Management of Inventory Systems
Prof. Pradip Kumar Ray
Department of Industrial and Systems Engineering
Indian Institute of Technology, Kharagpur

Lecture - 08
Inventory Problems and Selective Inventory Management (Contd.)

So, during the second week, we are basically discussing the Inventory Problems and the Selective Inventory Management. We have already you know the introduce the concept of inventory selective inventory management in the previous the two sessions of this week.

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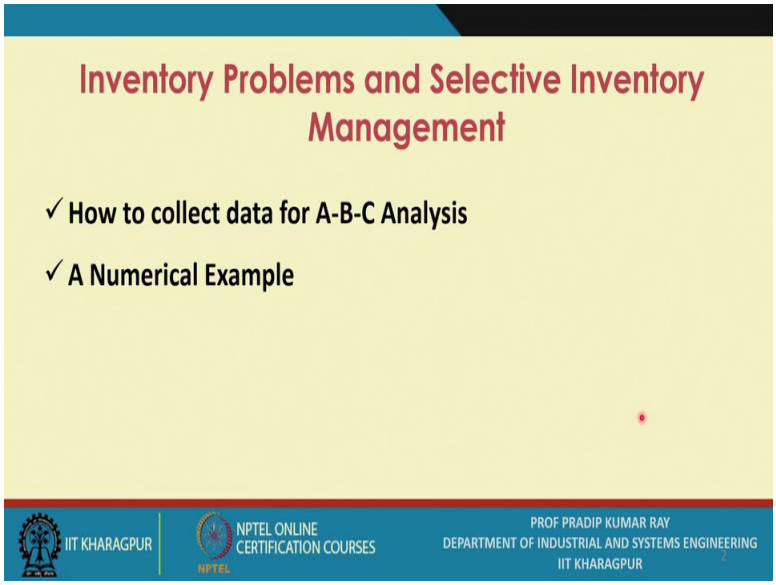

Now, during this lecture session, I will be discussing an important issue like if you want to conduct an A-B-C analysis, then what sort of data, you need to collect; how do you analyse the data. So, that from the A-B-C analysis, you get meaningful information and so, this so, I am saying how to collect data or A-B-C analysis this is very very important and then this will be supported with one numerical examples.

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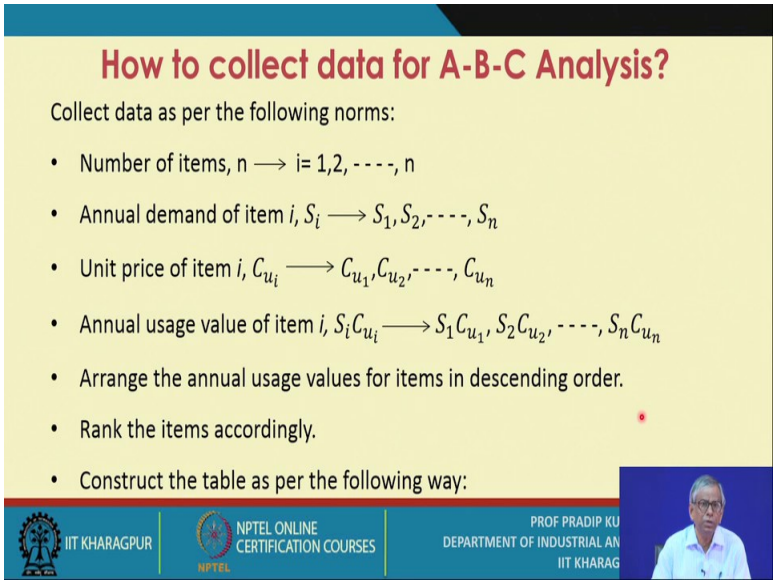

So, this will be our coverage as we have already mentioned that in selective inventory management, there are many kinds of the classification schemes and it is very common that come to the almost all source of organisations that could be 100s and 1000s of inventory items you need to deal with and for each and every item, there must be some inventory control policies and so, it is suggested that why do not you first select the important the inventory items.

And only for those inventory important inventory items, you the study the existing inventory control systems, you assess the existing inventory control systems for those items and then if you made some improvement you why do not you suggest the improved inventory control systems and so that the whatever the gains whatever the benefits, you get and that benefit will be maximum.

So, this is the basic the concept of the basic, you know the understanding when you go for selective inventory management and by this time, you are aware that there are 6 types of the classification schemes and the depending on the situation depending on the particular problems you face related to inventory controls or depending on the type of say. So, inventory item you are dealing with you select one or more of this classification schemes.

Now, here the most important classification scheme is called A-B-C analysis and you will find that as I already mentioned that A-B-C analysis is very very common and so, you must know how to carry out an A-B-C analysis is a very simple process. So, I will just tell you all the steps involved.

Now, what you need to do? You have to collect data as for the following norms and this the collection of data is related to the inventory items. So, suppose there are n number of items, n could be 50,000, n could be 10,000, usually n is a very large number of items n. So, you specify them like say i item i i varies form say 1, 2, up to n.

Annual demand; now what you need to do need to know that against each item I what is the annual demand, obliviously, it is the expected value you refer to the first data or you refer to the current, you know the dataset created to all the items and definitely, you will come to know what is the expected annual demand in physical units. So, the notation is S i; that means, for the ith item annual demand in physical units is signal. So, so, for against each item, you will have all these values that you note down that is S 1, S 2, S n; this is the notations we have used.

Now, the next important the data then information you must have that is against each item i, what is the unit price or the basically, you know if it is purchased; obviously, it is a purchased item if it is a purchased item. So, this unit price; that means, at which price you have purchased this item, right and this normally the there could be a fluctuations in the unit price over the time period.

What we are assuming at this stage that the unit price fluctuation is minimum or you may assume that the unit price of an item is constant over the particular time period; say one year. So, the notation is C u i; C u i. So, obliviously for all the n number of items, you have the corresponding unit prices.

Now, next what you need to do you need to calculate the annual usage value of items, as I have already mentioned, the A-B-C classification is based on the annual usage value. So, if you multiply S S i with C u i you get the annual usage value, fine. So, for all the items, you need to you calculate the annual usage values.

Arrange the annual usage values for items in descending order ok; that means, first you pick up that value which is having the maximum one that is S i C u i for a particular value of i, you will get the highest value and that the next highest value the this way, you arrange this values annual usage values for n number of items and accordingly you rank them rank the items accordingly, fine.

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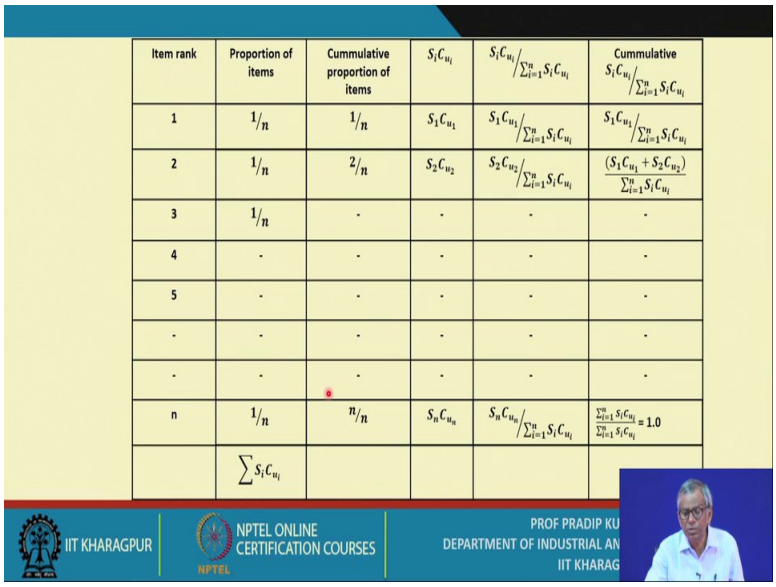

Construct the table as for the following way. So, how do you construct the table? Now the here, I will just show you all the details there are few columns and this particular table like first one is that what you try to do; that means, already you have run this item. So, the item ranking one two 3 up to n; so, n number of items you have. So, suppose this is the ranking. So, the proportion of items is one upon n 1 upon n 1 upon n for each one that is the proportion ok.

So, 1 upon n now, the cumulative proportion of items; that means, n could be you know the suppose 3000 items or 30,000 items. So, you just get the portion of that one, then the cumulative proportion of items; obviously, the first one with rank 1; it will be 1 upon n second one will be 2 upon n, third one will be 3 upon n and ultimately for the nth 1, it will be n upon n; is it ok? So, this is the proportion of the items, then you create this column that is S i C u i; that means, for the ith item what is your annual usage value. So,

this annual usage values they are all ranked is like for example, for the first item which is S one cu one for the second one S 2 C u 2 and so on and so forth ultimately for the nth item it is S n C u n.

So, now you create the next column; that means, this is the proportion; that means what you try to do; that means, if you add all these the values you will get the total annual usage value. So, this is the expression; that means, sigma I equals to one to n S i C u i; that means, the total annual usage value and then for a given item what is the proportion. So, this way you calculate like for the first item, it will be S 1 C u 1 divided by sigma and similarly for the second one similarly for the third one and so on ok. So, ultimately for the nth one you get these expressions each for each and every item as they are ranked.

Then the cumulative proportion values, you calculate; is it so; obviously, this will be cumulative one; that means, for the first one this is S one C one divided by the sigma; that means, the total annual usage value. The second one will be S 1 C u 1 class S 2 C u 2. So, like this you calculatefor each and every ranked item the cumulative or the proportion of the annual usage value with respect to the total annual usage value supposedly when you reach the nth item you get a value of 1; is it ok? So, these are the simple calculations you do.

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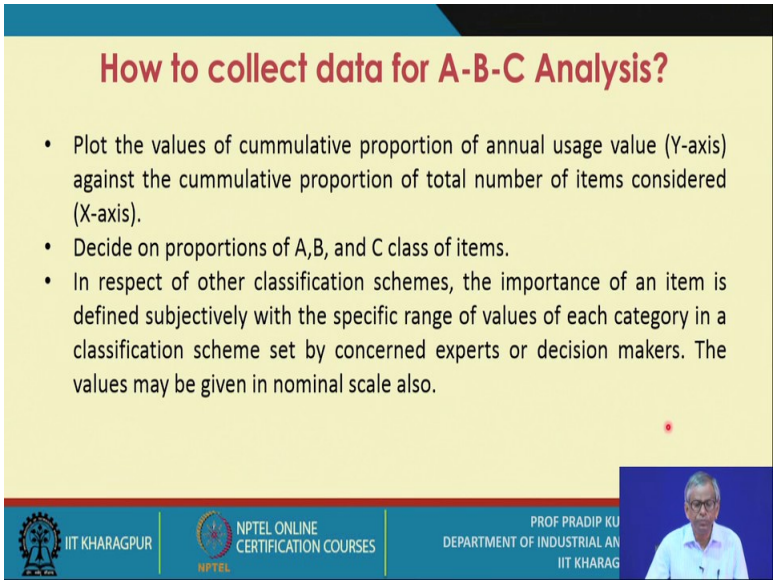

Now, what you need to do; that means, for the A-B-C classification, I must know that with respect to say A class items; how many A class items, you have what is the proportion of A class items and what is this you knowwhat in terms of the total annual usage value; what proportion of the annual usage value A class items contribute.

So, what you need to do? You need to plot the values of cumulative proportion of annual usage value on the y axis against the cumulative proportion of the total number of items considered. So, that represents the X axis, it is very simple decide on the proportion of A B and C class of items. So, this is very very crucial. So, once you plot this the values of annual proportion of annual usage values against the proportion of the total number of proportion of items with respect to the total number of items proportions.

So, you get a curve and depending on the shape of the curve, the nature of the curve you need to select the proportions of proportions for A, B and C class of items; is it ok? So, this is subjectively done if the curve is very stiff, you will find as with a small proportion of the items may be contributing say the high proportion of the annual usage value; is it ok?

Whereas, if you find that the curve is a flat one we will find that the more number of say

the items may be contributing to the lesser proportion of the annual usage value is it ok. So, the first thing what you need to do? You need to you know the plot this you need to get this curve and look at the shape of the curve, and then you decide what will be the proportion of A class item, what is the proportion of B class item and what is the proportion of C class items. In respect of others classification schemes the importance of an item is defined subjectively; is it that when we discuss the other classifications schemes you will come to know that that could be sum and the scaling of with respect to that importance related criterion for a given classification scheme, but essentially this is done subjectively.

So, in respect of other classifications schemes like say VED or say you know x, y, z or so, FSM. The importance of an item is defined subjectively with the specific range of values of each category in a classification scheme set by the concerned experts or decision makers. So, this is an important point, we looked into the values may be given in nominal scale also; is it ok; like say the criticality or say the consumption rate or say you know the availability; is it ok? So, how many the levels you should consider ok?

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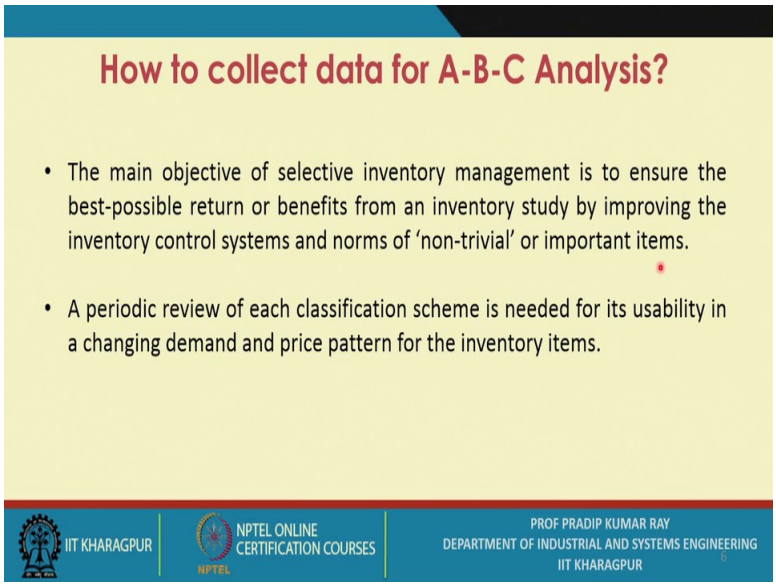

So, a particular you know the rating, you have to give and the rating scales, we need to use. Now the main objective of selective inventory management is to ensure the best

possible return or benefits from an inventory study by improving the inventory control systems and norms of non trivial or important items; that means, what you will come to know in the almost all these cases, this is based on the Pareto principles, you may be coming across the large number of inventory items, but in almost all cases in the majority of the cases, 90 percent of the cases, you will find that the few items are nontrivial or important whether the trivial or unimportant items whatever way you define the importance of an item.

The unimportant items could be in large numbers; that means, what we say the few nontrivial versus many trivial items. So, this is the basic principle. So, we should concentrate on identification of nontrivial or important inventory items and a thorough study is to be is to be done on the on their existing inventory control systems and as far as possible and improved say inventory control systems are to be are to be developed and are to be adopted in course of time. So, that the company for organisation again significantly in terms of its financial performance both operational as well as the financial performance.

So, a periodic review of each classification scheme say A-B-C classification is needed for its usability. Now this point is to be looked into; that means, today the proportion of a items could be say seventy percent or say you know proportion could be say 10 percent or 5 percent; contributing to 70 percent of the annual usage value tomorrow or may be the next year, they could many reasons for this one. Now this proportion may change it might be in the next year, it could be say 25 percent of the total number of items considered as a class items contributing may be 50 percent of the total annual usage value.

So, what you need to do; that means, while you determined this values while. So, it should be periodically review. So, periodic review is a must because of the data patterns are changing the demand is changing the unit price is changing and so, also the characteristics of the items. So, periodic review of each classification scheme is needed for its usability in a changing demand and price pattern for the inventory items.

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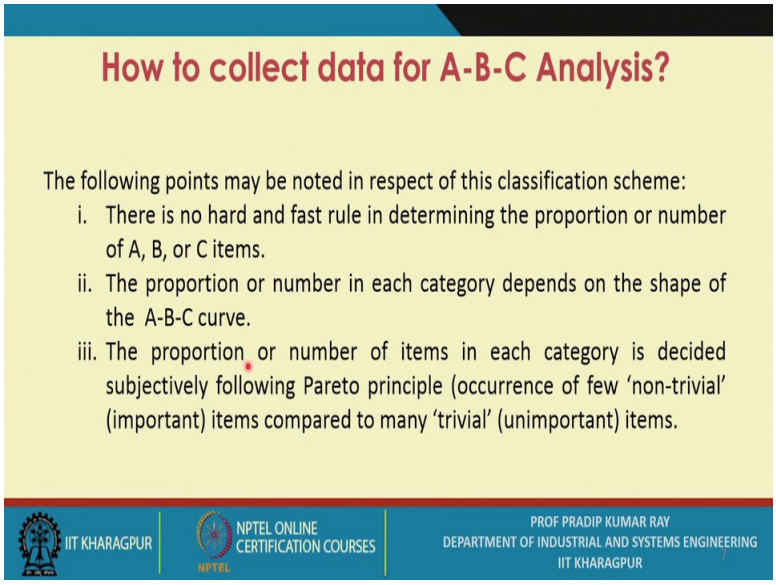

Now, the following points may be noted in respect of this classification schemes. So, right now we are referring to A-B-C classification. So, the first point is there is no hard and fast rule in determining the proportion or number of A, B or C items that is point number one ; that means, there is such there is no mathematical formula or there is no theory behind it.

The proportion or number in each category depends on the shape of the A-B-C curve this point, I have already I have already highlighted the proportion or number of items in each category is decided subjectively following Pareto principles occurrence of few nontrivial important items compared to many trivial this point, I have already elaborated ok. So, this is third point.

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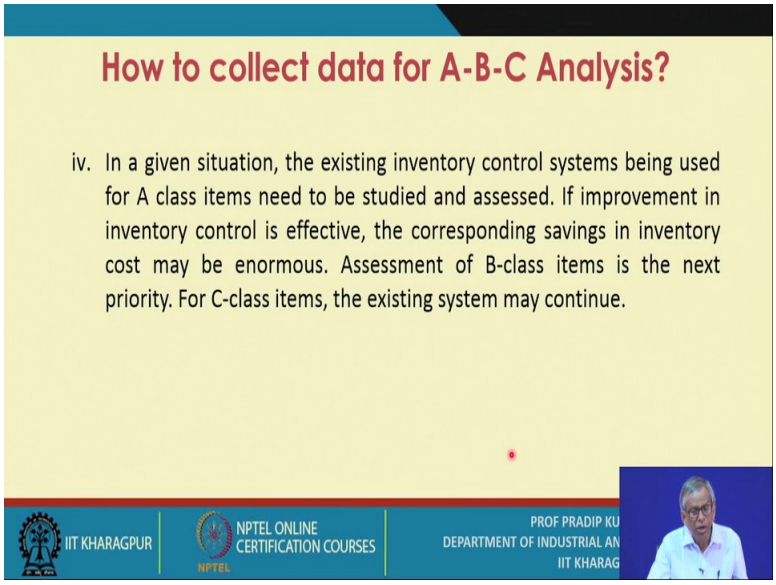

And the fourth point is in a given situation the existing inventory control systems being used for a class items need to be studied and assessed need to be studied and assessed you cannot. So, at the neglect a class items; that means, if you neglect suppose you do not take any action or even you do not assess the inventory control policies for the a class items the main purpose of selective inventory management are the gets defeated.

If improvement in inventory control is effective the corresponding savings in inventory costs may be enormous later on, we will take up this particular aspect; that means, many time there could be many reasons that the existing system, you have been you have been using for a long time, but suppose suddenly you make a change in the inventory control system, there could be the enormous gain and the company will be benefited and the financial performance as well as the operational performance will be substantially improved.

Assessment of B class items is the next priority for C class items existing system may continue; that means, in many cases, what you will find the maybe the 70 percent of the items or 60 percent of the total number of items; consider C class items contributing hardly say 5 percent of the total annual usage values so; obviously, there is an existing system for existing inventory control system for all these the C class items. So, let the

existing system be continued ok.

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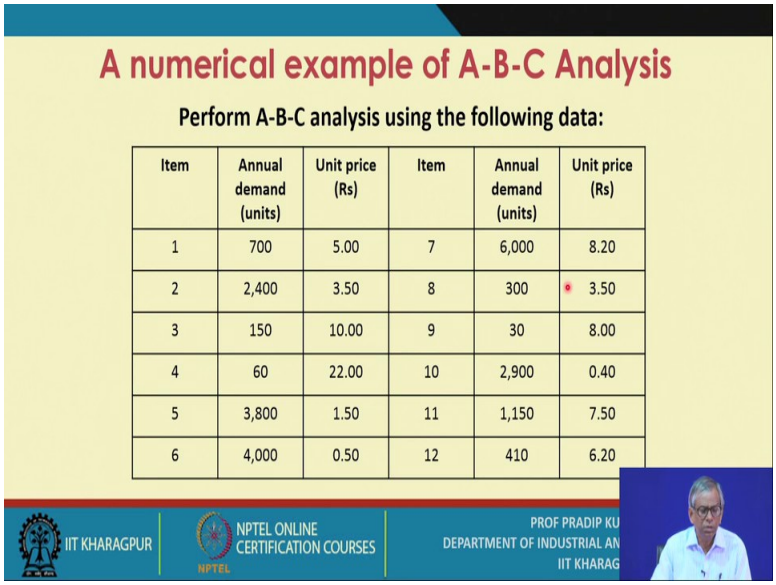

Item	Annual demand (units)	Unit price (Rs)	Item	Annual demand (units)	Unit price (Rs)
1	700	5.00	7	6,000	8.20
2	2,400	3.50	8	300	3.50
3	150	10.00	9	30	8.00
4	60	22.00	10	2,900	0.40
5	3,800	1.50	11	1,150	7.50
6	4,000	0.50	12	410	6.20

So, here isand in a numerical example of A-B-C analysis; so, what you what you have found? So, there are the 12 items. Item 1, item 2, up to item 12. So, there are 12 inventory items, you know, what is the definition of inventory so; that means, it is an ideal resource with some economic value. So, in many a time what you find that the each inventory item is coded; that means, there must be an unique identification code.

So, this point you just keep in mind that whenever we start say developing an inventory control system for an organisation. So, the first thing you need to do that this system that inventory control system to be created for the inventory items and each and there could be many types of items and in order to avoid duplication what you need to do; that means, you must use some coding scheme. So, that each and every inventory item is given a unique code.

So, so, instead of writing the item with the. So, with the number you may use a code also. So, the against each item now you know what is the annual demand. Now this annual demand what we are assuming that expected annual demand; is it ok? That means, it is more or less it is known with certainty annual demand there could be some

fluctuations are, but this fluctuations is minimum; is it or you can say that it is the last years data the last years data and this year the data say five percent increment; is it ok? Last year suppose it is 100 units. So, this year you may assume it to be say 105 ok. So, if it is a 5 percent, if it is 10 percent. So, increase; that means, you may assume it to be 110. So, this logic you follow and then what you try to do; that means, you assume that for one year the unit price remain same.

So, here of the basic assumption is you please note it down that unit price for the given year ok; does not change there are occasions where you will find the unit price might change is it ok. So, that is the assumptions you use or what you can say the, for the classification scheme that unit price either you can say the average if you find that the unit price is unit purchase price is changing significantly. So, first you calculate the average and or you can issue you can use the maximum value also ok.

So, this unit price in the fluctuation unit price conditions or the situations, you have to select judiciously.

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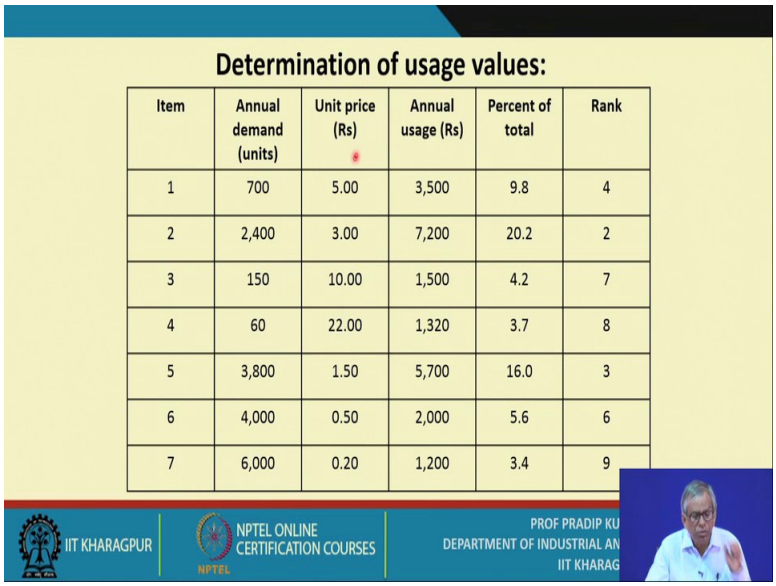

Then so, this 3 values; you have against each item, 2 values annual demand and the unit price next what you do; that means, now you calculate the annual uses like S i C u i;

what we have already done and then. So, these are the values like 700 into 5; lies 3500 like this in rupees percentage of total that is this one.

So, you calculate the total annual all these values you calculate and you get the total value. So, the percentage of total like 9.8 percent. The next one is 20.2 and all these. So, you have say all these values and then rank them like say item 1, it is ranking 4, item 2 ranking is 2 like this like item 3 ranking is 7, like this you rank them.

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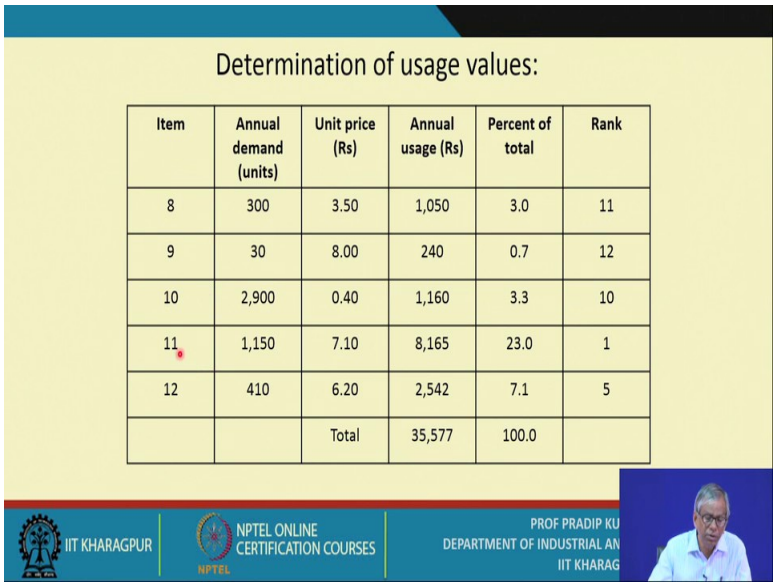

Item	Annual demand (units)	Unit price (Rs)	Annual usage (Rs)	Percent of total	Rank
8	300	3.50	1,050	3.0	11
9	30	8.00	240	0.7	12
10	2,900	0.40	1,160	3.3	10
11	1,150	7.10	8,165	23.0	1
12	410	6.20	2,542	7.1	5
		Total	35,577	100.0	

And what you find that 11th item; item 11; it is ranking 1; that means, it contribute 23 percent of the total annual usage value. So, it is considered to be very important item a class items ok. So, the total is; obviously, 100 percent, right; so, the 100 percent coverage.

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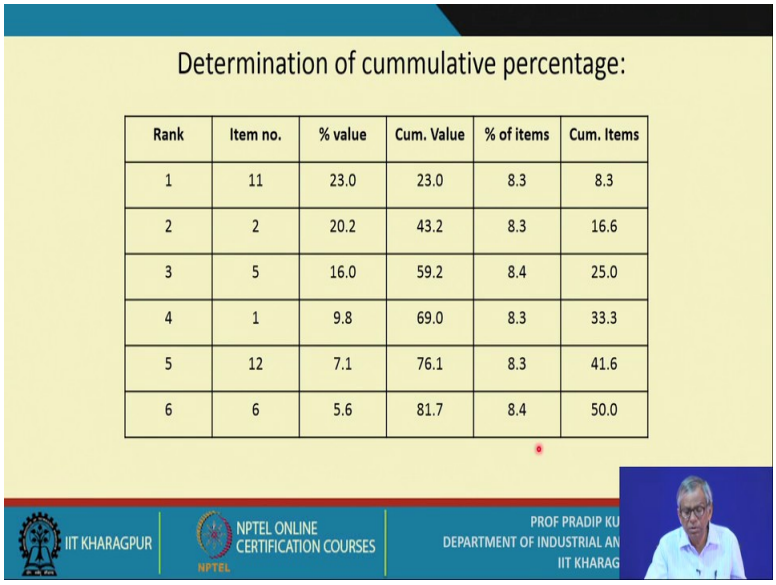

Then what you do you determine the cumulative percentage. So, this the calculation is very very easy. So, the item number you calculate rank one item number 11 percent is value 23 percent; cumulative value 23 percent and then the percentage of items is 8.3 percent cumulative items 8.3 percent; is it ok? So, there are 12. So, there are 12 items. So, the percentage is; obviously, say out of 100. So, the 12; that means, it is 8.3 proportion of 8.4; 8.33 or 8 point. So, we have assumed 8.3, 8.3, 8.4. So, that the total remains 100 percent.

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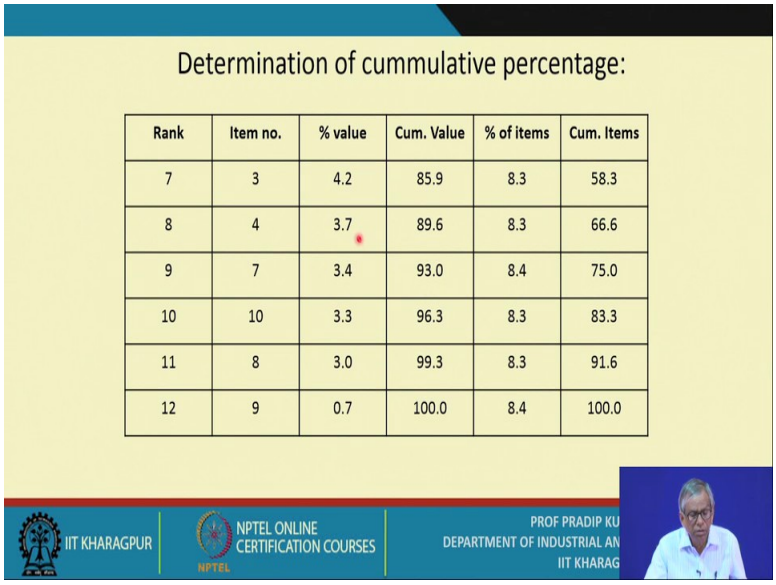

So, this simply calculations we do and then. So, this is the total proportion cumulative value for all the items we calculate. So, 8.3 percent of the items contributing to 58.3 cumulative value up to 7 ranks; is it like this ultimately when you reach the 12 ranked items, you cover 100 percent of the annual usage values ok.

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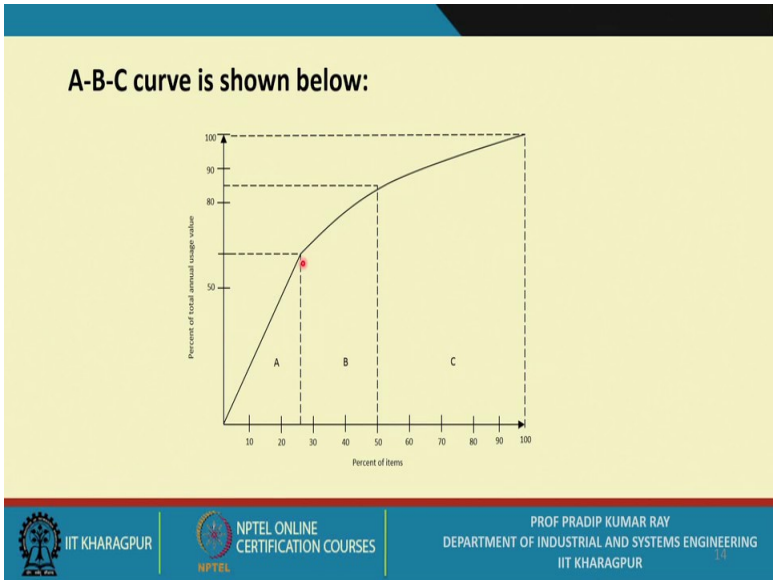

So, now what you do you construct this A-B-C curve. Now here one important point to be noted one very important point you need to 2 5 like here, you know as per given to be what we have assumed that this is almost say this is the curve. So, this items the percentage of items; that means, it is around 26-27 percent of the total number of items considered as a class items and this a class items; that means, around 26 or 27 percent, they are contributing around say 60 or 65 percent of the total annual usage value. So, x axis represents the percent of items and y axis represents the percentage of total annual usage value.

Similarly, the B class items; that means, it is around the 22 percent or 23 percent; is it around 22 or 23 percent is contributing to 65 to say 85; 20 percent of the total annual usage value and the rest say 50 percent; 50 percent of the total number of items considered contributing to just 85; the 15 percent; around 15 percent of the total annual usage value.

Now, this is one point you need to remember; that means, this is a point; that means, this is the cut off this is the cut off now just this point; that means, you need to identify what are those items. Now these are the cases like one item could be on this side considered as. So, the B class item and, but on the other side another item is in the in this zone. So,

that is considered as a class items. So, these are the borderline cases.

Similarly, between B and C; there will be there will be one item considered as B and adjacent to that B item with say slight change in say what you can say almost in the same value; is it that is individual contribution individual contribution. So, it is considered the C. So, see the borderline cases, right, now always that could be a problem in dealing with the borderline cases.

So, what I am suggesting right now? So, if you find problem in dealing with the borderline you know the items. So, may be. So, someone might say there is a class item. So, I do not; you control it whereas, the someone else might say that this is the b class item. So, you do not need to control it ok.

So, borderline cases later on we will discuss separately. So, if the shape here what you find; so, the shape of the A-B-C curve is flat 1 is not that stiff there are cases the shape could be like this one in many cases, you will find the shape may be like this shape may be like this one. So, in that case what will find that maybe 5 to 10 percent of the total number of items contributing to say the 80 percent of the annual usage value.

The remaining say you know next what you find may be its a 20 percent or 25 percent of the total number of items contributing to say the 10 percent of the total annual usage value and the remaining 70 percent; that means, 10 for a 20 for 20 or 25 for B. So, remaining say 65 to 70 percent of the items contributing to say 10 percent of the total annual as value so, that is considered to be the C class items.

So, what we are saying that do not bother about say the changing the inventory control policies for the C class items that is the general rule whether you need to look into definitely or you need to assess the inventory control policies of the a class items. So, is considered to very very important and the B class items. So, first you give priority to A class items for inventory control or reassessment or say assessment of inventory control systems whereas, the B class item takes the next priority.

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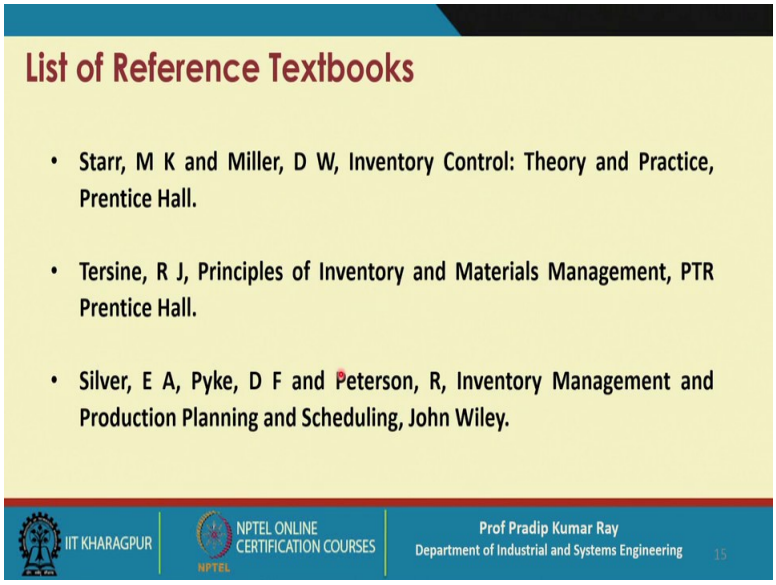

So, I conclude this session in the next sessions; obviously, I will be referring to some other classification schemes ok.

Thank you.