Economics, Management and Entrepreneurship
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Lecture - 26
Depreciation Accounting (Contd.)

Good morning. Welcome to the 26th lecture on Economics Management and Entrepreneurship. If you recall, we were discussing about the why depreciation occurs for different assets and how to account for such depreciation and we had illustrated basically 3 methods of depreciation accounting. One was straight line method, second was double declining balance method, third was the sum of the year's digits method.

And we have seen that starting with the initial investment, when depreciations are calculated every year then, at the end of that year or those years, we subtract those depreciations to get the book value and then it is desired that the book value at the end of the last year should be equal to the salvage value. In many case, salvage value is 0 and therefore, it becomes simply the initial investment to be recovered.

Otherwise, it is P-L the first cost-the salvage value, which is usually recovered in the process of depreciation accounting. Now, for the problem that we had taken, we will plot the depreciation or the book values against time and see how they actually behave.

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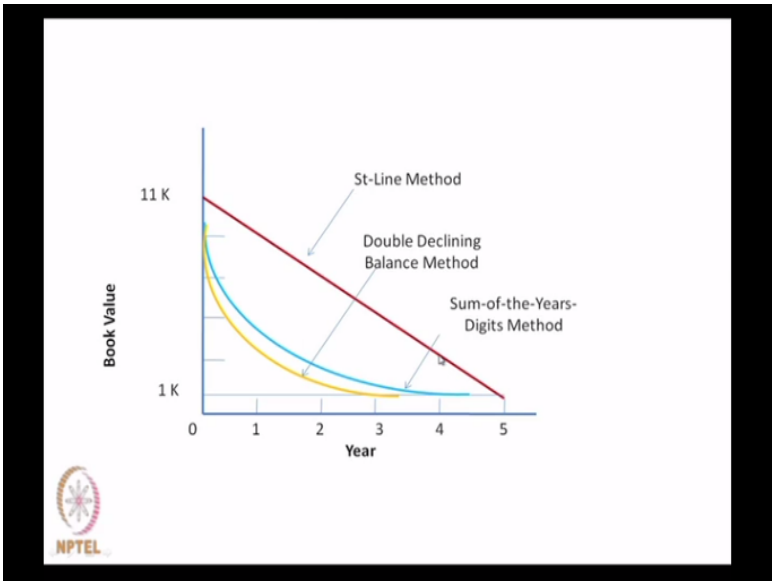

Now, in this graph, we have shown book value in the y axis and year in the x axis. Of course there is a it is not properly written 0 and this should have been 1, 2, 3, 4 and 5. I think let us make it so that there is no clarity here. That should be 1 yes. Now, in this picture, we have shown they are starting with the initial cost or the first cost also what is known as the cost basis of 11,000 rupees. It comes down in 5 years to a salvage value of 1,000 rupees.

Now, in the straight line method, the book value reduces in a constant manner so, this difference is 2,000 in the first year, 2 more 1,000 in the second year. So, the accumulated depreciation is 4,000 at the end of the second year. At the end of the third year, the accumulated depreciation is 6,000 so, 11,000-6,000 is 5,000. At the end of the 4th year it is 3,000 because the accumulated depreciation is 4*2,000 is 8,000 and lastly 1,000.

Now, in the double declining balance method, this is the way by which the book value falls. That means initially the depreciation charged is very high and slowly the value comes down. Whereas at the sum of the year's digits method also charges high amount of depreciation at the beginning and progressively less and less depreciation towards the as the years pass by. We will study the tax implications of such depreciation later.

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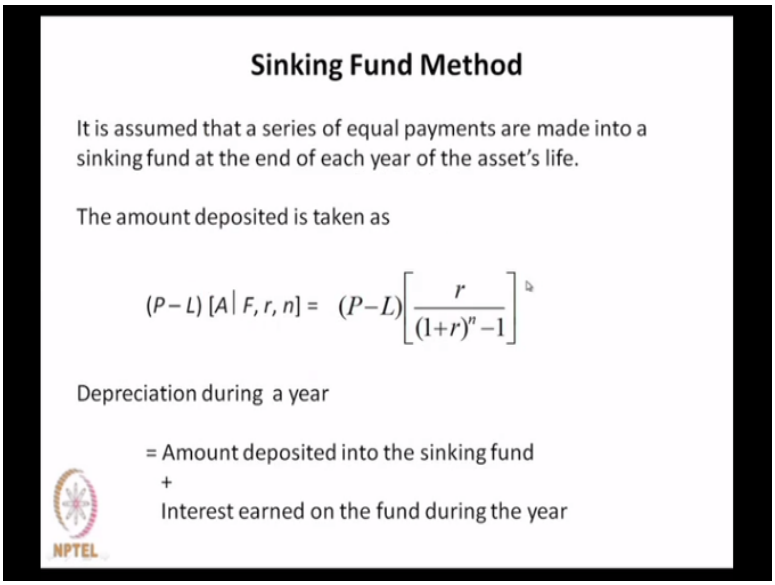

Now, there is yet another method which we had introduced which we had mentioned earlier and that is what we are now going to take up now. That is called the sinking fund method. It is assumed that a series of equal payments are made into a sinking fund at the end of each year of the asset's life to recover the amount P/L. So, if P/L is to be recovered at the end of

the 5 years, at the end of the n years, then what equal amount we should pay into a sinking fund every year so that we get back this P-L. Basically, this is a situation of this type.

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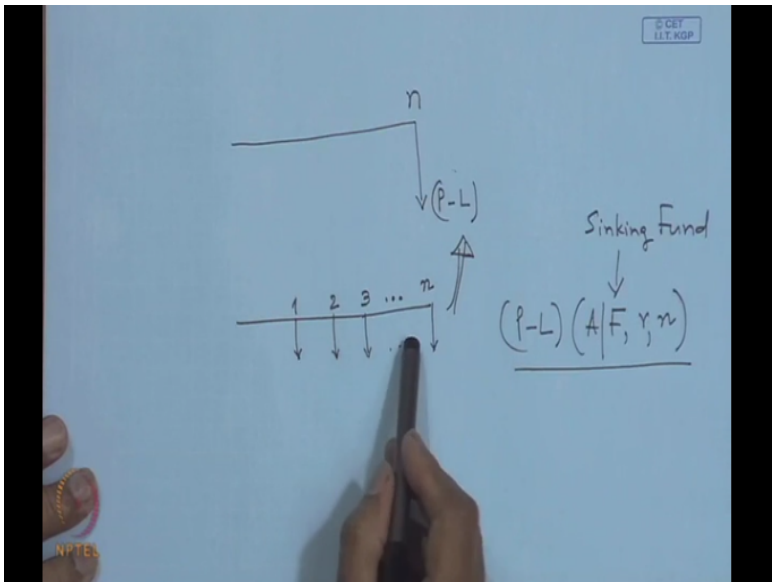

We are interested to get back P-L amount at the end of n years. So, what amount we should invest or put in a bank every year such that at the end of n years, it will be equivalent to P-L. so, this will be taken as the final sum P-L, the compound amount. So, P-L to be multiplied with the sinking fund factor A given F, r, n. This is basically if you recall the sinking fund. So, it is as if a fund is created by investing certain amount every year such that its equivalent amount at the end of n years becomes P-L, the amount we recovered.

So, that is what is done here. The amount deposited is taken as P-L*this. So, this is every year the amount is deposited. And what is the depreciation then? Depreciation is the amount deposited into the sinking fund + the interest earned on this amount during that particular year, which means that suppose I invest this amount in the first year then, the depreciation charged because it has not earned any interest in the first year.

The depreciation is the same amount that we had invested. But, in the second year, it will be the amount that we are putting into the fund + the interest that we have earned on the amount that we had put at the end of the last year. That is what is I am saying interest earned on the fund during the year.

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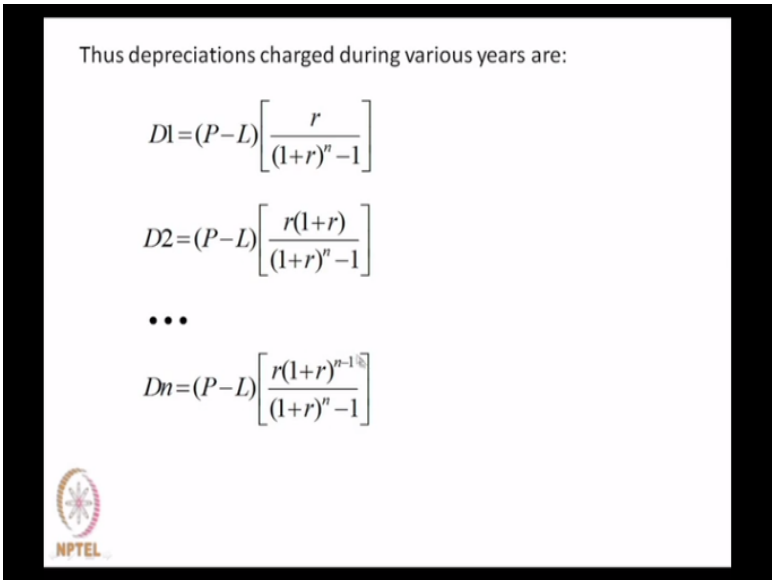

Now, thus the depreciations charged during various years are, in the first year there is no interest because, the investment is made at the end of the year. So, the D1 the depreciation in the first year is just = P-L*the sinking fund factor whose value is this. But, in the second year, it is P-L*this if I add the interest along with the amount that we had invested this is the amount that we will invest in the second year and the interest that will be obtained on the investment that I had made in the end of the first year is this*1+r this*r.

So, if I add this, this becomes r*1+r. And like this if I continue then at the end of the nth year, the depreciation charged is P-L*this expression.

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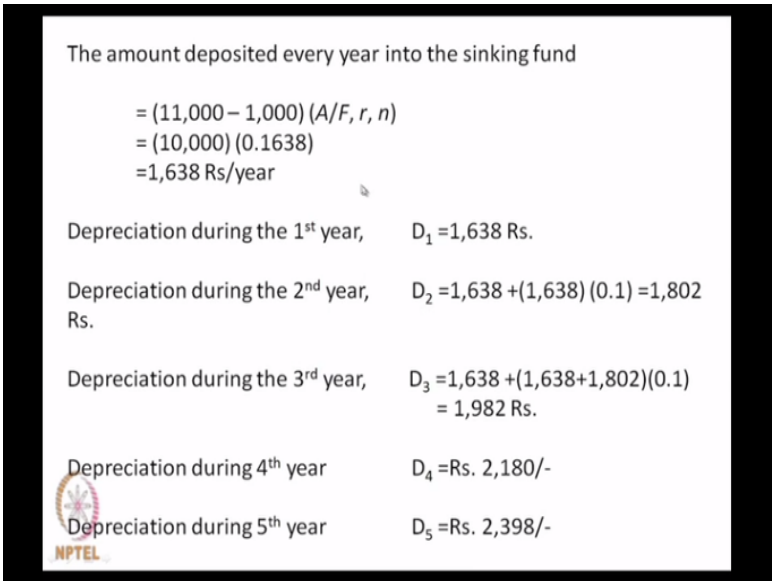

Now, let us take an example. This example is the same example it is the first cost is 11000 rupees, the salvage value is 1000 rupees and the sinking fund factor is A given f, r, n and n is

5 years of course we remember that. And from the table, this sinking fund factor value is obtained as 0.1638 multiplied by the difference amount to be recovered 10000. So, that gives us 1638 rupees per year. So, the depreciation during the first year is the same amount 1638 rupees.

But, depreciation in the second year is 1638+the interest earned on the amount invested so far, which is 1638 and that is when summed is 1802 rupees. Depreciation during the third year is the amount that we put into the sinking fund in the third year + the total amount invested and the interest obtained there on. So, total amount invested was this and this together. And the interest that it has earned in the third year is 10% of that and that is added with the new investment or new amount that we had put in the sinking fund.

That makes it 1982. And like this when we proceed, we get depreciation during the 4th year and depreciation during the 5th year. The amount are rupees 2180 and 2398. And if you add them up it should be =P-L which is 10000.

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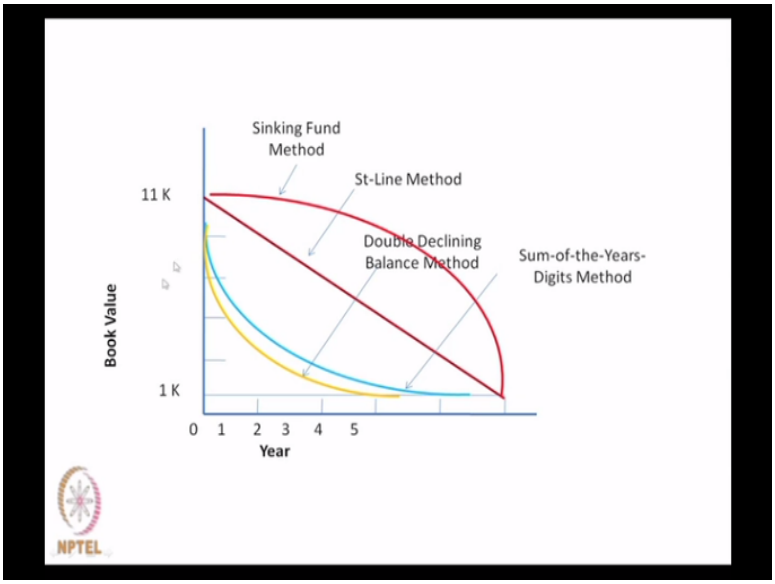

Now, the same diagram that I had shown earlier is now extended by putting the value for the book value when obtained with the help of the sinking fund method. Now, look at this previous diagram. Now the previous values are look at this depreciation was 1638 depreciation increases whereas in other cases, particularly double declining balance method and in the sum of the year's digits method, look at this is the sum of the year's digits method depreciation was decreasing and same was the story for double declining balance method.

But, in the case of sinking fund method, the depreciation values are raising. So, it means that here in the first year the depreciation is less this difference is less. This is less in the second year it is more. In the third year it is still more and in the fifth year it is the highest.

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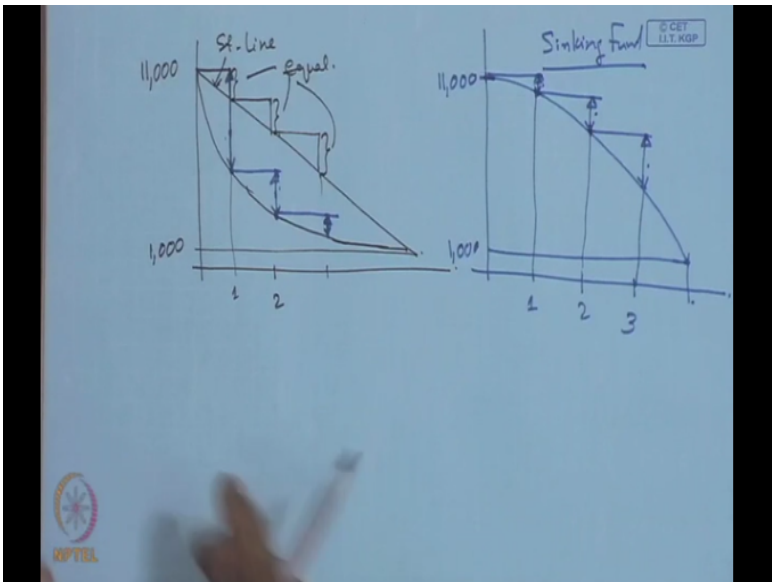

Basically, this is 1,000, this is 110,000 this is a straight line method. In sum of the years of digits method, if this is the first year, then the depreciation charged was only this. In the second year, the depreciation charged for the straight line method was same. In the third year, depreciation charged was this. So, they are all equal. Whereas, in the double declining balance method, the depreciation charged in the first year it is much higher and then in the second year, it is this.

In the third year, it is this. So, you can see that the depreciation in the first year is higher than that in the second year which is higher than that in the third year and so and so forth. So, here depreciation amount reduces as time progresses. Now, you are facing a situation in this sinking fun method, where it is just the opposite. In this, in the first year, the depreciation charged is less, in the second year, the depreciation charged is higher. In the third year, the depreciation charged is even higher.

So, this is higher than that and this is even higher than this. Thus, we see that in the sinking fund method, the depreciation charge during various years increase over time. Now, this has a resemblance with the actual phenomenon that occurs in nature. The actual physical depreciation or even functional depreciation of assets take place more later into the life. As time progresses, the deterioration is much faster.

Therefore, sinking fund method more or less emulates the natural phenomenon of deterioration of value of an asset. However, this is not preferred in practice. Because of tax implications, as we shall see very soon. What is preferred is either straight line method or double declining balance method with a switch over to straight line method. Let us see what we are trying to say.

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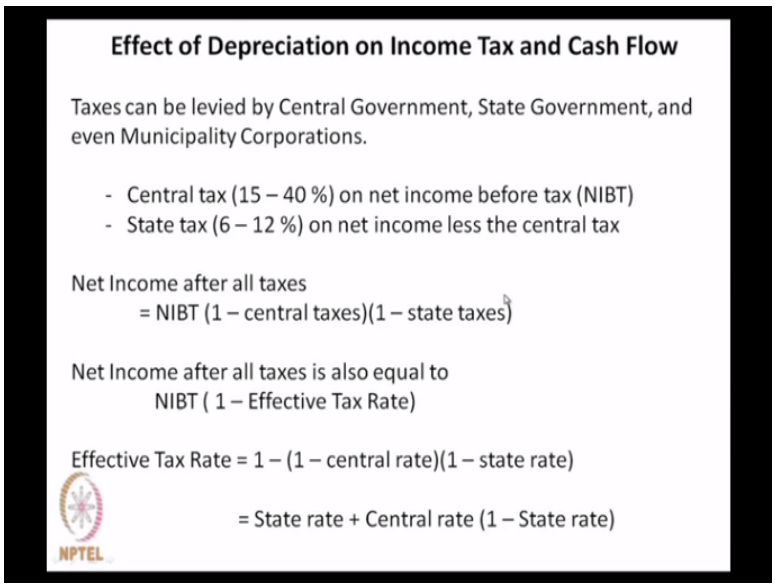

So, this brings us to the discussion on taxes. First of all, let us understand that there are different types of taxes. We will be discussing only these central tax and the state taxes. Here also there are certain variations. How are state taxes charged and how is central tax charged. Each has got its own percentage fixed by respective states and central. From country to country also, the tax rules change.

Sometimes, the state taxes are tax deductive and sometimes they are not. Sometimes, state taxes are charged on income after the central taxes are deducted. So, we shall see the implications here. Firstly, let us understand that central tax can vary from nearly 15% to 40% that changes every year on the net income before tax. We have already discussed this. Net income before tax is taxable or profit before tax, this is what I am trying to say PBT on that the taxes are charged.

And the state taxes are usually less. It can vary from 6 to 12% or little different on net income less the central tax. That means, net income before tax-the central tax whatever remains on that state taxes are charged. But, once again the practice may differ from country to country.

Therefore, after paying all taxes, net income after all taxes will be how much? It will be NIBT*central tax to be subtracted from NIBT.

So, that makes it NIBT multiplied by 1-central tax. And on this, the state taxes will be charged and subtracted to find out the net income after all taxes. Therefore, this =net income before tax multiplied by 1-central taxes multiplied by 1-state taxes. If I call this as NIBT multiplied by 1-effective tax rate, then I can find out what is or how effective tax rate is related to central and state taxes. I equate this, I get 1-effective tax rate=1-central taxes*1-state taxes.

From here, I can derive effective tax rate as =1-central rate*1-state rate. Or it can be written as state rate + central rate*1-state rate. Now, this can be also given another interpretation.

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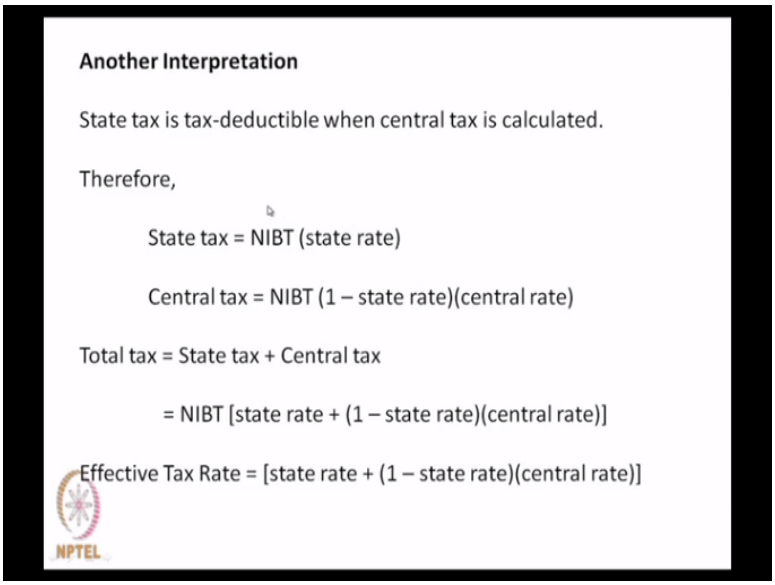

If state tax is tax deductable when central tax is calculated, then how it is to be done? State taxes to be first of all estimated it is =NIBT*state rate and then central tax will be calculated on NIBT because this is tax deductable we subtract this state tax giving NIBT*1-state rate. So, this is the amount on which the central tax will be calculated so, *central rate that is the central tax. Hence the total tax is state tax + central tax which is = NIBT*state rate+1-state rate*central rate.

Hence the effective tax rate comes same as before which is state rate+1-state rate*central rate. Let us see, this was the same thing that we had obtained earlier. And we are also getting the same thing here. In any case, once we determine or once we known the state tax rate and the

effective rate, we can now add or use both this information to find out the effective tax rate. Once the effective tax rate is known, we can now find out its implication or its impact on the depreciation and therefore, on the cash flows into the company.

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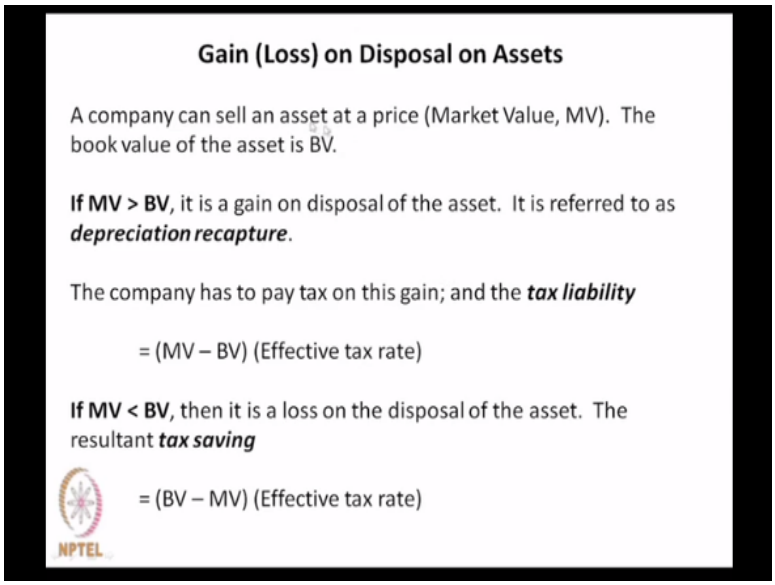

Before we do that, let us also take up another item that is often assets are disposed of at particular value which is called the market value, which may be different from the book value that we have written. Take a case, that suppose we had got an asset at a price p and for 3 years we have used the asset, the book value has come down to BV3 because, after 3 years, the depreciations will have to be deducted from the first cost to give the book value at the end of third year.

Suppose at that point of time, we sell the asset. If we sell that asset, then the market value will not be exactly =the book value that we have mentioned in our books of account. It will be > or < or accidentally it may also be exactly equal. If it is exactly equal to the book value, then there is no tax implication. But, if it is sold at a higher price, then the gain is taxable. And if is sold at a lower price, then the loss will be also considered in the tax.

That means you will get some refund for payment of tax that you have made earlier. This is what is the topic here. Gain or loss on disposal on assets. A company can sell an asset at a price which is the market value MV. The book value of the asset could be BV. If market value is > book value, it is a gain on the disposal of the asset. And it is referred to as depreciation recapture.

Because it is a gain, the company has to pay tax on this gain and the tax liability is the difference that means the gain multiplied by effective tax rate. Whereas, if the market value is < BV, then it is a loss. The companies save taxes and that amount=book value-market value*the effective tax rate.

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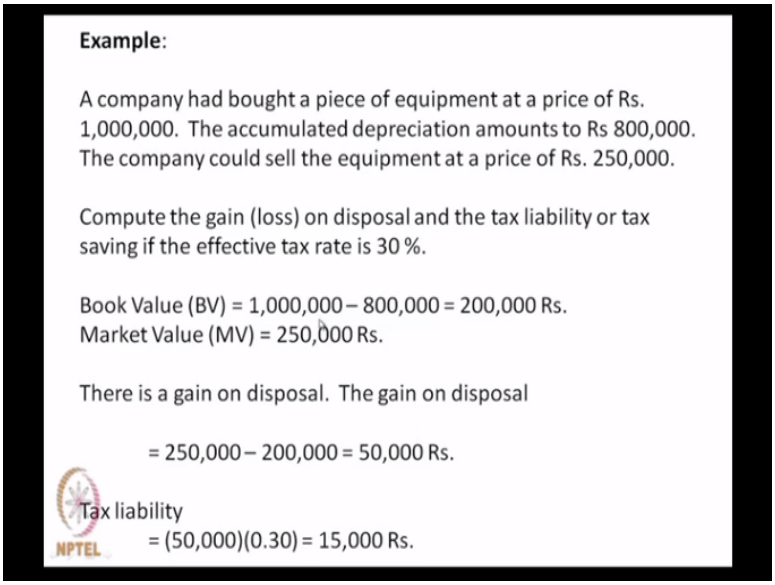

This is illustrated with the help of an example. A company had bought a piece of equipment at a price of rupees 1 million. The accumulated depreciation amounts to rupees 800000, which means that the book value is 1 milion-800000=200000 is the book value. The company could sell the equipment at a price of rupees 250000. So, market value is 250000. The book value is 2000. So, it is a gain on disposal.

The question is, compute the gain or loss on disposal and the tax liability or tax saving if the effective tax rate is 30%. It is very simple. First compute book value which is this-this giving 200,000 rupees. The market value is 250,000 there is a gain on disposal. The gain is =50,000 and this is therefore a tax liability. The company has to give tax on this amount that it has gained and this =15,000 rupees after multiplying with the 30% tax rate. So, this is quite simple.

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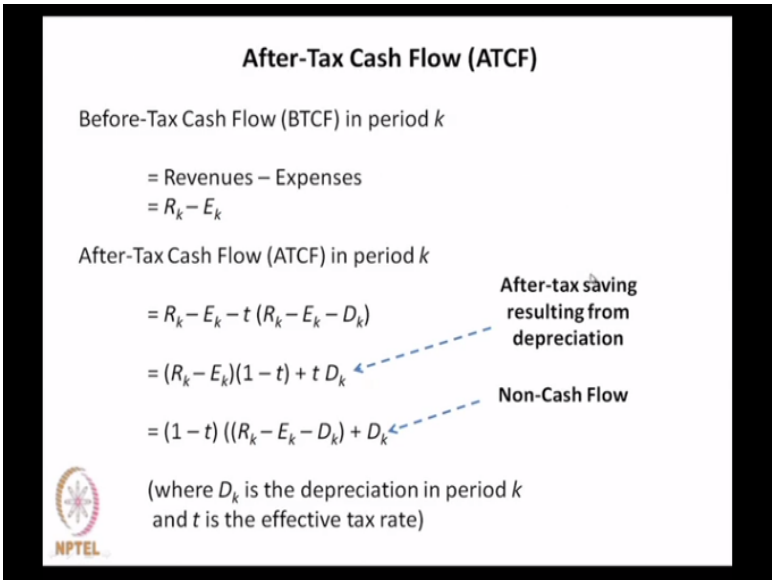

Now, let us talk about the effect of depreciation on cash flow after tax. Recall the taxes are paid on the basis of the net income, which is the gross revenue-all expenses. All expenses include expenses that does not include depreciation and then finally depreciation. Now, let us write that down in a different way. We call this before tax cash flow BTCT in period k. So, all the revenues that is the inflow-all the expenses Ek during that period.

Now, after tax cash flow will be from Rk-Ek, you have to subtract the taxes paid. Taxes paid tax will be calculated on Rk-Ek-Dk, -Dk because depreciation is really not a cash flow. So, it is shown separately. Because taxes are charged on revenues-the expenses not including the depreciation and then depreciation are charged or subtracted separately. We are shown this D, this D is also an expense but we are showing it separately because our interest is to find out how depreciation affects the tax and therefore the cash flow.

So, this becomes Rk-Ek*1-t, this is - and - makes it +, +tD. So, we see here that, because of depreciation, there is a tax saving -Dk it is subtracted that for the reason tax saving and therefore the cash flow increases. We have more cash. Because we do not have to pay taxes on account of depreciation. So, after tax saving, resulting from depreciation is t*Dk. Now, this equation can be written in another fashion if I write down this as 1-t*Rk-Ek-Dk because this is exactly the taxes paid.

This is +Dk. So, it is as if the cash flow increases because of depreciation. This is called a non cash flow. It increases it helps in increasing the after tax cash flow. So, this is the implication of depreciation. That means more the depreciation, more will be its contribution

towards cash inflow. Because, there is a tax saving to the extent of t*Dk. So, higher the D, higher is the tax saving and higher is the contribution to cash inflow.

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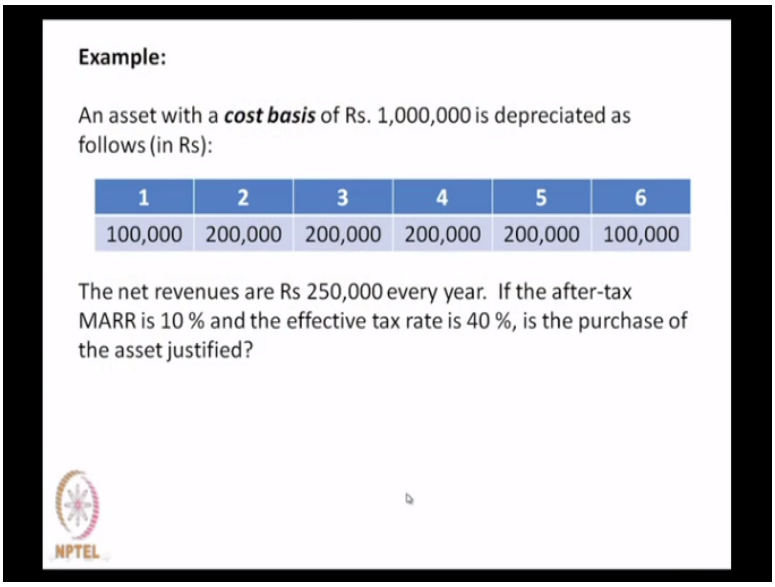

Here is an example. An asset with a cost basis of rupees 1 million is depreciated as follows. So, these are the depreciation calculations. The net revenues are 250000 every year. That means Rate of interest-Ei 250000 every year. And these are the depreciations. If MARR is 10% after tax MARR is 10% and effective tax rate is 40%, is the purchase of the asset justified?

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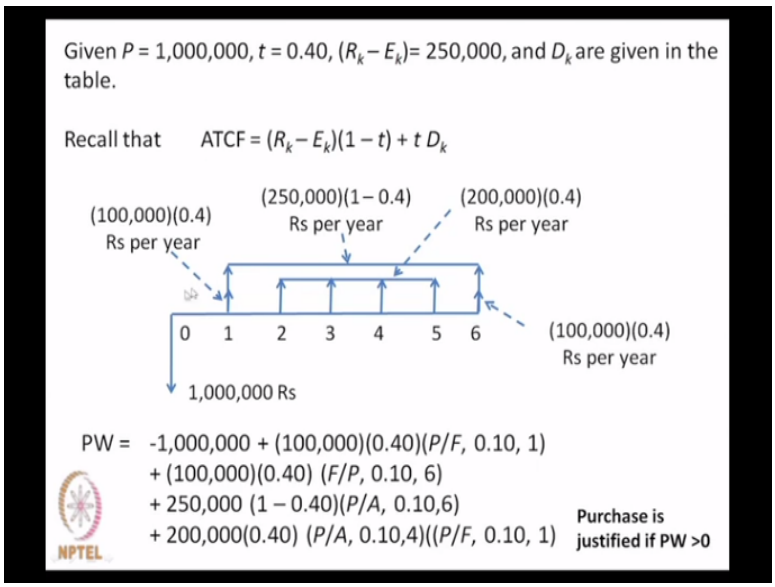

So, this is picturized in this form. What are given? These are the things given. The first cost is 1 million rupees tax is 40% Rk-Ek is given as 250,000 rupees in the net revenue and Dk are given in the table. Now, recall that after tax cash flow is Rk-Ek*1-t+t*Dk. We know Dk. Dk

is 200,000 in years 2, 3, 4 and 5 and 100,000 in the first year and the 6th year. So, this is the cash flow diagram. In the first year it is 100,000*tax 0.40 t*Dk.

So, this is t, this is Dk. Thus the first year cash flow and the 6th year cash flows also is the same 100,000*0.40 and in the second, third, 4th and fifth years, it is 200,000 Dk multiplied by 40%. So, it is this. Now, ATCF is Rk-Ek*1-t, Rk-Ek is given as 250,000 1-t is 1-0.4. So, this is the net receipt in cash flow that we are getting over the years. So, this is a annuity. Every year we are getting this receipts and this is +Dk therefore, these are all inflows of cash and this is the only outflow of 1 million rupees.

So, we calculate the present worth. Once we draw the cash flow diagram, we are in a position to find out the present worth of all the future cash inflows and the present is -1 million+100,000*0.4*this is single payment I am considering a single payment, present worth factor and then the last one is the 6th year taking place at the 6th year. So, it is a single payment present worth factor considering that as F and this also as F whereas this are equal payment series.

So, for the first one, it is 250,000*1-0.4*it is equal payment series present worth factor, P given a 0.16 for 6 years, this is occurring so it is equal payment series present worth factor. And for this one, it is 200,000 multiplied by 0.4 first of all we bring it to this point so it is equal payment series present worth factor and then from here, we bring it to this point. So, this is single payment present worth factor for 1 year.

Find out the value that the factors from the interest tables put them and find out PW. If PW is >0, then the investment is economically justified else not. So, we can see the depreciation changes or increases the cash flow and therefore it has significant contribution to increasing the profitability of a particular project.

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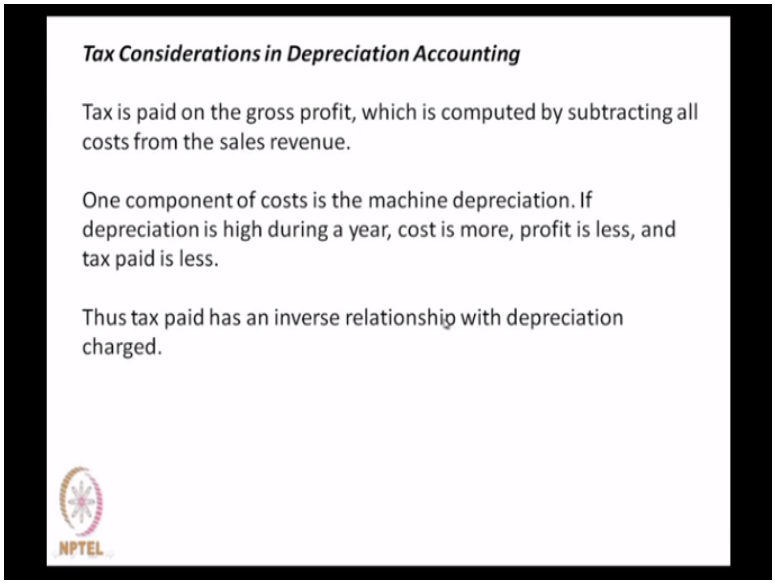

Now, tax is paid on gross profit, which is computed by subtracting all costs from the sales revenue. One component of cost is the machine depreciation. If the depreciation is high during a year, then the cost is more and profit is less and therefore tax paid is less. Thus tax paid has an inverse relationship with depreciation charged.

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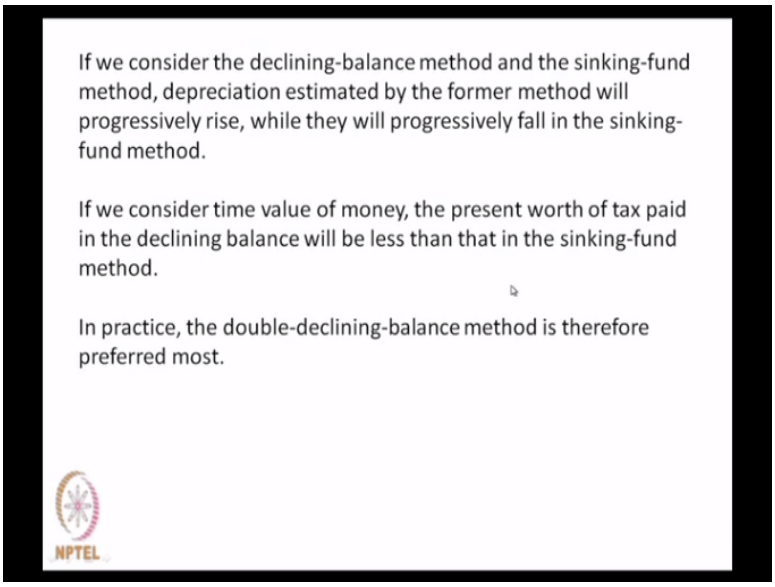

Now, we are basically trying to now compare the different depreciation accounting methods. In particular, we will compare the sinking fund method and the declining balance method. If you remember in the declining balance method, the depreciation it charged the highest in the first year and then it progressively reduces. Whereas in the sinking fund method, the depreciation charged is the highest in the last year and in the first year, it is less and less and less.

So, we will take a particular example and show how it impacts tax and which is actually economically better.

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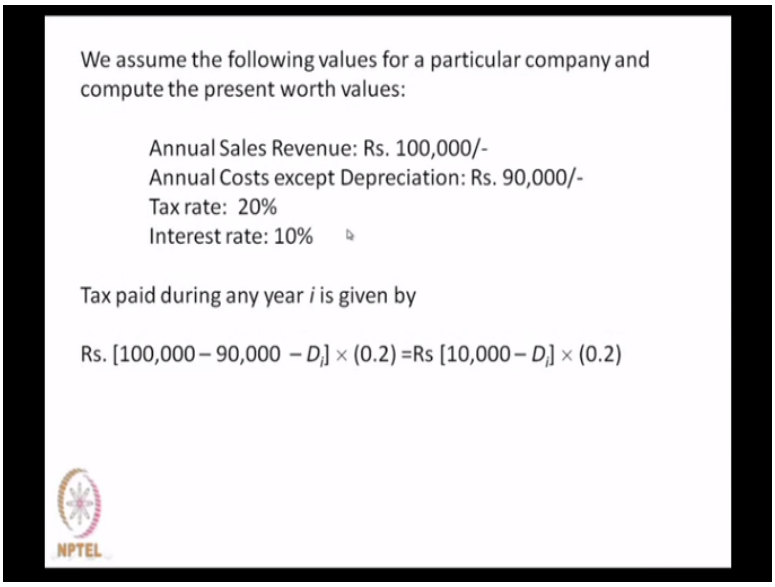

We do that with the help of this particular example. We assume the following values for a particular company. Annual sales revenue are given as 100,000 rupees, annual costs basically expenses when I am writing cost basically I should mean it by expenses except depreciation is rupees 90,000, tax rates 20,000, interest rate 10% and tax paid during any year i is given as 100,000-90,000-Di on this the taxes will be calculated.

The tax rate is 20%. So, it is =10,000-Di*0.2. So, this is the tax paid during every year. So, that depends on the depreciation charged during that year.

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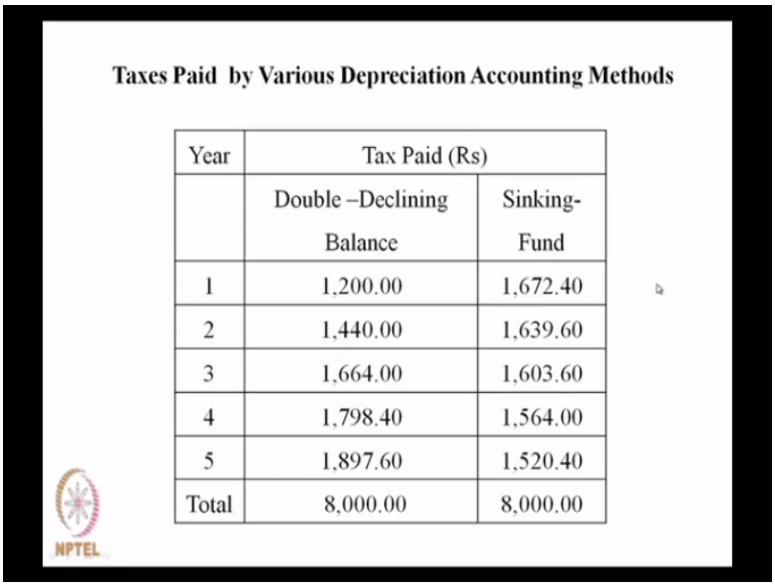

Year	Tax Paid (Rs)	
	Double –Declining Balance	Sinking-Fund
1	1,200.00	1,672.40
2	1,440.00	1,639.60
3	1,664.00	1,603.60
4	1,798.40	1,564.00
5	1,897.60	1,520.40
Total	8,000.00	8,000.00

So the problem that we had taken, the double declining balance method gives this values as the tax paid and the sinking fund method gives this values. So, because the depreciation charged was very high, the taxable income was low and therefore the tax paid was low in the first year. Sinking fund method, the depreciation was low in the first year therefore the tax paid was high. The net income was high and the tax paid was high.

And here the tax paid increases as time progresses. Here tax paid reduces as time progresses. However, arithmetically, the total tax paid is the same. But, the present worth of these cash flows, these are cash out flows will be different.

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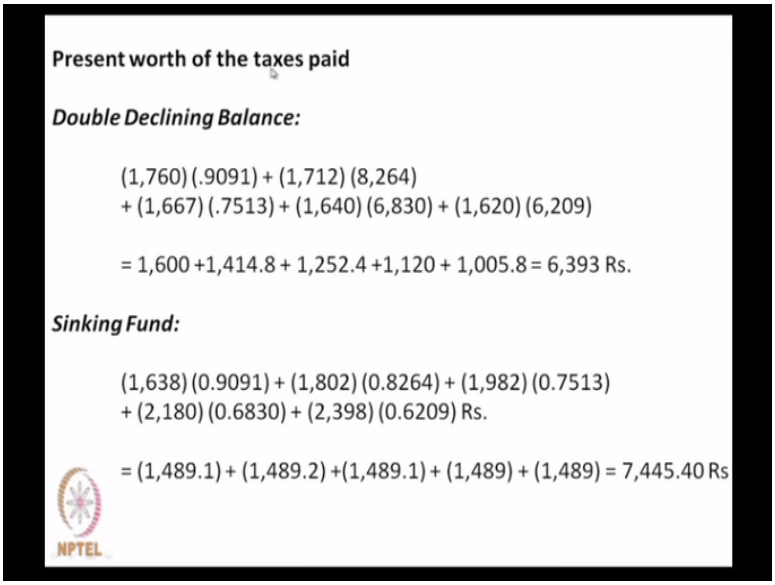

Present worth of the taxes paid for the double declining balance method is coming to 6,393 rupees. For the sinking fund method, it is coming to 7,445 rupees. So, you can see that although the arithmetic sum of the tax paid is the same for both. The present worth is higher of the tax paid is higher for the sinking fund method. So, this means that, whenever the depreciation is increasing over time, this is not a desirable phenomenon from the point of view of taxes and therefore from the point of view of the companies.

And that is the reason why the double declining balance method is always preferred in practice.

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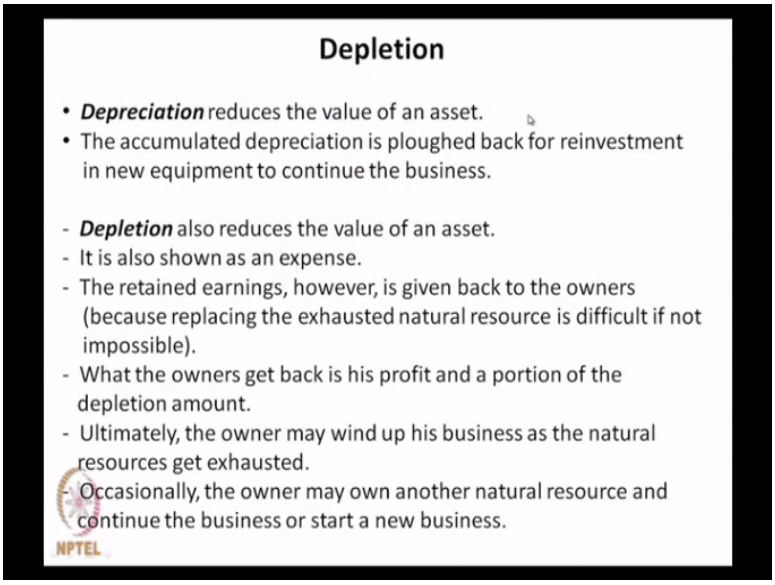

Now, we take up a topic that is similar but not exactly similar to depreciation. Many companies such as mining companies, they have certain assets that do not depreciate, they are actually used up that is they get depleted. Assets decrease their values as time progresses. Similarly, for mining companies, their assets they get depleted over time.

The difference is that in normal businesses which do not have such natural resources that deplete over time with the help of depletion fund, you can acquire new assets or new machines or equipments or buildings. But, natural resources cannot be easily recovered. You cannot get natural resources that you have depleted as you would like to have. In many cases, what happens, the owners get not only the profit but also the amount that they have consumed out from their natural resources.

And if the natural resources get completely depleted, they may go out of business. Unless they acquire more assets of similar type or of a different type. That means, they may go or change over to another business unless the acquire similar businesses or similar natural resources. Therefore, there is a little difference between depreciation and depletion. But, the similarity is that over time, they get consumed up. So, this is what we are trying to say. Depreciation reduces the value of an asset.

The accumulated depreciation is ploughed back for reinvestment in case of depreciation. In depletion, this is also an expense. The return earnings however are given back to the owners. Because replacing exhausted natural resource is difficult if not impossible. What the owners

get back is his profit and a portion of the depletion amount. Ultimately the owner may wind up his business.

Occasionally he may own another natural resource and continues with the business. Now, how to calculate the depletion allowance. There are 2 methods. One is the cost method the other is the percentage method.

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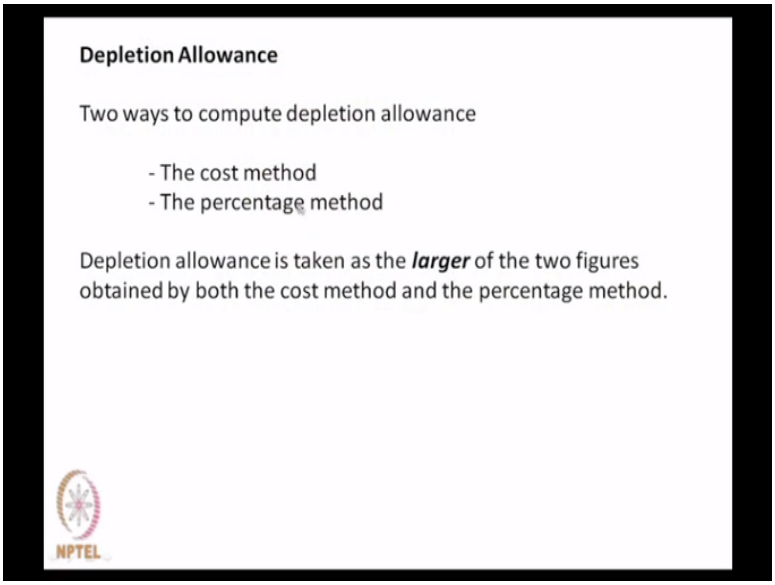

And depletion allowance is taken as the larger of the 2 figures. That means, we calculate depletion allowance with the help of the cost method and then calculate with the help of the percentage method, whichever is larger is taken as the depletion allowance.

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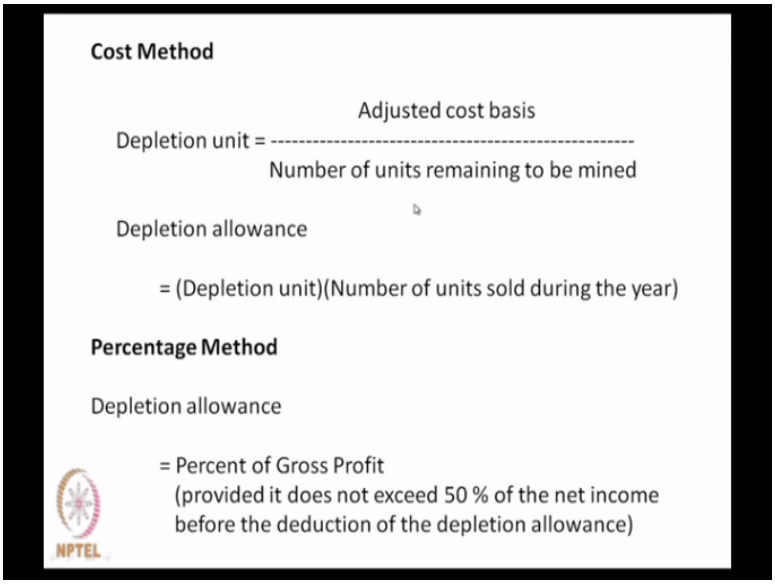

First, the cost method. Cost method is find out your number of units remaining to be mined. I am saying mined because I am assuming a mining resource. So, it could be so many tons of coal if it is a coal mine. And what is its price? So, total price divided by total amount of the resource in terms of tons or kg or area, hectare or volume or whatever. That is called depletion unit. And in a particular year, you might have consumed and sold some of the assets.

So, that is the number of units sold during that year*the depletion unit is the depletion allowance. The percentage method is that certain percentage of the gross profit provided it does not exceed 50% of the net income before deduction of the depletion allowance. We will illustrate this with the help of an example.

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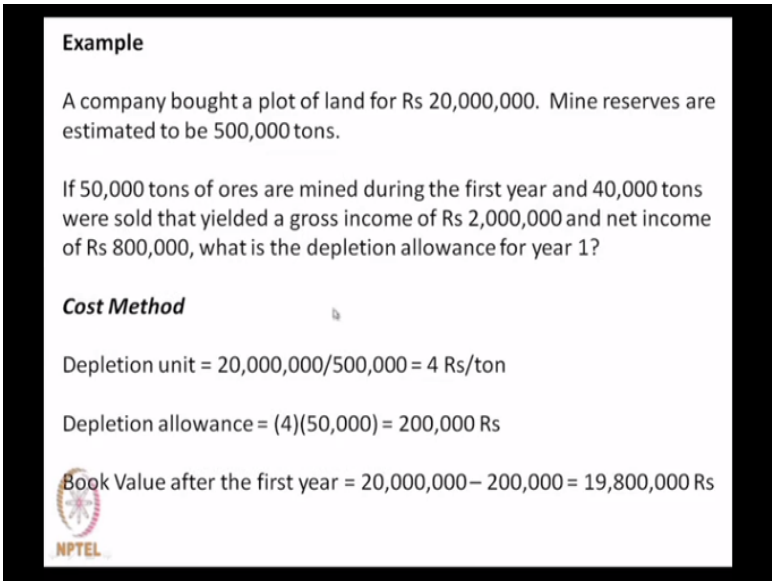

That will clarify the 2 methods. A company bought a plot of land for 20 million rupees. Mine reserves are estimated to be 500000 tons. So, the land contains a mine. The reserves are estimated to be 500000 tons and 50000 tons of ores are mined during the first year and 40000 were sold that yielded a gross income of 2 million rupees, the net income became 800000. What is the depletion allowance for year 1? We use both the methods.

First, the cost method. To use the cost method, we have to know depletion unit how much we have consumed in one year. First of all, we will have to find out the cost of the land which is 20 million rupees the reserves are 500000. So, if you divide this 20 million by 500000 we get 4 rupees per ton. We call this the depletion unit, per unit cost basically. And we have mined

50000 tons in the first year. Let us take an example to illustrate how the depletion allowance is calculated.

The example is like this. A company bought a plot of land for rupees 20 million, mine reserves are estimated to be 500,000 tons. If 50,000 tons of ores are mined during the first year and 40,000 tons were sold in that year yielding a gross income of rupees 2 million and net income of rupees 800000. What is the depletion allowance for year 1? So, first we calculate the depletion unit. We have the resource of 500000 tons that costs us rupees 20 million.

So, per unit charger or per unit cost is 4 rupees per ton. This is the depletion unit. And how much we have actually sold? Although we have mined 50,000 tons, we have sold 40,000 tons. So, 40,000*4 is 160,000 rupees. Therefore, the book value after the first year will be 20 million-160,000 so, that is 19,840,000 rupees after the first year.

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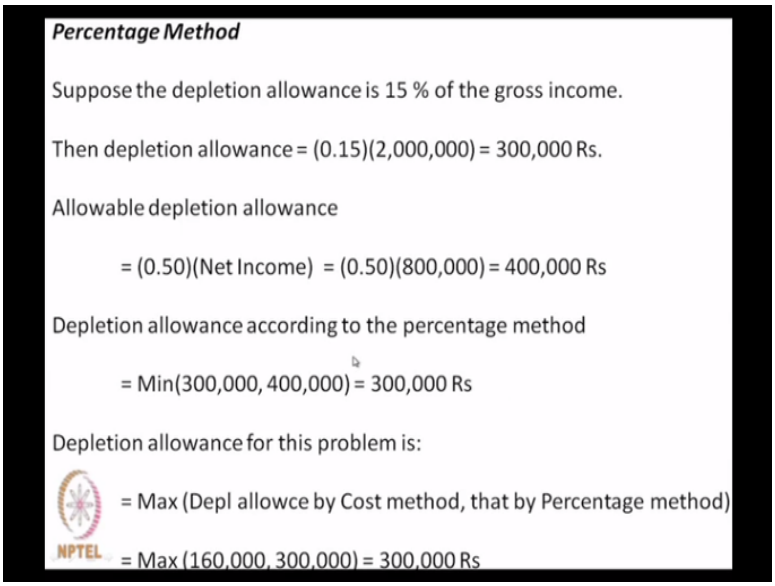

Now, the percentage method according to the depletion allowance is sum percentage of the gross income. Normally, various governments they prescribed depending on the type of resource, what should be this percentage. Let us assume that it is 15% of the gross income. The depletion allowance therefore is 15% of whatever is given as gross income. Gross income is given as 2 million rupees.

So, 2 million rupees of 15% of that is 300,000 rupees. The allowable depletion allowance as I have told you is 50% of the net income. Net income is given as 800,000 rupees. 50% of that

is 400000 rupees. So, this depletion allowance should not exceed 50%of the net income. Therefore, we make a comparison of this 2. The depletion allowance according to the percentage method therefore becomes the minimum of the 2 which is 300000 rupees.

So, in the percentage method, the depletion allowance should be 300,000 rupees but, according to the cost method, the amount depletion allowance is 160,000 rupees and we take the higher of the 2. The depletion allowance for this problem therefore is depletion allowance by cost method, depletion allowance by percentage method whichever is higher is taken as the depletion allowance for that year.

In this case, it is 300,000 rupees. Therefore, the book value should not be 20 million-160 but, it should be 20 million-300,000 which is therefore 19,700,000 rupees. So, this is how cost methods are calculated. We stop here today and we will take up some more topics and some exercises in our next class. Thank you.