**Economics, Management and Entrepreneurship**
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**Lecture - 25**
**Depreciation Accounting**

Good morning. Welcome to the 25th lecture on Economics Management and Entrepreneurship. In the last lecture, we discussed about the internal rate of return, external rate of return, capitalized worth method, payback period method, discounted payback period method, varying interest rate, more frequent compounding in a year and last topic that we took was uniform gradient cash flows.

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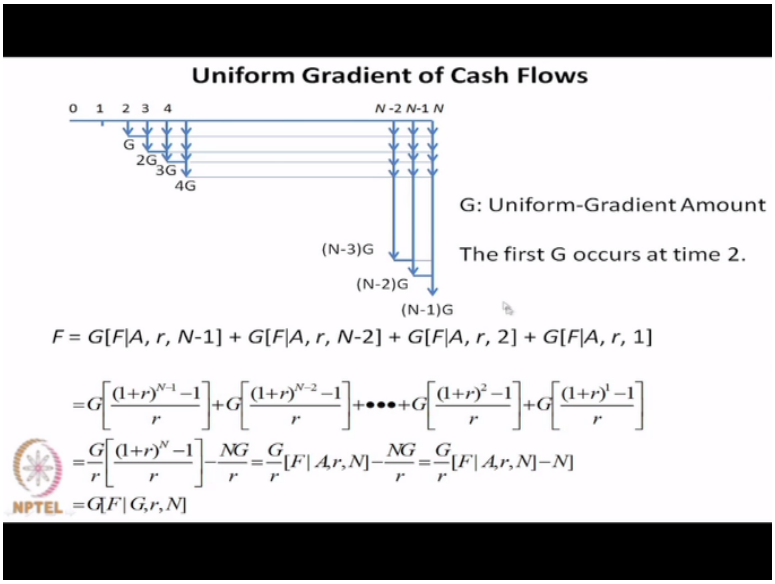


And we had drawn this diagram to show how we consider uniform gradient cash flows. Here, there was one mistake in the earlier diagram, this should be N-1G because, this is 2 the first cash flow is occurring at the end of the second interest period. So, if this is 2 and 1G for N, it is N-1G. Accordingly, this is N-2G, N-3G. Basically what you have to do, you have to consider each such cash flows as equal payment series of amount G.

This particular cash flow is yet another equal payment series of and it is G, this is still another G, this is still another G, till the last one, which is just G. This we sum and we can find out interest tables are also available for such factors, if given G, r, N and once F is known we can find out P, you can find out equivalent A and similar such factors. As we are aware of can also

be determined for uniform gradient cash flows. We will not discuss much about this, instead we pass on to the next topic.

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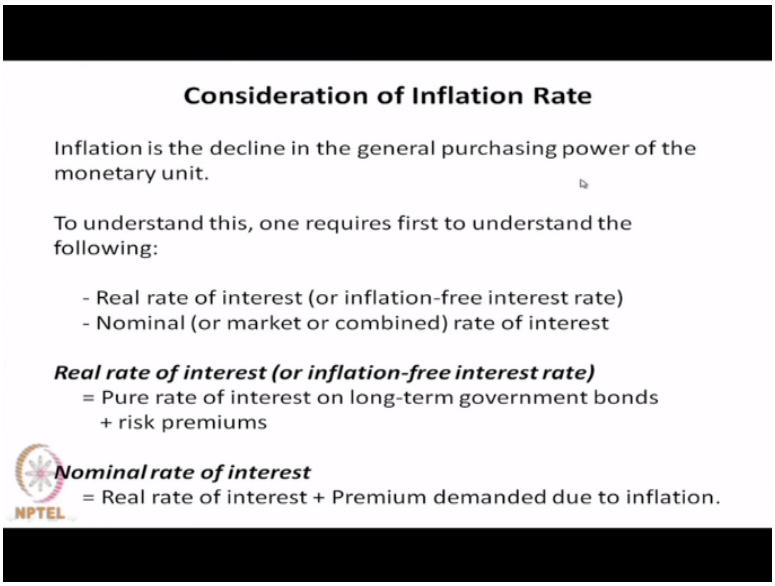


Which is the consideration of the inflation rate. Recall that in our definition of minimum attractive rate of return, we did not consider any inflation. But the fact remains that when somebody decides on the minimum attractive rate of return, it does consider the inflation rate. It also considers the risk premium and also the minimum interest that it can get by investing in long term government bonds. So, what we are now defining is that, there are 2 types of interest that we can consider.

One is the nominal rate of interest, which is what we had been considering so long. Basically, that considers inflation and also considers the real rate of interest. This real rate of interest is nothing but the rate of interest that anybody can get on long term government bonds + the risk, any premium due to the risk taken by the company. This is the real interest rate, also known as inflation free interest rate, whereas the nominal rate of interest is also known as the market rate of interest or combined rate of interests.

Because it considers all the cases of the government bond, the risk in the investment and the inflation. So, so long we had been considering without mentioning this nominal rate of interest. It is also possible to work with the inflation free or the real rate of interest.

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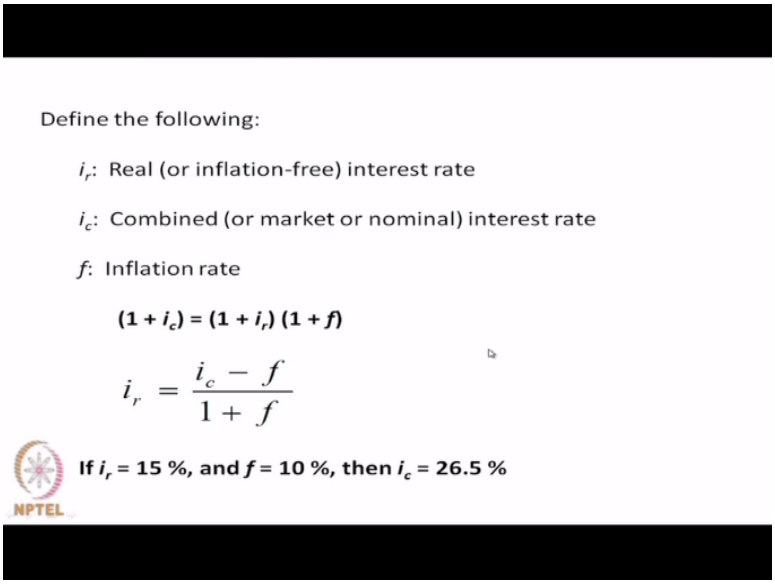


Basically, if we define ic as the combined or market or nominal rate of interest, ir as the real rate of interest and f as the inflation, then the relationship of this holds 1+ir*1+f=1+ic therefore, ir=it can be shown as ic-f divided by 1+f. So, if the real rate of interest is 15%, ir is 15%, f is 10% then the combined interest rate or the nominal interest rate is 26.5%. So, you can see that the combined interest rate is much higher compared to the pure interest rate.

One can work with this, one can also work with this both give the same result.

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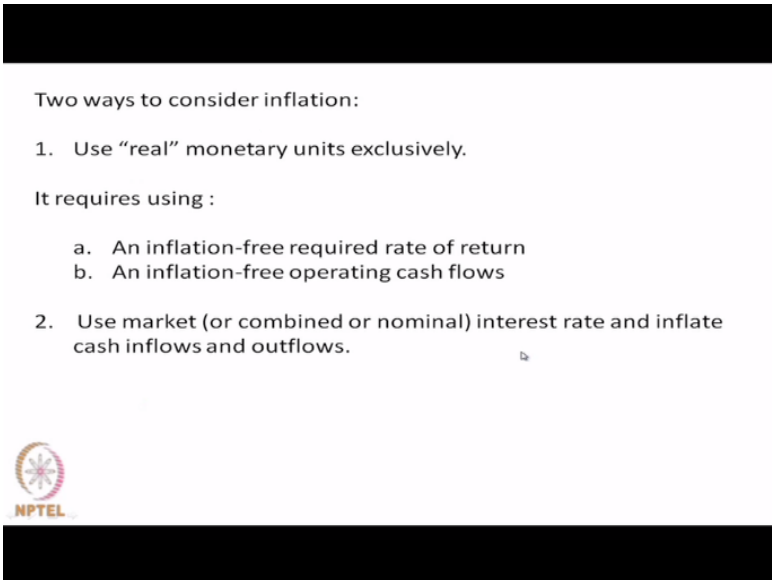


But, if one uses the real inflation rate, then he has to take the inflation free cash flows that is the main thing.

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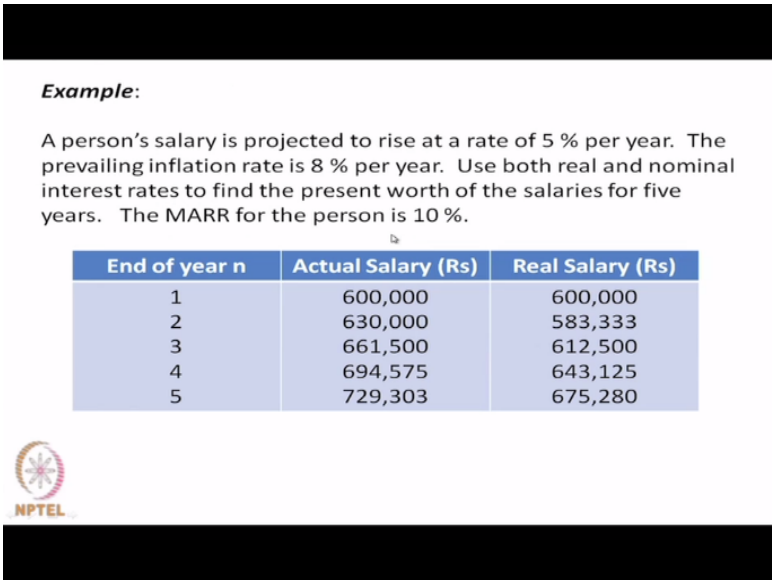


Here, we are showing with an example that they give the same results. Let us say that a person's salary is projected to raise at a rate of 5% per year. The prevailing inflation rate is 8% per year. Use both real and nominal interest rates to find the present worth of the salaries for the 5 years. The minimum attractive rate of return for the person is 10%.

So, the salary in the first year was 600000 rupees, next year is 5% more that comes to 631, third year is still 5% more so the salary raises at the rate of 5% per year. But the real salary is, this remains as it is, real salary means, actual salary divided by 1+f 1.08 in this case, 1.08. So, 630 divided by 1.08 is 583, 661 divided by 1.08 is 612. Like that, the real salary has come down in this manner.

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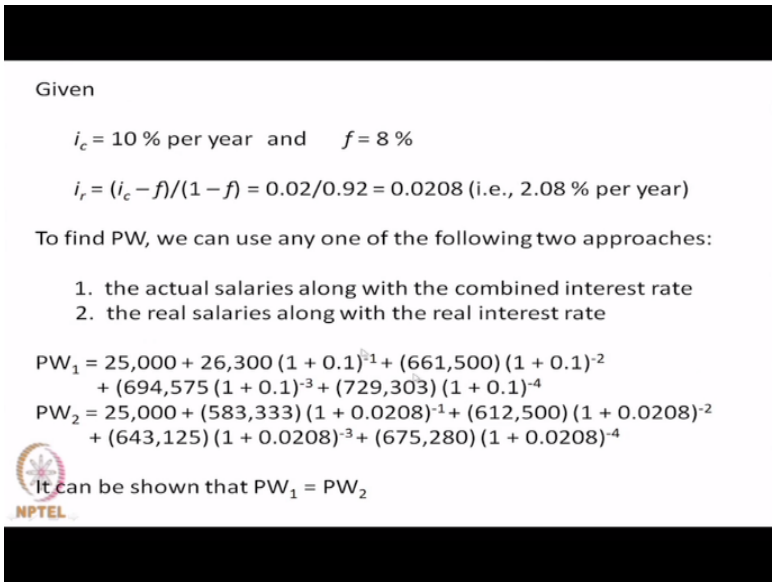

So, ic is 10% per year that is the combined interest rate and the inflation rate is 8%. Therefore, the real interest rate is ic-f divided by 1-f which is =0.02 only 2.08% because the inflation rate is very high, the combined interest rate is 10%, the real interest rate is 2.08%. So, the present worth can be calculated in either way. Either, take the combined interest rate of 10% or take the real interest rate of 2.08%. If you take the combined interest rate of 10%, use the actual salary of 600000, 630000 etc.

If you are taking the real interest so, the initial income was 600000 and 630 next years and it is discounted to the present therefore this is multiplied by the factor, the second year actual salary was this discounted with the combined interest rate. So, this value let us say is PW1, the present worth calculated using the combined interest rate. But, if I use the real interest rate, then I will have to also deflect the income.

So, the real income is calculated, this is the real salary so, I will have to work with the real salary and use the real interest rate and it can be shown that both the present worth values are equal. So friends, we have had nearly 3 lectures on interest formulae and their use in finding out the time value of money and then using them in particular to make comparison among economic alternatives. They are higher essential and you will see that in practice this consideration of time value of money is quite important.

We are now going to discuss a new topic and that is depreciation accounting. Depreciation accounting is our topic for today. Now, let us understand that, almost all physical assets they depreciate. And lot of money is invested in every such asset in acquiring these assets. And then this money has to be recovered because, these assets are put to productive use to produce products or services and then when the production services are sold, company generates revenues.

But the investment that is made in the assets are to be basically recovered while selling the products or the services to the customers. Now, a particular asset, any asset has a life of its own. Even though we might have spent a crore rupees in acquiring an asset. We are not going to recover the total amount in the first year. Because, the asset may have a life of let us say 10 years. So, in the course of 10 years, this amount that we have invested in the asset can be definitely be recovered.

So, every year, we will like to recover a portion of our initial investment. That is called depreciation. So, let us discuss in detail what is depreciation, what is the purpose, how it is accounted for in practice.

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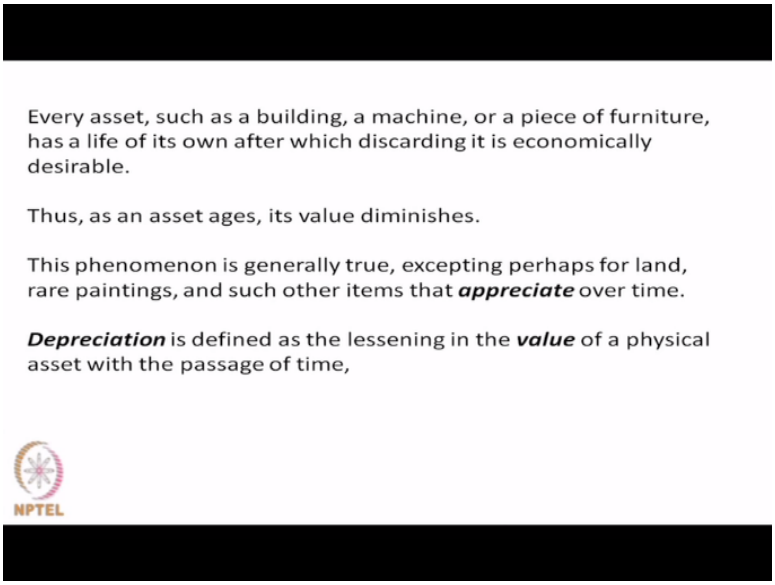


Firstly, let us understand that every asset, such as a building, a machine, a piece of furniture has a life of its own after which discarding it is economically desirable. Thus, as an asset ages, its value diminishes. The phenomenon is generally true however there are exceptions for example, land does not depreciate in fact, it appreciates, rare paintings may have may also appreciate. So, it is not true always that, every asset depreciates but most of them do depreciate.

Now, we define depreciation. It is the lessening in a value of a physical asset with the passage of time. This is a small definition. But, never the less it is a very good definition. Lessening in the value of a physical asset with the passage of time.

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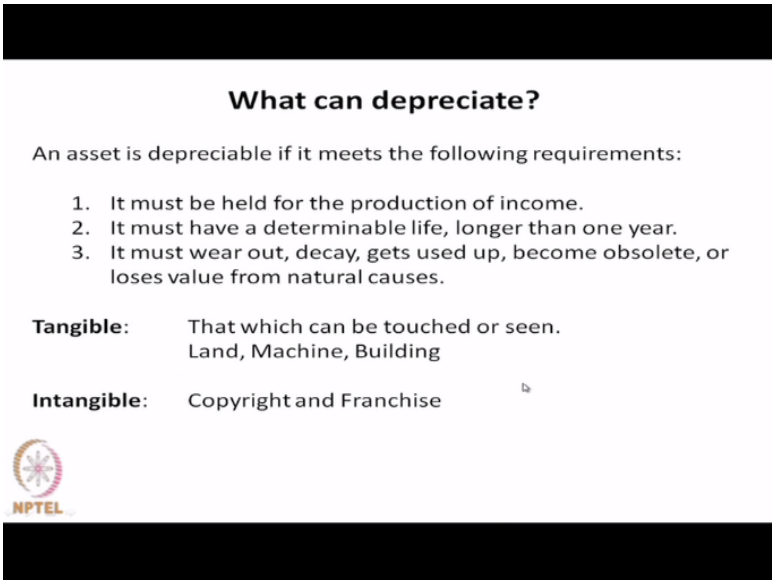


Now, what can depreciate? An asset is depreciable if it meets the following requirements. It must be held for the production of income first thing. Second, it must have a determinable life, usually longer than one year. Recall that, if it is < a year, then probably it can be expense stuff instead of showing this as an asset and instead of depreciating it in a few years' time because, it is < a year, it can as well be expense stuff.

It can be shown as an expense in the to be written in the expense and revenue account, the debit side. Third, it must wear out decay, gets used up, become obsolete or loses its value from natural causes. 2 types of assets we can think of. One is the tangible assets, which can be touched or seen such as land, machine, buildings etc. But, there are intangible assets also such as patents, copyrights, franchises and so on and so forth.

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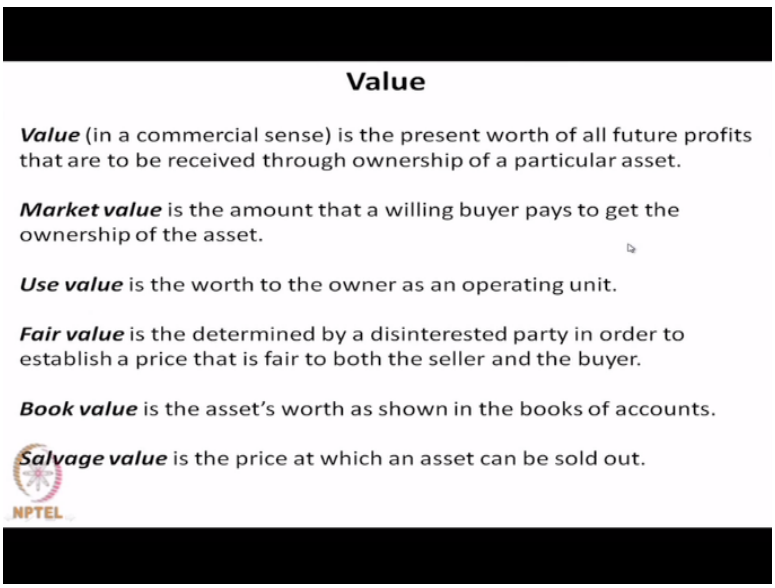

Now, we said that, deprecation is a lessening in the value of an asset. So, what exactly we mean value. In fact, values have large number of connotations. We shall be using the word value in a very monetary terms. And there are different types of values as we have mentioned here. In a commercial sense, value is the present worth of all future profits that are to be received through ownership of a particular asset. Is the present worth of all future profits that are to be received through ownership of a particular asset?

So, this is the normal definition of a value but, as I said, there are different other types of values. Market value is the amount that a willing buyer pays to buy an asset. Use value is the worth to the owner as an operating unit. Fair value is the amount determined by a third party, a disinterested party, something like an agent in order to establish a price that is fair to both the seller and the buyer.

Book value is the assets worth as shown in the book of accounts in the ledger account of that asset whatever value is written at the present time, that is the book value. Salvage value is the price at which an asset can be sold out. Thus, there are different types of value and we have defined them here.

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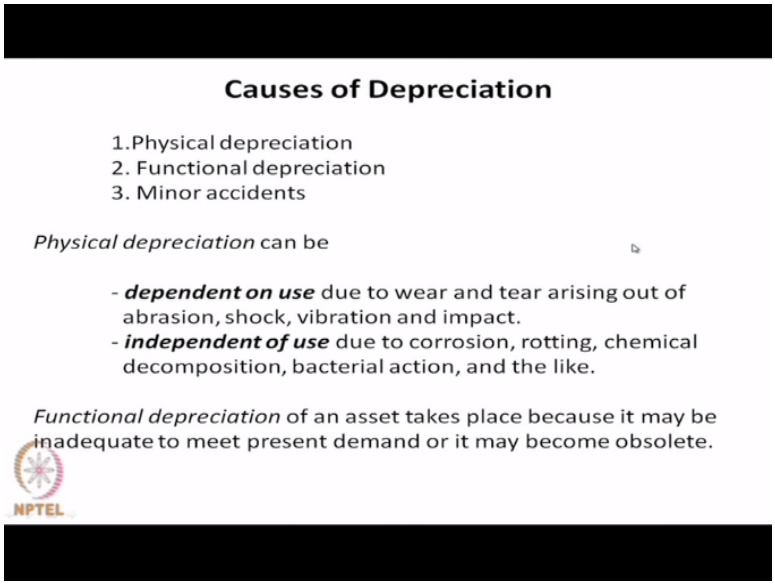


Now, why assets actually depreciate? Basically, there are 2 reasons, although I have written 3 here. One is the physical depreciation because of wear and tear, because of various types of environmental degradation and things of that type. And the second is a functional depreciation or obsolescence. These are the 2 primary reasons. However, the third type of

reason why assets also depreciate is due to minor accidents. Major accidents, they are insured for.

But, if there are minor accidents, the functionality reduces. Physical depreciation deterioration occurs. So, that is why also the actual value of the asset reduces. That is what we have written here. Physical depreciation can also be due to dependent on use as the asset is used due to wear and tear arising out of abrasion, shock, vibration and impact. So, this is dependent on use but also, it could be independent of use due to corrosion, rotting, chemical decomposition, bacterial action and so and so forth.

Also as I said, there could be a functional depreciation because it may be inadequate to meet the present demand or it may become obsolete. These are different process of depreciation.

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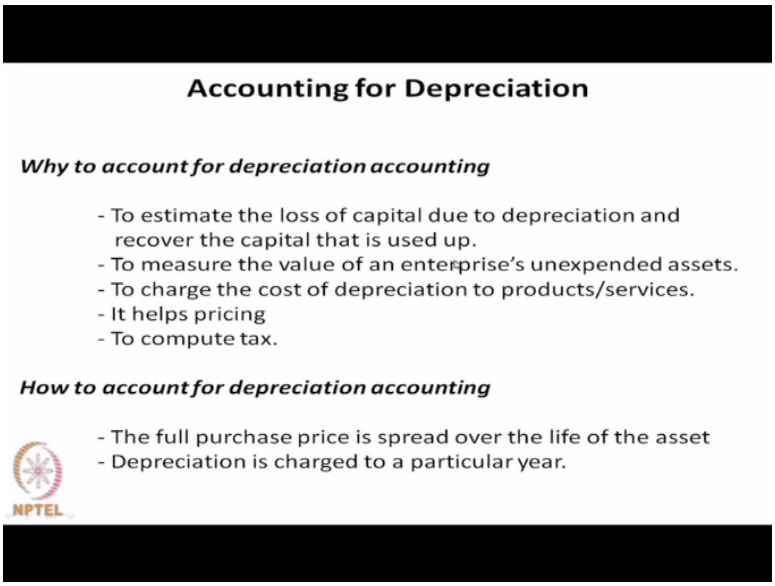


Now, the actual causes of depreciation not withstanding accountants have simpler ways to account for the depreciation. Nobody knows it is difficult to basically know the exact value of an asset after a few years of its functioning. But, as I said accountants do have very simple methods to account for the depreciation. But, why and how they are made? This slide shows that. Firstly, we need to have an accounting for depreciation to estimate the loss of capital due to depreciation and recover that amount from the goods or services that we sell.

So, this is first requirement. The second, at any point of time, an enterprise is interested to know, what is the value of all the assets put together in order to know its financial status. Third, it helps in pricing of the product to find the cost of depreciation and also to price the

products and once the cost of depreciation is known, we know that we can subtract this, this is a consider this as an expense and is subtracted from revenue to find out the tax to find out the income and therefore the tax.

So, depreciation is required for all these reasons to find out the cost of production, to find out the taxes, to help in pricing, to know the financial status on a company and these are the various reasons. How to account for depreciation accounting. The next question is the full purchase price of the asset is spread over the life of the asset instead of charging it in the first year itself, it is spread over the life of the asset.

And depreciation is charged to a particular year, that is for every year, we calculate a depreciation amount and we say, this is the depreciation for that asset in that particular year. So, this is the way by which the depreciation is accounted for. Now, before we go to the actual methods of depreciation accounting, we need to define some more terms that will be useful.

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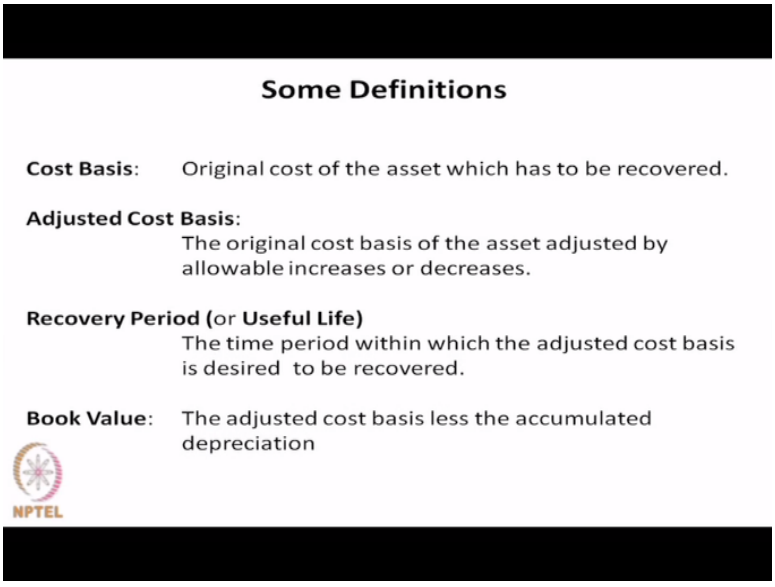


The first is that, sometimes we use the term cost basis. Cost basis is the original cost of the asset which has to be recovered. Now, if an asset is newly purchased let us say at 10 lakh rupees then, naturally the cost basis is that price 10 lakh rupees, the same, the initial investment also called the first cost. But, let us consider another situation, where we have a machine and its book value is 10000 rupees and we traded that machine with another machine.

We replace it with another machine, we sort of trade it. Meaning, we give it away to the new machine supplier, who charged us 1 lakh rupees. So, our cost basis for the new machine would be not 1lakh, but 1 lakh + the 10,000 rupees which we have given it away to the supplier of the new machine. So, our adjusted cost basis will be 1 lakh 10,000 rupees. 10,000 rupees was the book value of the machine that we already owned in the past, which we have now sacrificed for a new machine for which we had to pay 1 lakh rupees, that is the definition of adjusted cost basis.

The original cost basis of the asset adjusted by the allowable increases or decrease. The example that we had said was an increase. Then, we use the term recovery period and not useful life because, you see, a machine may be considered to have a useful life of 10 years but, if proper maintenance is given, then the machine can continue to work for 15 years or ever 20 years. So, we will say recovery period as a better term than the life by that, we mean that the initial investment will be recovered in that time.

So, we may be using a term useful life but, a better term is recovery period. In fact, both these 2 terms will be used synonymously. So, when I use the term useful life, it would mean recovery period, it does not mean that, this machine would not be actually used in operation. It may still be used but, its book value may be 0. So, this I would like you to know at this point of time. And what is book value? It is the adjusted cost basis, that is the initial cost + or - the allowable increases, less the accumulated depreciation over the years.

That means when a particular machine or an asset is acquired, the cost basis itself is the book value in that beginning of the year. At the end of the year, it will be the cost basis or adjusted cost basis - the depreciation charged in that year.

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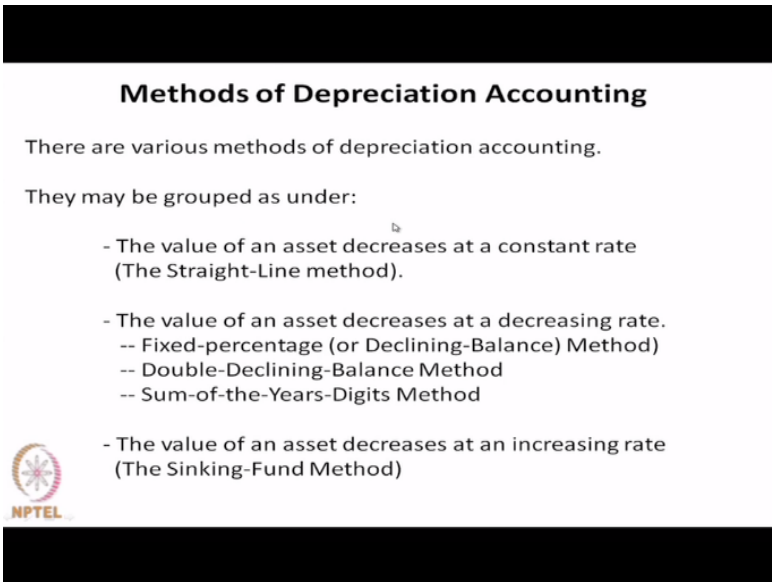


Now, we go to the topic of methods of depreciation accounting. Let us first of all understand that the actual depreciation taking place of the asset, the actual lessening of the values of asset, nobody knows. But, we are only making an assumption and making an accounting for the depreciation for that asset. This we must first of all know and therefore, there are different methods of accounting for depreciation. Some methods are based purely on the basis of simplicity, such as a straight line method.

But, some are based on principles of the advantages, economic advantage to the enterprise. Let us see how it is happening. The very simple method of accounting for depreciation is the straight line method. And sometimes we assume that the value of an asset decreases at decreasing rate that means, initial year, the lessening in the value is higher, second year it is little less, third year it is still little less etc. And there are 3 or 4 methods here.

Fixed percentage or declining balance method, double declining balance method, sum of the year's digits method or we may assume that, in the first year, the lessening in the value is less and as the number of years' progresses, the depreciation is more and more and more. So, that means, the asset value decreases at an increasing rate. So, there are these considerations, the simplest is the straight line method. Let us study what it is.

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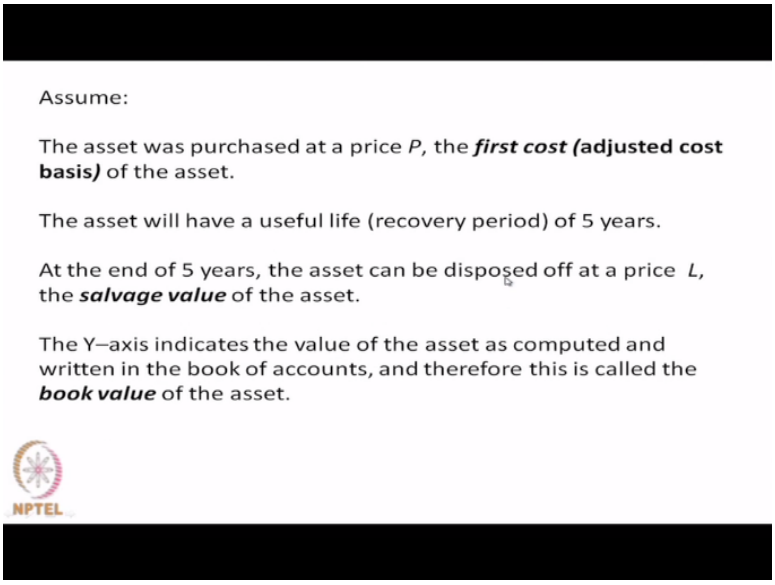


But, first of all let us say that the asset was purchased at the price P, the first cost of the adjusted cost basis. The useful life for the recovery period is taken as 5 years. And at the end of the 5 years, the asset is disposed off at a salvage value of L. So, salvage value is called L, purchase price is P, useful life is N=5.

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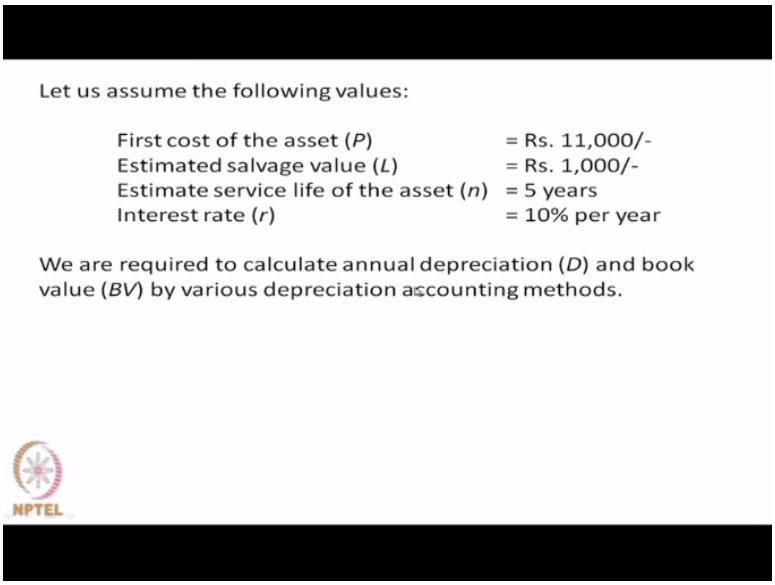


And let the values be first cost of the asset is taken as 11000, estimated salvage value is taken as 1000, estimated service life of the asset or the useful life or the recovery period N is 5 years and let the rate of return is 10% per year. We are required to calculate the annual depreciation D and the book value BV by various depreciation accounting methods. So, this is the sample example we have in mind, that the first cost, the cost basis is 11000 salvage value 1000 N is 5 years.

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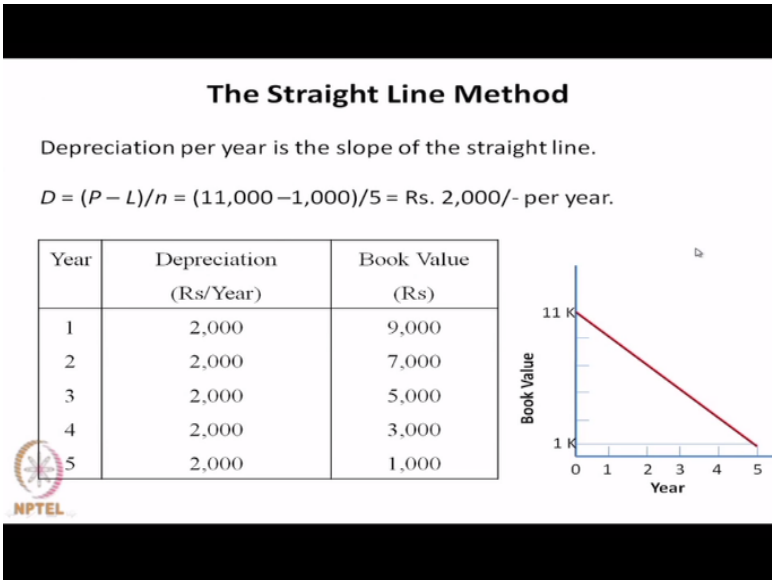


This is a very easy way of accounting or calculating the depreciation. In the 0th year, it was 11000, and in the first year 11000-the salvage value that is 10000. This amount has to be realized in 5 years' time. And we assume that in equal amount, this amount P-L will be accounted for, will be charged as depreciation or another expense. So, 11000-1000 is 10000 divided by 5 is rupees 2000 per year. That is every year, the depreciation is taken as 2000.

So, in the first year, depreciation is 2000. So, the book value is 11000-2000 is 9000. In the second year the book value is still 2000 therefore, the depreciation. Therefore, the book value becomes 9000-2000 is 7000. Third year it is 2000 so book value is 7-2 is 5000. In the 4th year it is still 2000 therefore 5-2 is 3000. And in the fifth year, 3-2 is 1000. So, we say that, at the end of the fifth year, as we had estimated the salvage value is 1000 rupees.

This we have plotted in the graph here; this is the book value. At the 0th year, the book value or the cost basis is 11000 rupees. At the end of the fifth year it is 1000 rupees. Therefore, book value comes down in equal amount of 2000, which is the depreciation charged every year. This is the straight line method. And this shows how book value declines in a straight line manner over the years very simple.

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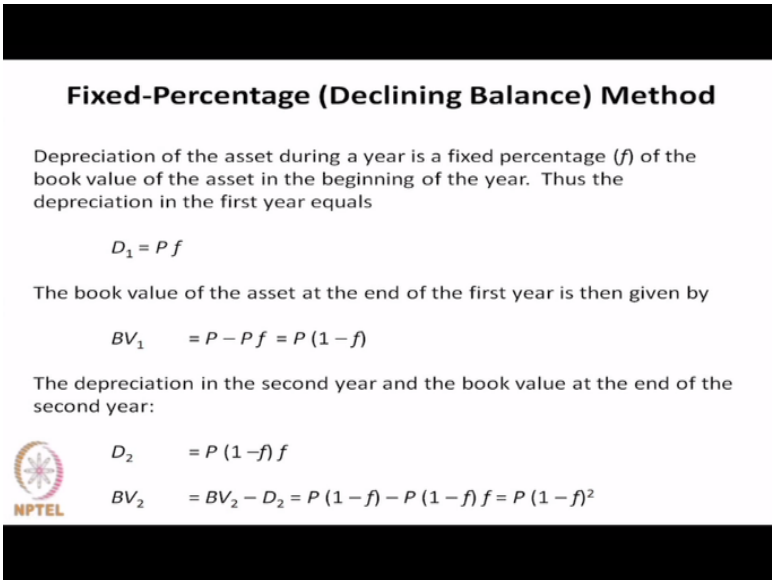


Now, we apply the declining balance method also known as fixed percentage method. It says that every year, a particular percentage of the book value is depreciated. That means depreciation of the asset during a year is a fixed percentage f of the book value of the asset in the beginning of the year. Thus the depreciation in the first year is P*f. If P is the initial investment, the first cost or the cost basis and if f is the percentage or fraction charge to depreciation, the P*f is the depreciation in the first year.

So, at the end of the first year, the book value is the beginning of the book value that is P-Pf. So, it is P*1-f. Now, depreciation in the second year will be f times the book value in the beginning of the second year or at the end of the first year. So, it is P*1-f*f and this has to be subtracted from BV1. So, book value in the first year-the depreciation in the second year is the book value in the second year. Book value in the first year is P*1-f-the depreciation which is this. So, that results in P*1-f square that is the book value.

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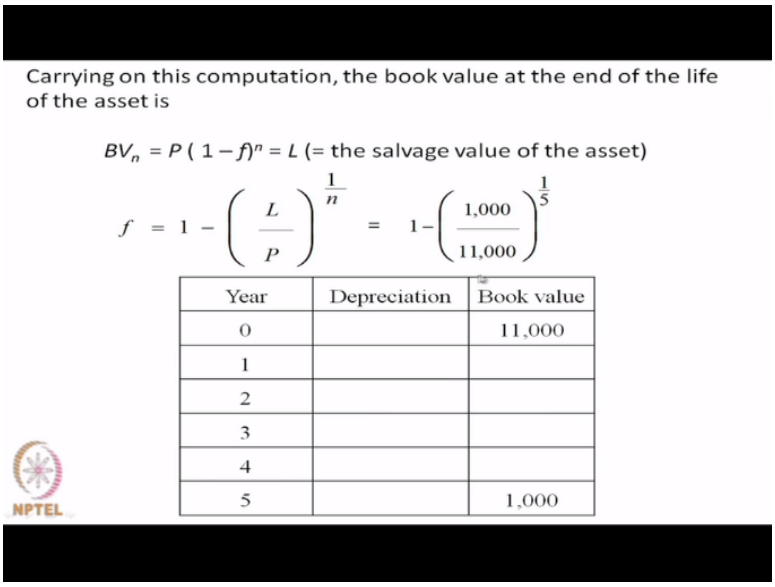


Like this, if we continued, at the end of the nth year, the book value will be P*1-f to the power n. look at this, at the end of the second year, the book value is P*1-f to the power 2. Therefore, at the end of the nth year, suppose we continue recursively this one then, the book value is =P*1-f to the power n, which is = the salvage value of the asset. If it is so, then one can find out the value of f as L divided by P to the power 1/n subtract that from 1. In this case, the value of f can be calculated.

And then the depreciation in the year will be 11,000 * this value of f. I have not calculated, I have not shown the calculations but, if I do, proceed in this manner, the book value at the end of the 5th year is 1,000. I have not calculated in this manner because, in practice, the declining balance method is not followed in the way in which I have just now discussed. This is theoretically true, but in practice, what is done is a little different. You will know it just now.

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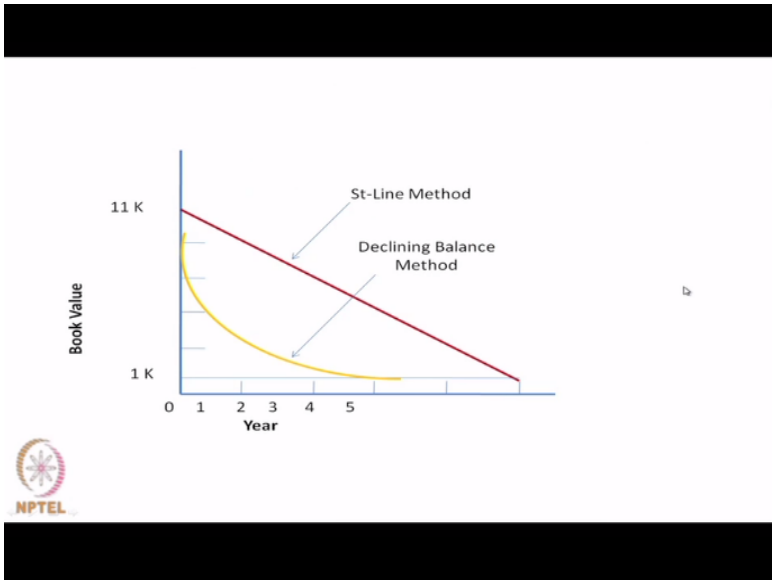


Firstly, before I do that, the same diagram that I had drawn for the straight line method is this and the declining balance method will show the book value to fall in this fashion. That is the initial depreciation is higher and then the depreciation comes down in less amount less and less and less as time proceeds. So, initial depreciation is much higher.

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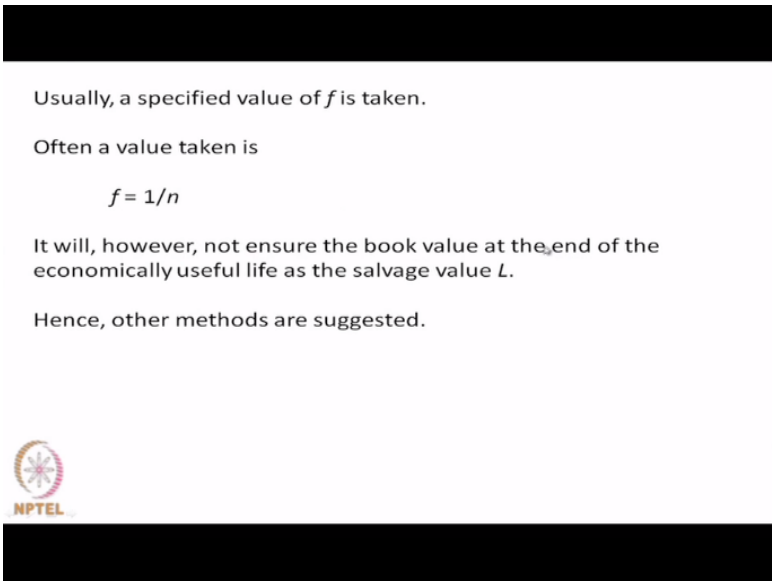


Usually, however instead of calculating f in that manner, a value of f may be given or may be taken as 1/N is the in this case N =5, therefore 1/N is 1/5, which is 20%. Normally, however instead of a fixed percentage method or a fixed percentage or a declining balance method what is done is a 200% or double declining balance method. 200% fixed charge is taken or even 150% fixed charge is taken. What is the meaning of that? This is given in the double declining balance method.

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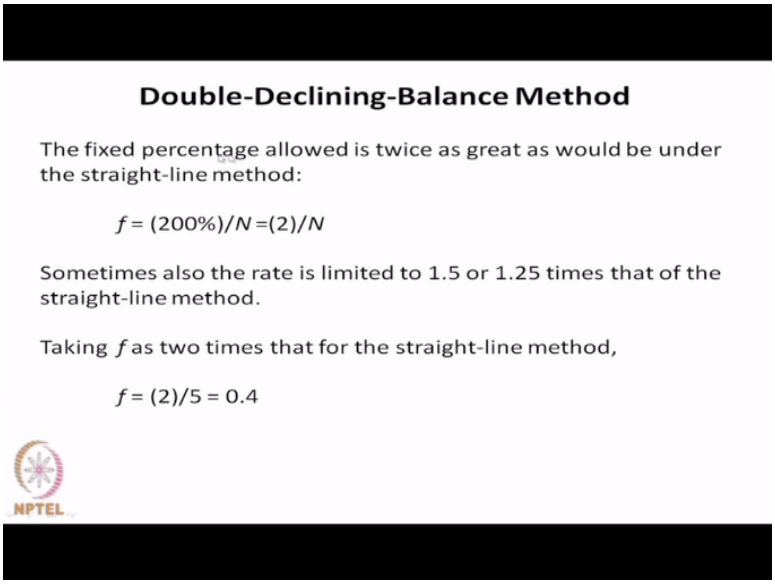


Here the fixed percentage method is twice as great as it would be under the straight line method. Under the straight line method, it would have been 1/N, 2 times that is 200%. So 2/N sometimes as I said, it could even be limited to 150% or 125%. If it is 200%, and if N=5, then the value of f is 2/5 that is 0.4.

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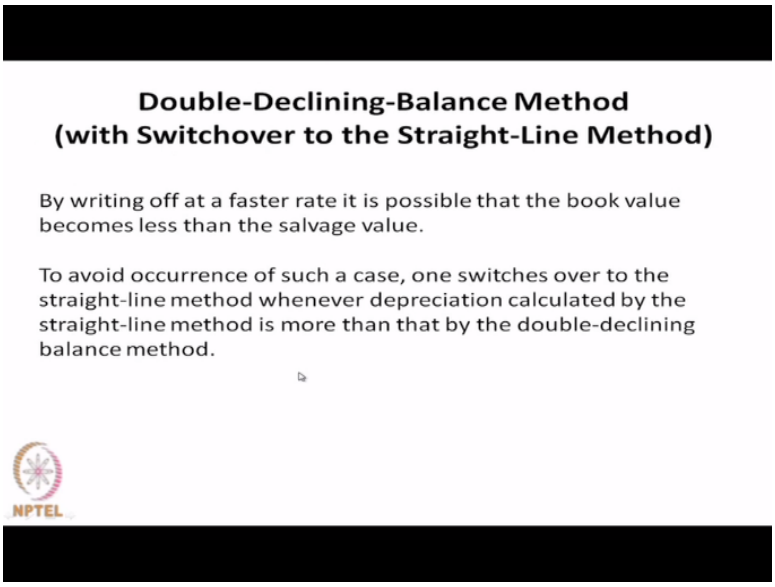


That means I could use f=0.4 and then use the same method and what is that method?

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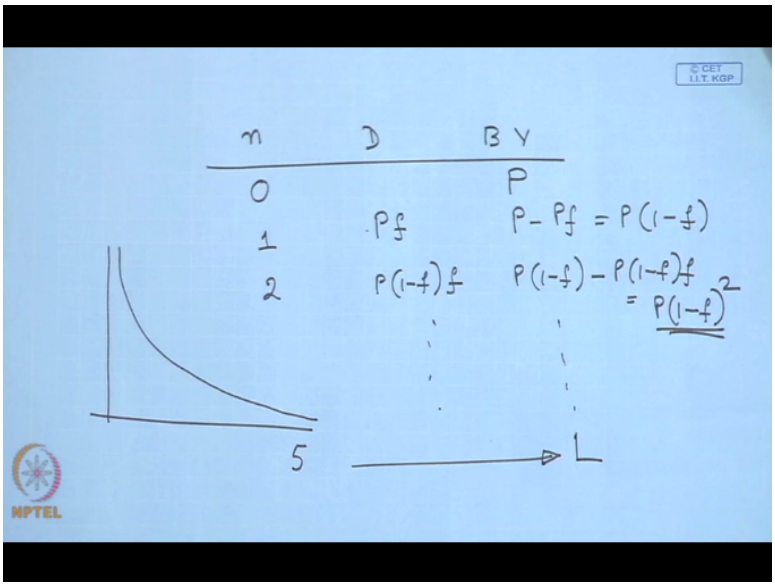


Starting with the value of P so N depreciation and book value. n=0, book value is P, n=1 depreciation is P*f book value is P-Pf=P*1-f. 2 it is book value in the beginning of the year*f and this book value therefore is whatever was previous book value-the depreciation, which is =P*1-f square so on and so forth this can continue. Now, if this continues, then you are not sure that, at the end of in fact, this will be asymptotically reaching it will go down like this.

You are not sure to get a value of L at the end of the 5th year. You are not sure to get this value. Whereas if I use the formula that I have given earlier, you are sure to reach a value of L at the end of useful life for the recovery period of 5 years. But instead if I arbitrarily or take a value of f following the double declining balance method, then I am not sure of getting L at the end of the recovery period. For this reason, a variant of double declining balance method is used.

And that variant is that double declining balance method we switch over from double declining balance method to a straight line method. If we find that the straight line method gives a higher depreciation compared to the value given by the double declining balance method. This method is the most popular in practice. That means, we start with using double declining balance method in which we take f as =2 divided by n.

Compute the depreciation at the same time also compute straight line method depreciation whenever we see that the double declining balance method depreciation is < that of the straight line method we switch over to straight line method. Let us show this with the help of an example.

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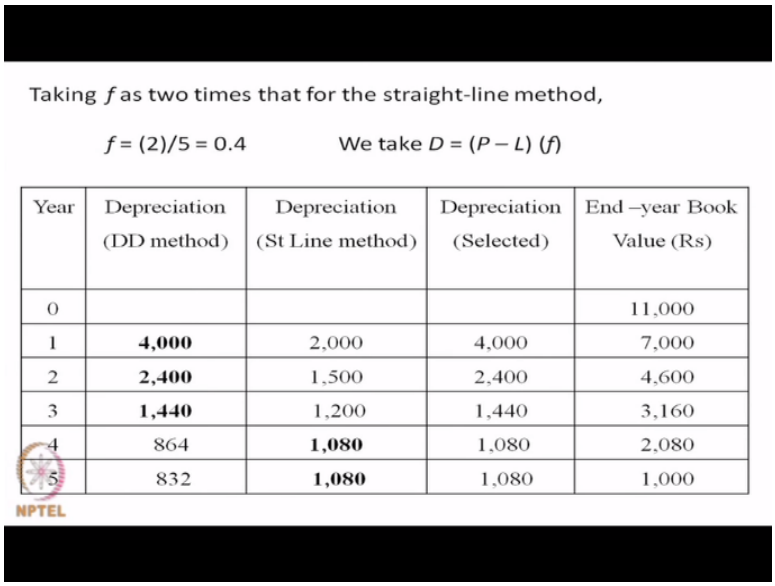


| Year | Depreciation (DD method) | Depreciation (St Line method) | Depreciation (Selected) | End –year Book Value (Rs) |
|---|---|---|---|---|
| 0 | | | | 11,000 |
| 1 | **4,000** | 2,000 | 4,000 | 7,000 |
| 2 | **2,400** | 1,500 | 2,400 | 4,600 |
| 3 | **1,440** | 1,200 | 1,440 | 3,160 |
| 4 | 864 | **1,080** | 1,080 | 2,080 |
| 5 | 832 | **1,080** | 1,080 | 1,000 |

Now, let us take this example. In this example, we have taken n=5 years and since it is the case of double declining balance method we have taken the fraction f as 2/5 which is =0.4 and now, we calculate the depreciation as = P-L*f. Now, this is a variation because we are required to find or get a value of L=1000 we are subtracting L, the salvage value from the initial investment P and then with that we are multiplying f.

Now, we started with in this table, we have written the cash flows and we have also written the depreciations that are calculated on the basis of the double declining balance method and the straight line method. Now, in this column, we have written the book values. In the beginning of the year, the initial investment was 11000 so, that is the book value. Now, L is 1000 therefore, 11000-1000 is 10000. 40% of 10000 is taken as the depreciation for the first year according to the double declining balance method.

Now, simultaneously as I said, we calculate also the depreciation by the straight line method. In this, it is 11000-1000 that is 10000 divided by 5 years therefore it is 2000 and the higher of the 2 is 4000. So, this is taken as the depreciation for the first year. If that is taken as the depreciation in the first year, then the book value at the end of the first year is 11000-4000 which is = 7000 rupees.

Now, on the basis of this, let us freshly calculate the double declining balance method depreciation and the straight line method depreciation. 7000-1000 is 6000*40% of that is 2400. Whereas 7000-1000 that is 6000 divided by 4 years remaining and that gives a straight

line method depreciation is as 1500. 2400 is higher than 1500 and therefore 2500 rupees are taken as the depreciation for the second year.

Now, this is subtracted from the book value in the beginning of the second year, which is 7000 subtracting 2400 we get end of the second year end book value as 4600. Once again follow the same thing P-L in this case, 4600-1000. This is 3600*40% that is 1440, that is the depreciation according to the double declining balance method. But, if you follow the straight line method then, it is 4600-1000 that is 3600 and only 3 years are remaining so, we divide by 3 and this amount is 1200.

Once again we find that the depreciation calculated according to the double declining balance method is > that by the straight line method. So, we choose 1440 as the depreciation charged for the year 3 giving a book value at the end of year 3 as 4600-1440 and that is =3160. Now, in the 4th year, once again 3160-1000 so, it is 2160 40% of that comes to 864 rupees according to the double declining balance method. But, according to the straight line method, it is 3160-1000 divided by only 2 years remaining, this becomes 1080.

Now, the higher of the 2 is 1080. So, that is what is taken as the depreciation. So, this is the time when we find that the depreciation calculated according to the double declining balance method is lower compared to that calculated by the straight line method. And this is where we switch over from the double declining balance method to the straight line method. So, that is what we have taken here as 1080.

So, subtracting we get 2080 as the book value at the end of the 4th year and since now we are following the straight line method the depreciation calculated will be same as year 4 and this now is taken as the depreciation and this subtracted gives us the final desired salvage value of 1000 rupees. So, this is an illustration of how a switch over takes place from the double declining balance method to a straight line method of calculation of depreciation.

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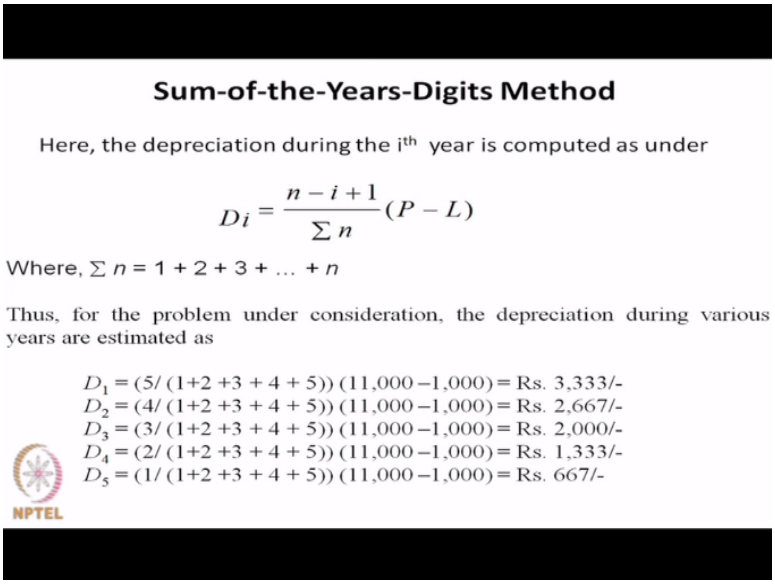


Now, we take up the yet another method and that is the sum of the year's digits method. Now, this is quite simple, it says, that the depreciation during the ith year is computed as per this Di is the depreciation during the ith year and sum n is the sum of the number of years. If n is the number of years, then 1+2+3 if n is the recovery period, then sum n is the symbol showing the sum of the years. That is why the name sum of the years*P-L.

This is best illustrated with the help of the same example that we have taken earlier, the initial investment was 11,000, that is P and the salvage value is 1000. So, the amount we recovered is 10,000 rupees. The depreciation charged in the first year, the denominator is 1+2+3+5 that is = 3+3=6+4=10+5=15 and 5 years remaining so, 5/15 that makes it rupees 3333. Depreciation charge in the second year, 4 years remaining so 4 divided by 1+2+3+4+5 that makes it 2667.

D3 it is similarly 3/sum of n gives us 2000 rupees. D4 is 2/sum that gives us 1333 and D5 is 1 divided by sum of n and that is = rupees 667. So, in this example, we can see that the depreciation charged every year actually reduces. The highest is in the first year and it gradually reduces. The same was also true for this case, when we followed the depreciation accounting the double declining balance method. The highest was in the first year then there is little low in the second year still lower in the third and 4th year.

Of course because we have changed over to the straight line method, this remains same. But usually the trend is this. So, we have studied basically 3 or 4 methods in fact till now. One is the straight line method of calculation of depreciation the second is the declining balance

method but, we preferred double declining balance method and then we said that we should change over to straight line method and we gave an example of how to change over and then we also discussed the sum of the year's digits method.

So, in the next lecture, we shall study about still another method, the sinking fund method and then we will make a comparison as to how these 4 methods differ from one another. Thank you very much.