Management of Inventory Systems
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Lecture – 40
JIT-based Approaches for Materials Management (Contd.)

In this session, the lecture session this is the last one. This is the 5th lecture sessions. Again I will elaborate few other important issues related to the JIT based production and inventory control system.

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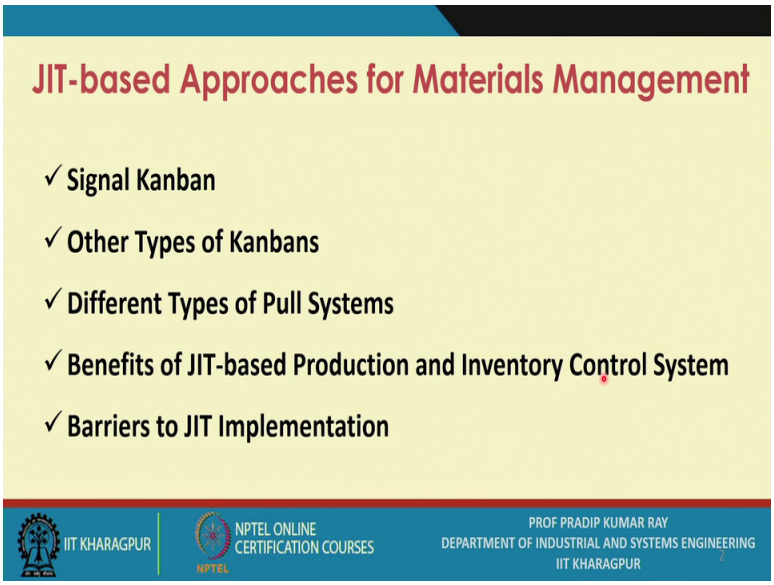

Now, one such the system I am going to discuss at this point in time. That is the signal Kanban system and then other types of Kanbans as over the time you know the many companies proposed are the many barriers of the Kanban system.

So, you should be aware of these different types of Kanban system and under what condition which type is recommended? That also you must know very clearly and we refer to different types of pull systems. As I have already pointed out that entire Kanban system is based on the pull systems of dispatching essentially, it is a kind of dispatching system.

So, it is not the pull system so the first thing what do you need to do? That means entire manufacturing systems or the production system is to be converted from push to pull

system. And then you start thinking of say you know the using so the JIT based tools and techniques.

So, what are the benefits of the JIT based production and inventory control system in specific terms you also must be aware of. So, this we will point out. And obviously, there could be some barriers there could be some problems in general category, the general, problems you might you may face while you go for or the JIT base systems implementations. So, you should be aware of and this we say the barriers to JIT implementation.

So, these barriers you must know in advance so that it becomes easier for you to take effective you know are the preventive measures to overcome those problems.

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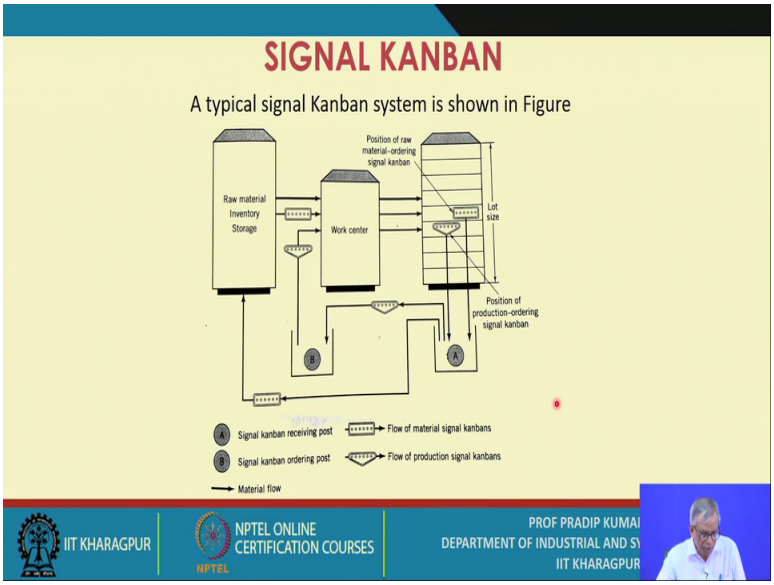

Now, let us talk about the signal Kanban system. Now, as I have already pointed out that in the original the 2 card the Kanban system. What we are assuming we are assuming that the setup time is negligible yes. There are many the manufacturing processes where you know the substantial reduction in the setup time is possible. And so, before you implement the JIT base systems to certain preconditions you have to fulfill.

So, one such precondition is the reduction are substantially of the machine setup and for machines setting up a system setup. The controlling or the setup reduction you need to take a systematic approach particularly. You must know that with respect to a particular

say the item which were going to produce on a machine tool. And the kinds of the machineries you are having or the kinds of holding devices you have there are varieties of holding devices; so what sort of so the internal setups you have and what sort of external setup you have.

Now, for the internal set of means those kinds of activities you need to you need to do for setting up when the machine is idle. That means, the productivity you cannot get any level of productivity while you are you are doing the internal setup. Now, but the external setup is the kinds of adjustments you do while the process is on.

So, as such during the external setup there is the no hampering of production and that is why the productivity is maintained the. So, entire say the exercise should be for reduction of setup that how to convert what are the ways? And means with which the internal set of elements be converted into external one.

So, there are the several cases case studies and for setup reduction. So, I will suggest that you referred to those case studies in course of time maybe we may refer to for the certain of the cases when you will come to know that in a manufacturing setup. So, what are the practitioners? They apply varies various sorts of approaches and they are all practical to reduce the set of time; that means, essentially converting the internal setup into the external one.

So, this is one category so where wherever the setup time reduction is possible you go for it; that means, you go for the 2 say. So, the 2 Kanban card based save the Kanban systems, but there are processes where the setup reduction is not possible. That means, setup time is substantial in comparison with the say the processing time or in comparison with other elements of say the throughput time.

So, what to do? Can you not apply? Say your Kanban systems for such cases like say or the press for press operations for forging operations or die casting operations. Yes, you can do, but in that case you need to were modify your original say the say the Kanban systems and this modified version is referred to as a signal Kanban. Now, here is just one the simple representation of for the working of a signal Kanban.

So, what you have here? In fact, like say you know there are 2 types of the Kanbans we are referring to and one particular Kanban it actually shows the position of raw material

ordering signal Kanban. So now, this is a lot size and usually what happens that in the original Kanban systems. As soon as you send say withdrawal Kanban and at the same point in time you send your production Kanban to the previous stage. So, one to one so here, what we what is important is that here suppose this is the withdrawal Kanban. So, this Kanban or say the container goes to or the next stage and as it goes to the next stage. You are not sending any production Kanban to the preceding stage; similarly, for the next one similarly for the third one, similarly for the fourth one, but if the fifth one goes to the next stage ok.

Now, this is an indication; that means, this position of the raw material ordering signal Kanban is shown; that means, the 5th Kanban goes to the next stage and immediately what you do; you send this the raw material ordering signal Kanban to here; that means, the Kanban box and from the Kanban box it goes to say. It goes to the raw materials inventory storage systems; that means, now you prepare your production systems at the preceding stage and for producing this item what you need that is the raw material.

And before you start producing make sure the raw material is made available. So, that is why first you send the raw material the instruction to the raw material inventory storage. So, it gets the instruction as soon as it gets this Kanban and then it sends the raw materials the raw materials to the work center; that means raw material is ready.

Now, in the next Kanban; that means the next container when it goes to the next stage? That means, this is the 6th one; that means, 1, 2, 3, 4, 5 from 5th one is for the raw material ordering signal Kanban. And the next one is the position of the production ordering signal Kanban; that means, the material is ready, but you need to process the material, but there must be an order for the production and these order or this authorization is given by this signal Kanban; that means, it is referred to as the production ordering signal Kanban.

So, as soon as you reach to the 6th containers. So, you just you send the container to the next stage, but simultaneously you detach this card you send it to the Kanban box. And then from here it goes to the next Kanban box that is b and then it goes to the work center. Now, by the time it reaches over there already the raw materials is waiting to be processed.

So, ultimately the production is made and then the container wise you send you send the production quantity through at this stage. So, this is this way you know what happens so the entire cycle is completed. So, what is important is as a student as a learner you must be able to understand that. What is the starting point and how you get back to the starting point once again? And in the process you know the entire cycle of operation.

And you must not have any doubts and understanding that, what are the factors affecting? Say the activities in this cycle. So, one cycle you need to explain and I am trying to explain the one cycle of operations. So now, there are several notation so for the raw material signal Kanban we have this rectangular card whereas, for the production ordering signal Kanban.

We use a triangular card as far as the shape of the card is concerned and this is the post a; that means, signal Kanban receiving post and this is post b; that means, signal Kanban ordering post. So, several kinds of notations you have been using, this is the lot size and this is where the raw material inventory storage and this is the work center ok.

Now, so here, what are the parameters of a signal Kanban system? So, the first parameter is you need to determine the lot size point number 1, what is the point number 2? That means, the next important parameter and the value of that parameter you need to know that is basically the position of raw material ordering signal Kanban ok.

So, the given data set definitely you can determine this and I will tell you that. What are the you know where the data you required to determine the lot size to determine the position of raw material ordering signal Kanban. That is the second parameter of this system and the 3rd parameter is the position of production ordering signal Kanban.

So, once you determine their values in a given system now; obviously, you run the signal Kanban systems and you may question that why do you have a lot size are substantially greater than one so here, what is this lot size? In terms of the number of containers that is 1, 2, 3, 4, 5, 6, 7, 8, 9; that means, your lot size is the line containers and usually you know.

The container to containers there is no change in the size of the container; that means, how do you define the size of a container? Is in terms of the number of number of units of a particular say the item that, you can hold that you can keep in a container. So, that is

the size I have already mentioned that usually in a typical or the Japanese production systems. So, these container size could be 50 100 152 100 like this ok.

So, so this is so the first is the lot size in terms of the number of containers. And similarly, the position of say production ordering signal Kanban in terms of say the number of or the Kanbans; that means, here 1, 2, 3, 4, 5. So, as it shows in this particular diagram, in this particular figure, you will find that the position of production ordering signal Kanban is 5.

And usually position of say the raw material ordering signal Kanban is 5 whereas, the position of production ordering signal Kanban is 1, 2, 3, 4, 5 and usually the next one to say the material a raw material ordering Kanban the signal Kanban. Usually the next one becomes the position of the production ordering signal Kanban ok. So, this is all about signal Kanban.

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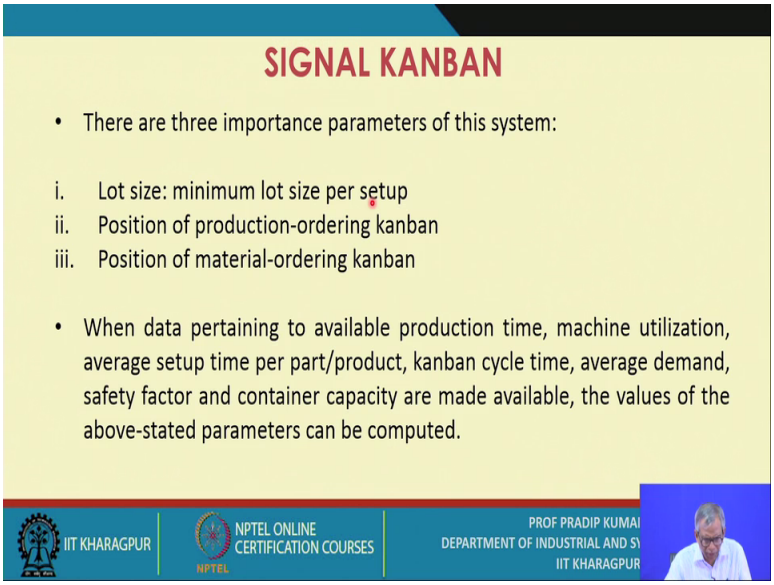

Now, there are 3 important parameters of these systems I have just mentioned you can note down the first one is the lot size minimum lot size per setup, that you have to ensure. So, this is the condition and while you determine the lot size what you can do? Actually, you can use the traditional approach. That means what you need to do? That means, the availability of the machine tool you must know. This is 0.1 the second one is the in a particular shift say in a day.

So, how many the possible parts you are producing? And for each part what is your average setup time. So, this you must know and the available time like say you say that my the utilization is on an average is 80 percent; that means, 80 percent of the available time is made available. Whereas, the remaining 20 percent time is say you use for the setup.

So, how much time you spend or you are supposed to spend for setup in a day or in a shift. So, this you must know and then what is your demand for each setup? And what is the demand for each part suppose there are 3 or 4 parts you need to produce same machine and for each part what is the setup time? So, what do you once the demand is known for each part and the setup time is known.

Obviously, you can determine against the each setup how many parts or how many units you are going to produce? Is it ok, against each setup. And for each part and suppose the total number of units you can produce that is say for each part. It is say suppose, it is say some 800 and your say the container capacity is 100. So obviously, your lot size in terms of the number of containers is 8. If it is say 850 and your container size is 100. Obviously, you know it is actual value is 8.5 and now what you do? You must have for the 9 to make it a whole number or say the integer.

So, this way you calculate the lot size and for determining the position of the production ordering Kanban or for determining the position of the material ordering Kanban, what actually you supposed to do? That means, you already know that how to determine the number of Kanbans. So, a particular formula we have used as given by the Toyota, say or the motor company. We have already studied that one that is y is greater than equals to i means there is a formula like say the demand rate the into say the safety factor, into the lead time and divided by the container capacity.

So, this formula you are using and when you assume that the deterministic model is applicable. So, you can use that that particular formula and you can determine against a particular data set that, what is the position of production ordering Kanban? And what is the position of material ordering Kanban? Like we have stated; in the figure, if you refer to the figure what you will find that the position of the production ordering Kanban is 4 whereas, the position of the material ordering Kanban is 5 ok.

So, when data pertaining to available production time so these are the data you must ask for to determine the values of all these 3. You know the parameters of a signal system a signal Kanban systems available production time machine utilization. So, I have already mentioned average setup time per part or the product this point already, I have mentioned Kanban cycle time. This is very, very important I have already mentioned that the cycle time since the cycle time for say the material ordering signal Kanban ok. So, start point and the end point.

So, what is the time the elapsed total time elapsed that is basically the Kanban cycle times so; obviously, for visual ordering. So, ordering signal Kanban the total the Kanban cycle time could be 4 hours. Whereas, for the production ordering signal Kanban the signal or say the Kanban cycle time could be less than 4 hours. Maybe 3 hours or 3 hours and half like this or say 2 hours.

So, this the timing what we were assuming that these the timings do not change or what you can do; that means, you can assume so the maximum possible values ok. And, but make sure that when you say it is a maximum possible values never you include the factors related to inefficiency. Then, if you do this then the entire purpose of installing or implementing JIT based production system the entire purpose gets lost ok.

So, you have to be when you determine this cycle time this is very, very important the Kanban cycle time; that means, this cycle time should be as tight as possible ok. If you make it very, very loose what happens that because of these reasons the Kanban system may become useless average demand, this value must be known the safety factor I have already mentioned. That means, the value of say the alpha that is very important that is what is the possible value of alpha initially it could be point 3.25.

For the make sure that the value of alpha should be as minimum as possible; that means, from a disorderly system it is becoming an orderly system; that means, how do you define an orderly system; that means, your production inventory control system you have you know a system which can say which can protect. Say, this your production and inventory control systems from the external disturbances ok.

So, if you can achieve this obviously the value of alpha should be very, very less. So, are the container capacity this is known and this data are made available the values of the

above stated parameters can be computed. So later on, we can have a number of numerical problems on this.

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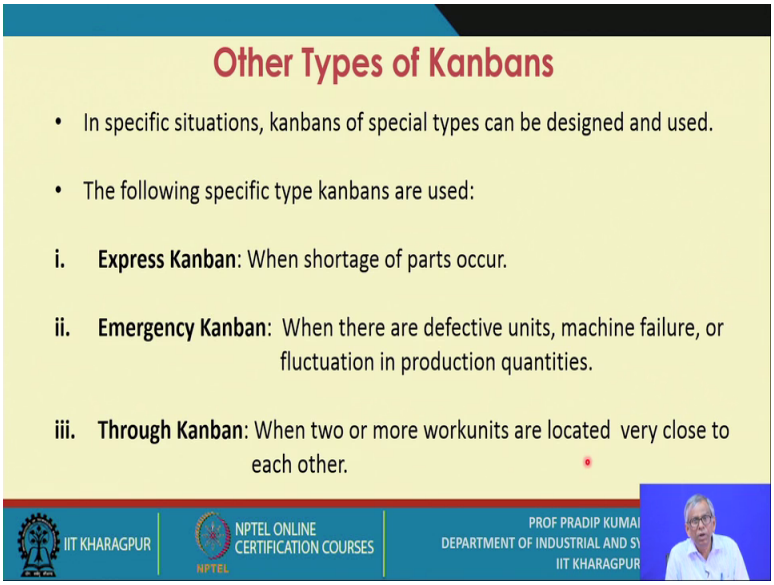

Now, before I conclude my lecture sessions on the JIT based the production systems are manufacturing systems. Now, I also should the refer 2 or I must say tell you something and some characteristic features of other types of Kanban systems.

So, in specific situations Kanbans of special types can be designed and used is a special purpose ok. So, these 2 kinds of the systems which we have explained which we have already explained one is the Kanban systems and the second one is the signal Kanban systems. And these 2 systems we can apply in general conditions; that means, those are basically referred to as the general purpose, but you may face the special situations and whenever you face special situations you have to the propose the new kinds of the Kanban systems.

So, the following specific type Kanbans are used first one is the Express Kanban ok. So, what does it mean? That means, it actually monitors and control the shortage of parts occur ok. It is like say, suddenly due to many reasons the shortages are occurring. So, you need to use this sort of express Kanban; that means, now it becomes an important say very critical Kanban. So, you need to the produce as for the express Kanban specified or the quantity emergency Kanban when there are defective units.

The systems what we are assuming that the defective units you must not produce and if you produce it do not include it in the flow of the materials you must have the ways and means you must have the system. For it is separation from you your the basic the material flow system.

So, when there are defective units the machine failure or fluctuation in production quantities the emergency Kanban you need to use through Kanban it is like through ticket; that means, when 2 or more work units are located very close to each other. So, what do you do? As they are physically located close to each other. So, instead of having suppose there are 3 such systems you have a very close and everything is visible from at any stage. So, instead of using say 3 specific Kanbans why do not we use just 1? Ok.

So, this is referred to as the through Kanbans like now we have the through ticket.

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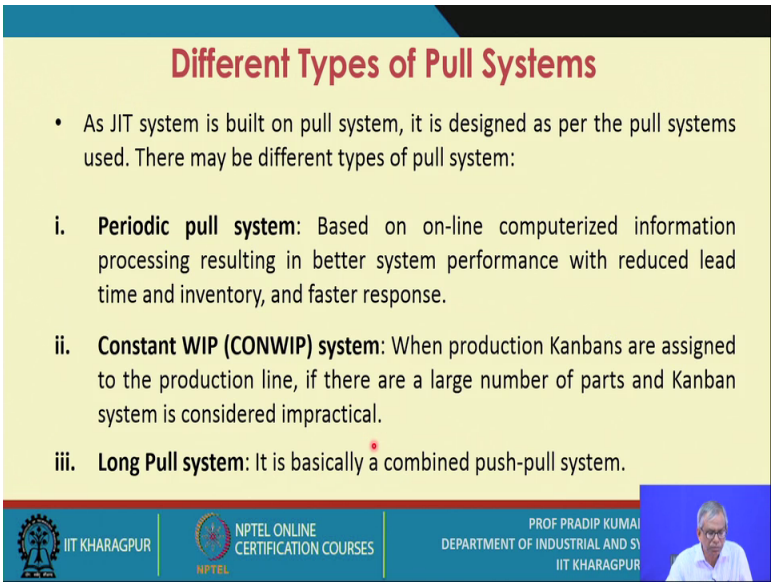

Now, you also must be aware of at this stage what are the different types of pull systems? So, the researchers the practitioners they have you know the developed or a number of say the different types of pull systems. To meet specific objectives, and whenever you look at all these systems you will find actually by using different types of pull systems. We are able to strengthen your systems the pull systems in a very effective way.

So, as JIT system is built on pull system this is a necessary condition. It is designed as for the pull systems used there may be different types of pull systems again. You know,

we have already whether define the pull systems in a in a general way whereas, in specific situations you need to define you need to implement the pull system in a specific way.

So, one such a specific so the pull system is referred to as a periodic pull system based on online computerized information processing, resulting in better system performance with reduced lead time and inventory and faster response; that means, initially we assume in any Kanban system it is essentially is assumed to be a manual system, but why do not you know you implement a computer based system?

So, when you try to implement or you try to use online computerized information processing in a Kanban system. So, this is referred to as the periodic pull systems; obviously, there are many advantages one advantage is reduced with time and inventory. So, as far as inventory control is concerned management of inventory systems is concerned. So, this is many times you opt for online real time control systems like MRP systems and all we have already discussed.

And the faster response time this is also important. In fact, and as I have a told you that whenever you talk about the JIT base systems; that means, waiting time must not be there it should be as minimum as possible constant WIP; that means, the WIP is the control is one of the important issues or one of the important objectives in JIT based production system.

So, this is in short this is referred to as a CONWIP system. When production Kanbans are assigned to the production line; that means, the entire production line is having just one production Kanban. If there are a large number of parts and the Kanban system is considered impractical; that means, if there are large number of possible there are some 500 parts or 200 parts.

Now, for each part in a system you have to use a Kanban system now it may become an impractical one. So, what you try to have just one say the Kanban controlling the WIP of the entire production line; obviously, why do you design such a system you specify that what is that constant WIP? Ok so that value is to be specified.

And under that conditions so, you can a develop or you can specify the production rate at different stages. So, this is referred to as the CONWIP system or constant WIP system long pull system. It is also there it is basically a combined push pull system like this one.

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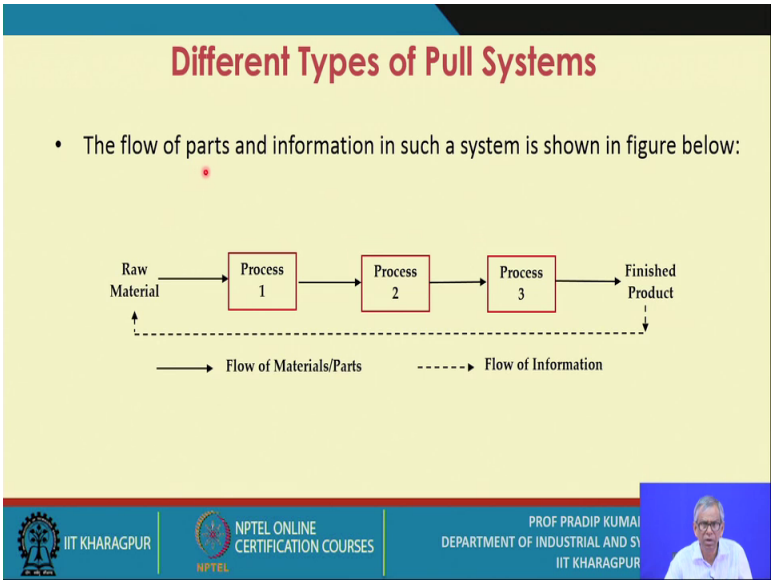

That means the flow of parts and information in such a system is shown is like this; that means, you have process 1, process 2, process 3 and then you have the finished product. And your start in say the system is the raw materials input section.

So, what do you try to do? Say in instead of having say or say considering all these processes. Separately you just consider all these 3 systems as a push system and over this pull system. What you have? You apply the pull system. Is it ok? So, is there no point is this may be treated as just 1 unit. So, I do not you have a push system and this 3 systems these 3 processes are considered as 1 unit. So, this is referred to as a combined a push pull system.

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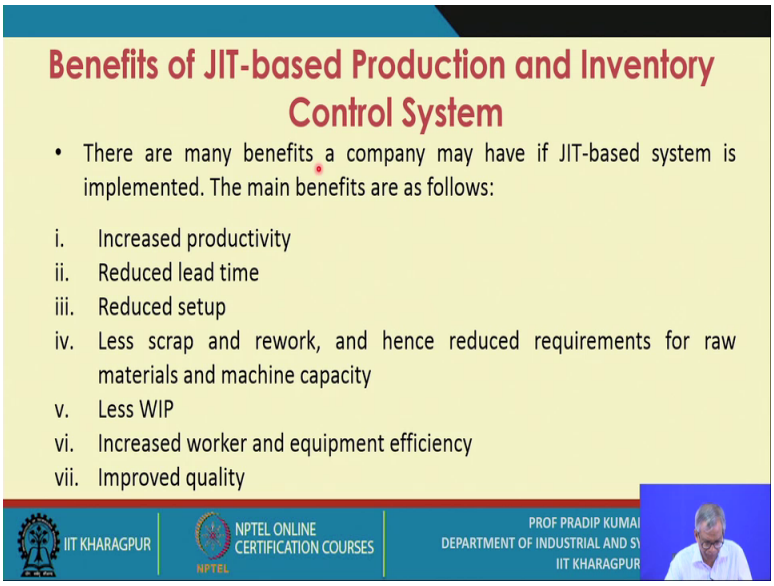

Now, there are many benefits a company may have if JIT based system is implemented. So, these the benefits are I have already listed. So, please go through them like say increased productivity reduced lead time reduced setup. And so on like less WIP this is an important say the benefit increased worker and equipment efficiency and improved quality.

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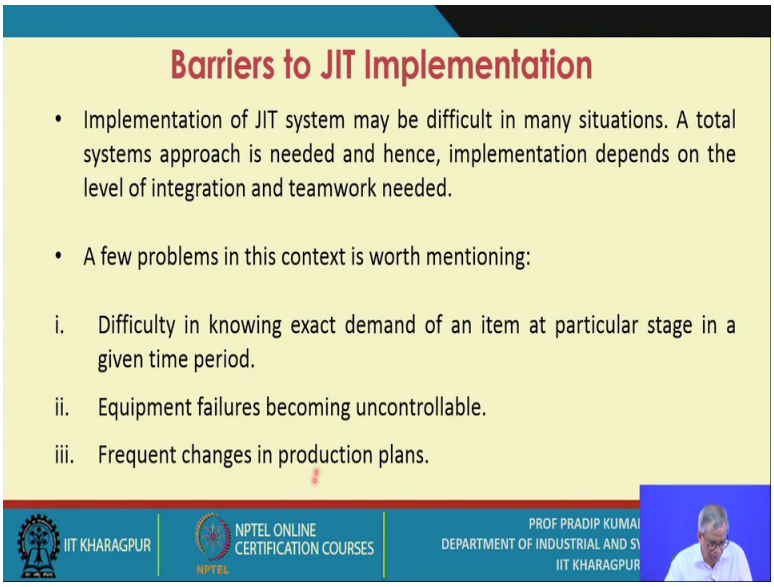

The implementation of JIT base systems may be difficult in many situations, I have already pointed out; that means, there certain preconditions you have to fulfill say a total

systems approach is needed. In order to achieve all the 7 will objectives or 7 goals simultaneously. And hence, implementation depends on the level of integration and teamwork needed.

So, what are the few problems? I have just highlighted a few problems like difficulty in knowing the exact demand of an item. At a particular stage, in a given time period this is one difficulty may face equipment failures becoming uncontrollable. So, this problem you have to tackle beforehand and frequent changes in the production plans; that means, as we have already discussed in MRP systems. That means, for a certain period of time you have no other alternative, but to feed your mps.

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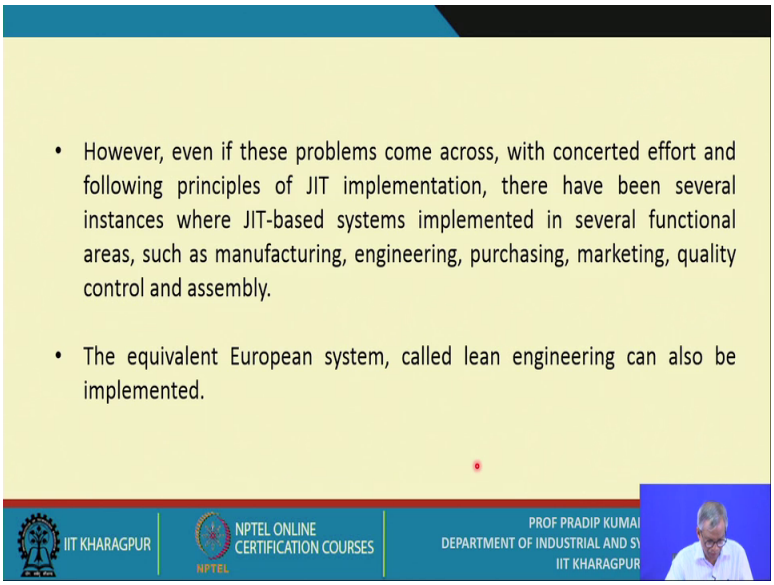

So however, even if these problems come across with concerted effort and following principles of JIT implementation there have been several instances where JIT based systems implemented in several functional areas like manufacturing engineering purchasing marketing quality control and assembly. So, everywhere you can implement JIT based systems as a general say the methodology. So, the equivalent European systems called lean engineering and management can also be implemented ok.

So, with this I conclude this session, I hope that you have understood the details of the JIT based systems and what extent it is able to say? You know say create a combined production control and inventory control systems.

Thank you.