Quality Design and Control
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Lecture – 04
History and Evolution of Quality Control and Management (Contd.)

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I am now going to discuss under history and evolution of quality control and management, an important sub topic called offline and online quality control and quality aspects in product development process. Now offline and online quality control based tools and techniques are widely used for almost all types of products and while we go for this offline and online quality control tools and techniques, certain quality aspects; we always refer to we always discuss, and if you look through the history of quality control and improvement. We will find that many sorts of tools and techniques, we use under offline as well as on online quality control, which are actually you know the instrumental in producing a product which have excellent good quality as well as the robust in nature.

So, later on I will explain; what do you mean by a robust product in the context of quality improvement.

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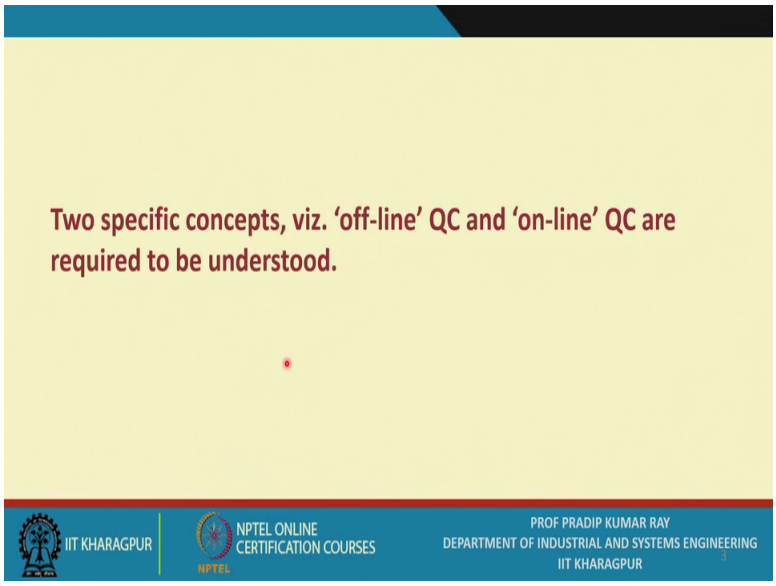

Now, I have already mentioned that these are 2 concepts. In fact, online quality control and offline quality control. Now the context in which they refer to must be understood very clearly and in totality. So, that is the purpose. So, that you know as a learner; you get the; you know the real understanding of this 2 concepts.

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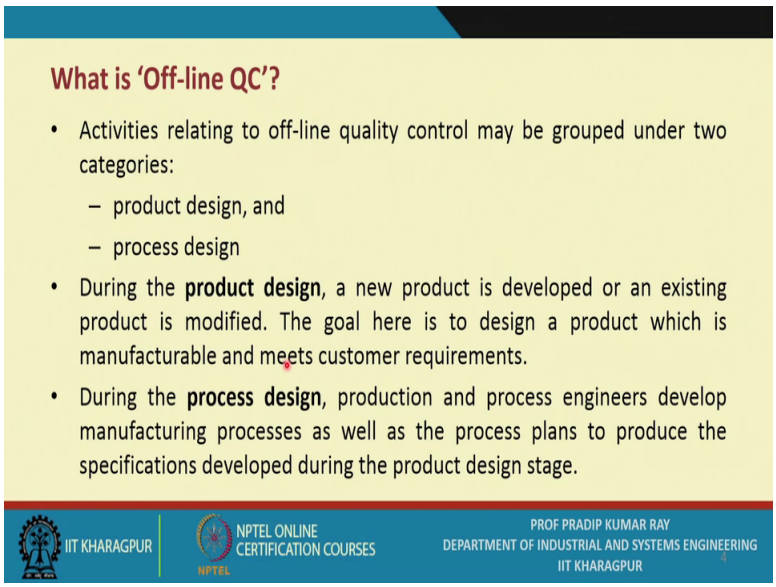

Now, what is offline quality control that is you know it has there many types of activities you carry out, mainly the activities relating to offline quality control may be grouped under 2 categories; one is product design and the second one is the process design these

are the 2 important aspects we have in the product development process now during the product design a new product is developed or an existing product is modified. Like if you visit any manufacturing company invariably you will find that there may be a new product developments cell or sometimes you know even you will find if the companies having rnd cell or rnd department, it is also the purpose of creating rnd is to a create new product in many cases.

The goal here is to design a product which is manufacturable and meets costumer requirements this is very very important manufacturable and meeting customer requirements which is obvious. During the process design what you do production and process engineers developed manufacturing processes as well as the process plans. To produce the specifications developed during the product design stage now here the QR is the process plan. In fact, in many factories; in many companies, you will find that the process plan is refer to as a technology.

So, if the process plan is known; that means, you are ready to produce a product. So, as per; you know the design requirement what you try to do? You build up your process, you line up your process, you identify the best possible a processes, you know it includes all sorts of activities related to the; you know the manufacturing. So, that is to be properly planned. So, this is process design. So, offline quality control are tools and techniques are normally used before the product is manufactured.

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Now, there are normally you know in the field of you know the quality there are many pioneers has contributed a lot, now one such you know the name is Taguchi who introduced the concept of quality engineering and he emphasized on offline quality control; that means, if you want to improve the quality of the product, why do not you take up the quality related activities during the design stage. And so, he recommends a 3 step approach; this 3 steps are system design parameter design and tolerance design.

Now, in the system design; what you try to do you create the prototype of the product based on relevance scientific and engineering principles of. Obviously, the product to product there will be changes in the relevance scientific and engineering principles. So, you as a scientist as an engineer, you must now all this principles related to a particular product and you create a prototype.

Now on the prototype lot of experimentation, you have to do and one kind of experimentation you do that is he refers to as the parameter design in the parameter design what you try to do; you try to determine the settings of the control parameters of the products and processes so that the performance of the product is expected to be at the acceptable or maximum level. So, this is point number one in the sense as I have already pointed out that the performance is one of the key dimensions in quality and that is the main dimension.

So; obviously, for the designer. So, that we ensure the performance and then simultaneously; what you have to do you make sure that the product performance is assured in the presence of uncontrollable noise factors; that means, you know even if you start you know using a particular product in an very adverse you know environment extreme situation like say may be in the underground mines or in the end of the desert with high ambient temperature say 55 degree Celsius, you will find that the product is running, now this was not possible some 50 years back for most of the products, now today it is possible.

So, what is it? The basic concept is you just test the product in several adverse conditions and you make the settings in such a way that the performance is guaranteed. So, when you know even if the effect of the uncontrollable noise factors like say the temperature humidity dust fumes and etcetera, etcetera. So, the effect of the uncontrollable noise factors on the performance of the product is minimum you say that the product is a

robust one. So, this is the second stage the parameter design and then the third stage what you do you go for the tolerance design here you know we go to this steps; that means, it is basically you go one step further; that means, instead of the specifying the point estimates of the parameters why do not you go for the interval estimates and this is basically the tolerance zone you create. So, that is why it is referred for each you know controllable you know the factors.

So, this is referred to as the tolerance design is it? So, this is tolerance design is essential for process settings are you getting my point otherwise it may be impossible to control the process settings at their point estimates, it is just not feasible that is why you specify the tolerance. So, the basic objective of this approach is to create a product which is robust in nature and today we will find there are lots of examples of such products like say car batteries like that toys like the Sony TV or the computers the car engine, etcetera, etcetera, none of these you know; obviously, you know these products have been created with another robustness in mind. So, they are referred to as the robust product.

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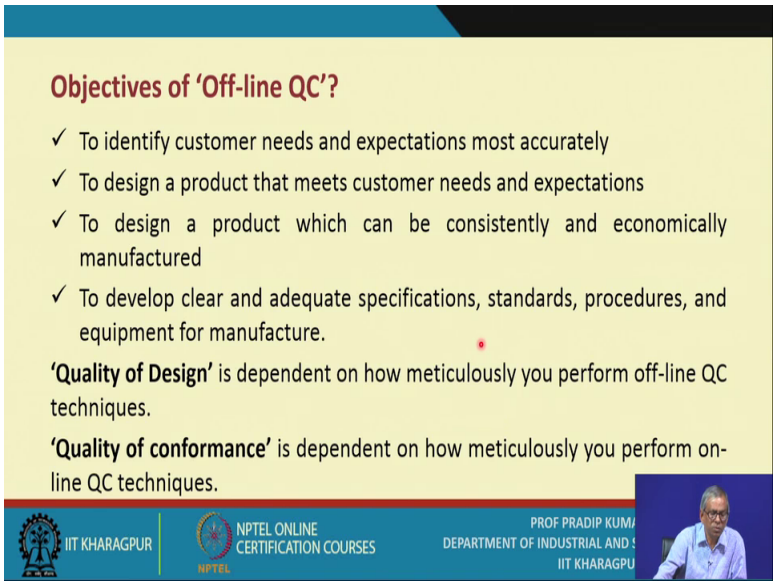

Now, what are the specific objectives there are you know the four fold objectives we have first one is to identify customer needs and expectations most accurately sometimes what you do you go for market research and you get the you know the product brief from the customers to design a product that meets customer needs an expectations to design a product which can be consistently and economically manufactured now here the point is

consistently. Now this is you know whenever you try to create a quality system make sure that the variability is under control and whatever you do you are able to do it consistently for longer period of time.

So, this way you create the quality systems in any manufacturing or service organizations and the last objective is of offline quality control to develop clear and adequate specifications the standards procedures and equipment for manufacture. So, these are four objectives specific objectives you have now there is a term called quality of design you know everything starts at the design level and. So, the quality of; that means, the product which you which were going to manufacture the product which will going to design now it must meet some requirements in the system, it will use over there.

So, normally, it is a design process now at the design stage like you know make sure that the quality aspects separately is dealt with like say sometimes, what you do in the traditional you know the designed process you bring in the concept of factor of safety. So, that is just one issue there are many other considerations you must have at these stage.

So, the quality of design which is a; it is a; we will explain it later on the quality of design, it is a essentially we refer to offline quality control and the quality of conformance this part is dependent on how meticulously you perform online quality techniques; obviously, when the design is ready quality is assured that blueprint is made now what you try to do you go for a manufacturing it and while you manufacture make sure that whatever the specifications you recommend at the design state, these are conformed width. So, the entire system of manufacturing sometimes is referred to as the quality of conformance, which is very important.

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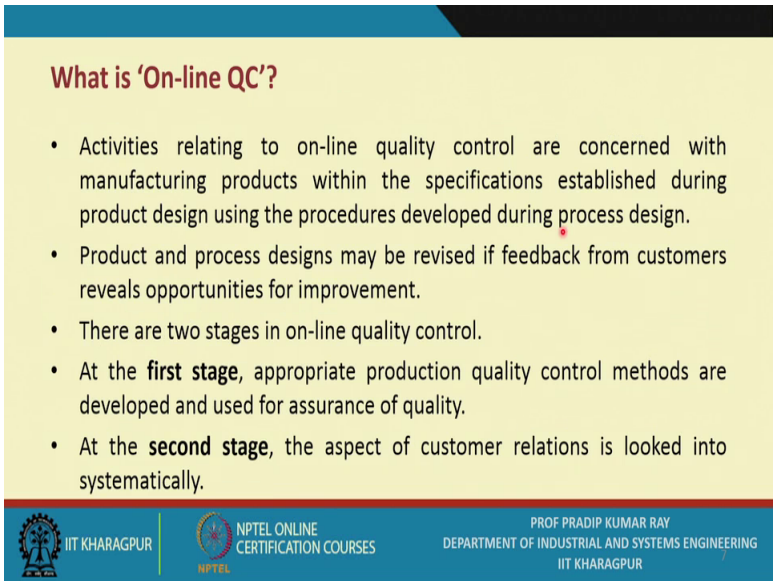

So, whenever you talk about quality of conformance we must there we must use you know the various kinds of tools and techniques for quality control and these are referred to as online quality control usually this online quality control techniques are used on real time; that means, you know the real times that is the point; point to point or say unit to unit you must control so that sort of system. So, the activities relating to online quality control are concerned with manufacturing products within the specifications established during the product design I have already referred to using the procedures developed during the process design.

So, this is the process developed mainly we also refers to is the process plan its. So, the output of the design is basically the engineering drawing and the output of the process design is essentially the; you know the process plan. So, both are used and then product and process designs may be revised if feedback from customers reveals opportunities for improvement; obviously, you are in the con you know the constant cyclic of improvement continuous or continual cycle of improvement; obviously, you know it is a close loop.

So, you always try to get back you know try to get the feedback from the customers and based on the feedback which you get feedback information you try to revise the design, you try to revise the process design and there are 2 stages in online quality control at the first stage appropriate production quality control methods are developed and used for

assurance of quality like for examples like say specie statistical process control or the control charting many many other tools and techniques you are going to use.

So, those will be use at the first stage and at the second stage the aspect of customer relations is looked in to systematically.

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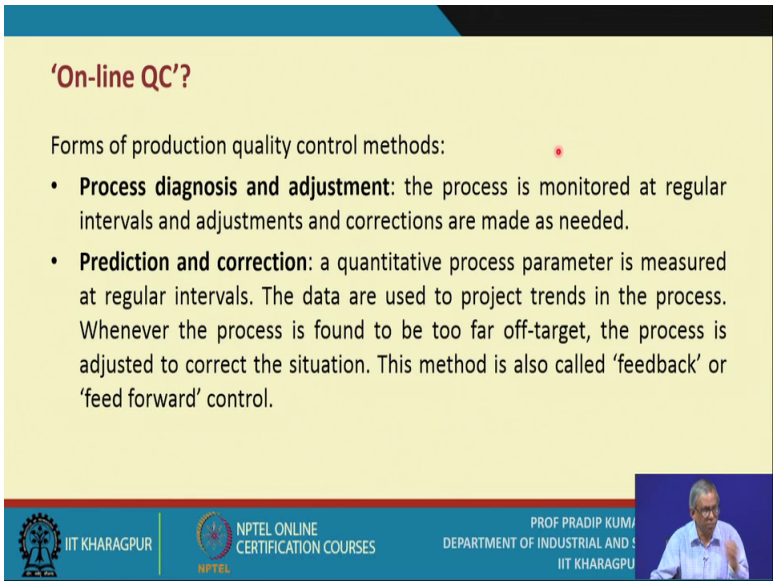

So, this is the features now forms of quality production quality control methods. So, you know like different kind of tools and techniques you use. So, sometimes they refer to as one category of such tools is referred to as the process diagnosis and adjustments like say you know the diagnostic tools you use for fault identification for trouble shooting through the maintenance. So, till there you can use different types of diagnostics and the process is monitored at regular intervals and adjustments and corrections are made as needed; that means, there are many examples of a process like it could be facility it could be a machine tool it could be a group of facilities is it in that plant like this.

So, this is very very important and the second one is prediction and correction a qualitative process parameter is measured at regular intervals like there was like say the process parameters like the speed feed depth of cart the type of coolant you use you know typical the machining pollutions and all suppose the operation is turning. So, what you do metal turning. So, at regular intervals this possess parameters their values are being monitored the data are used to project trends in the process whenever the process is found to be too far of target the process is adjusted to correct the situation.

So, normally what happens the well trained workers or the supervisors they can do these job the correction one and they move that what sort of correction mechanisms they have these method is also called feedback or feed forward control is it; that means, you must do it for the adjust to the process when a you know; you notice some deviation from the target as quickly as possible.

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How would the related to product development process; this is a you know the product development is got 3 main interrelated phases one is the product design followed by processed design followed by manufacturing and when your represent them; that means, the first phase is linked with the second stage, it is also linked with the third stage, second stage is linked with the you know the third stage and as well as it is linked with the first stage and the third stage is; obviously, linked with the first stage as well as the second list; that means, when you look at all these 3 phases they must be looked at in the closely fashion; that means, product design effects the process design effects the manufacturing ok.

So, now when you look at the product design aspect or the process design aspect the kinds of tools and techniques you use related to quality or quality control or quality improvement where mainly those tools are related to the quality improvement, these are referred to as the offline quality control like say you know the statistical design of experiments or say quality engineering best tools, and techniques which you use those

are referred to as offline quality control. So, mainly for quality improvement and quality sustains then when you start producing the product; obviously, there will be some manufacturing variations.

So, product deterioration this will be there. So, online quality control is the next step is it whatever the standard you have developed at the offline stage to what extent you can you can maintain that you can produce that standard that is very very important; obviously, you know you phase lot of the effect of several uncontrollable noise factors in the manufacturing systems there be lot of variations and you have to take care of that.

So; obviously, it must be an online quality control technique and this techniques are used for during manufacturing.

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Now the stages in product development process is it. So, there are mainly the five stages we have the first one is identification of the customer requirements and setting up of design objectives that is most important. In fact, later on when we talk about the quality loop concept we will you know discuss it in much more detail identification of the customer requirements is setting up the design objectives. This is very very important step, then identification of the design alternatives; that means, here comes you know first you have the ideas or the new design then you have the detailed design and; obviously, you know the always that could be 2 3 alternatives more than one alternatives you can prefer and accordingly now you can say that what is my design level.

So, today the design level may be one the tomorrow you say, I will offer an improved design with a better quality; obviously, you may say that this is design level 2 and subsequent the design level 3 also you may opt for. So, these aspect also will deal dealt with. So, we will we will be dealing with and identification of the design alternatives this is the job of a designer selection of the appropriate design that seems detailing that is always do and assessment of product design and manufacturing.

So, these aspect the assessment part constantly you do all the time these evaluation is a must; that means, the entire system is very very dynamic and as you may be knowing one particular important aspect is you know the design is never the matured their examples very you know this you know very the small product may be just be 1 or 2 components you have it took almost one hundred twenty years one hundred thirty years to get it matured.

So, always there is a there is a scope for improvement in the product development process its. So, these are very very important and so the mainly what you need to do; that means, the before where the production starts actually there are 3 stages we have we have the design stage, then the production stage and that the design stage is sometimes is referred to as the pre production stage if you had focus is on production; that means, the production is the central point and then before production the pre production stages and after production you are engaged in post production stages.

Now, everywhere these aspect the aspect of quality you need to consider this is one. So, another one is when you try look in to the process quality now there is a concept called process life cycle the process means maybe say workshop you will develop a plant you develop. Now how do you develop this plant it is very important. So, the first stage you go for designing it you have to install plant and the next stage you will have the commissioning at the third stage after the commission is over you start working with the manufacturing systems so; obviously, there will be a policy will be dealing with the operations and simultaneously you will be dealing with the maintenance.

So, that is essentially the manufacturing systems now the manufacturing system has its life. So, you can you know when the technology changes may be your manufacturing systems becomes entire plant may become totally obsolete. So, what you need to do at some point in time either you go for you know the improving the manufacturing process

quality for what you try to do you try to the stop producing and you say yes its life is over economic life is over, I will be going for decommissioning and then after decommissioning you go for disposal at all these phases; that means, the design commissioning operation slash maintenance decommissioning disposal everywhere you need to maintain the quality standards.

So, this is total approach. So, where ever someone talks about you know the linking the quality issues with the product development processes or you know when someone discusses offline as well as online quality control you assume that he takes a total approach and quality is such a complex issue unless and until you go for a total approach the success rate may be very very poor. So, with this a brief introduction to this course; I complete this particular topic ok.