Financial Mathematics
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Lecture – 33
Tax Depreciation Methods

Welcome to the lecture on tax depreciation methods. So, in this lecture we are going to discuss about the tax difference depreciation methods which was basically because of the Tax Reform Act in U.S. in the year 1986 and in that basically there were two types of you know system which were devised one was the general depreciation system and another was the alternative depreciation system that is GDS and EDS.

So, the basically the point was that in this case normally we deal with the; you know class life of the asset. You have assets which are defined basically based on the class life and actually all its cost is recovered so there is a concept of recovery you know cost recovery. So, for that there are certain guidelines there are certain rules you know which are set and you know the difference between GDS and ideas is that EDS is normally for the larger you know cost recovery periods and in that straight line system is used.

However in GDS normally you have either double declining balance method is used switching to a straight line or the; you know 150 DB is used switching to a straight line. So, we will discuss about you know this system especially we will discuss about GDS general depreciation system and in that basically the method which is normally popular is known as the modified accelerated cost recovery system, Mockers.

So that is what we are going to discuss in this class so depreciation schedule is based on recovery period rather than useful life of the asset.

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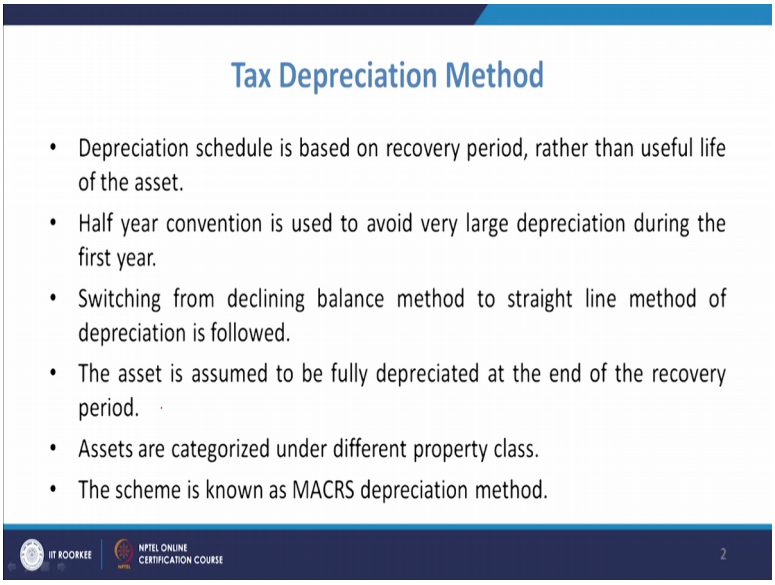

Now these are under the tax depreciation method because you know the there are tax benefits which are enjoyed by the investor for this on the basis of these rules. And this rule certainly can be you know tailor-made you can change any country can change according to the you know existing laws and that can be followed for giving the tax benefit to the you know investors when they purchase assets for the normal working of the industry.

So, in this case you have depreciation schedule is based on recovery period rather than useful life of the asset. Now one of the traits of this schedule is that here you normally use the half year convention to avoid very large depreciation during the first year. So, what happens that when we use these accelerated methods of depreciation then we know that depending upon the life of the asset 1 / n is that if the n is the life of the asset so 1 / n will be the you know the exponent is depreciation rate.

Now suppose their life is 5 years it means 20% is there a depreciation rate now in most of the cases you have the double declining balance if you use then in the first year itself its depreciation is 40% which is very large. So, normally to avoid very large depreciation during the first year itself what we do is normally we apply the half year convention method in these cases. Then we have also switching from declaring balance method to straight-line method of depreciation that is being followed in these general depreciation you know schemes.

Then asset is assumed to be fully depreciated at the end of the recovery period. So, in this case the whole you know amount is assumed to be depreciated at the end of the recovery period. So, depending upon the life you have a recovery period and then if whatever we the cost it all has to be depreciated in that recovery period. Now here as observed categorized on

the different property class and that is why the scheme is known as in these cases as we discussed it is modified accelerated cost recovery system.

Modified means you do certain modifications in the accelerated methods of depreciation which we study is the declining balance method or second declining balance method switching to a straight line. So, in that we follow certain depreciation rate from the beginning but here we do some modification like we use the half year convention. So, in the first year depreciation is only half of that year.

So, so that is modification then accelerated cost recovery so do you have a recovery period that whole cost is recovered in that period so that is why it is a modified accelerated cost recovery system.

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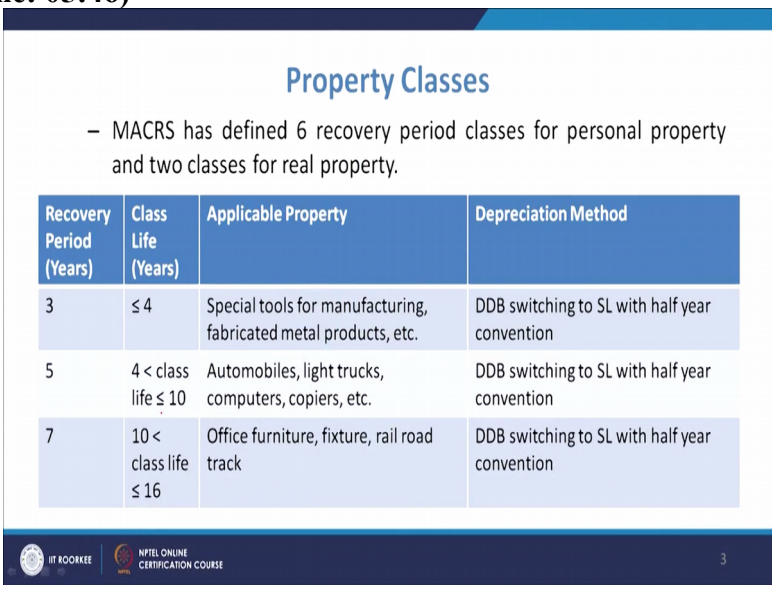

Now in these cases you have the property classes defined and these property classes are basically for different personal properties and real properties like if you have a property like special tools for manufacturing fabricated metal products and all in those cases its class life is said to be less than four years and the recovery period is set as 3 years. So, in the 3 year basically the the whole cost is assumed to be recovered.

So, and depreciation schedule is like DDB the double declining balance switching to a straight line with half year convention. So, in these cases in the first year suppose if you are doing that so for 3 year period you will have rate of depreciation is 33.33% so it is double declining balance rate of depreciation will be 66.66%. So, in normal case it will be 66.66% but now when we use Mockers then we go for half year convention and in that case we take it as 33.33% for half year. So, your remaining is 66.66% and again 66.66% of that so it will be

something close to 44 will be in the second year and then again also you will be checking with the you know straight-line amount.

And for that you have to see that whenever the straight line you know depreciation using straight line scheme will be more than that by the you know declining balance that because you have to switch to straight lines. So, that way because whole cost is to be recovered so you cannot get it recovered through any accelerated method of like these accelerated methods like declining balance or so. So, we will see that how these depreciation schedules go.

Then you have another property you know like automobiles light trucks computers and copiers they have they are said to be a class life of about 4 to 10 years and in that case we take the recovery period as 5 years. So, there also you have the depreciation method will be declining balance switching to double declining balance switching to a straight line with half year convention similar to that for the 3 your recovery period you know properties.

So, further if you have properties like office furniture, fixtures, railroad tracks all these things are said to be having falling under the class life of more than 10 in less than 16 years and they are said to be having recovery period of 7 years and they're also again you have double declining balance switching to the straight-line with half your conventional.

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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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You have the assets like used in petroleum refinery in the manufacturing of castings and forgings and railroad cars which is said to be having class life of 16 to 20 years and here you have discovery period which is set is about 10 years and again the depreciation method is about that in the double declining balance switching to a straight line with half year convention.

Then you have more than 20 years and less than 25 years class life is for properties like telephone distribution equipment, wastewater plants and their recovery period is taken as 15 years and here we switch to 150% declining balance rather than DDB we go for 150% declining balance and that is switch to straight line with half year convention then you have the class life more than 25 years.

So, in that case you have municipal sewers, electrical power plants and in these cases you have the recovery period is taken as 20 years and the deposition is 150% declining balance switching to a straight line with half year convention. So, this is for the property this is now for real properties you have residential rental property apartment buildings they have 27.5 years of recovery period and this is straight-line depreciation with half year convention.

And non residential real property office building elevator escalator they are in 39 years recovery period and straight-line depreciation with half year convention. So, these are the different types of properties and what are the deposition method which are to be applied that is mentioned and then the respective recovery periods are also shown. So, they are used basically to see that how they are going to be you know were taken into considerations while you are going to find the depreciation schedule for these you know assets.

Now let us see that how we are going to see that how these depreciation schedules should vary when you are talking about certain kind of you know property. Say we are talking about a 5 year property. So, suppose you have a property of 5 year class.

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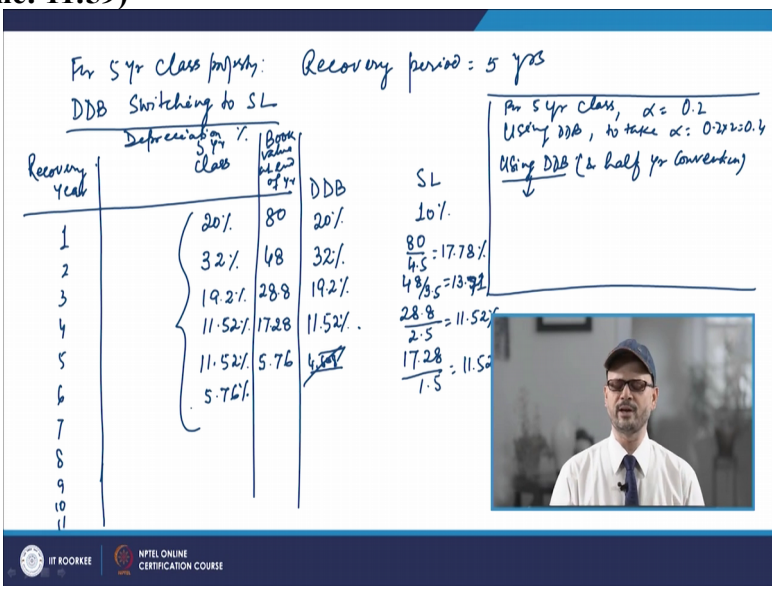

So, for 5 year class properties like you have recovery period is 5 years now in those cases what we do is that we know that for markers it is double declining balance switching to straight line. So, this is the; you know depreciation rule which is to be followed. Now what

we do is you have you have the recovery year and this way you will go and suppose you have a 5 year class 5 year you know class. So, in this case we know that we are going to have this scheme as double declining balance switching to a straight line.

Now if you look at the way how these computations are being carried out so we know that rate of for 5 year class rate of depreciation will be 0.2 so it will be 1 / 5 that is 0.2. So, using double declining balance method to take alpha as 2 * 0.2 so it will be 0.4 now what will happen that 2 as we move 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 like that it will go now let us say for a 5 year class what will be the you know percentage of amount recovered in the first year.

So, in the first year it will be 40% so now you can basically you have to ensure that how you know what will be the depreciation using the you know declining balance method and what will be the depreciation percentage using the straight line method and then only you will be finding which one to be taken. Now if you take using DDB, so using DDB if you find now in the first year it has to be 0.4 but since it is half year convention.

So, it will be 20% so and a half year convention, so in the half year convention it will be 20% so now you can also have you know a table where you can see that using double declining balance and using the straight line. So, there straight line method here or so you where you will be finding depending upon the book value and remaining years now what we do is that when you are going for first year in this case it will be half DDB and that to for half year so in the first it will be 20%.

And with the straight-line method we know that straight line method the depreciation you know percentage is same throughout. So, now it will be 20% in normal and for half year it will be 10%. So, this being larger you will take as 20% that is there is no switching as of now. Now after this the book value which is remaining is 80%. Now on 80% if you take in the second year using DDB your depreciation is 0.4 that 40%. So, it will be 40% of 80.

So, it will be 32 now if you take the straight line method in the straight line method we know that for half-year we have already computed. So, the remaining life is now 4 1/2 years. Now for 4 1/2 years with 80 you know as the value your straight line method deposition will count 80 by 4.5 so that is 160.9 so it will be something like 17.78%. So, if it is 4.5 years remaining the straight line is depreciation scheme is telling out to be 17.8% and the double declining balance is telling you to be 32%.

And since 32% is larger we are going to have this 32%. Then in the; you know so this is basically the depreciation percentage okay. So, this is depreciation percentage. Now you are

coming to 3rd year now we know that 20% and 32% is already you know depreciated so 52% is depreciated so your book value is now 48 out of 100. Now in 48 again using DDB your rate of depreciation is 0.4.

So, it will be 48 into 0.4 so that is your 19.2% now in this case the time remaining now is for 3.5 years so using the straight line it will be 48 by 3.5 so that is you know 96 by 7 and it will be 13.57, you know 13.7 so it is 96 by 7, 13.71. So, now what you see is that using the double declining balance method the depreciation is you know 19.2% and the straight-line method is 13.71% so we will take it again as 19.2%.

Now we can also have a; you know table where we can write book value at end of year. So, here it will be 80% it will be here as 48% and then you will have now you have 19.2 is gone so it will be 28.8% out of 100 it is basically you know we are calculating. Now again we are going to 4th here in the fourth year you have the double declining balance method again 28.8 will be multiplied with 0.4 so it will be 11.52 and using a straight-line method as we know that we have still 2 1/2 years of life remaining so it will be 28.8 / 2.5.

So, if you to do that 57.6/ 5 and it will be 11.52% what we see is that in the 4th year you know we are getting the similar value of depreciation percentage and we can take any one of them and but certainly we have to switch after this to the; you know straight-line method. So, it will be 11.52% you know is taken and now the book value will be 17.28%. So, 17.28 out of 100, if we take that certainly 17.28 now we have basically 1.5 years remaining and we have to switch to a straight line.

So, we cannot go by this basically now we have to move to switching. So, now we are moving to switching and here you will have 17.28/1.5 so it will be 34.56/3 so it will be 11.5% again so it will be 11.52% so it will be you know we have not to do by this double declining balance. For instance if you do by double declining balance if you calculate it will be 40% of 11.52 so it will be less basically it will be 4.608.

So, anyway that is not to be taken so you have to take this 11.25 and then half here remaining is 11.52 so you will have 5.76. And this 5.76 basically is there so that will be coming in the final value so basically. So, 11.52% is basically the rate so certainly this 5.76 will be coming as the percentage depreciation in the final year. So, this is the; you know calculation method using mockers in a 5 year class property whereas the recovery period is 5 years.

We know that since we are starting with the half year convention so basically it is going into the 6th year so being the depreciation for five years it is going into the 6th year and in the 6th

year it is being done. So, this way what we you know do we calculate these you know depreciation percentage for the different classes and you can calculate for the different you know property classes and you see that how you are switching to the different you know you know that from DDB to straight-line method of depreciation.

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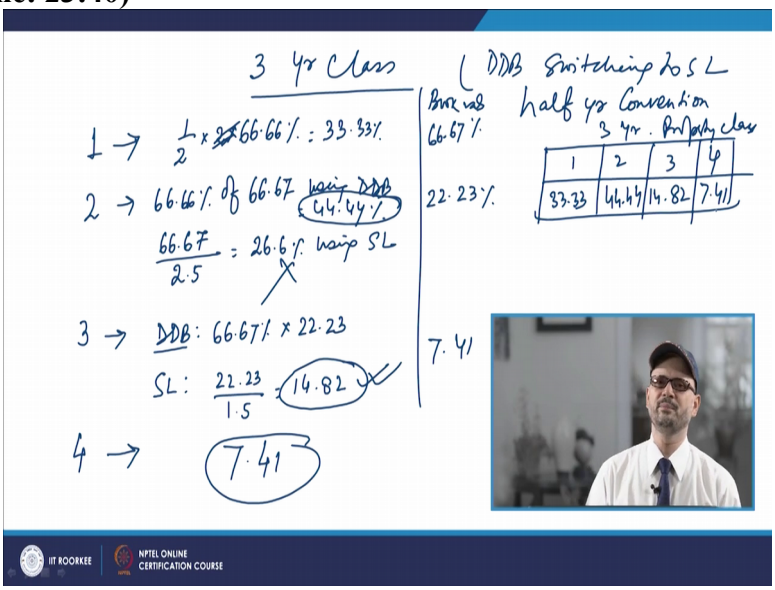

For example if you try now you can cursory you can go for suppose for 3 year class say so for 3 year class in the first year we know that it is DDB switching to a straight line and half year convention so in the first year the percentage depreciation will be half of 2 times you know this is 66.66%. So, it will be you know 33., so it will be now DDB is 66.66% so not to here it will come.

Anyway thirty 3.33 * 2 is 66.66% because in normal case rate of depreciation is 33.33% so it will be 2 to the EDB 66.66% and half your convention is there so we go for you know 33.33%. So, if you take Book value at the end of the year it will be you know 66.67% then in the second year now you could have computed using the straight line method and using the straight line method it will be coming as 33.33% / 2 so that is 16.66% so that is basically quite lesser than this so you are not going to take it.

In the second year again it will be 66.66% of you know 66.67 yeah using DDB and using the straight line since your 66.67% is there and you have you know 2.5 years remaining so will be 66.6 7/2.5 so it will be something like 133.34 / 5 so it will be something you know close to so you can multiply it with 4 so it will be 26.6 something like percent using a straight line. And by this you will be getting something like 44.44%.

So, this will be coming not this one because this is larger. So, this using DDB you are getting 44.44 and using the straight line you are getting 26.66 so you are going to get this so it will be

44.44 so book value will be 66.67 – 44.44 so it will be 22.23%. Now you go to 3rd year using DDB it will be you know 66.67% you know multiplied by 22.23 so this you will be getting and then using straight line you are going to get you have the value of 22.23 and you have the remaining life is 1.5 years.

So, it will be 44.46/3 so it will be 14.82 and if you multiply this basically 20.23 and 66.67 so ultimately you are going to get this value you can have the multiplication may be that it may come to be the same. So, that way 44so here you have switching going on. And in the 4th year basically you switching will be occurring so you can compute, for the 0.82 if it is coming out then it will be 7.41 is the book value remaining and that 7.41 will be there for the you know since it is for the half year so you will be coming to 7.41.

So your depreciation schedule will go like 1, 2, 3 and 4 so for 3 year property class you are in the first year 33.33, second year it will be 44.44 then you have 14.82 and then again 7.41. So, this way your, switching occurs here and you can see that. You can go for even 10 year property class and in 10 years you could know that you are using DDB it will be 20% and that way it will move.

So basically you are going to get these different depreciation schedules you can calculate and you can get it.

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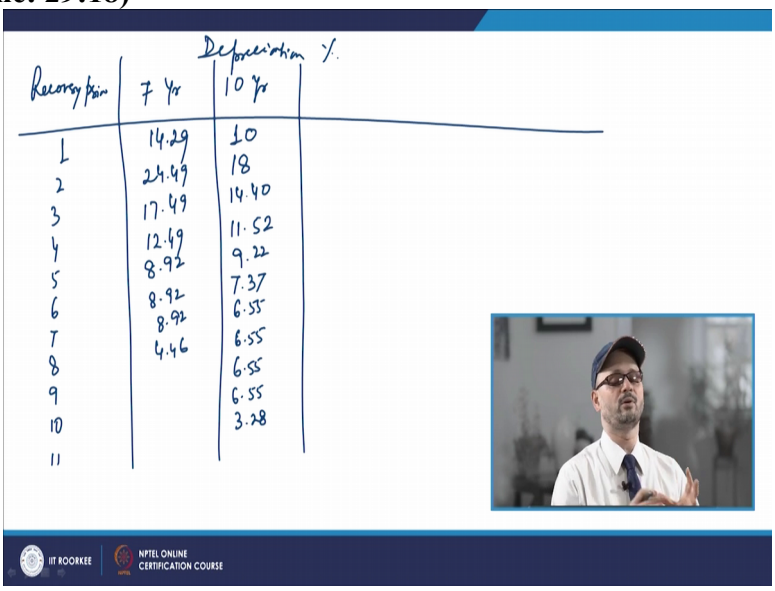

So, suppose for a 7 year class so what happens that if you have a recovery period and if you calculate you know for different you know periods so we have done for 3 and 5 years we can see for a 10 year class suppose we are 7 year class, so for 7 years if you calculate it will be 14.29 then you will have the 24.49 then you will get 17.49 then you will get 12.49 then you it will be switching so 8.92, 8.92 and 4.46 it will go to 80 in the case of 7 years.

Similarly if you go to 10 year class in ten year class it will be quite simple you have 20% of the you know deposition rate so in the first year half is 10 then 19 remaining then 19 of 20 so 18 will be there so that will be 18 so similarly it will go 14.40, 11.50 and then you have switching of 19.22. No switching is not there you can calculate it and then you will have 6.55, 6.55, 6.55 and then ultimately in the end 10th year you will have 3.28.

So, this way your depreciation percentage will be there for different you know property classes that can be computed and that can be calculated used for the; you know what amount of depreciation is there in a particular period. So, this is about that you know tax depreciation method using mockers we calculate, thank you very much.