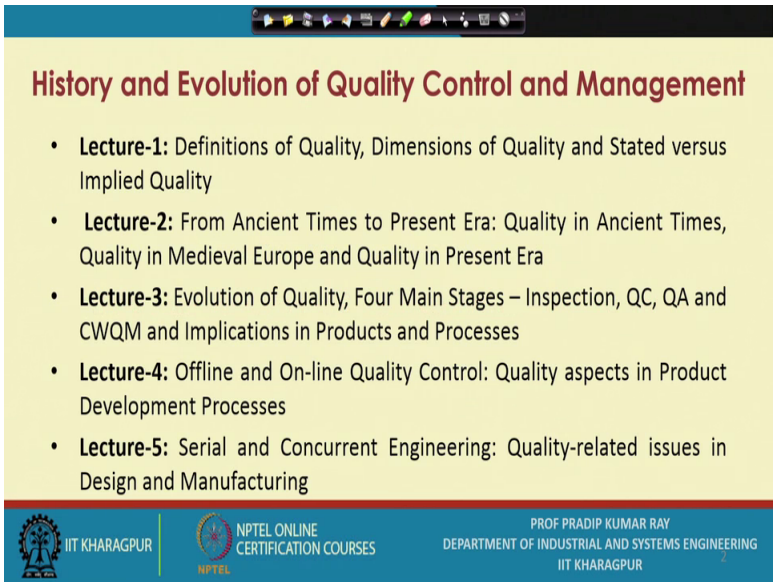
Quality Design and Control
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Lecture – 01
History and Evolution of Quality Control and Management

So, on the subject called quality design and control there are many topics we need to consider as you are already aware of that this will be a 12 week course and as such there will be 12 specific topics. That today I am going to discuss the first topic called history and evolution of quality control and management.

(Refer Slide Time: 00:45)



Now, this particular topic has 5 sub topics and each of these sub topics will be covered with corresponding lectures. In the lecture one we will be discussing definitions of quality, dimensions of quality and stated versus implied quality. Lecture 2 from ancient times to present era: quality in ancient times, quality in Medieval Europe and quality in present era we will be discussing certain characteristic or important points we will highlight.

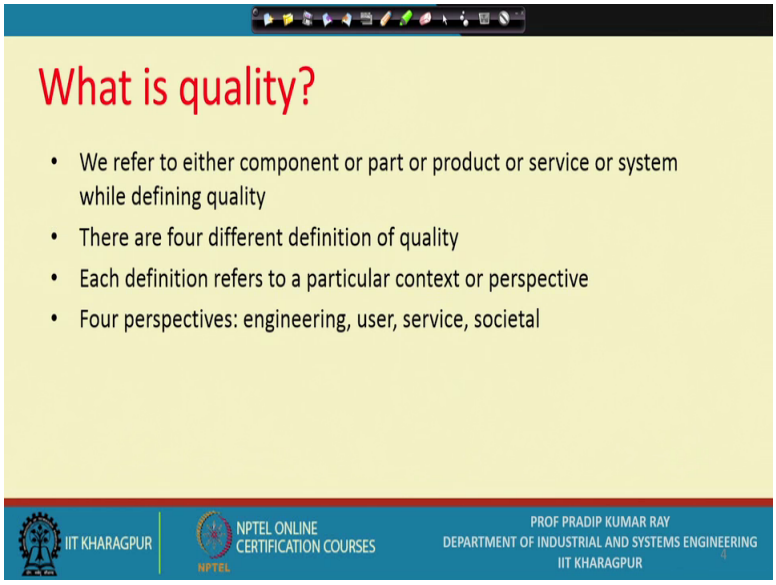
In the subsequent lecture we will be a discussing the evolution of quality and mainly there are 4 stages we will highlight inspection, quality control, quality assurance and companywide quality management hence their implications in production processes. Similarly on lecture 4 we will be highlighting offline and online quality control and what

are the quality aspects in product development processes and in the last lecture in this particular topic we should highlight serial and concurrent engineering, and what are the quality related issues in design and manufacturing, these are the 5 soft topics.

(Refer Slide Time: 02:17)

Now, as for as a history and evolution of quality control and management is concerned, you know we should be aware of first what are the different types of the definitions we come across while we try to define quality, what are the dimensions of quality and what are the stated quality features as well as what do you understand by implied quality.

(Refer Slide Time: 02:50)

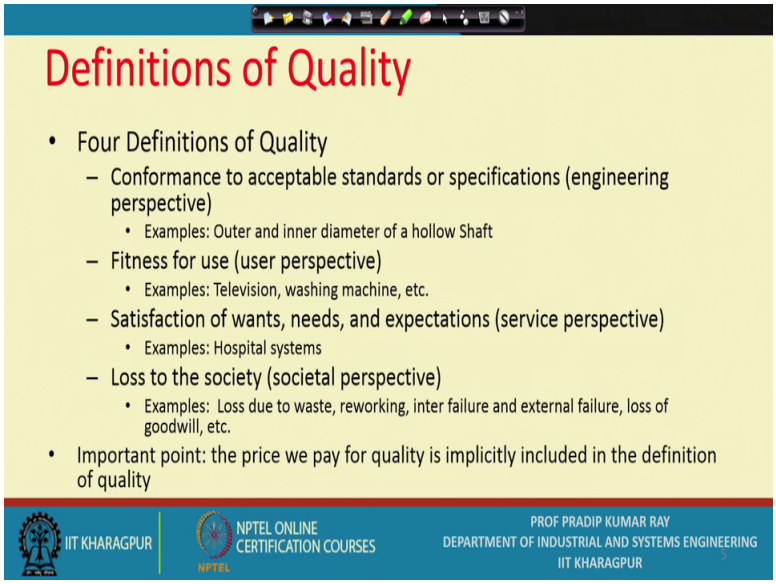


Now, you know the quality has been defined from several perspectives and if you go through the literature, if you go through the text book, you know what you find that while we define quality we refer to either component or part or product or service or systems.

There are you know at the part level or component level you have to define the quality similarly at the product or the service level and at the systems levels also. There are 4 different definitions of quality we depending on which perspective you are referring to and while we refer to the dimensions of the quality each dimension refers to a particularly context or the perspective. Now as we are all aware of that there are 4 perspectives we have; one is the engineering perspectives; that means, from the engineers point of view what could be the definition of quality. From the users of the customer's point of view what could be definition of quality.

Similarly, there are many service organizations like hospital, like transport, like police systems, like legal systems, how do you define quality in respect of service organizations and there is a bigger issue that is with reference to the you know the society at large how do you define quality, this 4 perspectives we are going to discuss.

(Refer Slide Time: 04:30)



As I have already told you there are 4 definitions of quality, the first one from the engineering perspective when we say quality it means conformance to acceptable standards or the specifications and for examples you know when we talk about the outer

and inner dia of a hollow shaft, you know for both outer dia as well as the inner dia there must be a specifications and while we produce a hollow shaft we must check whether we are able to confirm to this specifications or not, our perspective is engineering.

There are several cases where the person whose is using a product or a system he may not be aware of the engineering specifications, but you know he makes his opinion about the product quality. So, the next definition like say quality is nothing, but fitness for use for example that means, if you look at your television you say that television is very good or television is very bad even we are we are just referring to it is a whether it is fitness, whether it has got the right kind of fitness for use or not, similarly you say washing machine, hundreds of users they may be not be knowing the engineering specifications, but they might say that these washing machine is very good or very by very you know very bad as far as quality is concerned.

This is basically the users perspective and when you consider the users perspectives for 100s and 1000s of products we refer to a kind of definition which is called fitness for use. Then for a service system you know like hospitals, like for the legal system or the transportation banking insurance and all, these are all service systems now the service systems the quality has been defined as satisfaction of once needs and expectations; that means, there are users and they want their wants and needs to be fulfilled and they have certain expectations. So, while we define the quality for service systems we must be aware of what are these ones needs and expectations of the users.

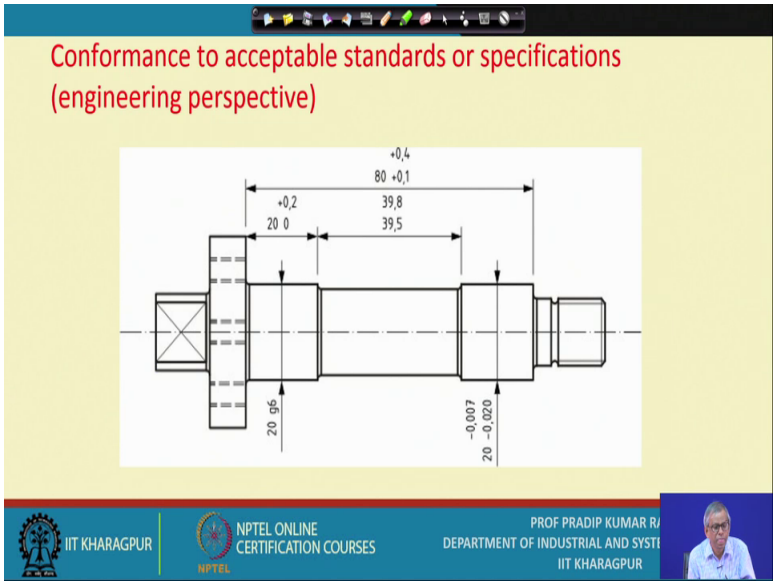
For example the hospital system; obviously, you know there are many issues involved many kinds of wants and needs you need to satisfy the last one you saw a very very important like any productive produce ultimately you know during it is manufacturing phase as well as during it is use phase you will find that ah if the performance or the quality is poor or not as per the standards; that means, it is it has got a you know it creates a negative effects on the society like say while you produce a product you produce wastes you go for reworking and then when you start using it you may not be satisfied, or say sudden you know the failure may occurs.

These are the aspects to be looked into while you define the quality of a product with respect to the loss to the society. This is a very unique definition and in many cases these days you know when you talk about you know the products manufacturing systems and

what is it is impact on the environment what is it is impact in the societal systems, you need to define quality in terms of loss to the society that means, if the loss is less the quality is very high and if their loss is very high the quality is assumed to be very very poor.

So, examples like several examples you can have the loss due to a waste reworking internal failure and external failure and where the loss of good will etcetera. The most important point that is should you should keep in mind that is while you define quality has to be defined with respect to the price you pay; that means, the price will pay for quality is implicitly included in the definition of the quality that means, there cannot be any definition of quality without refereeing to the price you pay.

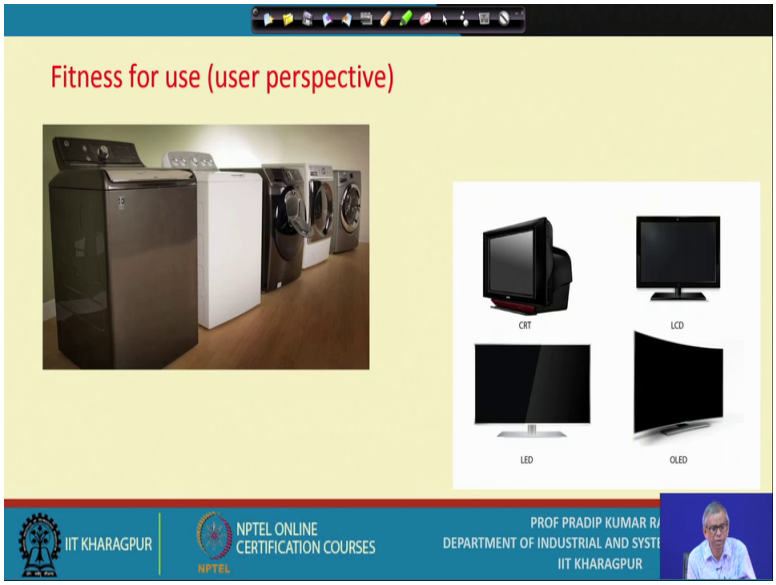
(Refer Slide Time: 09:18)



Now this is an example of conformance to acceptable standards or specifications case while we define quality and this is engineering perspective as already mentioned. So, this is a typical you know ah either we know as there is a shaft or say particular work piece and you know there are many quality characteristics on again at each quality characteristics while you design such a component you specify it is standards for the specifications like what could be the specification of the surface finish what could be you know the specifications of the inner dia outer dia etcetera. Now, while you produce a particular piece of a such a component of a unit of such a component you just check

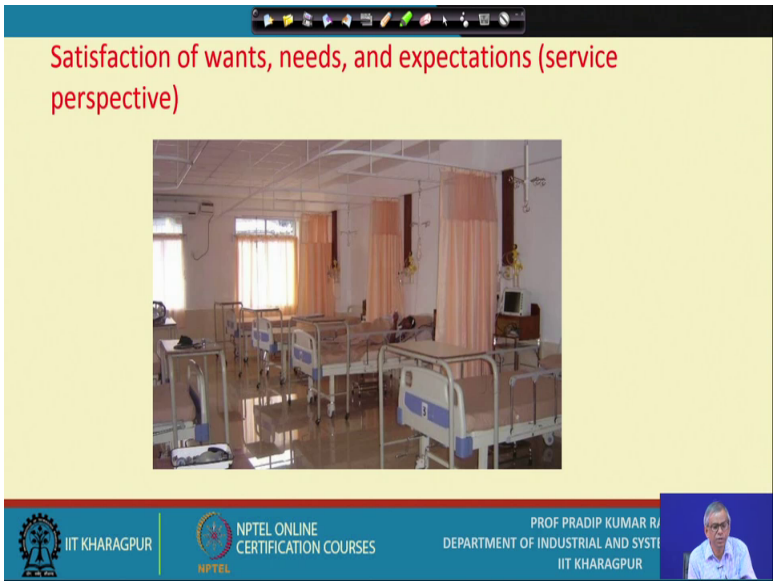
whether you are able to meet these standards or not, that is from the engineering perspective fitness for use.

(Refer Slide Time: 10:15)



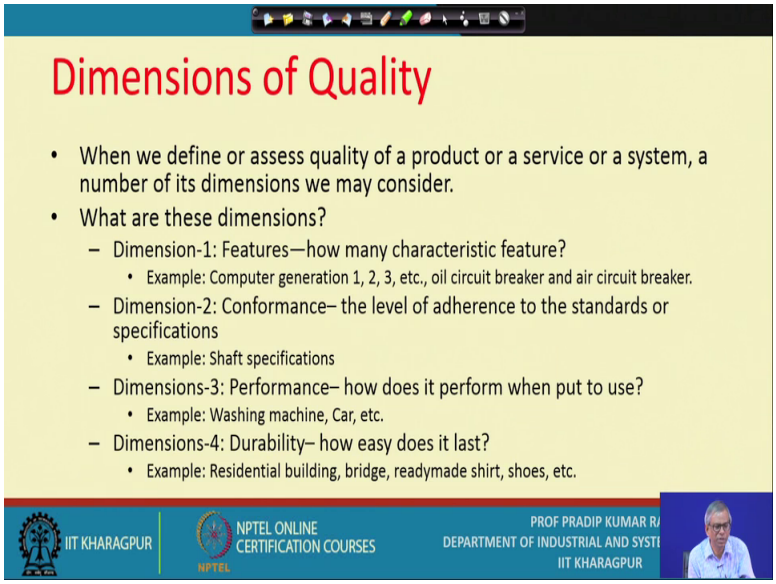
This is a product may be we as a as a user we may not be knowing it is engineering specifications, but then while I use this particular product say the fridge or say washing machine. We say it is very good quality or it is very bad quality, this is while we define quality in this case we say quality is nothing, but fitness for use it starts my purpose. So, these are the examples like say in the television and all, like for the television may we say the color density is one of the quality characteristics is very very important, but as a user I may not be bothering about what is this specifications I say yes it is you know while I get the you know the programs built through this you know while I see some programs on this particular TV it is fantastic it is very good, this is we refer to as fitness for use.

(Refer Slide Time: 11:15)



Similarly, as I have already told you that the satisfaction of once needs and expectations that is from the service perspectives, while we come across such a system, say whether it this you know the indoor of a hospital systems indoor services, we get different sorts of data we say we look at from several perspectives, whether from the patient perspective the system is good or not. This is essentially the satisfaction of once needs and expectation, but first you try to meet the needs and once the needs are you know satisfied then you go for creating such a system that you are able to meet the once and what is your expectations at individual level.

(Refer Slide Time: 12:04)



There is another concept called dimensions of quality, as you are aware that the quality has been looked at from several perspectives; that means, whenever you say that this is a quality product or this is a quality component you have in your mind several issues and while you know we consider these issues or these ideas you know we say that these ideas must be there you know must be considered while you define quality and these ideas or these are the features of a particular product these are referred to as the dimensions of quality.

So, what are these dimensions, when we define or assess quality of a product or a service or a system a number of it is dimensions we may consider is it so, I am just trying to give you an idea that what are these dimensions. So, the first dimensions are the features how many characteristics you have in a particular product and as the product are changes that means, today may be the product is made available in model 1, tomorrow you might get the model 2 and similarly you might the next model or the next version of the product you might get.

As you know the version changes version of a product or the model of a product changes you will find that the number of characteristic features this number also changes for example, computer you know generation 1, generation 2, generation 3, today suppose it is a generation 5 computer or say microprocessors or whatever you say you will find that there are many kinds of features you have in the basic system whereas, 30 years back when used to have say generation 1 or generation 2 you may have only few features.

So, while you know, while you look at the dimension of quality the first thing we should focus on that is what are the features, like say you know while circuit breaker is to the while end of the circuit breakers and that is to be that used to be the oil circuit breaker today we go for air circuit breaker. In the oil circuit breaker the number of the features you have and that the air circuit breaker the number of features you have obviously, there is a change.

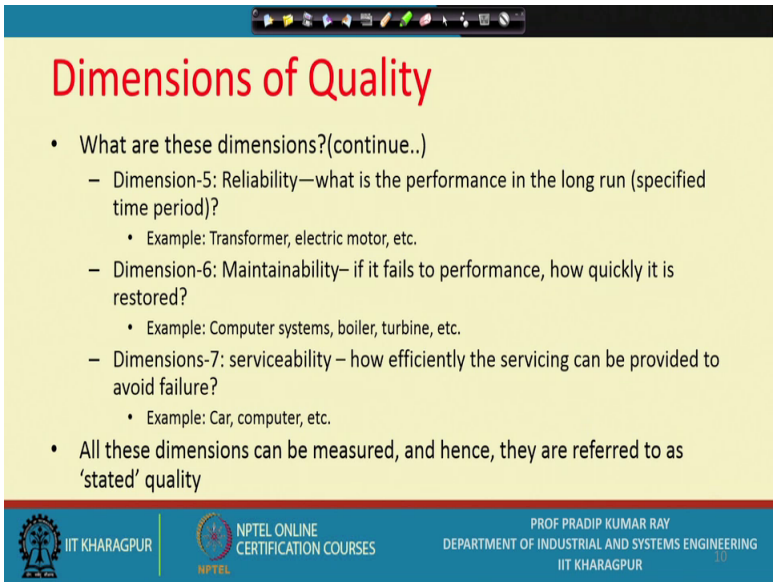
Second dimension is essentially the conformance as I have been telling you that this is from the engineering perspectives, any product you look at or say the design of a product, you know the quality is primarily defined with respect to ah with respect to it is design, and when you look at the design say suppose you will referred to the engineering drawing, obviously you must get an idea about the conformance the level of endurance to

the standards or the specifications. This is your assessment like for the short specifications it, you say to what extent suppose we have 4 or 5 characteristics to what extent we are able to conforming to the standards given for all this you know the quality features or say you know the quality characteristics.

Third dimension is essentially the performance to you know the majority of the people quality means you known it is the performance, if the product performance is well accepted to you that means, the quality is very very good and suppose the performance is not guaranteed then you say yes the product quality is questioned, how does it perform when put to use. That is the major test you have and a while you producing quality or not like washing machine, car etcetera, if there are many models available and the each model have it is own performance standard.

Dimension 4 you know it is called the durability; that means, how long it lasts, if the product because the last for 4 years this may not be considered as very good quality, but if it lasts for say 15 years it may be considered it is a very good quality, how easy does it last. So, example like residential building is it normally it is designed for say 50 years similarly the bridge they have their own norms, this is very very important like say even when you go for readymade chart or the shoes you wear is it, you say whether it is durable or not, it is very important if someone says it is very durable he is referring to it is quality.

(Refer Slide Time: 17:18)



Then dimension 5 reliability; that means, the reliability part we will discuss later on, but what is reliability; that means, the quality at these point in time is assured whether when the same product the qualities assured even after few years or few months after certain time period, it is referred to be actually what is the performance in the long run; that means, through the quality in the long run we refer to and this is very very important, that means, today create a quality product you must ensure that this is very very reliable.

So, examples like transformer where they use when the production system, the electric motor took a, should you must be reliable if it is not reliable; that means, performance is not you know the guaranteed then what happens; that means, as it is linked with the production system. So, production systems should be affected and ultimately there will be severe cost.

Next dimension is the maintainability now whether the product is sophisticatedly designed or not it is a high quality product or not one thing is sure; that means, the product may fail at any point in time is it, if it fails to how quickly you can restore this function; that means, how quickly you can get backs your quality. So, how do you what do you do actually you go for repairing and the, how quickly you can do that and to what extent you get back to it is original state of health, that is basically this concept is known as maintainability, of the maintainability is high you say thus the quality product is very high. So, if it fails to you know tools required performance how quickly it is restored, like say computer systems, boiler turbine these are the systems you have.

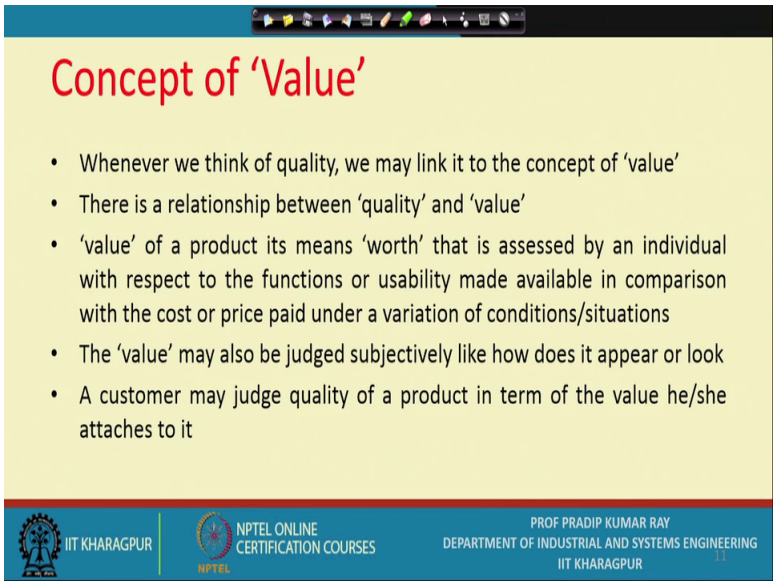
Dimension that the last dimension that is called serviceability how efficiently the servicing can be provided to avoid failure. There are few products there are many products these days you know while we defined the product; that means, the services include can you think of a product called a computer systems is hardware now without bothering about it is service, can you think of a product called car without bothering about it is serviceability because at any point in time it might fail. So, what you try to do that means, to prevent the occurrence of failures in advance you do some you know thought of checking and the servicing activity you do. The serviceability; that means, while you design a product for quality; that means, you most look in to whether you know you are designing for the serviceability or not.

Similarly, you know, but the design is most important to create quality, you must look into whether I am creating a design for a product, whether I am considering design for reliability, design for maintainability, design for serviceability or not. Now all these 7 dimensions if you look into you will find they are measurable; that means, if you collect data from a system definitely you will be able to measure them, but you know there are many products we use even if we do not measure the dimensions we say this is very very good is it. So, when say suppose you say it is a Belgian glass you glass you use, without bothering about all these dimensions you say it has to be good, if it is you know Indian textile it has to be good, there are if it is a German camera it has to be good, if it is you know the Sony TV it has to be good, if it is IBM computer it has to be good.

So, you know, sometimes what happens at a certain level when you continuously you know improving the quality you reach a state where you do not bother about all these dimension you say yes it is coming from these particular company or this is the product name fine it has to be good. So, ultimately any exercise you carry out on quality you have to you know definitely we will consider all these dimensions while you manufacture it, while you produce it, but ultimately what you try to develop you reach the maximum quality level and the you know your performance is excellent at these information goes to all strata of the society and then your product your systems will have a very good brand name like for Indian railway system it is a fantastic system it is a highly reliable system considering it is a huge the dimensions and all.

So; obviously, you know ultimately in any exercise on quality we refer to you know the brand value, ultimately you know the quality of the product should be such that you get ah a value out of it and this is called brand value

(Refer Slide Time: 22:46)



And this is called implied quality now, as for as concept of value is concerned; that means, whenever someone look at a product with respect to the quality he or she may have a may have idea about that what is value, he is attaching he or she is attaching value to the product, while he or she gets an idea about it is quality or when he or she assesses the quality of a product.

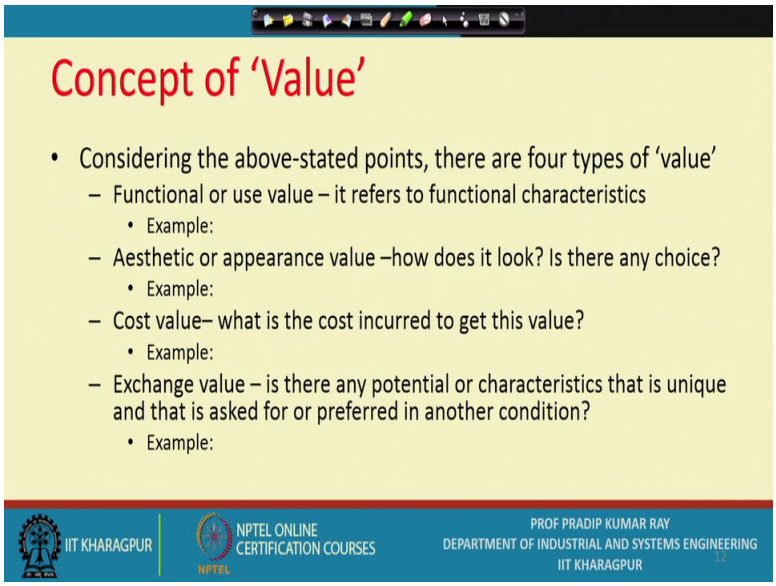
Now at this stage I would like to highlight you know certain aspects of value and the concept of value must be well understood as a student, as a learner, as a practitioner, ultimately knowingly or unknowingly while you define quality you accept maximum importance to the value. So, I have made certain comments like, whenever we think of quality we may link it to the concept of value it is there is a relationship between quality and value usually there is a positive relationship. If suppose the quality increases immediately the meaning is the value has also increased, value of a product means worth; that means, it is worth that is assessed by an individual. So, individual to individual this might vary to you it may be a valued product to me my perspective may be different I say it is not a value product.

It is individual base definition in many cases with respect to the functions or usability made available in compressively the cost of price paid under a variation of conditions on the situations like say when you purchase a parker I you know you do not mind paying a 1000 rupees or 2000 rupees, but then when you pay this price you expect certain level of

quality. The quality in the sense that is when I use a parker pen it has to last forever that is sort of you know say the you know the feeling you may have or assessment you may have and as per these assessment you attach value to such a product whereas, when I purchase a 10 rupee say buy ball pen I mean may not attach you know the such a value to this particular product.

The value may also be judged subjectively like how does it appear or look, this is very important, like say appearance value like say Banarasi silk is it is a highly you know high quality product definitely for then again while you select a particular you know the saree or say silk you also you know the look at it is color or the appearance value. It is an individual choice, the customer may judge quality of a product in terms of the value he she attaches to it.

(Refer Slide Time: 25:56)



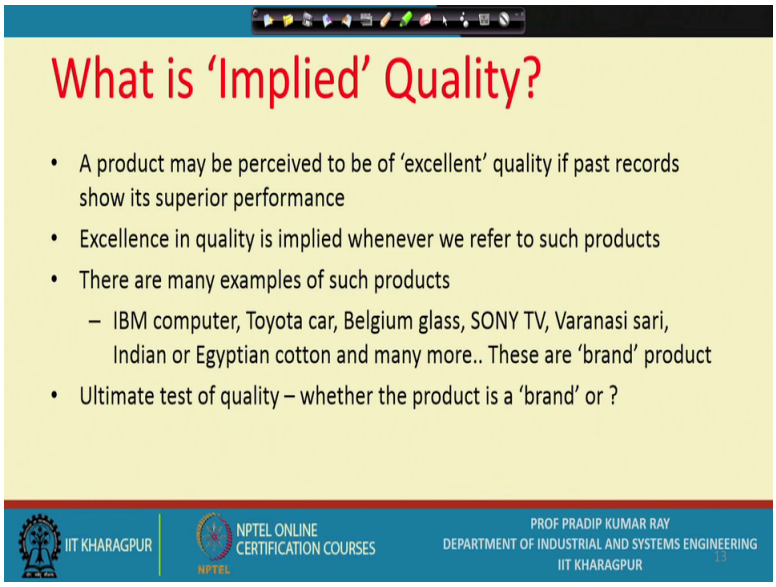
So, concept, considering the above stated points there are 4 types of value 1 is the functional use value it refers to the functional characteristics, then you have Aesthetics or appearance value how does it look is there any choice, the my request is that you select few examples in each case you select any product and then you try to identify it is functional value say example must be known and you search for the examples as a learner.

The cost value what is the cost incurred to get these value and most important thing the exchange value is there any potential or characteristics that is a unique and that is asked

for or preferred in another condition; that means, you solve it in a with say the 50 rupees over here the same product you can sell it with 50 us dollars in another country; that means, your product is known your brand value is known and this is the ultimate test, that means, if you continuously increase the quality of the product ultimately the exchange value of the product will increase.

Now what is implied value?

(Refer Slide Time: 27:05)



A product may be perceived to be an excellent quality if past records show it is superior performance, this is this is to be achieved excellence in qualities implied whenever you refer to such products. There are many examples of such products as I have been telling you one is the IBM computer, Toyato car, Belgian glass, Sony TV, Varanasi saree, Indian or Egyptian cotton and many more, these are the brand products and ultimate test of quality whether the product is a brand or not so.

Thank you.