Engineering Economic Analysis
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Lecture 24
Modified Accelerated Cost Recovery System (MACRS) Method of Depreciation, Depletion

Welcome to the lecture on tax depreciation methods. So far we have discussed about the methods in which the special mention is to the Double Declining Balance Method of depreciation or Declining Balance Method of depreciation, SOYD that is Sum of Years Digits Method and also the Straight-Line Method.

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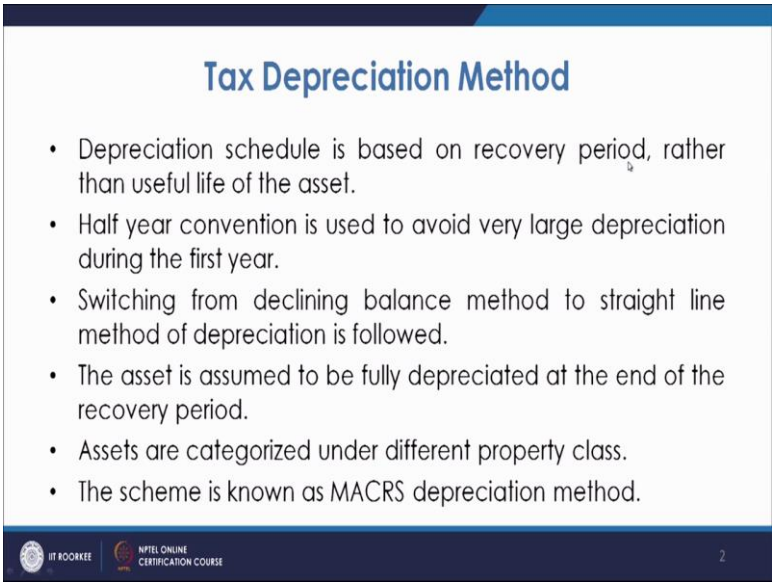

Now based on the US tax laws, there was a depreciation method which was suggested that was known as Modified Accelerated Cost Recovery System. So basically in this we talk about a term known as recovery period. So in this method basically there are few conventions which are used. So first is that we have the recovery period rather than the useful life of the asset.

Half-year convention is used to avoid very large depreciation during the first year because it is assumed that if the capitals asset does not depreciate too large during the first year, the capital can be used for other investments. So during the first year only half of the year is depreciation charge is taken into account and this is known as half year convention.

Now in this case switching from declining balance method to straight-line method, that we have discussed in our earlier lecture, is adopted, so that you can come to a value of 0 salvage

value at the end of the period. So in this case it is assumed that at the end of the recovery period whole of the assets cost is recovered. Now in this case, the assets are categorised under a different property classes.

So depending upon the assets useful life basically there are different property classes and the asset is required to depreciate fully during that period. Now these different property classes are based on the recovery period and based on the class life of these properties, it is the average life.

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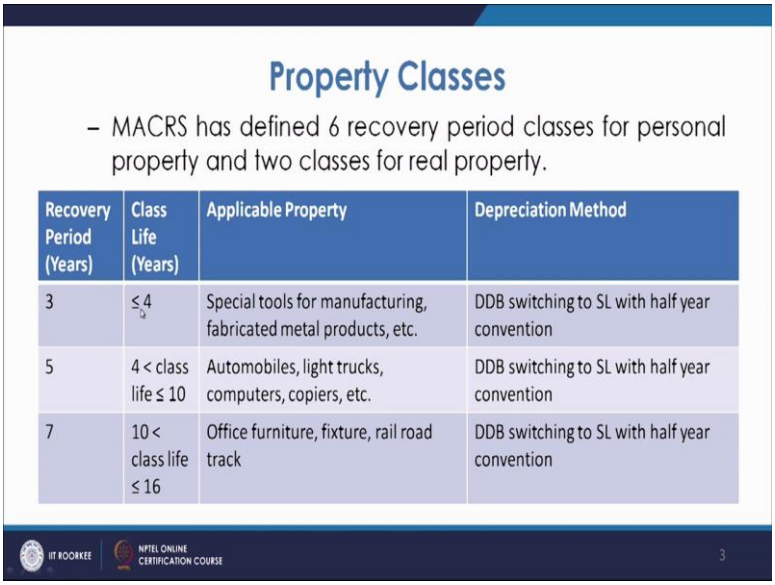

So in that the three-year recovery period is for special tools for manufacturing, fabricated metal products etc. and the depreciation method which is adopted is double declining balance method switching to straight-line with half year convention. So we will discuss how we calculate the depreciation schedule for all these property classes.

If we have been given the assets like auto mobiles, light trucks, computers or copiers then it is kept under the recovery period of 5 years. So five-year property class which has class life of normally more than 4 years and less than equal to 10 years. Again it has the same convention being followed DDB switching to straight-line with half year convention. Then 7 year period, it has basically the class life more than 10 years but less than or equal to 16 years.

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The assets which come under this category are office furniture, fixtures and railroad track and again the same depreciation method is applied DDb switching to straight-line with half year convention. Recovery period of 10 years with class life of more than 16 and less than or equal to 20 years. Assets are used for petroleum refining and for the manufacturing of castings and forgings, railroad cars come under this category.

They are basically assumed to be recovered in 10 years of period and here again you have the convention of DDB switching to straight-line with half year convention. Further in the 15 year period recovery period basically you have the equipments like telephone distribution equipment, waste water plants etc. they have the class life of more than 20 years and less than equal to 25 years and here the depreciation schedule will be followed by this rule.

150% declining balance and switching to straight-line with half year convention. So again further for 20 years which has class life of more than 25 years, you have the equipments as municipal sewers, electrical power plants etc. and here also you have 150% declining balance switching to straight-line with half year convention. So these are the 6 types of personal properties classes.

Apart from that you have two types of real properties, under that you have two recovery periods 27 point 5 years and 39 years. So this is for residential rental property, apartment buildings and it has SL depreciation with half year convention and for 39 years you have non-residential property, office buildings, elevators and escalators, you have SL depreciation with half year convention.

So for the two real property classes you use the straight-line method of depreciation with half year convention and for the 6 personal property class you use, the first 4 is used with DDB switching to straight-line half year convention and the last two is with 150% declining balance switching to straight-line with half year convention. Now how we calculate the depreciation schedule during this calculation using MACRS method, so let us calculate.

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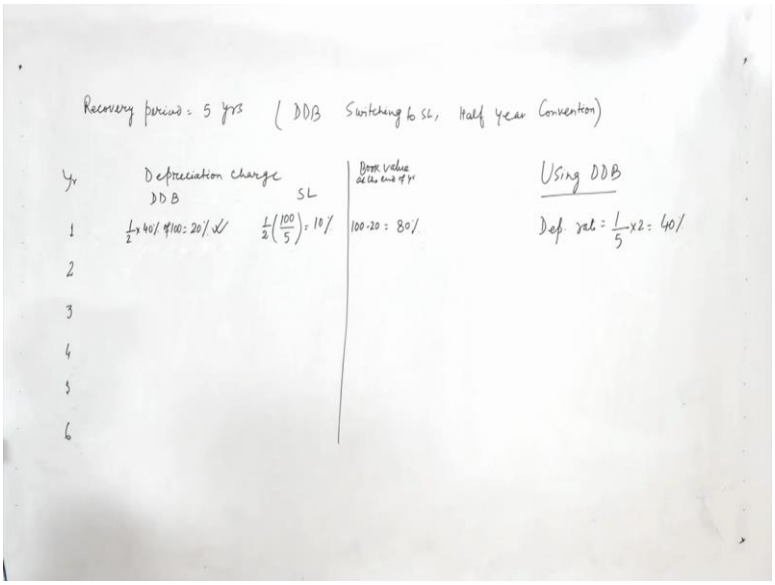

Now let us see we have an equipment with the recovery period of 5 years. So as we see that the equipment which is coming under that property class, here the depreciation method is DDB with switching to straight-line, DDB switching to straight-line half year convention. Half year convention means during the first year the depreciation charge will be calculated on the basis of only half year.

So in that case if you look at the year, if during the first year only half year is calculated, it means it goes in the sec sixth year. Since only half year precision charge is calculated here, so half plus 1, 1, 1, 1, so it will be only 4 and a half years, so half year will be remaining year. So in this depreciation schedule we will have under the year column you have upto 6 years.

Now let us see you have to calculate the depreciation charge, now depreciation charge is to be calculated using both double declining balance method as well as straight-line method because the condition of switching to straight-line is applied at the time when it is felt that the appreciation charge calculated using straight-line method is larger than that calculated by using double declining balance method.

So if you calculate using DDB and if you calculate using straight-line, we will calculate based on the two and see which one is larger and that will be calculated. Then we have the book value at the end of year. So during the first year since only half year convention is used, now in this case using DDB when you use, now using DDB depreciation rate will be 1 by 5 into 2, so it is 40%.

So if you take as the amount as 100%, in that case using DDB what you get get is half since it is half year convention, so half into 40% of 100 that is 20%. So basically we are taking the 100 as the first cost of the asset. So 20% is the depreciation charge when we take the DDB method. If we take the straight-line method, since it is done for half year and charge is, depreciation rate is 1 by 5, so it will be coming as 10%.

So what we see is, this is more, so this the appreciation charge will be calculated and because of that the book value will be 100 minus 20 that is 80%. So book value remaining at the end of year one is 80%. Now if you go to the second year, in second year using double declining balance method, now this half year convention has been applied for half of the year in the first year, so now we will apply for the full year.

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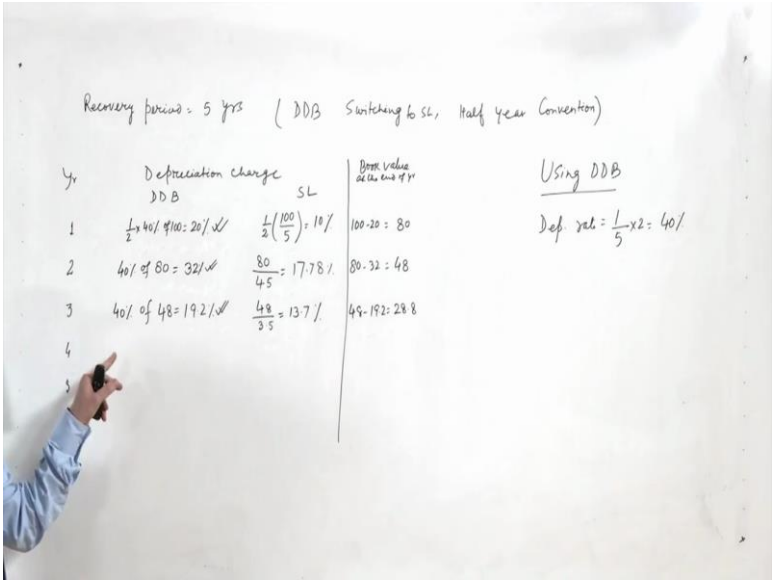

Now in this case using double declining balance method it will be 40% of 80, so basically it is you can have 80, so it will be 80 that is 32%. Now in this 32%, now we will calculate using straight-line method, we see that the life remaining at present is 4 and a half years, so using the straight-line method the book value at the end of year 1 is 80, so using the straight-line method the amount of depreciation will be 80 divided 4 point 5.

Because in straight-line depreciation method the depreciation charge is 80 divided by 4 point 5 or 80 multiplied by rate, so 80 divided by 4 point 5, so 160 by 9 and that will be 17 point 78. So in that case again we see that, we see that this is larger, so we will have this as a depreciation charge and it will be a 80 minus 32 that is 48 as the book value of the asset. Then now we have 48 as the book value at the end of year 2.

So using DDB, the assets depreciation will be 40% of 48, that is 19 point 2%. Now using the straight-line we have time remaining now as 3 point 5 years. So it will be 48 divided by 3 point 5, so it is nothing but 96 by 7, 13 point 7. So what we see is, again this charge is larger, the depreciation method still adopted is double declining balance and that is why it will be 48 minus 19 point 2 that is 28 point 8.

Now again we will calculate using the double declining balance method, it will be 40% of 28 point 8. This will be 11 point 52. Now if we calculate using the straight-line method of depreciation, the life remaining is 2 point 5 years, so it will be 28 point 8 divided by 2 point 5 and this comes out to be 11 point 52.

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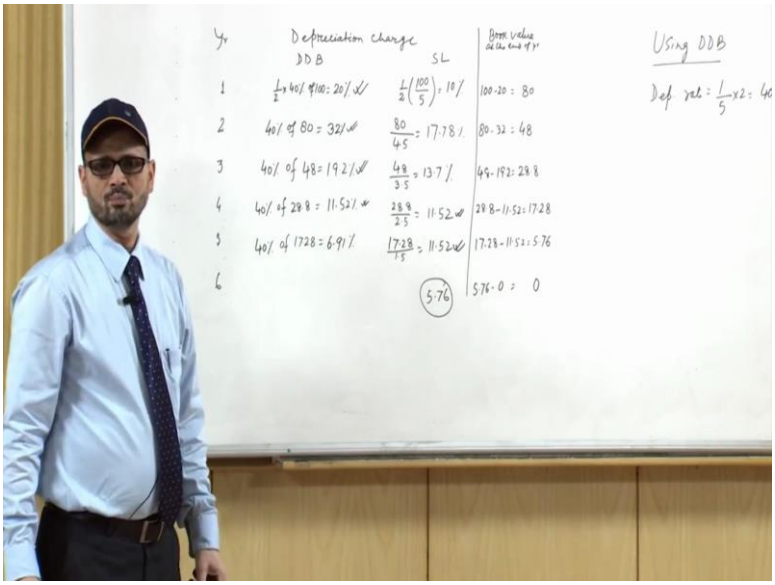

So basically here, both look equal, so switching occurs at this time itself because after this time we will see that the amount of depreciation which we calculate based on two methods, by this method it will exceed as compared to the DDB method. So we have the book value as 28 point 8 minus 11 point 52 so it is 17 point 28. Now if we calculate using DDB, it will be 40% of 17 point 28, it is nothing but 6 point 91%.

And if we calculate this depreciation charge using straight-line we have 1 point 5 years of time left and you have book value as 17 point 28, so using straight-line 17 point 28 divided by 1 point 5 and it comes out to be 11 point 52. What we see is that the amount calculated using the straight-line method exceeds as compared to that calculated using the DDB method.

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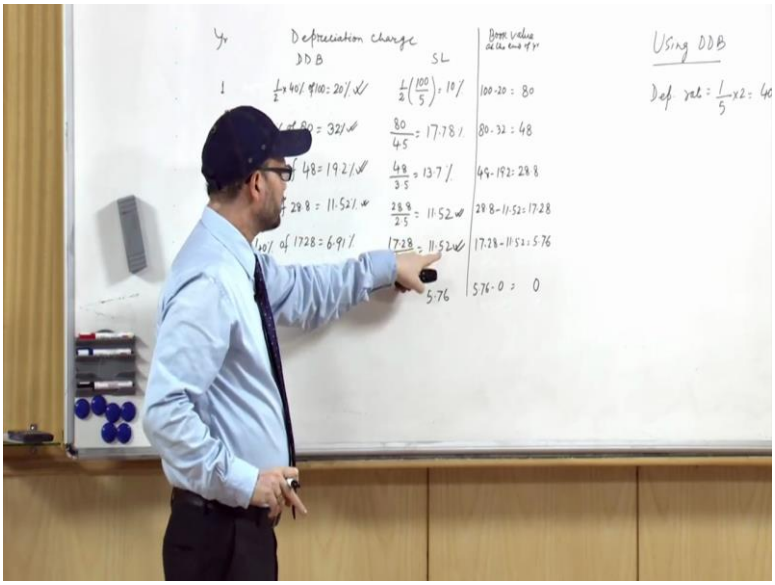

So the switching occurs in fact at here itself but here it is adopted by this method, so your amount remaining is 17 point 28 minus 11 point 52 that is 5 point 76 and this 5 point 76 basically will be done here, so you will get 5 point 76 and this will be 0. Basically this 5 point 76 is nothing but, this is the rate of depreciation now onwards. From here itself this rate of depreciation will be applicable.

Now this rate of depreciation using this, you have only half years left, so into half comes out to be, so for half year it comes out to be 5 point 76. So 5 point 76 by point 5, that comes out to be 11 point 52 that is our rate so 5 point 76 is the depreciation charge and ultimately you get the book value as 0. So this is how we calculate the depreciation schedule for MACRS method.

Now in this method some points which we discussed needed to special mention that, basically there is no meaning of having any salvage value because whole the cost is recovered, so in this case ultimately the whole cost has to be recovered and your salvage value is treated as 0.

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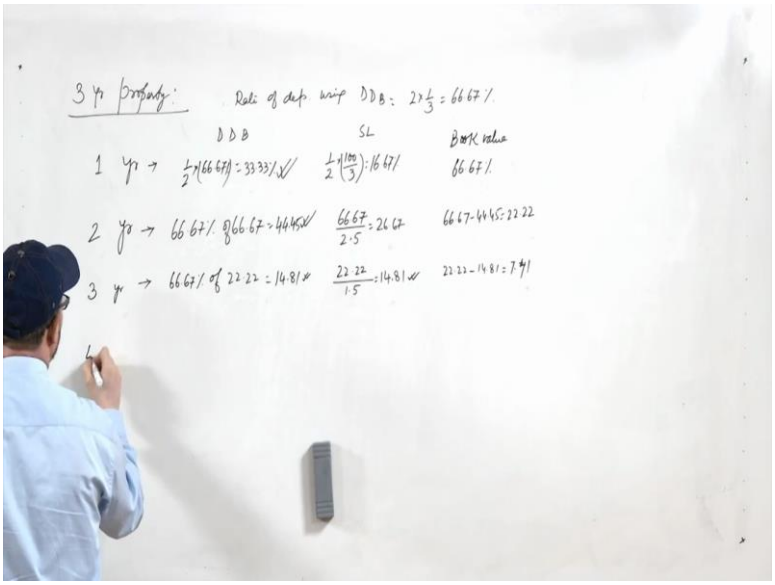

Now if we see the 3% methods or for example, if we calculate using the 3% method, so for three-year property class, in the same method we can calculate the depreciation schedule.

In the first year you have using DDB and using straight-line. So what happens here rate of depreciation using DDB will be 2 times 1 by 3 that the 66 point 67%. So in the first year you have since it is half convention year convention, half into 66 point 67%, so it is 33 point 33% you can have. And if you take using straight-line, it will be half of 100 by 3, so it will be something like 16 point 67%. So basically using the DDB method you are going.

You go to second year, in the second year now your book value which is remaining at the and will be 100 minus 33 point 33 so it will be 66 point 67. So in the second year now your rate of depreciation is 66 point 67, so it will be 66 point 67% of 66 point 67 and this will be 44 point 44 45. Now if we calculate using the straight-line method, we see that you have 2 and a half years left, so you have book value as 66 point 67 divided by 2 and a half, so it will be 33 point 33.

Sorry 66 point 67 divided by 2 point 5, it will be 26 point 67. So in the second year still we see that DDB is having higher value, so once you have this your book value will be 66 point 67 minus 44 point 45, so it will be 22 point 22. Now in the third year your book value is 22 point 22, so it will be 66 point 67% of 22 point 22, so it will be 14 point 81. Now in this case book value is 22 point 22 and your life remaining is 1 point 5 years now, so it will be 22 point 22 divided by 1 point 5, it will be 14 point 81.

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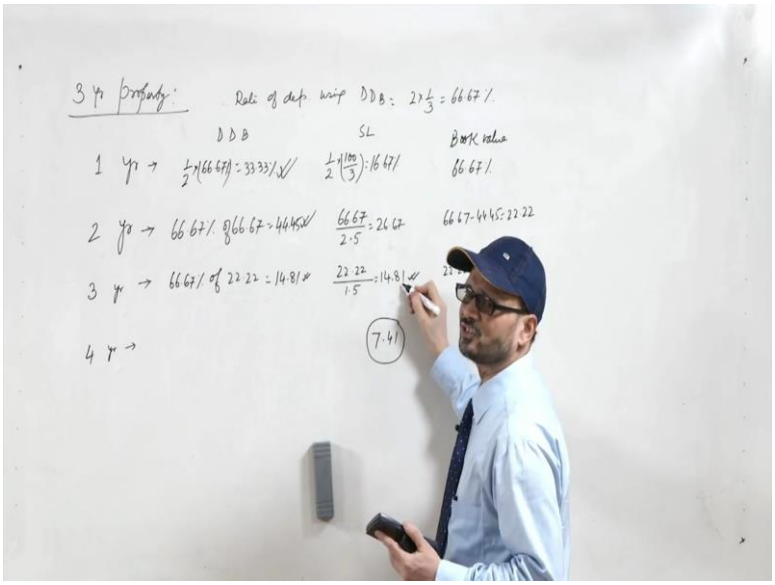

So what you see is, here they come equal, it means here the switching will occur. So both are equal and so switching will occur here and it will be 22 point 22 minus 14 point 81 7 point 41. Now this 7 point 41 since it is half year convention, in the fourth year the 7 point 41 will come here and because the rate is now 14 point 81, 14 point 81 at this rate for half year it comes out to be 7 point 41 and so in this year end you will have value as 0.

So this is how you computer depreciation charges during the different years. Now if you have, so this is for three year and five year class, we can compute the depreciation method for the different property classes. As we have seen that for 5, 3, 5, 7 and 10 years of recovery period, we use DDB switching to straight-line. Now let us say if we go to the 15 year recovery period.

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Recovery Period (Years)	Class Life (Years)	Applicable Property	Depreciation Method
10	16 < class life ≤ 20	Assets used petroleum refining, in the manufactures of casting and forging, rail road cars, etc.	DDB switching to SL with half year convention
15	20 < class life ≤ 25	Telephone distribution equipment, waste water plants, etc.	150% DB switching to SL with half year convention
20	25 ≤ class life	Municipal sewers, electrical power plants, etc.	150% DB switching to SL with half year convention
27.5		Residential rental property, apartment buildings	SL depreciation with half year convention
39		Nonresidential real property: office buildings, elevators and escalators	SL depreciation with half year convention

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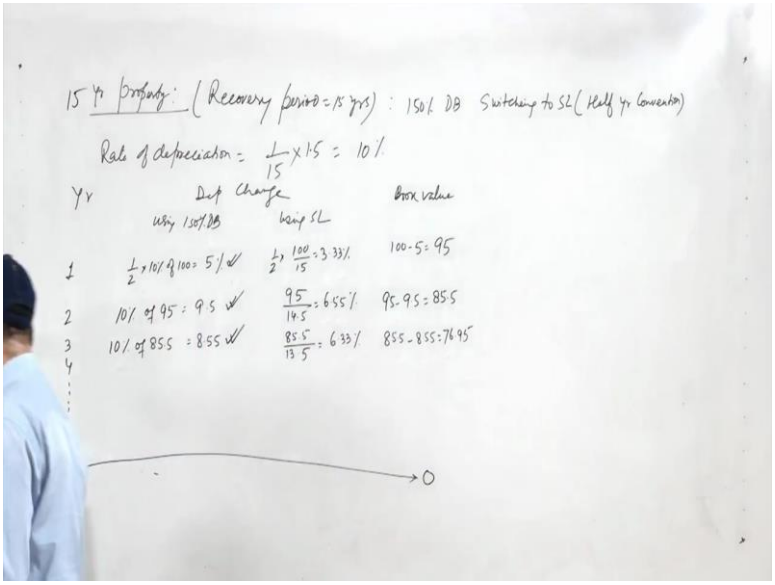

So in that case, so if it is a 15 year property, recovery period is 15 years. In that case the appreciation schedule is, basically depreciation method adopted is 150% declining balance switching to straight-line half year convention. Now in this case, what we see is for 15 year property, rate of depreciation will be 1 by 15 times 150% that is 1 point 5, so it will be basically 10%.

So using 150% declining balance, when you go with declining balance method of depreciation calculation, your rate of depreciation becomes 10%. Now in this case if you look at the first year, using 150% DB and using straight-line and then you have book value. So in

the first year using 150% declining balance and you have half your convention half of 10% of 100, so it is 5.

Using the straight-line method, half of 100 by 15, so it is 3 point 33. So this is larger and your book value will be 100 minus 5, 95. In the second year, book value is now 95 so in the second year it will be 10% of 95. So it now it is calculated for every year, so 10% of 95 that is 9 point 55. Now in this case using straight-line you have and a half years left, so it will be 95 divided by 14 point 5. If you take this amount, 95 divided by 14 point 5, it will be equal to 6 point 55%.

So you see that this one is larger, it is basically 9 point 5. So the book value comes out to be 95 minus 9 point 5, so it will be 85 point 5. In the third year, it will be against 10% of 85 point 5, so it will be 8 point 55 and here you will have 85 point 5 divided by 13 point 5. The life remaining is 13 point 5, if we calculate this, it will be 6 point 33%. So we will further go with this, it will be 85 point 5 minus 8 point 55, so it will be 76 point 95.

So this way you will go in the fifteenth and the sixteenth year because the life is 15 years, it will go up to sixteenth year because of the half year convention followed and in the sixteenth year you will calculate and ultimately it will come as 0 in the sixteenth year. So basically this is the method which is followed for different property classes.

You will be given a problem, we will solve them some problems based on this in which the equipment will be given to you, you must be able to know under which property class it belongs to and as per that the depreciation method is to be used, depreciation schedule is to be used and in every year by having these known value of percentage of the first cost of the asset you can calculate the depreciation charges using this MACRS method of the appreciation. Thank you.