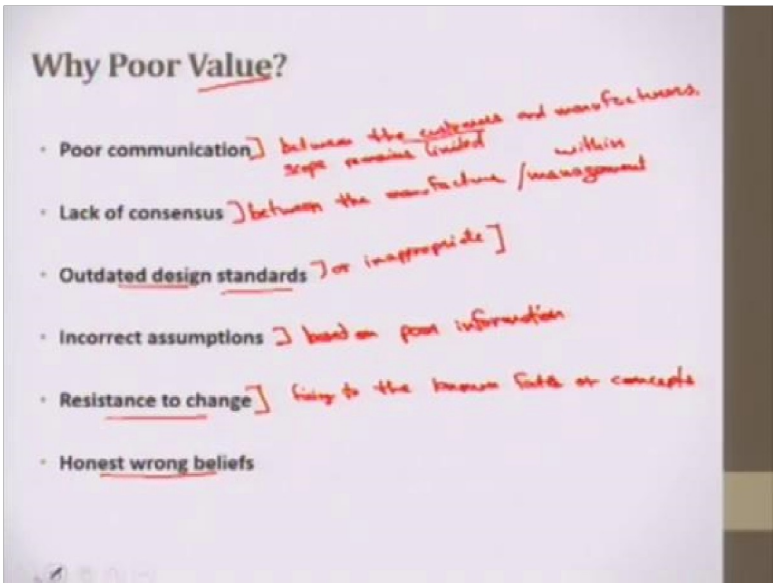
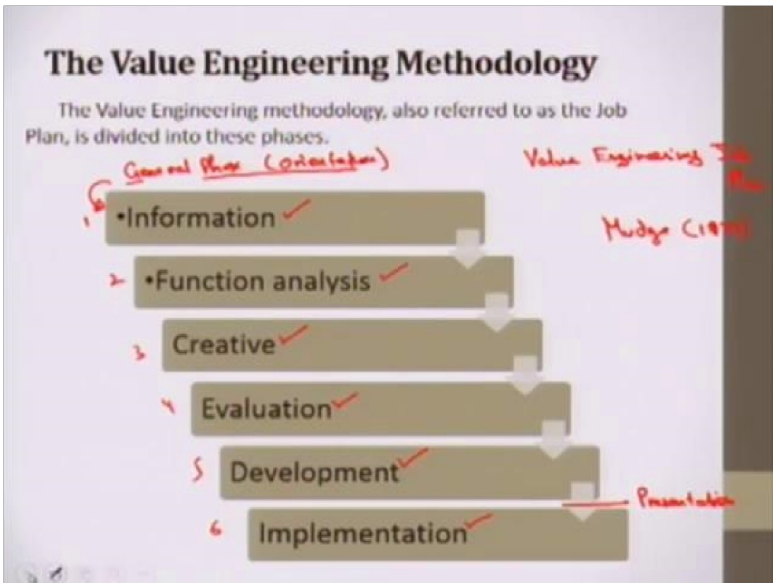


Why do products exhibit poor value? The reason for that is, number one; poor communication, poor communication between the customers and the manufacturers; the scope of the product is not defined adequately. Scope remains limited. Next is lack of consensus. This consensus is between the stakeholder between the manufacturers or within the management. Next reason might be outdated design standards. Design standards are sometimes outdated or inappropriate. We see their certain blocks, or certain thing things those keep one from being creative. So, value engineering implies creativity. Since value engineering implies creativity, so, outdated standards sometimes, one think of ok, I have tried this, and this is true, this is working well, I will keep in rest. There is a resistance to change that happens.

So, also one of the reason may be incorrect assumptions. Incorrect assumptions based on poor information. If the information is not correct, or misinformation is there the assumption which is made are not correct, those lead to poor value. The cost might raise performance may fall. So, the next reason may be resistance to change.

Just ah, already mention it here; outdated designs. Resistance to change is a fixation of previous concepts or fixing to the non-facts or concepts. Then also their honest wrong beliefs, which also does not let one do the creative thing. So, there is a poor coordination among the designers, failure to network with customers, and definition, poor definition of the product is there. So, design based on habitual thinking or resistance to change is there, mistaken beliefs are there, not enough time for project formulation on design, sometimes failure to utilize the latest technologies. So, these things lead to poor value so,

will see a methodology here that is known as value engineering job plan job plan. (Refer Slide Time: 04:21)



So, I have divided into these phases, this is 1, 2, 3, 4, 5 and 6 phases. Such and such would be divided into 7 phases, some would be divided into 8 phases, some would even be divided into 9 phases. So, I have selected 6 major phases here, Mudge 1979. He says there are 7 phases. He says of before information, there is also phase known as general phase or orientation phase. And other researches have given; given some other phases after development, they say before implementation, there is the presentation as well.

So, what goes here? From information collection, the function analysis conducted; creativity is practiced to find the alternative ideas. Those ideas are evaluated in the evaluation phase, and the evaluated ideas are then developed. Developed means evaluations are the ideas are compared for the best idea to be selected. Then the idea which is selected is seen for it is implementation then finally, implementation is carried out. In general, phase, what much says, it is just getting the swing of the things. It says just gear up with the initial information; what your goal would be, who would be your team, but that can be included in this information phase as well.

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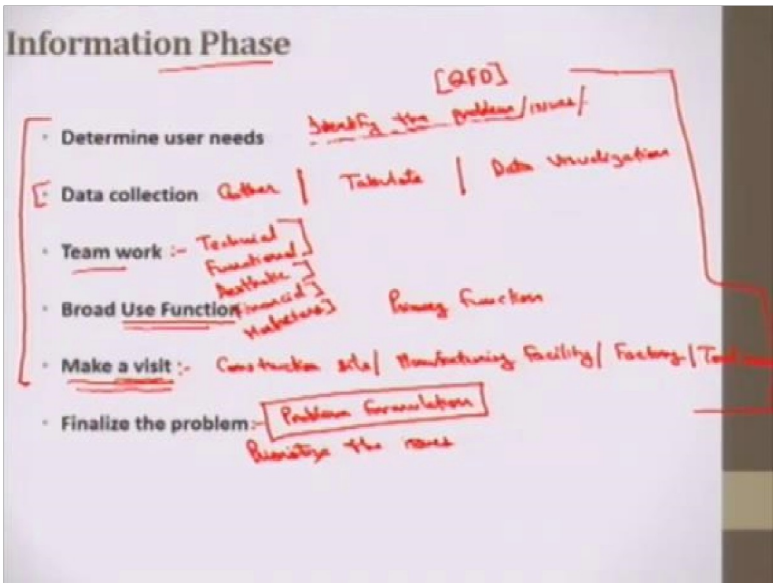

So, let us start with the information phase. In the information phase, what happens, the first step is to determine user needs; that is, identify the specific issues to be addressed here. Identify the problem or issues. The next step here is data collection.

Data collection here is, to gather and tabulate the information consenting the item that is presently designed. We gather the information and put the information in the right form. That is tabulated, or provides the graphics data visualization. Tabulation is just like putting the list of the materials that the product is made of, and the number of employees would be required to work on this project, just put making the tables.

Data visualization is making the graphs of that, comparing the cost of the most expensive component, and the various components with reducing cost. So, this making graph that is a data visualization. So, in data collection, we do this.

*Next step is teamwork. This is actually not stepping, these are the characteristics or the various tips in the information phase. Teamwork; the purpose of the team is to build knowledge and understand the project. Essential team members characterise the project goal, and they include technical and functional expertise. You can say; technical functional, these can be the same. Then we have aesthetic and various interpersonal and inter-functional teams; those who can work on, the financial manager, then marketing, marketers. So, value engineering is a teamwork. In general, it is said a group of minimum four people should be there when we talk about value engineering; because also the creativity is to be practiced here. And when one thinks of the creative ideas, one can even

skip of; one can even get out of the track if he is working individually. So, that is the team members, those who work together would make the things come into the single line.

So, next is broad use functions; the broad use functions is defined here, in the information phase itself. The broad use function is, for instance, we are trying to design a chair; the broad use function is, the chair has to made somebody to sit; it has to support a load, it has to provide comfort. So, the major use function is, here is the primary function. So, that is defined here. Next is, if it is a site, construction site; or if it is a manufacturing facility or a factory or the tool room where our product is to be manufactured, it is recommended to make a visit. So, as, this will give a broad introduction to what kind of resources we do have at this time, in the current time.

So, we actually prioritize the issues here; in the information phase when we talk about the project, when we talk about the product; there are lot and lot of things which are to be handled. So, the issues are prioritized here. So, this is the information phase. Then finalize the problem. We finalize the problem, we give the problem definition. We just identify the problem in the user needs, like using may be QFD; quality function deployment. And we have worked on the data, we have seen the data, with the help of the team; the broad use function is defined, and looking out the, looking on the resource is which; we have the problem is finally formulated; problem formulation. So, this is the rule of the first phase here; that is the information phase.

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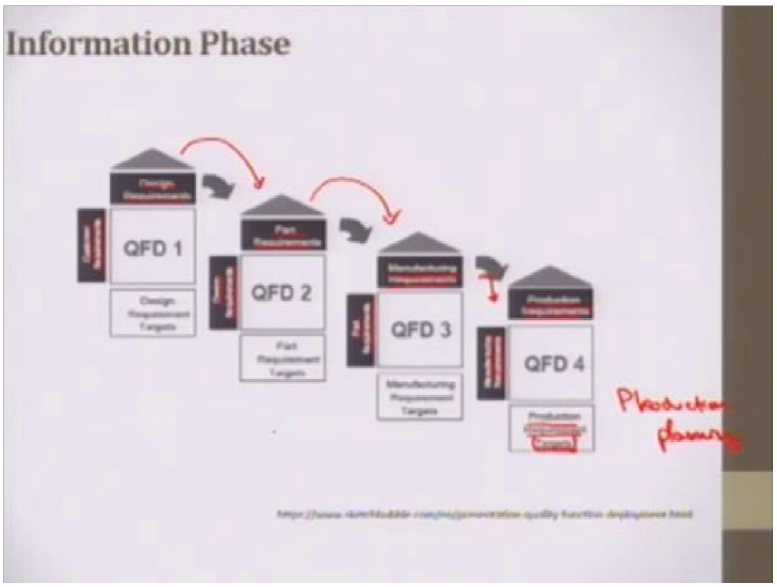

So, this Q F D as we have already discussed in the previous sessions; it is a methodology, to transfer the customer's voice into the manufacturer's requirement. It actually works in these phases, these steps. So, what happens? A customer requires are broadly identified, they are broadly set here, and design requirements are made. Finally, actually, production is to be made. Here production planning has to be made production planning. So, how does it go? First, we need design requirements.

The customer broad or qualitative information is correlated with the quantitative information that is the design requirements. Then these design requirements, we have broadly listed what that design could be. Based on the design requirement, what are the components so, the parts, which are to be manufactured here are required? For example, if I need to manufacture a chair, (Refer Time: 13:01) the components of the chair may be the backs, the supporting seat, the pedestal or legs, and all these. So, these parts are then listed here. Then these parts for manufacturing, each part, the manufacturing requirements are there.

What are the kinds of machines that are required? What are the inventory level workers? All those manufacturing requires. Based on the manufacturing requires, now these go to next step, next phase here; where manufacturing requirements are the input and production requirements is the final output that we have; production requirement targets, these targets are the final thing.
So, in this way the Q F D is practiced.

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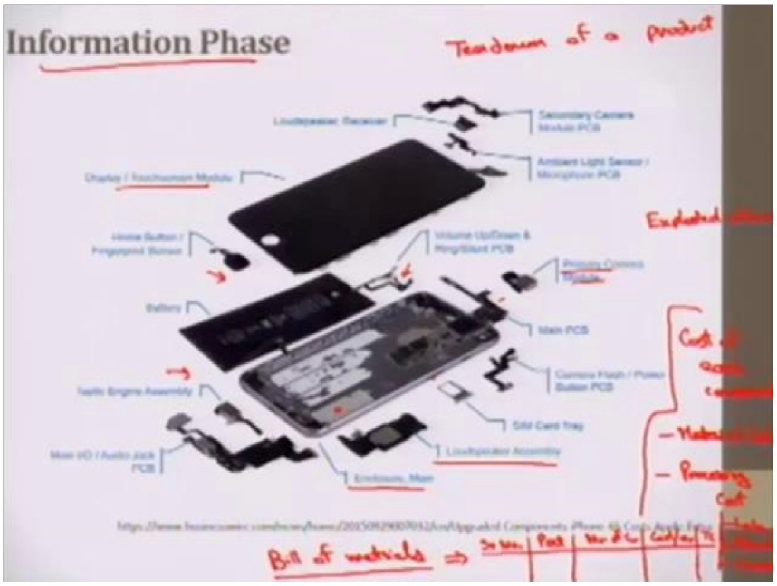

So, next, I have an example here of a teardown process; tear down of a product. This is actually tear down of Apple iPhone, this taken from a reference here. So, to this kind of view is known as an exploded view. So, if one has to design this mobile, or make some changes in this mobile; he has to learn what are the various components. He has to know, is it display that can be separated from the body; from the enclosure, the loudspeaker assemblies put in here, the sim card is put in here, the primary camera the module is put in here, the location of each component, and also after this; the cost of each component. The cost involves the material cost and processing cost. Processing cost also has certain elements like labor cost machining cost, machining; and I will put rest as overheads.

So, each component is studied here in the information phase itself. We make a bill of materials. Bill of material is the list of materials in a tabulated form, where we have this is the serial number, this is the bill of materials; serial number, the part or component name, then we have the number of components. Then cost per component, the total cost. So, this is the bill of materials; this is just gathering the information. We do not know what are the low-value areas here yet. So, value improvement potential; that we will identify in the next phase that is the function phase.

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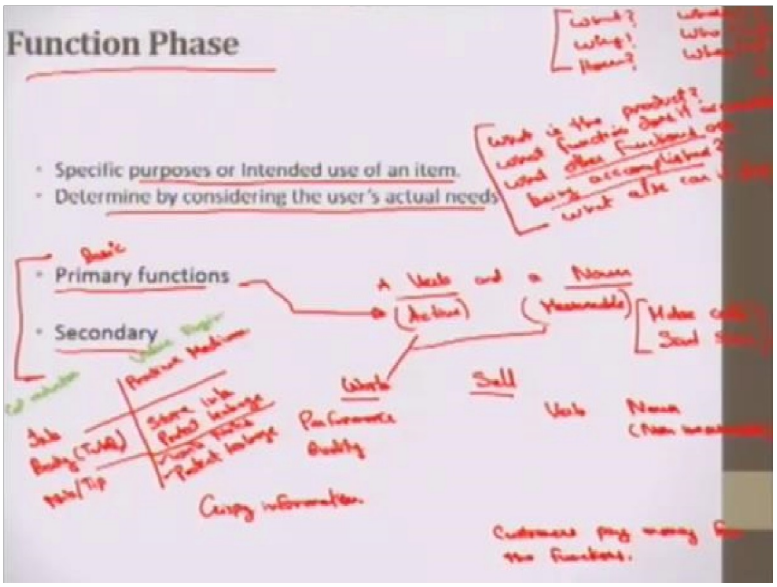

So, in the function phase; what happens? Specific purposes or intended use of an item is; so, that definition of the function is; it is the specific purpose of or intended use of an item. that means, what is are the product? What is it supposed to do? So, what else it can do? I can put these questions here. You asked questions; what is the product? What function does it accomplish? What other functions are being accomplished? So, this is just listing of the various questions that one asks. So, it is generally said, I keep six serving men, they keep telling me what I do. Six serving men are what? Why? How? These are the primary. Then, Where, who and When? So, these questions are generally asked to know, what we are going to do in a product.

What we are going to do. Why? why because, one through the value, how will use this methodology, where the product or the site, or the project on which you are working on, who the value engineering team will do, when that time would decide here. So, these functions are determined by considering the user's actual need. So, what is the product is one thing. So, what is the product? Let me say, I am carrying a mobile phone here. The product is a mobile phone.

The basic function is to make a call, to receive a call, to send messages, receive messages. What else is it doing? It is helping me to access the internet. It is helping me to surf the internet in that. It is helping me to take photographs. It is helping me to record data. It is helping me to take notes. So, many things mobile these days is a multifunctional product. So, what other functions are being accomplished? This I have just mentioned.

So, next question we can ask is, what else can it do? Earlier the mobiles were just manufactured to make calls, to receive a call; only do the basic functions, and what else it can do? I am already listening to music, watching movies on the mobile. What else can it do? Ok, I can think mobile is about 250 grams; I can use this as a paperweight. Ok. What else can it do? I have a ring in this mobile. So, this is being carried; this is some actually kind of an accessory, which is also we being used. So, earlier the mobile was not ah, this big size mobile; was not easy to carry in one hand. Dialing, the dial pad would make an issue over there.

So, in this case, I can hold this from this ring and use it with one hand only. So, this is a kind of an accessory that is put in. So, this is a this value engineering might lead to these things. So, here, in this case, the issue might be the holding of the mobile phone in one hand, or the mobile fells if it is, ah, used in one hand only. Ok. So, this issue is being addressed by this component here. So, we divide the functions into two parts. Primary functions and Secondary functions.

In value engineering functions must be defined by two words, that is a verb and a noun. So, it is said the less the number of words, the more defined or more clear is the problem. If I say, the function of my mobile phone is to make calls; this is a big line. So, make calls is the keyword. These are the keywords. Here make is a verb and call is a noun here.

So, it can be defined make calls, then make or send S M S. So, here it is like this if the verb is active and the noun is measurable. It gives the more clarity to our function. So, this is our primary function. Always primary function would have an active verb and measurable noun, like make calls; click, snap, surf internet. So, these are all; surf is a verb, make is a verb, a click is a verb, internet, call and snap are my nouns. Ok.

So, this primary function is the basic function for which the product is designed for. Actually, the customers are paying for the functions only; I can put it here. Customers pay money for the functions. So, there is two kind of functions work functions and Sell functions. Some functions are directly identified, directly seen from the product by itself, like ah; making calls, receiving a call, chair; we can sit. There is a height specific, the

height of the chair. The chair has arms, this the function; arm has to support, arm supports are to supporting arms. So, these are all work functions.

Sell functions are induced in the product to sell the product. Suppose if I want a chair that is of brown color; giving the brown color, brown colour cloth or brown colour paint or maybe brown texture, is not the primary function; is not the work function. That is something that is making the product to sell because the customer wants that color in the product. Also, if I say, I want a pen that can also, help me to work as a stylus on my mobile phone. So, actually, this is a kind of a multi-functional product now.

So, these two becomes the primary function, if that is the; my requirement. Otherwise, if it is a pen, the primary function is made marks or write, make writing or write notes; the way we define. Actually, this is a no specific way to tell the functions in two words. Someone can say, it makes marks for the primary function of the pen. Some other person can say, ah, provide notes. Someone can say record information. So, all these things do vary here.

So, in general, the work function has an active verb and measurable noun. So, this work is a performance or quality. Sell functions just need to have a verb and a noun. This can be a non-measurable noun.

Sell functions, a verb, and a noun, that is non-measurable; like I just said in the exact. So, defining the functions in two words, a verb and a noun is known as two-word abridgement. The advantages of the two words abridgement is it focuses on the function rather than on the item. It encourages creativity. It frees the mind from the specific configuration. So, it actually gives the information in a crisp form crispy information. So, like if I say, the function of a pen refill. If I say product; example, I have this pen here, I am taking out refill here. The function of; if I say, ok, this is my refill tube. I have ink in this. I have tipped in here. So, a cost reduction or a general, engineering concept would say, we have these components, but value engineering would say what we have in this? We have, I will put the parts here. It has ink, it has a body or tube that is of plastic, then it has nib; actually, it is a tip.

So, what value engineering would say body, what is the body? The primary function is store ink. So, also the secondary function is to protect or to, ok, we can put it protect

leakage. The function of the tip is again, protect leakage; can be one of the secondary function for that tip, but the primary function of the tip is to write notes. Actually, this is the primary function of my pen itself, but which the tip is doing. So, the purpose of the ink is to provide the medium, provide a medium for writing.

So, this is the way that cost reduction looks into the product and value engineering.

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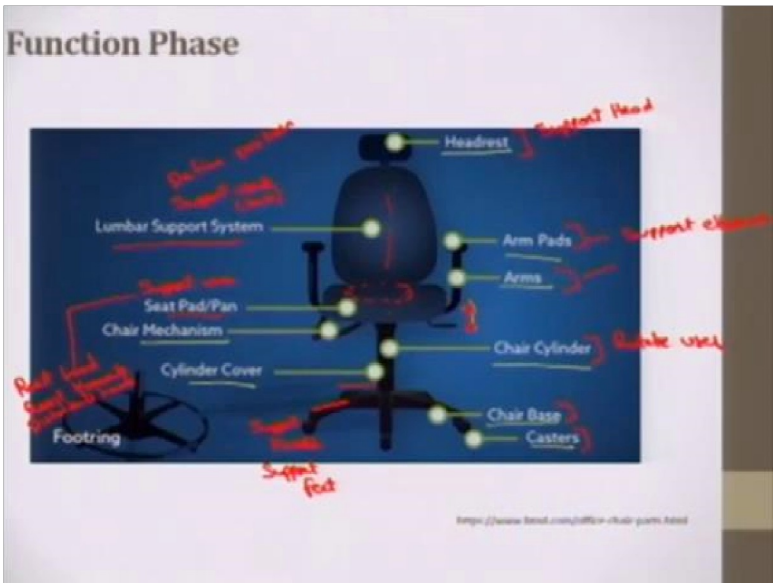

So, the next, similar phenomena you can see here in the case of a chair. In the chair, we have these components; headrest, arm pads, arms, chair cylinder, then chair base. These are castors that help the chair to revolve. This is actually a kind of an adjective chair. They have various segments of this product. So, this is an adjective chair. This is a cylinder cover, chair mechanism that may help the chair to go up and down. Then we have a lumbar support system. It helps the body to keep straight. So, this is a seat pad that provides a cushion that also gives a comfort here.

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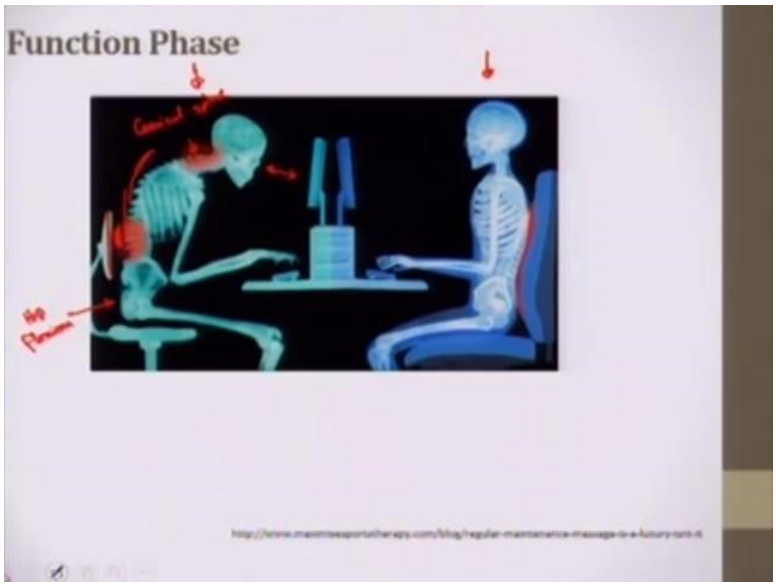

So, if you see these two postures; which posture would you prefer? However, in this case, this person is not even touching here, this is not the issue of the design here; it is actually the way this person is trying to work here.

So, their kind of advertising let me say this company, this manufacturer is kind of trying to sell his chair. He says that, in this case, this lumbar support would help your spine to keep in the right position, right posture. So, what are the issues with this posture? This is a cervical spine here. ok. He can have loaded on this thing. Then hip lection, hip lection is here. So, all the issues, this is the worst posture I could say one can have. So, he is too much indulged in this work, he is not even making his backrest on this back pad, that is here.

So, then elongated inactive weak upper back muscles, with T spine curvature is here. So, if we see these components here of the chair, or components if I say, ah, the parts of the chair, I can define this functions of each component here. What is a function of seat pad here? It has to support; I would say the user. The lumbar support also supports the user, the function is the same; but is actually supporting the back. We can choose a way we want to put this function. Then to support the user, actually, it is also the secondary function can be, it is resisting the load of the user then resisting the movements of the user, then distributes loads as well. Distributes loads into the area where the user is sitting. So, this, this lumbar support the main, his ah, the main function here is support user.

The secondary function is to define the position, or ah, this can also be; better to put this as a primary function; because this is the support here that is defining the position of the person who is sitting, a user who is sitting here. So, the primary function is to define the position, the secondary function might be support user. Then this cylinder is here, chair cylinder. The, it is a function is rotated user. Then this arm pads and arms; these support elbows. Headset supports the head, support head only; I have not put d here, two words have to be used.

Then support bottom, this supports the feet or knees. Support knees or support feet. In value engineering, no component is just seen as if a physical component, ok. This is support, this is base, this is back, this is an arm, this is the pen tube, this is the pen rifle and so on. We look into the function; what is the function it is trying to accomplish? Then in the next phase, we will see in the creativity phase, we forgot what was the main product, for the time ok then we say, what is the function? What does the way, what are the various ways in which this function can be accomplished?

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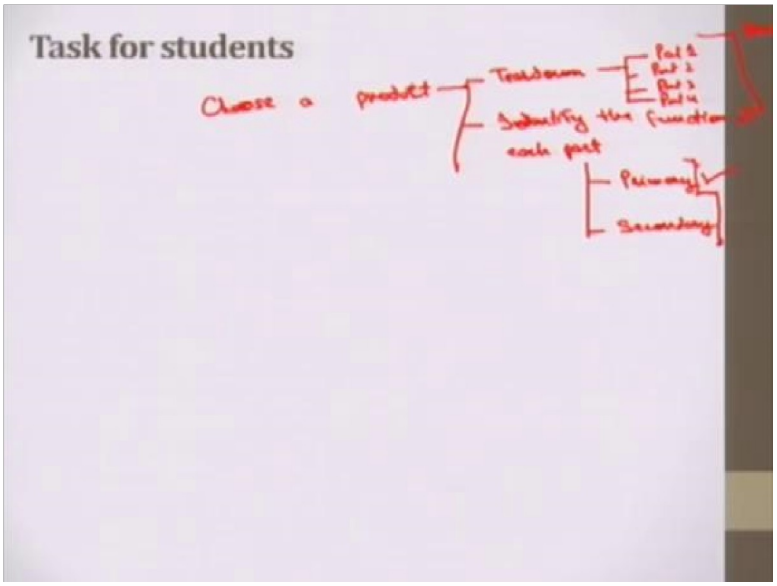

For this lecture, I have a task for you. You please choose a product; you can even work on the product that you have chosen in the previous lecture, ok. Then identify or first tear down. You need not tear down physically; you can just see the information about the product. For example, if we choose a pen, you can see what are the various components; of the pen tear down the product into various components, ok part 1, part 2, part 3, and

part 4. Then try to identify the functions of each part. Then divide this function into two categories primary and secondary functions. Ok. What you will see, the primary function of the product you choose; for example, if you choose a chair, the primary function of the chair is to support the user. What is the component that is accomplishing this function? This is a kind of work function; the texture of the here, the blue color of the bag, or the chair, the black color of the arm pads, was all aesthetics. Those are all selling functions.

So, what you will see here the primary function of the product of the whole body or whole assembly here would also be the primary function of the part. So, please do this task, and will meet in the next lecture. We will discuss the fast diagram function analysis and system technique. That is a kind of a diagrammatical representation or presentation of the various functions. We place the functions into various positions, where it should be we will see how that works.

Thank you.