Management of Inventory Systems
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Lecture - 33
MRP, MRP-II and DRP (Contd.)

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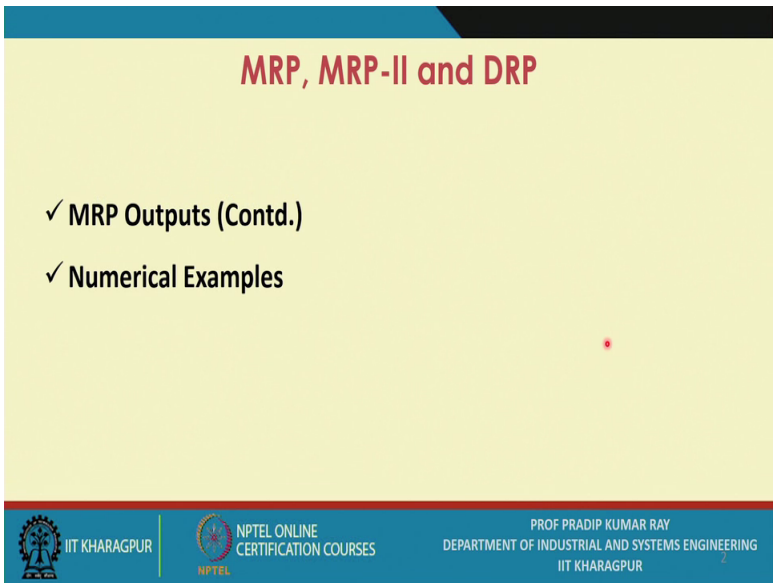

So, during this lecture sessions on MRP we will take up a number of numerical examples, but prior to the discussing this is a numerical examples; so, let me just again refer to the MRP outputs ok.

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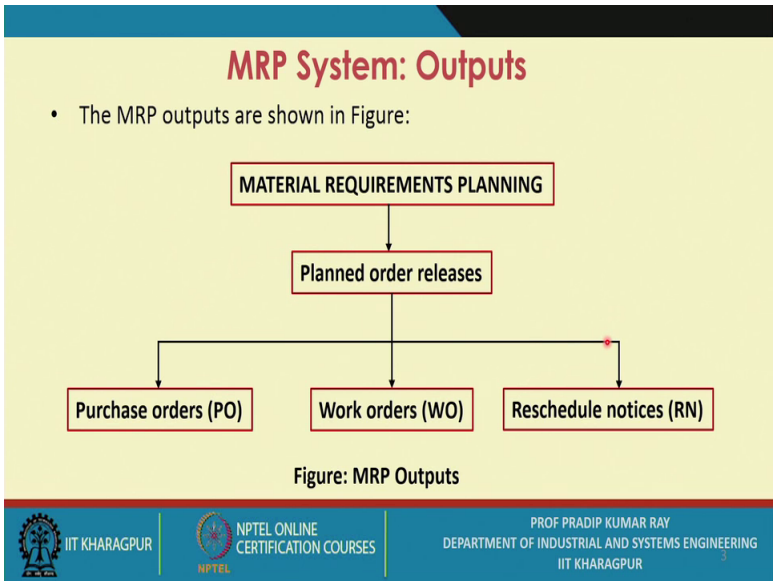

So, in the past the lecture sessions, in the previous lecture sessions you have come across you have seen these diagram or these figure. So, here what we have specified; that means, the plan requirements say a material requirements planning MRP systems. So, it is basically with the designed with 3 kinds of inputs; you already aware of. One is the MPS, the second one is product structure code and the third one is the inventory status these are the 3 inputs.

And these 3 inputs are creating the material requirements planning system. And what is the basic output? The basic output of material requirements planning or the MRP is the planned order releases. Now this planned order releases can be of 3 types; first one is the purchase orders; that means, how many units or how much you are going to so, the get from the suppliers.

And so you need to procure from outside and that is why you need to raise a purchase order. The second one is the certain portion of the quantities required a portion, you plan to produce in house. And for producing in house that quantity what you require? You need to place an work order say to your fabrication shop or to your say assembly units to your machine shop. So, you need to place an work orders; so, how much quantity are under work orders that must be known. And then what you try to do now you constantly you monitor the situations. So, these are the basically the order work orders you are placing; now you are monitoring the lead time.

And as the time passes the situation changes and as per the change situations or the change conditions, many a time you need to go for a say the; so, making them aware or the sending notices through the concerned persons or the concerned group or the concerned work unit or the concerned suppliers. So, these aspect is referred to as reschedule notices; that means, you need to re plan the whole thing; that means, as a time passes ok; so these aspect you just keep in mind.

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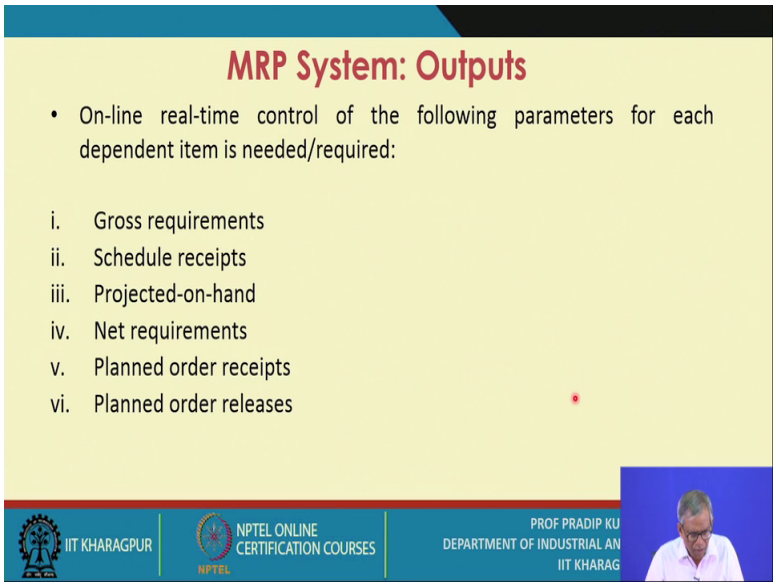

And then as far as the outputs of the MRP system is concerned; it is an online dual time system control system. Now what actually you are controlling, which aspects? So this is the standard format in any MRP system and what we try to explain that is what are the parameters you need to control all the time on the online real time basis? Now, this the parameters you should the values of these parameters; you constantly monitor over the time, over you know the time buckets and over the planning horizon for each dependent item. So, what are these? First one is the gross requirements ok.

So, this information you must have; what is the second one? Second one is the schedule receives; that means, you have a say production unit and you have a supplier for the given item, you have production unit, you have a supplier for the supplier from the supplier ah; so, you are supposed to get these items on a particular date.

And similarly from say the work orders which you have placed to your say the own systems, own manufacturing plant. So, again you expect actually that at what point in

time you will be getting see this work orders. So, with this information you have these the scheduled receipts say the data. Then the projected on hand; that means, you have that inventory control system; that means, there could be there is always some you know inventory transactions like issues, like receipts and the balance.

So, what is the balance amount at a on a particular day at the start of the day? So, this is the projected this is that you know and based on your, the normal consumption rates or use rate can you project this amount; that means, the projected on hand; that means, suppose this is the first day of say the first week. And you have say on hand inventory of a particular item; now can you predict say what could be the on hand inventory on the first day of the following week or the next week for the same item?

So, so; obviously, there will be some assumptions and so for each item the projected on hand say the inventory level ah; so, you must be able to calculate and we will calculate this in fact. Then the net requirements and these net requirements; that means, projected on hand the schedule receipts and projected on hand. So, if you subtract from the gross requirements then you get the net requirements and once the net requirements is known as of now; then either you know you place an order to the supplier or you place you know the work order to your in house facilities. So, you have these data planned order receipts and planned order releases; is it ok.

So, these are the first 6 important parameters always you try to monitor in this online real time control system. So; obviously, you will find that this inventory related parameters primarily are the dependent on the production related parameters. So, we have already discussed the inventory management systems the kinds of the say the systems we have already discussed.

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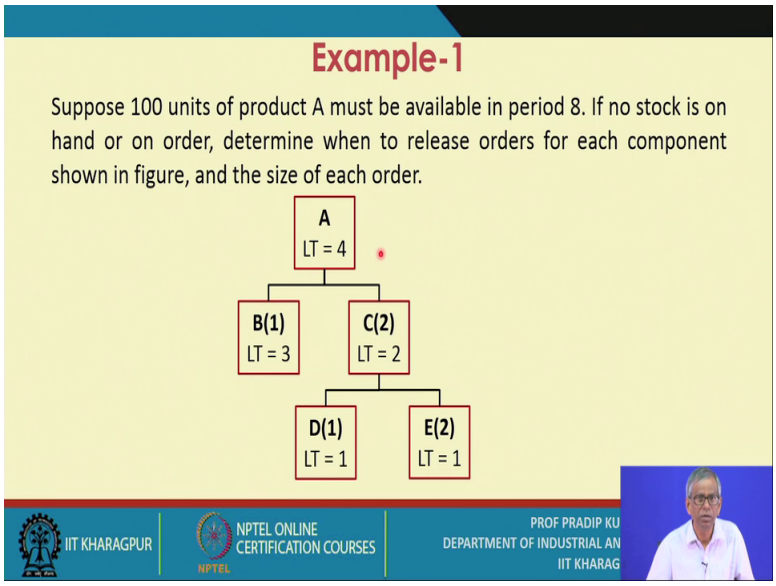

And during in during those lecture sessions or inventory management systems what we have assume in; that primarily that inventory systems is existing independently right say the procurement function can act independently; that means, it has several the features which are the unique.

And say the inventory model is primarily the decided by the procurement function. But here when we extend your say your concepts to say the dependent demand items, then you come to know that how much say the dependent you are on the controlling the inventory of dependent demand items on the production control systems. And that is why the MRP is systems is created; MRP it is original versions or say the new versions or updated versions whatever it is.

So, essentially it represents both inventory control as well as the production control systems. Now here is an example, so now what will be explaining you say the all the aspects of certain numerical the problems which we have taken up. Suppose, so this is example 1 numerical example 1; suppose 100 units of product a must be available in period T.

Now, the measuring units we could be week; that means, on 8 week in period 8. So, the period 1, period 2 period 3; say 1 period I represents 1 week like this. So, in period 8 if no stock is on hand or on order; that means, the starting point at the initial condition is 0 inventory determine when to release orders for each component shown in figure.

Now what is this figure? These figure actually is a simple representation of the bill of material and what you need to do you need to also determine the size of each order. So, order for which item? So, the order for say B, C, D, E; that means, in order to say the produce the end item capital A what do you require as for the bill of material? You require item B and item C. And to produce 1 unit of capital A; you need 1 unit of B and 2 units of C ok.

So, this is the first level; so this is level 0 and this is level 1. Now this may be the sub assemblies, this may be the sub assemblies or I this could be a component, C also could be a component or this could be item B could be subassembly and item C could be a component ok. So, depending on how which particular product you have design. So, given a particular product you will have this specific information.

Now in order to manufacture C, what you require? You require say item D and item E and in order to produce say 1 unit of C; what you require? You need 1 unit of D and 2 units of E. So, this information you collect from the bill of material; that means, you must go to the design department and get this data; that means what you are trying to do? That means, I am creating an inventory control systems primarily, but I have linking it with the design department and first I link it to the design department that is why the bill of material.

Next what I will do I will link it with the master production schedule and so; obviously, I have linking my inventory control systems to the manufacturing systems or the production system. So, how many levels you have? Level 0, level 1, level 2; now what is this LT? LT stands for the Lead Time information; that means, the lead time for item D is 1 week or 1; the time unit.

And for item E; it is also 1, for item B it is the 3 time periods; the 3 week or 3 days and item C the lead time is 2 and for item A; the lead time is 4; so, this is the data we have. Now if no stock is on hand or an order determine when to release orders for each component ok; so, this is shown in figure. So, this is I hope that you understood the problem and the size of the each order you need to determine.

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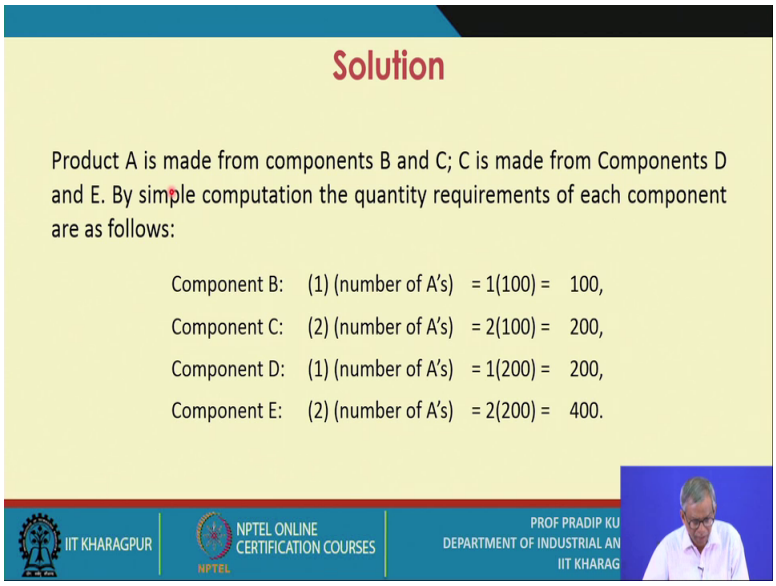

Product A is made from components B and C, C is made from components D and E; this point already I have elaborated. By simple computation, it is very I have already mentioned that that MRP calculation is essentially a simple arithmetic calculation. So, by simple complication the quantity requirements for each component are as follows.

The component B; that means, 1 the number of A's equal to 1 into 100; that is 100 units, component C is 2 that is number of A's; that is 2 into 100 that is 200, component D that is 1, the number of A's is 1 into 200; obviously, component D and E is dependent on component C. So, you need one unit of say sub to produce; so it must be multiplied with say the say 1 and this is 2, that is 400; it is clear?

So, the 100 units you need to produce; that means, for which; so if you refer to this one; that means, this is 1; that means, 100 units if you want to produce, you need 100 units of B and 200 units of C. And against say the C; that means, it is 200 units of D you require and this is 2; that means, 400 units of E. So, exactly; so 100, 200, 200 and 400; is it in order to produce 100 units of product A; that is the final assembly or the end item.

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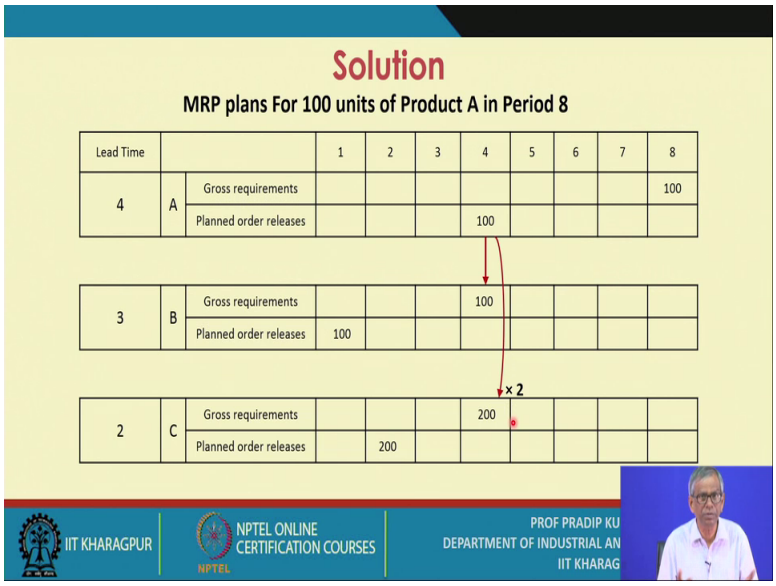

Now, what you do? MRP you make a plan; that means, MRP plans for 100 units of product A in period 8; is it ok. So, what do you require; that means, your lead time is 4 weeks as you just refer to the figure, you will find that against A; the lead time is mentioned as 4 time period or 4 weeks.

So, you need this item at time period 8; that means, the gross requirements is 800. Now what is your lead time? That means, the planned order releases; that means, just 4 weeks before the say the 8th; 8th week you need to release the orders. So, on fourth time period; that means, say suppose each ah; so the time unit is week; that means, it is the eighth week, this is the fourth week. As the lead time is 4; so you need to have the planned order releases on fourth week and the amount is 100.

Now you explode; what you try to do explode; that means, you need say for producing for producing say 100 units of A, you require 100 units of B items. And for B items there is a lead time of 3 weeks so; obviously, if you want to have say 100 units on week 4 or time period 4; that means, these 100 units, you must get; 100 units of B, you get you must get on the fourth week, but for this item you have a 3 lead time period; is it ok.

So, 3 weeks; so on the first week; that means, this is the third week you backtrack. So, you need 100 units of B to be ordered in the first week for item B. So, your gross requirement for item B is 100 on the fourth week and your planned order release is 100

units on the first week; it is clear? Now in order to produce say the end item capital A, you require you know the 2 units of item C.

So; obviously, you require at the same point in time that is on fourth week or the fourth time period; you need 200 units of item C and for items C the lead time is 2 weeks. So, I am explaining it very slow so that your understanding is appropriate and you will come to know say the all the intricacies of say the MRP systems and how does it work and how do you know do the computations for different the parameters in an MRP systems.

So, there are 200 units you require at fourth time period and you have the 2 lead time. So, the second you know the week or the second time period; you have a planned order releases of 200 units. So, this is the gross requirements on the fourth week is it clear? Now the next what you do? You go for the item C; is it ok.

So, item C 200 units require; now this item C consists of 2 parts item D and item E as for the bill of material say the bill of bong document bill of material document. So, now, you need to produce 1 unit of say the C, you require 1 unit of D and the 2 units of E; so, that is as per the bill of materials. So, for the 200 units of C; you require the 200 units of D; so that is the gross requirements.

And what is the lead time? Lead time is one week hence there will be planned order release on or say during the first week or the first time period ok. And to produce say 1 unit of C, you require 2 units of E capital E. So, for producing 200 units of C, you require 400 units of E. And for item E you have 1 week or one time period, 1 the lead time is 1 time unit. So, that is why the planned order releases will be made on the first week on the total the requirement the total requirement will be 400 units; so, this way you make the plan.

So, this is your is this document you prepare and as the time as the time passes like say this is at time t equals to 0 you make this plan. Now, after say 1 week or 1 time period, you check the current situations for all the items and accordingly you make a make a plan. So, if the time bucket is say 1 week or say 1 day; that means, every week once or everyday once; you have to take stock of the situation and the gross requirements against a particular item must be calculated that is already known and the planned order releases ok. So, you re calculate or constantly you update these values; is it ok?

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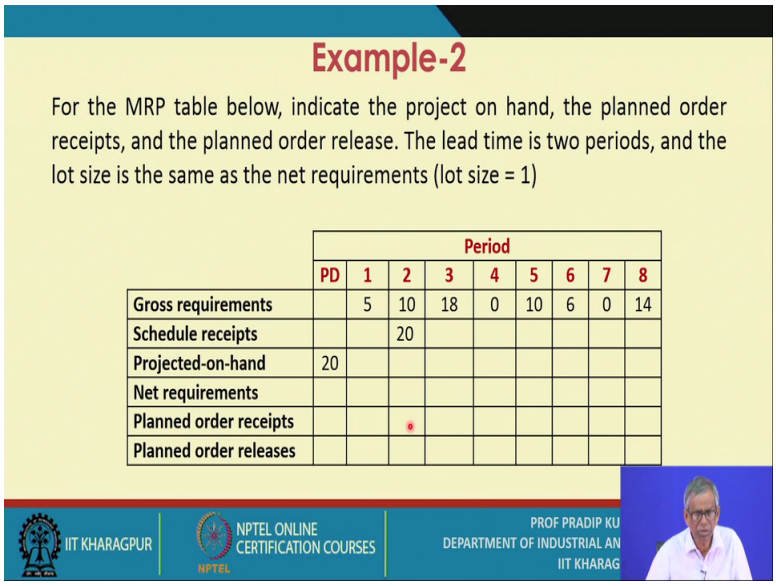

Now, once you so, the this is the first step, but you have not completed all the steps in an MRP calculations. Because what you need to do that is that the ordered releases now so the order I will be placed. Now this order could be in the form of work order or this the order could be in the form of purchase orders. So, again when you place the order so there will be a say lead time for both work orders, as well as the purchase orders.

So, again you have to go further down and you need to constantly monitor say the current situations and with respect to the work order say the work order and with respect to say the purchase orders. So, the inventory levels; so, is constantly and accordingly their effects on the inventory levels of a given item.

So, for the; so the next example we are we are moving to the next example that is also a say representative numerical examples in respect of MRP. So, for the MRP the table below is it ok; I have already mentioned the these are the items or these are the parameters in an given say the MRP document. And you need to constantly monitor the values of these parameters as the time passes.

So, I refer to the next example that is for the MRP table below indicates the project on hand, the planned order receipts and the planned order release. The lead time is 2 periods and the lot size is the same as the net requirements; that means, here the lot size is equals to 1. Now, what you have? You have this table ok; so, this is the planned or the projected demand.

And how many periods you have considered? That is 1 2 3 4 5 6 7 8; so, 8 time periods you have considered; so against each period you have the gross requirements 5, 10, 18, 0; 10, 6, 0, 14. Now here just one point you make a not like many such products these days you will find the on the end items, you will find that the demand is the demand is highly erotic. That means, you it does not follow any pattern and it is anybody's guess say what will be the demand of a particular item or the end item end item in the next period of time; so, it could be any value.

So, highly you know for many for many items particular in the repetitive manufacturing and batch production scenario you face this problem; so, erotic demand pattern. So, whenever you have this erotic demand pattern; now the mathematical modelling is very difficult; so the traditional approach for inventory control may not work.

So for this particular under these conditions; so, you have no other alternative, but go for MRP and similar 2 MRP or MRP like systems you have to implement is it ok? So, this point is to be noted; so, here the gross requirements what you find is more or less it is an erotic say the demand pattern 5, 10, 18, 0, 10, 6, 0, 14; it may not follow any particular pattern. Now scheduled receipts that is on the second period; it is known that there will be schedule receipts of 20 units. So, the projected on hand that is 20; now net requirements, you have to calculate you need to calculate the planned order receipts and you need to calculate the planned order releases.

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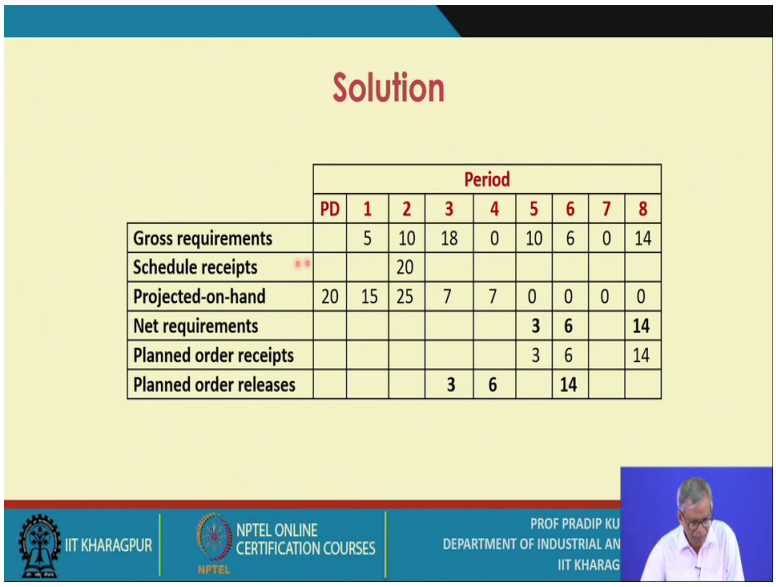

So, the gross requirements is this one; 20 is the schedule receipts in the second time period. So, the projected on hand is 20 so; obviously, you know this will be your projected on hand after the gross requirement this is 15. So, 15 minus 10 plus 20 equals to 25; 25 minus 18; 7, 7 this is 0 gross requirements. So, this remains 7 then; obviously, this will be your 0; that means, your gross requirements is 10 and you have projected on hand is 0. So, what you need to do? That means, your net requirements is 3.

So, the planned order receipts is what you try to do; that means, now you consider the lead time and you planned order releases; that means, you place an order for 3 units. And the after say the 2 time periods you get it supplied; that means, the planned order receipts you supposed to get it; that means, the 3 units and similarly in the next time period you your requirement is 6.

But you do not have any stock on hand. So, you require you know your requirement is net requirement is 6 units. So, what you try to do? You consider the lead time, you place an order the planned order releases that is the 6 units and you are supposed to get on 6; is it ok? And similarly and the seventh time period, you do not have any gross requirements, your projected on hand is 0. Whereas, and so you continue with 0 stock and when you reach the eighth time period, your gross requirement is 14.

So, you have a net requirement of 14 and this 14; that means, the order receipts you have to make a plan. So the 2 weeks before or the 2 days before or the 2 time periods before, you place an order of 14 units.

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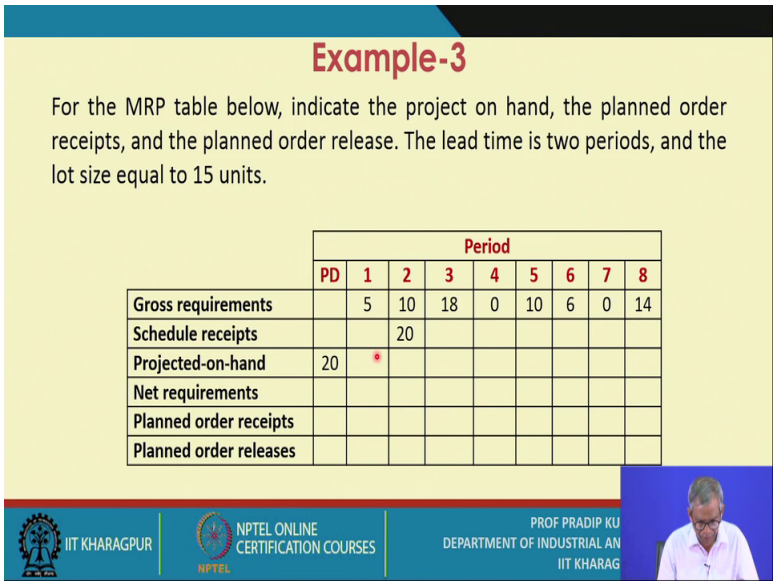

So, this way you create this table; now the third example is for the MRP table below indicate the project on hand, the planned order receipts and the planned order release. The lead time is 2 periods and the lot size is equal to 15 unit.

So, again the same sort of data you have like the gross requirements the same the same set of values. The schedule resource this is 20 and the projected that the demand that is the projected on hand that is 20 units, this stage. And you have to determine the net requirements the planned order receives and planned order releases.

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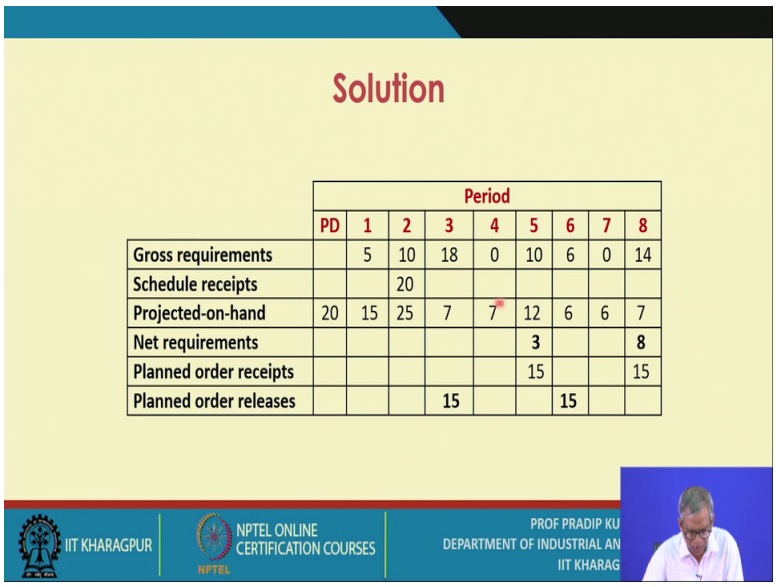

So, the same procedure you follow in fact, you follow the logic one by one. And then you have this planned order receipts; it is ok, this is just another example and planned order releases based on say is the lead time you compute.

Now, with this what we; we are what we are proposing? That you should be familiar with this particular table this is the; this is the basic table you have to create. Now; obviously, there will be many assumptions while you create such a table, but what is important is that at any point in time; the planned order receipts you must be able to calculate and the planned order releases is it ok; so, this is the first level.

And as the time changes you need to recalculate the all these the parameter values ok. So, I conclude this sessions the two particular examples we have we have taken up and the basic the procedures or the procedures you employ to calculate or to re-calculate the values of all these parameters that we have explained. In the in the next lecture sessions, we will take up the other examples and other issues related to MRP systems.

Thank you.