Quality Design and Control
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Lecture – 03
History and Evolution of Quality Control and Management (Contd.)

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So, under history and evolution of quality control and management, I am going to discuss the sub topic that is evolution of quality four main stages inspection, quality control, quality assurance and CWQM and the implications in production processes.

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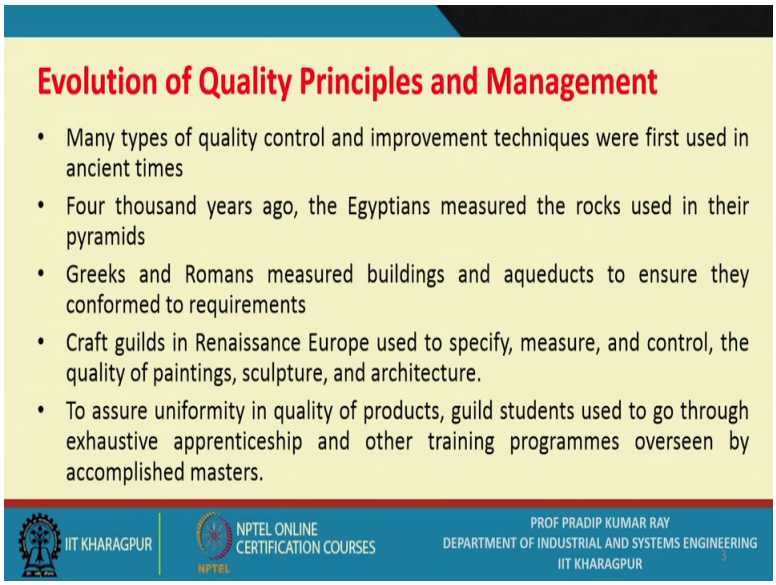

So, I have already mentioned that when we consider evolution of quality we refer to; we essentially the evolution of quality principles and management style over the years since may be 4 to 5000 years. So, many types of quality control and improvement techniques where first used in ancient times this point to be noted, 4000 years ago the Egyptian measured the rocks used in their pyramids.

So, this is a quality exercise Greeks and romans measured buildings and aqueducts to ensure the conformed to requirements there are several examples. In fact, I want to highlight one of the examples craft guilds in renaissance Europe used to specify measure and control the quality of paintings sculptures and architecture. So, unless you start measuring those quality features or quality characteristics how do you asses the level of quality. To ensure uniformity in quality of products guild students, I have already mentioned about the craft guilds. So, the guild students used to go through exhaustive apprenticeship and other training programs over seen by accomplished masters exactly the same thing even today, we have been doing at different organizations.

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Now, as I have already mentioned though we have gone through four stages in the modern quality; first one inspection, second one is the quality control, third one is the quality assurance and the 4th one is the company wide quality management. CWQM it is also referred to as the total quality or total quality control or total quality management. So, many authors; many practitioners, they prefer different names well the concept wise they are all same.

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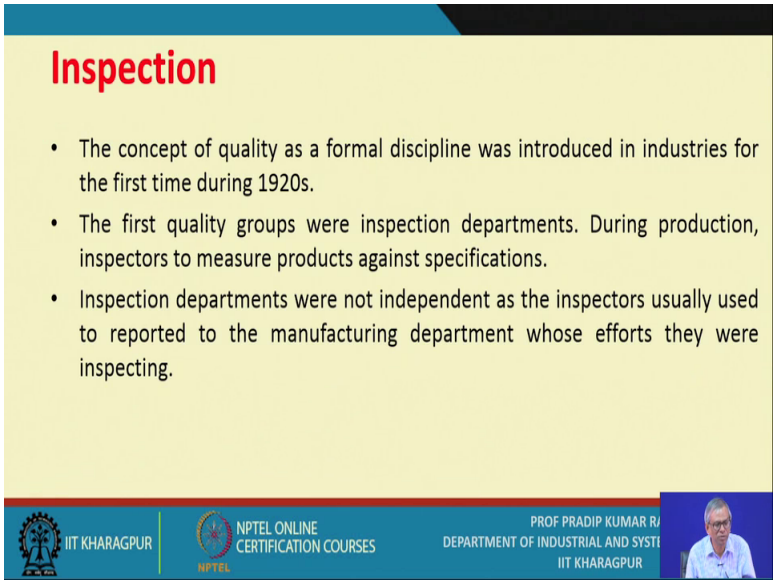

So, what is inspection? Under the concept of quality as a formal discipline was introduced in industries for the first time during 1920s.

The first quality groups where inspection departments, during production inspectors two measures products against specifications. Inspection departments we are not independent as the inspectors usually used to report to the manufacturing department whose efforts they were inspecting; that means, essentially you know the workers, they never used to have independent authority to assess the quality, they used to be treated as only the producer they used to produce and once it is produced; obviously, the inspectors they used to join in and they will ascertain whether the quality specifications are confirmed with or not. This present a conflict of interest; obviously, there are two groups the workers they are producing and the another group so, they are inspecting and the its quality.

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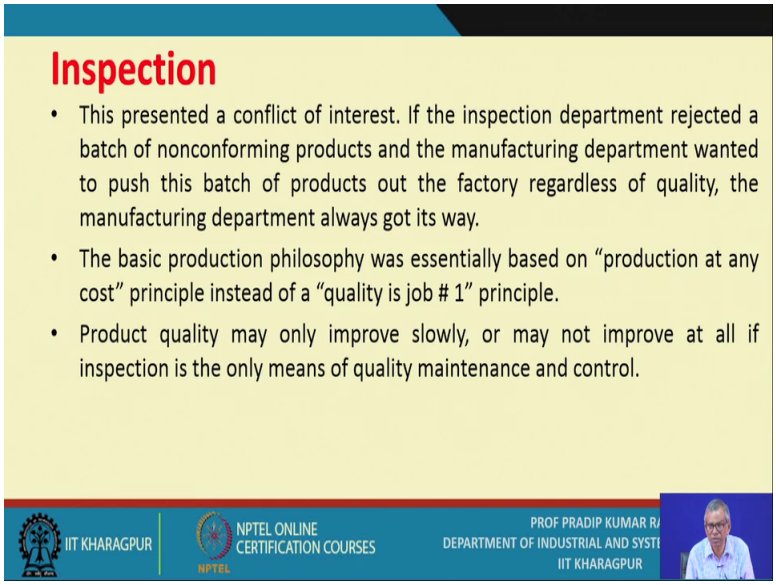

If the inspection department rejected a batch of non conforming products and the manufacturing department wanted to push this batch of products out the factory regardless of quality the manufacturing department always got it is way; that means, its it is like the philosophy behind there is a inspection based in quality has been that the production at any cost.

The basic production philosophy was essentially based on production at any cost instead of qualities job number one principle. So, even these days you will find many

organizations in India and several other countries you will find they go by this logic. Product quality may only improves slowly or may not improve at all if inspection is the only means of quality maintenance at control. Now this is the question you please mark it and the reasons behind; that means, a many a time a you should know that what are the specific reasons. So, can you high light the specific reasons that, whenever you find that there is an inspection department you know immediately you may conclude that the less importance is given to quality improvement; is it ok?

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So, there is some inherent limitations in this approach inspection based quality control as for as quality improvement is concerned.

Now, when in 1940s; now what has happen that these inspection groups evolved into quality control departments; that means, the first time we see that the organization is creating a separate department called quality control. The start of world war two required that military products will defect free; the product quality was crucial in winning the war and could only be ensured if the inspection department could control production process. So, everyone agrees to this point.

So, responsibility for quality was transformed to an independent QC department which was now considered the guardian of quality. So, the first time you know by the organizations structure, in the organization structure you get you know a department called a quality control.

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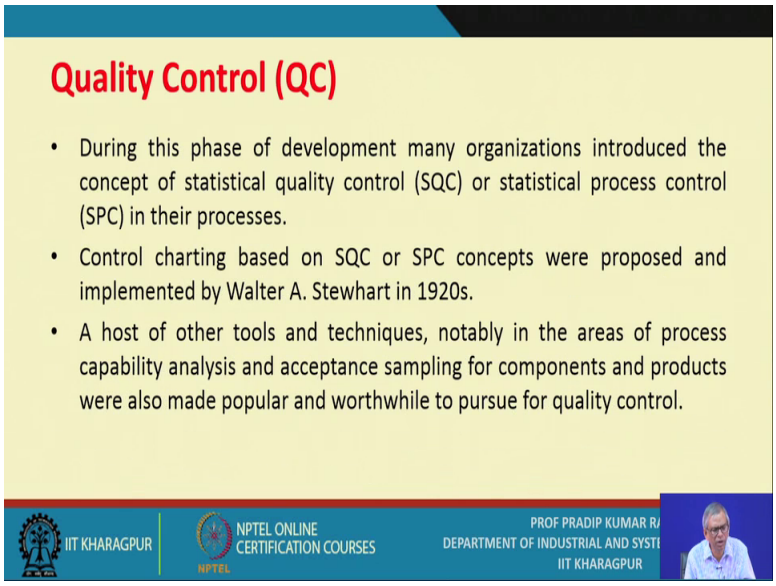

The quality control department was now separated from manufacturing to give its autonomy and independence and possibly we will find where ever you find a quality control department. So, organization structure is such that it has been given independent authority and power let now during this phase of development that is a form you know early 40s; it started many organization introduced the concept of statistical quality control.

So, this particular you know the topic will discuss in detail and SQC is one of the you know that the foundation topic in any course, one quality design and control and this also refer to as the statistical process; control charting based on SQC or SPC concepts were proposed and implemented by Walter a Stewhart in 1920s. So, any of this control charts are named after him and he is one of the pioneers who introduced the concept of say the control charting and the quality control or statistical quality control even in 1920s.

A host of other tools and techniques note only in the areas of process capability analysis and acceptance sampling for components and products were also made popular and worthwhile to pursue for quality control subsequently the persons like Dodge Romig, they contributed a lot in the area of acceptance sampling in the area of you know the process capability. So, so they are considered to be the pioneers and the I always insist that you should refer to the standards developed by them, you should refer to the text books return by them.

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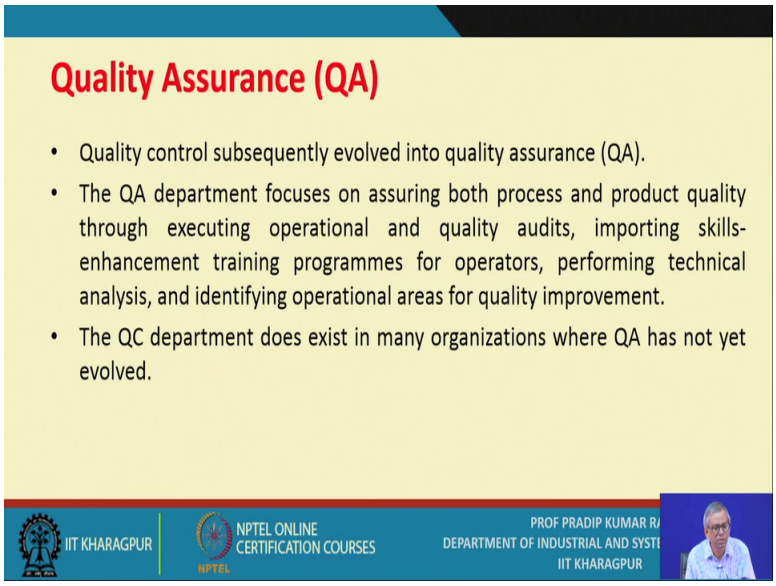

So we will get an total idea about that what is to be done what is to be you know what is to be learned in the field of quality. So, now, in the sixties onwards the quality control subsequently evolved into quality assurance; that means, here is the system you know I produce hundred consecutive items I do not need to inspect, I do not need to you know a check and achieve the item I am sure that hundred consecutive items I produce their all you know a good quality there will be not a single defective, but beyond hundred units I do not know.

So, that is my; a level of quality assurance. So, any company you visit any manufacturing systems you look at you; you must get an idea about this quality assurance in some other organizations in another plant you may find that they saying sir we have achieved that next level of quality assurance one thousand consecutive with these machinery with these facilities we have made the settings in such a way and we are controlling them in such a way that 1000 consecutive units are all will be conforming to the specifications of quality and hence, you do not need to inspect; you do not need to quality control. So, that is my level of quality assurance.

So, there are such measures available level of quality assurance now this quality assurance department focusing on in specific terms assuring both process and product quality through executing operational and quality audits as I have already told you that we ensure quality assurance what is important is there must be perfect match between the

product quality systems and product and process quality systems. So, there has to be quality audits importing skills enhancement training programs or operators performing technical analysis this is a must this is the backup and identifying operational areas for quality improvement.

So, many well known organizations, their engaged in this sort of activities as for as their effort, for quality improvement is concerned. So, the QC department does exist in many organizations where QA has not yet evolved. So, this is a situation in particularly in our country will find that we have an quality control part up to quality control part most of the organizations they have reached, but still we have to go a long way to reach the quality assurance stage for many many organizations.

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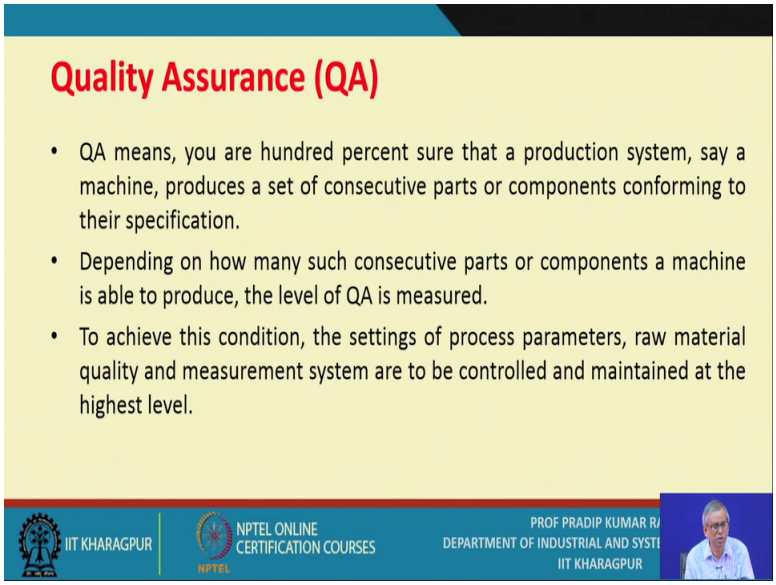

So, QA means you are hundred percent sure that the production system say a machine produces a set of consecutive parts or components conforming to their specifications. So, the assurance is hundred percent. So, depending on many such consecutive parts or components a mission is able to produce the level of QA is measured as I have been telling you to achieve these condition the settings of the process parameters raw material quality and measurement systems are to be controlled and maintained at the highest level. So, in this context, I should high light one particular point.

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That is quality is as good as the measuring instrument.

So, now we move to say from sixties one words late sixties onwards many companies they started talking about companywide quality management; that means, the quality is not only the responsibility of just one production department it is the responsibility of all the departments of an organization. So, companywide quality management is also called total quality management as a or total quality control or total quality for implementing total quality concept in organization its chief executive officer often leaves the quality management functions. So, these is important and as the quality message permits at all level of organization and all hierarchies their all levels of the hierarchy more people become involved and slowly a quality ethic and culture. So, it is a slow, but the definite process.

The focus of the total quality program is companywide customer oriented and competitively driven. So, this is an important point you please look into these aspects company wide. So, that is your responsibility, quality no longer resides in one department it is a companywide issue essential to the organizations survival. So, to produce a quality product or deliver a quality service requires the attention and commitment of everyone in the organization; that means, it is the individual effort that to be guaranteed.

It is the responsibility of the person doing the work whether it is the security guard controlling arrival of persons or transport the mangers supervising employees the operator working on the machine or the person delivering flowers; that means, whatever may be your job against that job you must be able to define its quality standards. So, the top management usually defines a realistic policy line management establish says.

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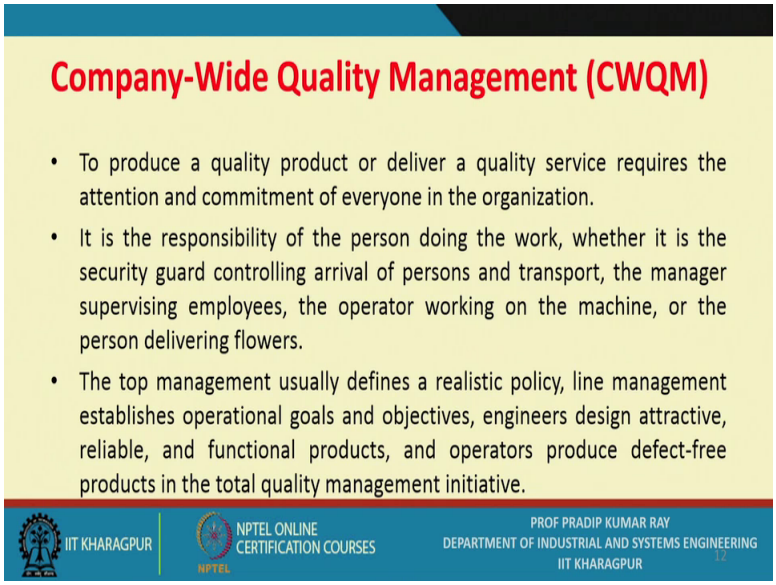

The operational goals and objectives engineers design attractive reliable and functional products and operators produce defect free products in the total quality management systems.

So, this particular you know the points, I advise all of you to look into and then only you will get an idea about what is actually the total quality management systems.

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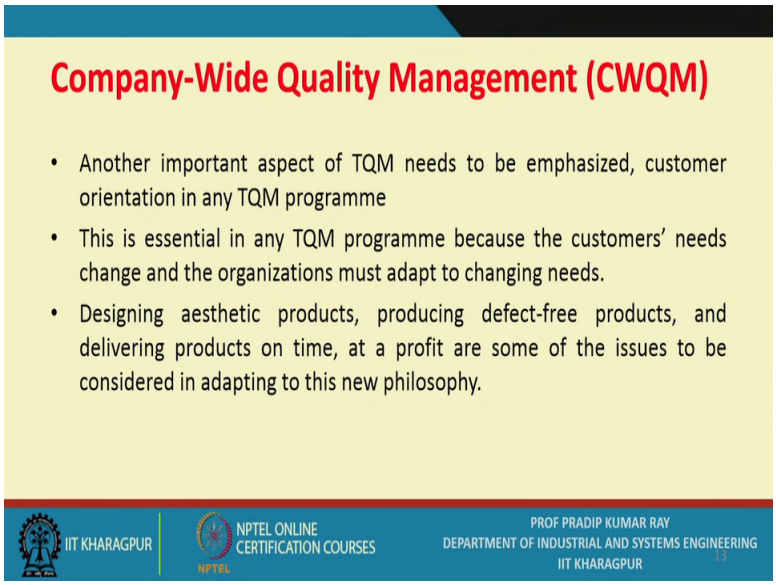

So, another important aspect of TQM needs to be emphasized that is the customer orientation any TQM programs. So, that is one of the; you know the pillars one of the focused areas. So, this is essential in any TQM program a program because the customer's needs change and the organizations must adapt to changing needs; that means, constantly you have to look into the new standards and the new customer the requirements designing aesthetics products producing defect free products and delivering products on time at a profit are some of the issues to be considered in adopting to this new philosophy.

So, like say you are running an organizations so; obviously, you must look into one aspect that is quality at what cost that is very very important and what is the ideal relationship at this point in time is it. So, it is a very complex issue and whenever you try to quantify these issues you must be able to collect data on this.

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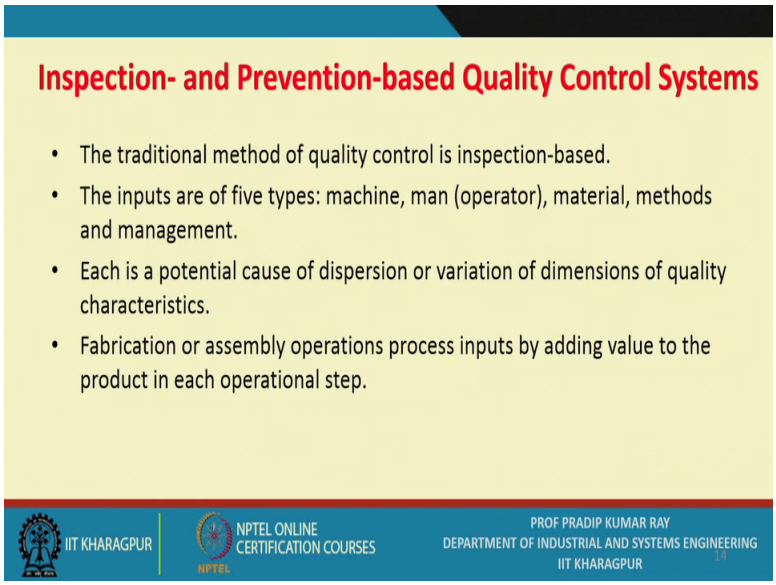

So, now as a as a student of quality you know you should be aware of what is the difference between the inspection and preventions the quality control systems is it always you will conformed this 2 types of systems ok.

So, many organizations when you visit you start taking up some quality related projects; obviously, you will be confronted with a systems call inspection best quality control systems and all efforts are should be directed towards making it as per as a prevention based quality control systems. So, the traditional method of quality control is inspection based certain points I am going to high light the inputs are of five types machine man operator material methods each is a potential cause of dispersion or the variation of dimensions of quality characteristics I have already mentioned that an exercise on quality is essentially an exercise on variability and consistency.

Fabrication or assembly operations process inputs by adding value to the product in each operational stage.

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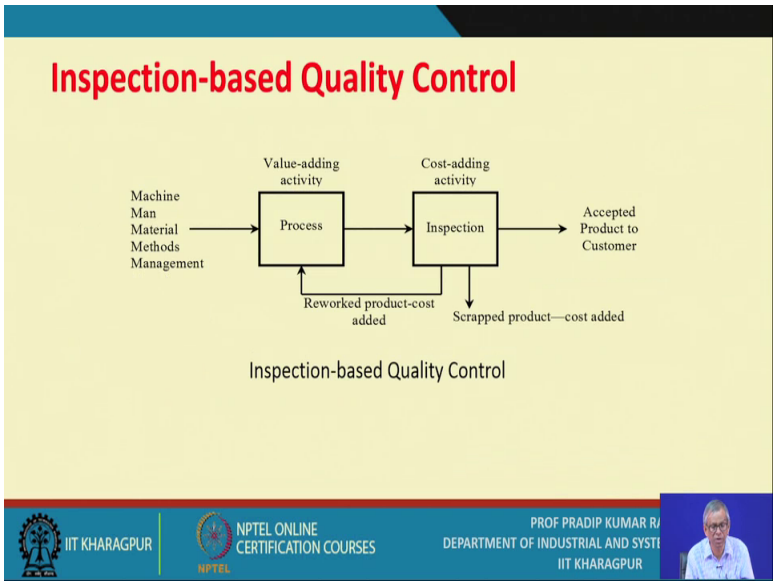

So, this is a typical you know say system it is referred to as a inspection based quality control. So, you have five types of inputs it is a generic presentation now the process could be one step or hundred steps depending on the process plan you have for the product and the manufacturing systems which you have. So, it is a value adding activity is it because at this stage for the manufactured product you change the shape and size of the product.

So, these are value adding activities, but then the output is you get the output and then the output is given to the inspection department and inspection department they decide whether you are going to accept this output or not and if you accept it; that means, the confirming to the specifications and then those you know the outputs or those proportion of the output will be sent to the customers then; obviously, certain proportion may be scrapped and the other proportion may be say five percent or ten percent or certain numbers they may be reworked.

So, there are three types of outcomes on is acceptable second one is the scrap and the third one is the rework now; obviously, the inspection is a cost adding activity and what we say, then why do not you; you do have with the inspection. So, that is the challenge you accept; that means, if you want to act as a quality expert; that means, the first object you should be that I will move from. So, inspection to quality control and while you

move from inspection to quality the first thing you should look into that is can you do have with the inspection because inspection is a cost adding activity.

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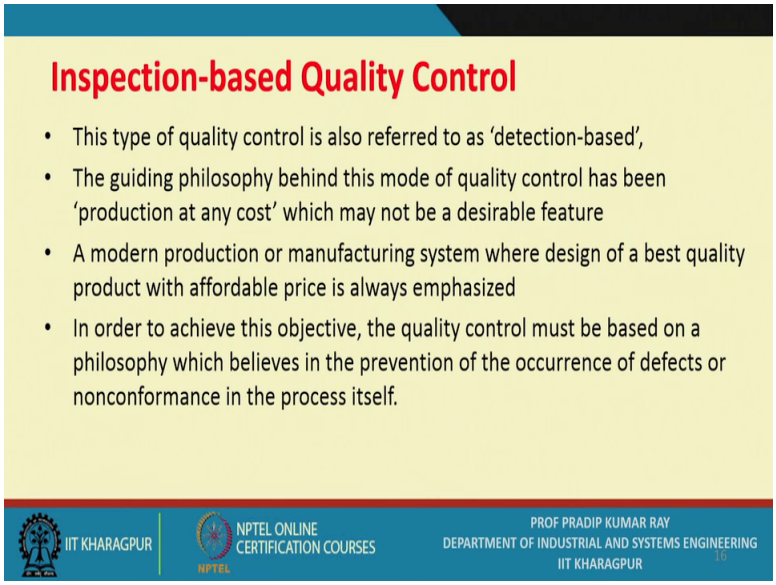

So, what are the features referred to as the detection based; obviously, it means. So, many units you are producing it is quite natural that some of this units we will defect and. So, I have already mentioned the production at any cost that is the philosophy; that means, do not concentrate on quality it will come because we have engaged the inspectors. So, first you produce then you will see and if the defective comes will be very prompt will be very prompt enough to detect them and remove them. So, that sort of systems you have.

So, in order to achieve these objectives, the quality control must be based on a philosophy which beliefs in the prevention of the occurrence of defects or nonconformance in the process itself. So, what is this philosophy then; that means, this how long you can continue the inspection based quality control so; obviously, you will be producing defects and it becomes a you know the way of life. So, you are detecting it fine, but can you not can you not prevent the occurrence of sub defects or defective items. So, when you do that.

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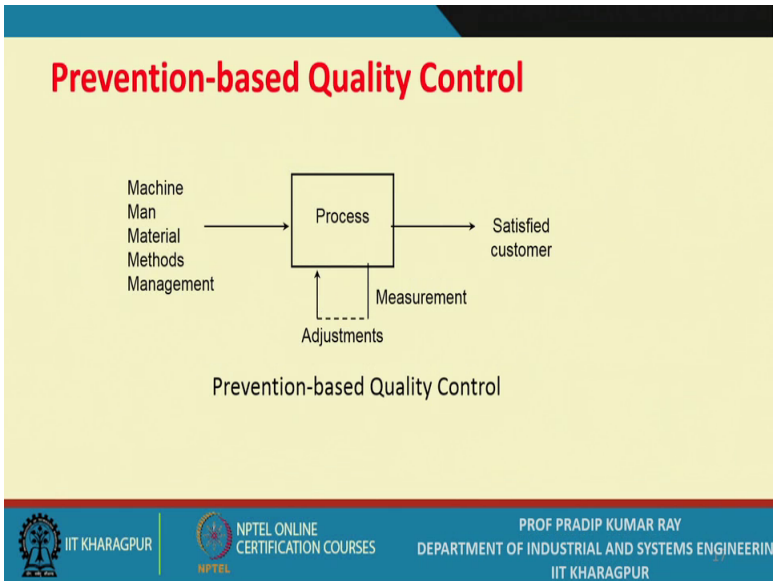

We move from say inspection based quality control to prevent machine based quality control.

So, here the inputs are same process may be 100-101 step or 100 steps and the process means absolutely value adding activity and unit by unit you check that sort of system must be given to you unit by unit in many many world renowned organizations the systems already they have created in fact, so, now, here the human labor or the worker. So, each and every unit in respected and if he finds that one particular unit is defective or say nonconforming he has to take some corrective measures immediately; is it ok.

So, you go one by one; one by one and each and every unit you check and if you find that this unit is acceptable then only you will go to the next stage. So, the next stage or at the customers level you send it. So, adjustment is to be done and the person who is producing the component, he will be given the responsibility he must be given the authority for ensuring quality; that means, he must be able to say use the gages or use the instruments is it measuring instruments. So, that he certifies that this is this particular dimension this particular quality characteristics of the given part conforming to the specifications.

So, there is no inspections over here and the; whatever you produce there you know you which you send to the next stage these are all acceptable units you are sending it.

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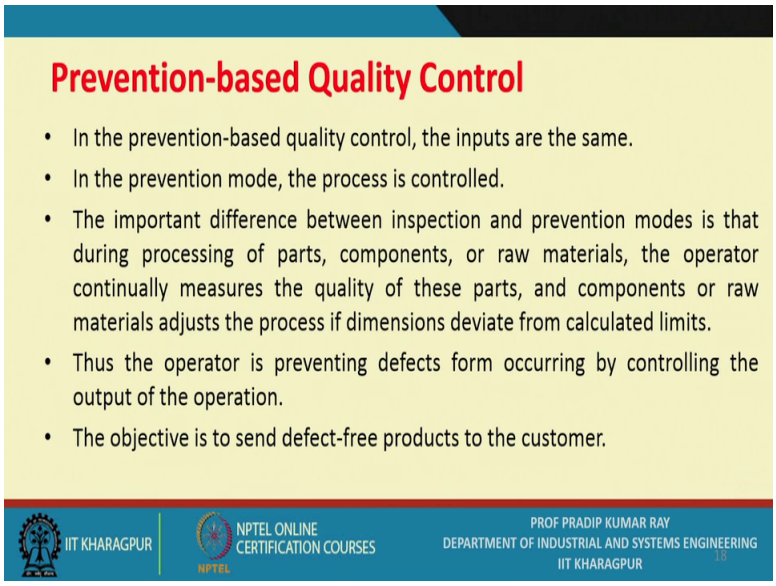

So, what are the critical features say the main important high lights of this particular system first one is in the prevention based quality control the inputs are the same; that means, you do not need to bring in different ins of inputs. So, that is that is sure; that means, you do not need to change second thing is in the prevention mode the process is controlled; is it ok.

So, that has to be done; that means, which by which. So, the important difference between inspection and prevention modes is that during processing of parts or the components of raw materials the operator continually measures the quality of this parts and components or raw materials adjust the process if dimensions deviate from the calculated limits; that means, you know in many cases we find that the operator is expert, he knows what is go or no go gage in many a times for mass production purposes.

So, we design go no go gauges plus different types of gauges he may use or different kinds of measuring instruments. So, the; obviously, the idea is the person who can run the machine who can you know what is how to create the perfect process settings. So, it is become easier for him or her to use the measuring instruments to a certain the quality of each and every component which he or she produces.

Thus the operator is preventing defects from occurring this from occurring by controlling the output of the operation the objective is to send defect free products to the customers.

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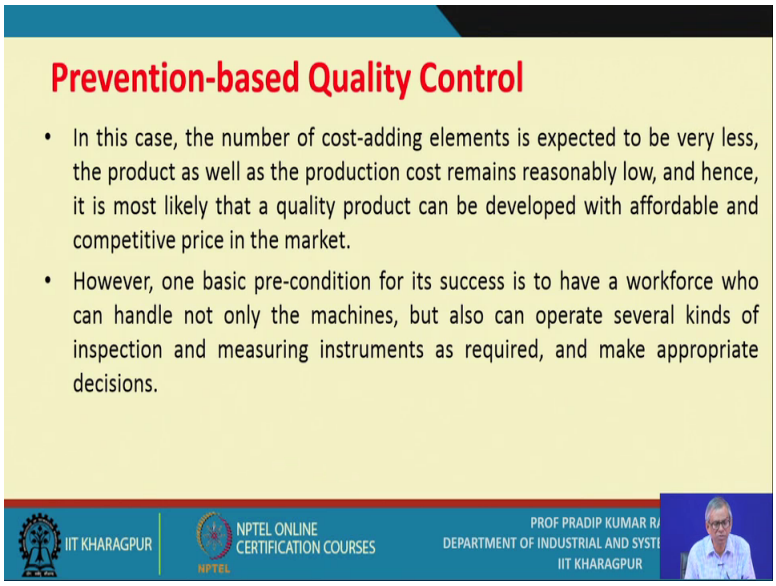

So, in the prevention based quality control the number of cost adding elements is expected to be very less the product as well as the production cost remains reasonably low because the cost adding activities are less otherwise hardly any cost adding activities and hence it is most likely that a quality product can be developed with affordable and competitive price in the market.

So, as I have been telling you at that the quality must be defined with respect to the price. So, here if your production system is very expensive even if you know the specifications are acceptable, but you may not be able to produce this specifications or the quality at an affordable cost. So, your product may not be competitive. So, ultimately you cannot hold on the quality levels. So, in today's context, when you phase lot of you know competitions because there is hardly any monopoly in the market for your product. So, or the monopoly market is not there. So, for most of the products, what you must do; that means, the cost to be reduced and you have no other alternative, but to go for prevention based quality control.

However one basic free condition for its successful is to have a work force who can handle not only the machines, but also can operate several kinds of inspection and measuring instrument as required and make appropriate decisions.

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so what is this implication; implication is in the products and the processes quality of products and process if you adopt this philosophy prevention based quality control various kinds of tools and techniques are to be used at each of the four phases you have no other alternative; that means, very soon you will come to know what are SPC related tools and techniques.

So, those tools you have to use and the and then only you will feel comfortable in you know in creating a system which is prevention based quality control a typical manufacturing system producing a product may have a number of interdependent manufacturing stages in order to maintain and control quality of their products and processes at the manufacturing stages the quality of all the system components such as work holding devices this is very very important jigs and fixtures cutting tools, raw materials material handling systems set of etcetera and their settings are to be ensured is it then the quality of a product determines the cost of the total manufacturing systems.

So, if the quality level is; it might mean that the cost of the manufacturing system also is very very high. So, what is important is that while you go for see this one like say this one the prevention based quality control what is important is that the process details must be known and I many time you know that the process plan or the process planning components is it you must be able to create and in the process planning component what what you have basically; that means, any product you produce. So, there you know it the

way you create the process plan or the process plan ultimately determines the quality level and it is a total document where you find that the process plan is having the details of all the operations their settings the kind of machine tools you use kinds of jigs and fixtures you use kinds of set up you do is it and ultimately there are you need to control production related variables also and now in the prevention based quality control the entire you know the responsibility in many cases there are many distances are given to the workers.

Now, the today what has happened like say we are moving from the say traditional say the manufacturing system to say c and c based systems or d and c based system in sewage systems and the there will find that we get the qualified workers gone are those days when the you know whenever you look at the workers we used to assume that he is having only the skills, but not the knowledge, but today we will find that even many sorts of automated control devices automated missions the workers the field comfortable in handling.

So, prevention based quality control the many kinds of tools and techniques we learn later on and you will find that we this prevention based quality control tools and techniques will be able to will be able to improve the quality improve the quality of any product or any process. So, we have essentially you know the three stages in a prevention based quality control first thing is you have to create a system called quality planning. So, you have to the document.

So, entire the process of creating quality that is the first stage and then you go for the quality control at the at a particular say work center or at a particular profit center or at a particular mission on the facilities and once you achieve quality control then at the third stage we go for quality improvement phase; that means, that means suppose the for the quality control phase you have certain level of variability now when you move to quality control phase or quality improvement phase I mean; that means, that level of variability should be changed and this variability level must be reduced; is it ok.

So, ah. So, ultimately whatever there are two kinds of tools we will focusing on one set of tools they are related to quality control and another set of the tools will be using for quality improvement is it, but our main focus is to what extent you can prevent the occurrence of defects occurrence of defects and defectives in I will exercise now here

normally we use two terms one is defect another one is a defective now whenever you say the defect; that means, we say that related to a particular quality characteristics whereas, whenever you say its defective; that means, we refer to the entire product mainly its functional value this is one now these are the terms normally you know any user or the nontechnical person they use, but as a technical person as an engineer we use two other terms one is nonconforming and this and the other one is non conformity nonconformity.

Nonconforming means; that means, the product has become the defective the car has become defective; that means, even if some of the quality characteristics are very good while it does not mean anything; that means, the engine is down; that means, you are not getting any functional value is it. So, that is to be looked into. So, there are many tools and techniques with which you can you can control the non conforming part and the outer part is the non conformity or the defect; that means, there could be on a particular product there could be many types of the defects or the many types of quality characteristics against each quality characteristics you may define its.

So, the defect and there could be control on quality with respect to one or more such defects or such non conformity. So, these basic ideas they must before you know we take up the other issues related to, the quality design and control.

Thank you.