Management of Inventory Systems
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Lecture - 32
MRP, MRP-II and DRP (Contd.)

So, continuing our discussion on MRP systems; now during these lecture session I will be discussing the MRP inputs.

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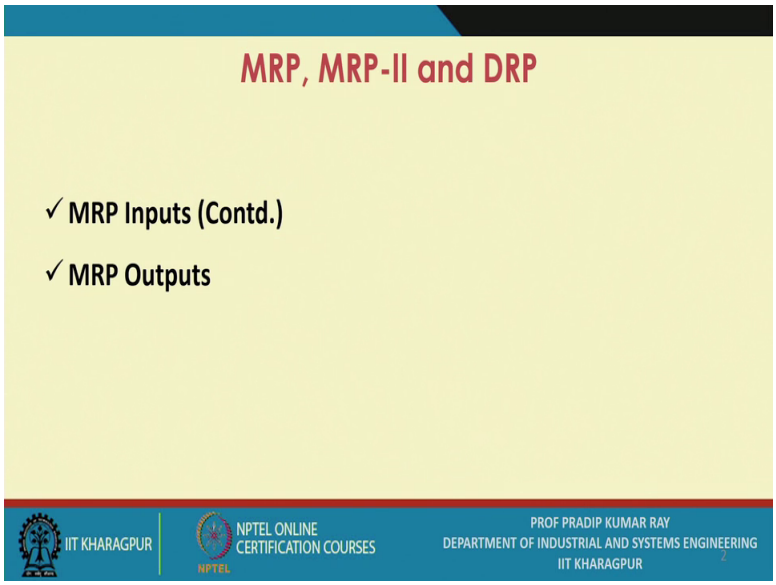

So, in the last session we have just initiated our discussion on MRP inputs. So, we will continue with the discussions on the MRP inputs and on conclusion of these discussions we will also be discussing the MRP outputs ok.

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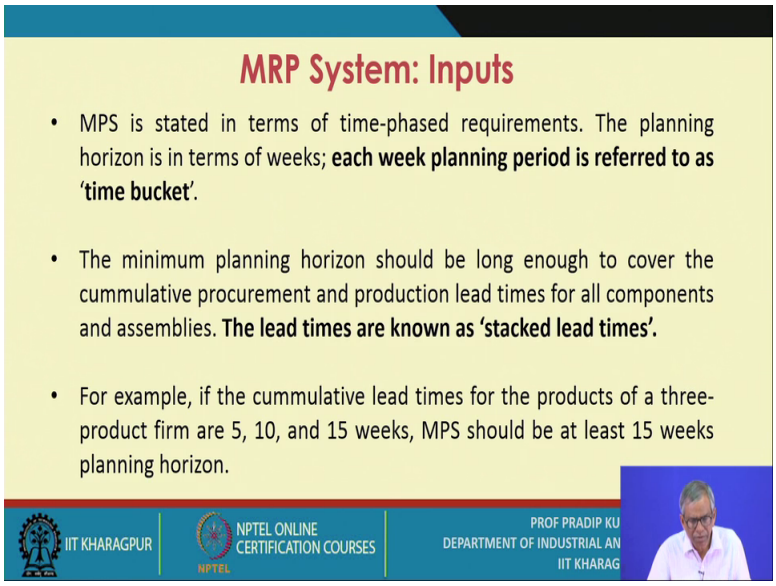

So, now MRP is an online the real time control system and what is important is as such there is no mathematical model. And what are the factors actually affecting the inventory level of an item whether, it is dependent item or so an independent item. Now; obviously, you know; so these two factors one factor is the demand and the second factor is the lead time and in the real world case; that means, in the real systems both these you know say the demand as well as the lead time both are actually a variable.

So, there could be hundred reasons that why you know the demand is changing or why the lead time is changing and many of these factors affecting the demand level or say that the lead time are external factors on which you do not have any control. So, what you can do; that means, you must create an highly alert system; that means, highly sensitive system. And constantly you monitor say the demand levels and as per the demand levels either for the independent the demand item or say the demand at the next stage or the parent item.

So, you start say start producing or you start ordering or you start both start or you start working on both; that means, a particular demand at a point in time that these demand level you compute based on your parent item say demand level at the next stage. So, this is the demand level; so, at a particular point in time or say period of time say 1 week or 1 day must be known. And what you do? Once it is known then you decide that how much of these demand you can fulfill by manufacturing and how much you need to; how much

of the demand you need to fulfill or you need to say the full filled through placing and purchase orders. As soon as you place a purchase order, then you need to monitor its; its lead time, so, supply lead time.

So this is the basic you know the aspect of the characteristic features of a MRP systems and the constantly you update the data. So, there will be data basis and you constantly object data that at different points in time; you need to take say a different kinds of actions. Particularly, suppose you can take an action called I am going to produce this much and you mention its lot size.

And the time period expected time period also you must know and when the; when you go beyond this extended say this is a time period now you monitor. So, what is actually your; so the proposed the order quantity or say the manufactured quantity and what you or the plan manufacturer quantity and what is act basically the actual say the manufactured quantity.

So, and then you adjust your requirements and with the next time period; when the next time bucket you, you change the value; you change the values and accordingly you take action. So, the MPS is stated master production schedule; is stated in terms of time phase requirements, this is very important. And as you may be knowing that when you talk about the scheduling; so, the scheduling is for the shorter time period. So, maybe you say; so, the week wise you make the schedule or the day wise you make the schedule.

So, master production schedule is stated in terms of time phase requirements; that means, suppose your total planning horizon is 15 weeks; that means, when each week what is your requirement. So, this must be known is it and this data you; you use or you determine from your forecasted data. The planning horizon is in terms of weeks usually each week planning period is referred to as the time bucket.

So you have become familiar with this particular term called time bucket; the minimum planning horizon should be long enough to cover the cummulative procurement and production lead times for all components and assemblies. So, whenever you do some kind of exercise; a exercise on MRP for an MRP exercise; the first you know thing you need to determine that is the planning horizon.

So, what is it? That means, the minimum planning horizon you say and it is based on say you need to consider all commulative procurement and production lead times. The lead times are known as the stacked lead times that means; this is essentially the procurement and production lead times for all components considered; that is why it is referred as the stacked lead times. So, another MRP related terms you have come to know, the first one is the time bucket and the second one is the stacked lead times.

For example, if the cumulative lead times for the products of a three product form; that means, there are three products is the multi product manufacturing forms. So, the lead times are 5, 10 and 15 weeks; so, the master production schedule should be at least 15 weeks planning horizon ok. So; that means, the maximum value you consider of the lead time you should consider.

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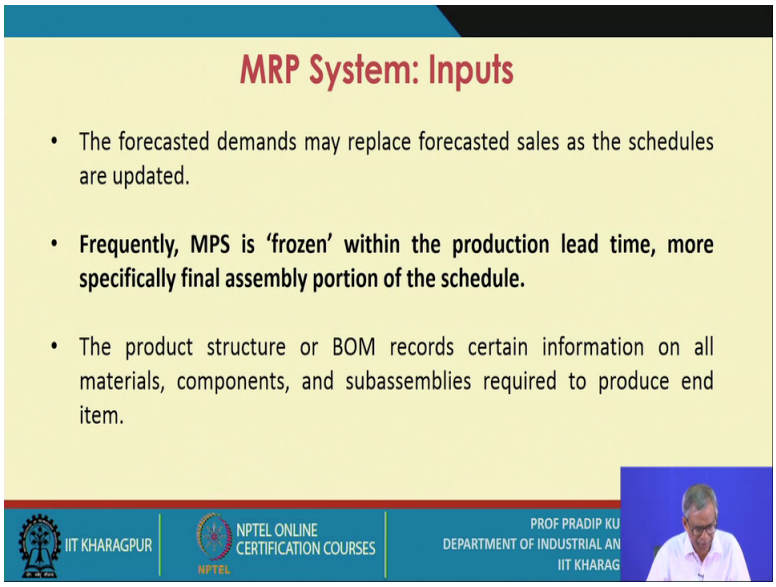

Now, you know the forecasting is an important tool you used for say the demand prediction. And so the forecasted demands may replace forecasted sales as the schedules are updated ok. So, we are interested in forecasted demand values; values of forecasted demands and for forecasting there would be many say quantitative tools you may use. So, you may refer to say several say one or more of the textbooks on forecasting business forecasting particularly.

And you will come to know that what kinds of tools and techniques you are supposed to use under the different conditions; for a or the under different assumptions for

forecasting the demand levels of a product. Frequently MPS is frozen within the production lead time; so, suppose the production say the lead time is say 10 weeks or say 5 weeks. So, what you try to do? That means, you make a plan of the activities to be carried out or the controlling activities to be carried out within this week.

And once so all the demand levels are known and the manufacturer and the decisions regarding the manufactured quantities, the plan manufactured quantities or the planned order quantities are the decided then you do not change it. And so; the master production schedule is frozen; so and then for a specific the time period more specifically final assembly portion of the schedule ok. So, assembly part it is very important and the and you carry out different sorts of operations at the assembly stage and you have a demand level.

So, you must be able to freeze your say the production plan for a specific time period say weeks. Now, the product structure or the bill of material records certain information on all materials components; that means, essentially the type of materials which you require, the types of components with its the design with its the coding all these details are given including their drawings all these details are given. And the sub assemblies required to produce end items; that means, to produce 1 unit of the final product or the end item; how many different types of materials components and subassembly you require as well as their individual quantities or the numbers ok

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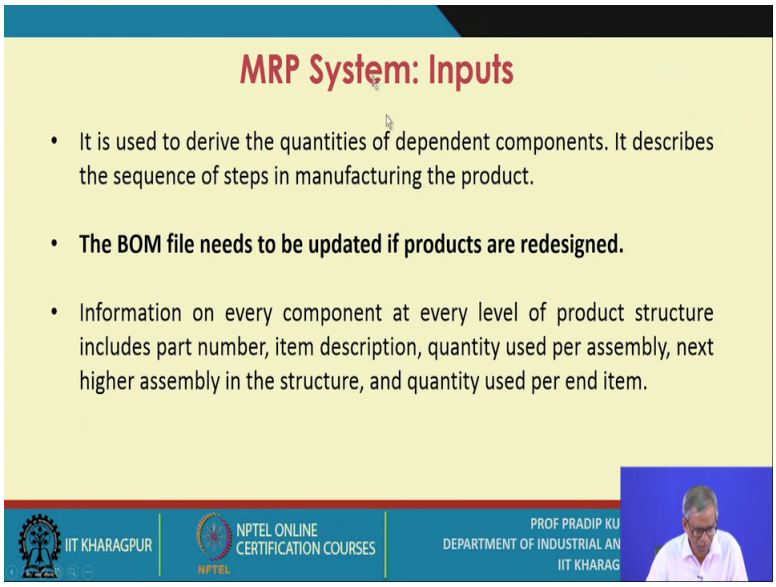

So, this you get from the bill of material document; it is used to derive the quantities of dependent components or the dependent demand items. It describes the sequence of steps in manufacturing the product; that means, there are different fonts of bill of materials; later on you may refer to when we refer to the numerical examples we will come to know what type of you know the structure is required in representing the bill of materials.

So, there could be the different levels; level wise hierarchy like say at the assembly stage or the end item. It could be treated as level 0 and as you go down; that means, at the next level there could be you know the many sub assemblies. And these subassemblies maybe level one and similarly say as you go down from the sub assemblies, you will have you may have sub assemblies plus the individual components.

So, that level may be referred to as the level 2. So, like this you the create the entire structure hierarchy from say the 0 level to the nth level. So, the bill of material file needs to be updated if products are redesigned; so, this is very important. The same product may be available in different models or the different versions and sometimes the technically it refer to as the design level. So, a product may be say the offered in four design levels; that means, four specific models or what we can say that as you create a new design, a new design level; so, the old designs are discarded.

So, in that particular condition there the BOM files; that means, bill of material files needs to be updated, if the products are redesigned. Information on every component at every level of product structure, this point I have already elaborated includes part number. Now this point you please note; first one is the part number, you must know; that means, the evening uniqueness must be there.

Part number, item description; the short description is preferred, quantity used per assembly or for the next you know the parent item. The next higher assembly in the structure when you look at this particular say the product structure code or the product structure records has to be made very clear and the quantity used per end item ok. So, that pi cycle example already I have given; so, this is just an extension that is a very simple case; that means, you have just elaborated the concept with that example ok.

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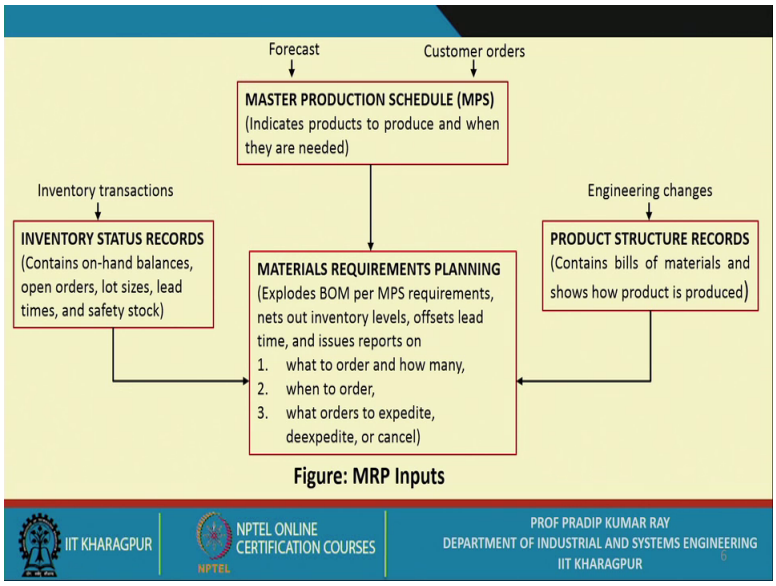

Now, what is important is that these inputs they are interrelated. So, what are these inputs? The first one is the production master production schedule or MPS, the second one is the inventory status records and the third one is the product structure records or the bill of material.

Now, how do you create what are the inputs you require to prepare these master production schedule MPS document? The first one is the forecast or the forecasted values of the demands for the specific time period say 1 year or say for the next 1 month or next 6 months or the next quarter. So, the first input is the forecast and the second one is the customer orders ok. So, the forecast is one part and there is to be corrected with the customer orders. Now, you are dependent on the forecast; if your marketing strategies produce too stock.

Whereas the customer orders actually we determine the; the number of units for the number of say the dependent items to be produced in a given time period. So, this these decisions you have to take is based on the cut small orders when this situation called assemble to order or say the produce to order or manufactured to order marketing strategies is it ok. So, anyway; so with this these two important aspects to be considered, you have the master production schedule accordingly. Now this indicates the products to produce and when they are needed; the both quantity or the type of the items, so the type of products the end times as well as the timing.

Next what you have? Now you are; you have any inventory management systems already in place; in your manufacturing systems, in your production system; otherwise if there is no inventory control systems, there will be no production control and there will be no production system existing. So, inventory transactions are there like say against a particular inventory item, there could be issue, there could be you know the receipt and there could be balance; so, all the time ok.

So, later on when we referred to say the valuation of say the inventory as a part of the stores management; we will refer to this kind of transactions. So, against any inventory item there could be the two types of transactions; either it is issued to the using department or you are receiving certain quantities of the item from through the purchasing department fine. So, inventory transactions are there and as that and depending on the transactions. So, you have you update the inventory status records; so, what it contents? It contents on hand balances receipt issue.

And then the third column in the record you keep that is the balance. So, on hand balances; on hand means which is physically available which are visible is there, open orders; that means, there will be you know against a particular item there could be pending order. So, how much quantity under to be to be made available at through purchase that is basically the order is pending. So, the quantity will be known what is the lot size lead times and the safety stock. So, how do you have all these values; that means, what we are assuming that that the these inventory status records are very are dependent on what sort of inventory control systems you have.

And so what we are assuming that against a particular inventory item, you have all these information's. That means, the lead times the safety stock you have already come to know the different procedures usually employed to determine the safety stocks or the buffer stock. So, the safety stock against a particular item is known, the lot size is known; that means, the order quantity are say working stock; this is sometimes referred to as the working stock.

Next what do you have the product structure records or the bill of material files. So, it contains bill of materials and shows how product is produced; this point already I have elaborated. Now as per as materials requirements planning is concerned; that means, MRP system is concerned; it explodes bill of material per MPS requirements; that means,

is linking you know the master production schedule; that means, at any point in time or during a period say 1 week what is your end item requirements? And say suppose the say for a particular end item the 5 units are to be produced ok; so, in a given week.

So, immediately what you do? You refer to this particular end item and against the end item; the product structure code is known; that means, bill of material is known and now the bill of material when you refer to the bill material, you get the list of raw materials and the components and other parts required to produce 1 unit of the end item and at different levels; that means, at what point in time, which particular say the item is required in which quantity when the say the total quantity of the end item is known.

So, these exercise is basically referred to as the explosion of bill of material; so, the another term you have come across in the context of MRP that is the exploding bill of material. So, please write it down that is the exclusion bill of material explosion of bill of material per MPS requirements, unless the MPS the requirements or known how can you have say you explored the bill of materials; it is not required, it is not necessary.

And then net nets out inventory levels, offsets lead time and issues reports; so, so the net requirement is to be known net requirement was already you refer to the inventory status against a particular item the dependent say the demand item. So, the net requirement will be known and the offsets the lead times; that means, already you know the some of the units already under order; so, on order items.

So, already supposed the lead time is expected to be 7 days, it is essentially it is say is the third day. So, within the next 4 days, this particular item in the required quantity as for the order as per the purchase order will be delivered. So, that sort of the information you get and you constantly update these information.

So, the issues reports on what to order and how many ok? That means, at any point as already pointed out that if it is you know a continuous review systems or q systems of inventory control; that means, at any point in time you need to decide say the everyday or every week you need to decide whether it is the time to place an order.

And if so what will be your order quantity; that means, when to order and how much to order and what to order; that is very important because we have list of items a large number of items you, you are considering in MRP systems. So, what to order and how

many; when to order that is the next question and what orders to expedite this is very important.

That suppose you know the remaining lead time is just 1 day or 2 days and for the last 15 days there is hardly any response; there is not getting any orders. So, you need to go for expedite in the purchase order and this is many a time you for routine follow up and certain cases for an important project work for the important items you go for the field expediting.

So, when we discuss the purchasing management as say the follow up action we will we will discuss in detail both the types of follow up; one is the routine follow up against purchase order and the field expediting for the important items. So, this is very important in fact, what orders to expedite or de-expedite I do not bother about it supply and or you can cancel the orders also.

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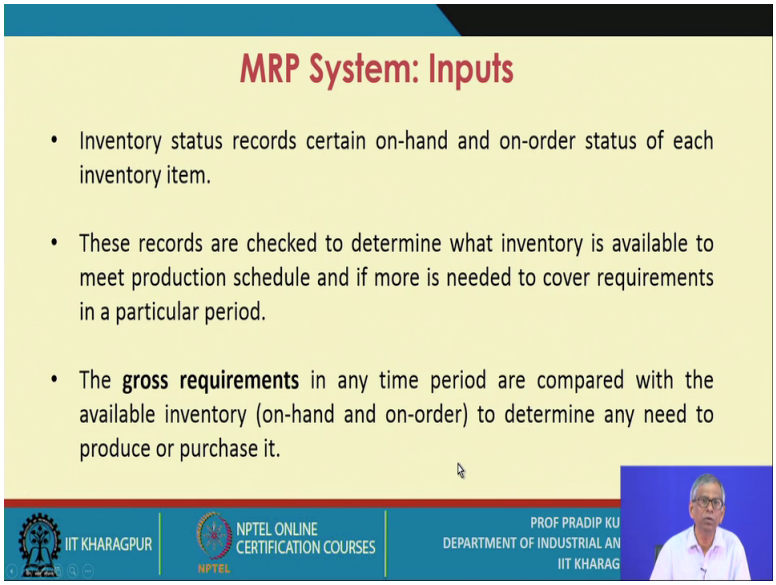

So, all sorts of possibilities as you come across in a in the real world situation; you go for it. So, what is important is that certain points I like to highlight on the MRP systems inputs; inventory status records certain on hand and on order status of each inventory item ok; that means, you have clear idea about like say you know we have use the term called inventory position.

So, what is an inventory position actually? The on order plus say on hand minus back orders ok. So, here what you try to do? That means, it say continues the monitoring system. So, the inventory status records certain on hand and on orders status of inventory of each inventory item. These records are checked to determine what inventory is available to meet production schedule and if more is needed to cover requirements in a particular period.

That means the system is or say the situation is constantly changing and means there could be some commitment of say meeting the order requirements, but, but many a time it may happen that for certain say in all the suppliers they are unable to supply the item on time; as well as you know the exact amount has not yet been supplied; that means, there is a deficit.

So, what you try to do; that means, two kinds of situation; that means, what inventory is available to meet production schedule is it and if more is needed to cover requirements in a particular period; so, constantly you update this information. Now there is a term called gross requirements in any time period; now these gross requirements for any item, in any time period are compared with the available inventory; that means, on hand plus on order ok; to determine any need to produce or purchase it.

This we will constantly do; that means, suppose the time bucket is one week so, every week we have to we have to update the data and take a decisions on this. That means, given an item how much to produce during this week and how much to order or how much to purchase. And if we go for purchasing then what you what is your lead time and the lead time, the expected lifetime must be known and then you constantly over the time periods; you update the lead time.

Similarly, when you go for producing it certain amount then; obviously, you place some work order and then what is the plant production units and what is your actual production units ok. So, this two always you compare and so you actually control the system with the actual data.

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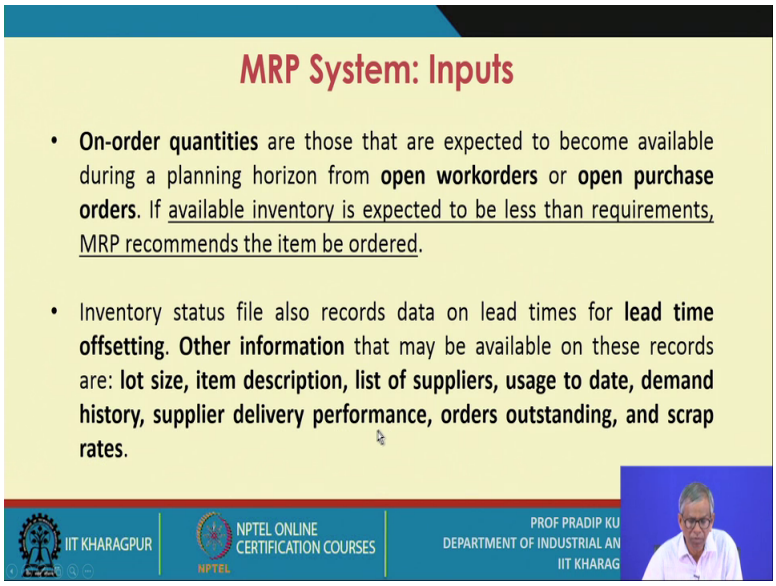

On order quantities are those that are expected to become available during a planning horizon from open work orders or open purchase orders. So, these are called on order quantities; that means, there will be work orders; that means, it is in house supply and if it is a purchase order that is the outside supply.

So, both may be pending you may have to wait for say the 1 week. So, these are basically referred to as on order quantities; if available inventory is expected to be less than requirements, MRP requirements the item to be ordered ok; this is quite natural. Inventory status file also records data on lead times or lead time off setting, then constantly you need to change the lead time as the time passes.

Other information that may be available on these records are so, please note down all these points. The first one is the lot size; so you must be able to determine the lost size or sometimes this is referred to as the working stock. Item description, the list of suppliers ok; so when you discuss when we discuss the purchasing management; you will come to know that how to select the suppliers, how to assess the performance of the suppliers and how you will you will be able to constantly update up update the list of approved suppliers or approved vendors.

So, the list of suppliers for the given item you must specify users to date as of today, as of now, till date, demand history, supply delivery performance and orders outstanding and scrap rates.

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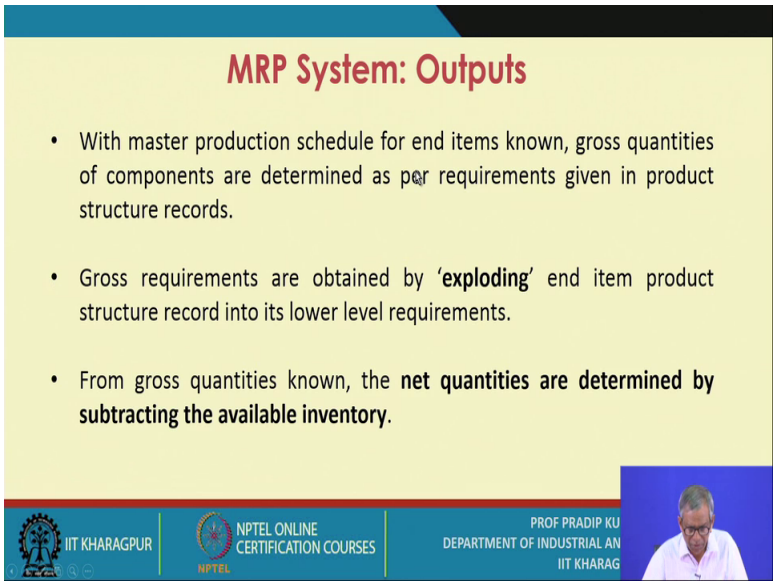

With master production schedule for end items known gross quantities of components are determined as per the requirements given in product structure records. Gross requirements are obtained by exploring end item product structure record into its lower level requirements; this concept already I have explained. And from gross quantities known, the net quantities are determined by subtracting the available inventory; this is a clear cut you know say the arithmetic.

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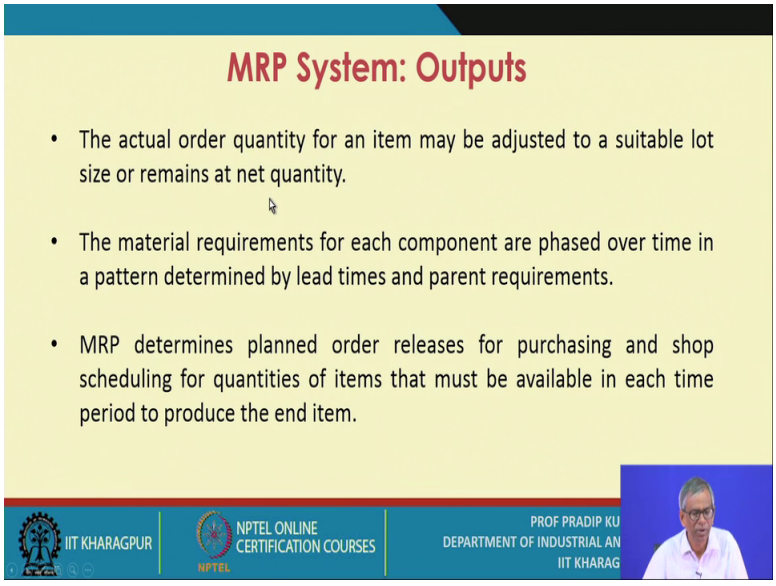

So, just you mention that some few you know a simple arithmetic is required to calculate all these; the actual order quantity for an item may be adjusted it is distributed lot size for remains at net quantity. The material requirements for each component are faced what time in a pattern determined by the lead times and the parent requirements. MRP determines planned order releases for purchasing and shop scheduling for quantities of items that must be available in each time period to produce the end items.

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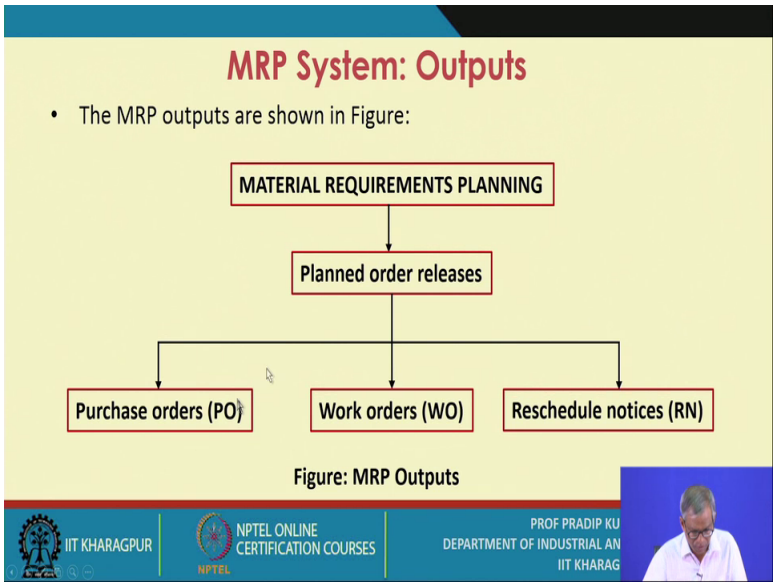

So, this is the systems output; the MRP outputs are shown like this. So, one is the purchase order, so second one is the work orders and the shaded and the third one is the reschedule notices as the situation demands. So, these are the MRP outputs.

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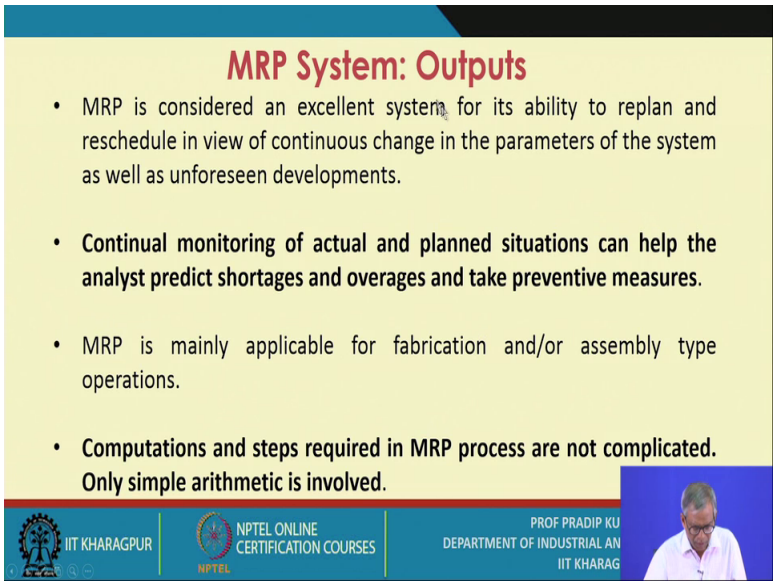

So, these are the MRP outputs the MRP system outputs; there are many and what is required is the continuous monitoring of actual and planned situations. And computations and steps required in MRP process are not complicated only simple arithmetic is involved and MRP is mainly applicable for fabrication and or assembly type of operations; so, I have explained the entire process. Now in the next lecture sessions, we will be taking up a few of you know the numerical examples on MRP.

Thank you.