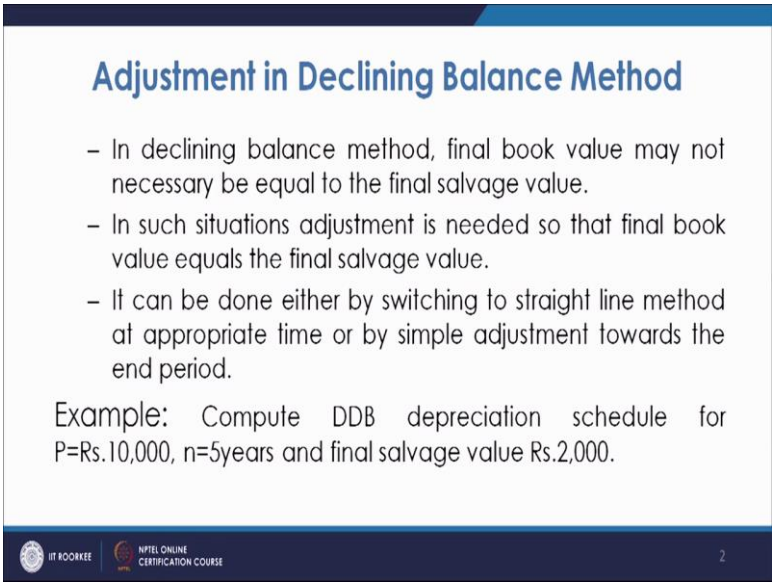
**Engineering Economic Analysis**
**Professor Dr. Pradeep K Jha**
**Department of Mechanical and Industrial Engineering**
**Indian Institute of Technology Roorkee**
**Lecture 23**
**Depreciation: Declining Balance Switching to S-L, SOYD Method**

Welcome to the lecture on depreciation. So in this lecture as we had discussed earlier there may be cases when you cannot get the exact value of salvage value using the declining balance method of depreciation.

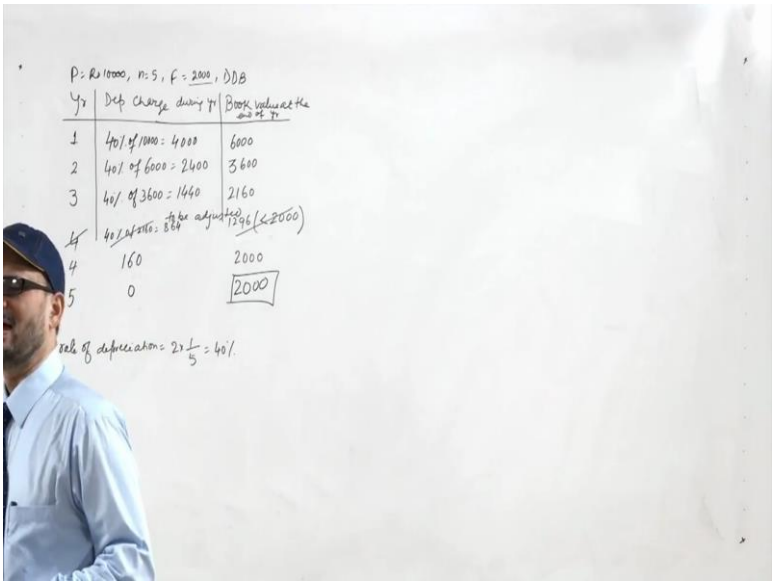
(Refer Slide Time: 00:49)




So as we had seen in the earlier question, when you had the salvage value of 778, then using the declining balance and double the declining balance that is DDB you what exactly the value of 778. Now in many cases you will not get the 778, you are given a salvage value other than 778, so you cannot get using that DDB method the same value so you will have to adjust the declining balance method of depreciation.

So it is written that if the final book value is not equal, in that case you need to do certain adjustment so that final book while it equals the final salvage value, that is what our aim is. It can be done either by switching to straight-line method at the appropriate time or by simple adjustment towards the end period. So let us see if we have the question like this where you have to use the DDB depreciation schedule.

(Refer Slide Time: 06:06)




For this data given first cost is Rs. 10,000, n is 5 years and final salvage value as Rs. 2000. In that case as we see you have year then you have depreciation charge during year and book value at the end of year. So this is for the data P is 10,000, n is 5 and the salvage value is 2000. What we see is in the first year, the depreciation charge using DDB schedule, so using DDB schedule your rate of depreciation is 2 times 1 by 5 that is 40%.

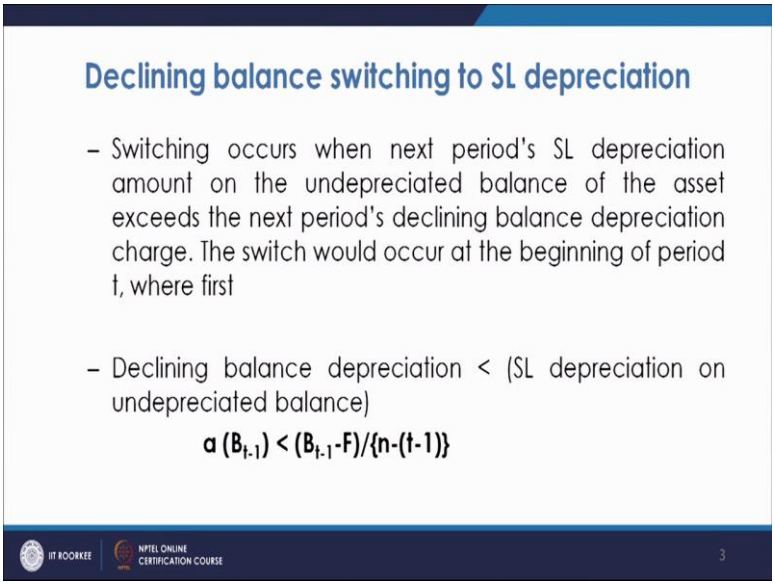
So during the first year, the depreciation charge will be 40% of 10,000 that is 4,000 and your book value at the end of first year is 6000. In the second year it will be 40% of the book value at the end of first year, so 6000 that this 2400 and this is 3600. In the third year you have 40% of 3600 that is 1440 and this comes out to be 2160. Now it is given that your salvage value has to be 2000.

If we go for the depreciation during the fourth year at the same rate, at the same rate if we can calculate 40% of 2160 that is 864 and it comes out to be 1296. Now this 1296 is less than 2000 which is the salvage value. Now the book value under the tax schemes, the book value at the end of any year cannot be less than the salvage value which is mentioned. So this will not work in this, this is to be adjusted. So it is to be adjusted.

So actually during the fourth year the only amount which is left is 160, then only you can get 2000. So in the fourth year your depreciation will be only 160 so that you get the charge of 2000 as the book value at the end of forth year and during the fifth year your appreciation will be 0 and your book value at the end of fifth year will be 2000 and this is nothing but the salvage value which is given at the end of its life.

So this is how we adjust the salvage value to be 2000 and this is the depreciation schedule which should be followed. Now let us see a case in which the estimated salvage value is given a 0. So basically using the declining balance method of the depreciation which is calculated as a certain faction times the first cost of the asset or the book value of the asset at any time, so we can never achieve 0.

(Refer Slide Time: 07:12)




So basically you have to switch to straight-line method so that you come to a value of 0, so that is known as switching to straight-line method. So switching occurs when next periods straight-line depreciation amount on the undepreciated balance of the asset exceeds the next periods declining balance depreciation charge. So basically when to go for switching?

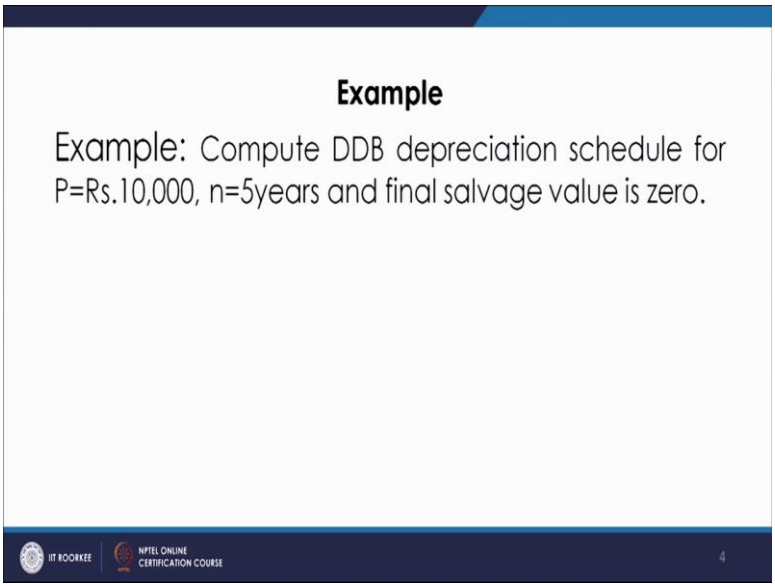
So basically switching is practiced when it is seen that at this period if you calculate the depreciation charge based on the life remaining of the asset using the straight-line method and using the declining balance method or double declining balance of method, in that case whichever is larger that should be taken.

So declining balance depreciation when it is less than the straight-line depreciation on undepreciated balance in that case you go for switching to straight-line. Now we know that using the declining balance method, during that the tth year the amount of depreciation is alpha times the book value at the end of t - 1th year and for that time the straight-line method of method of depreciation will calculate the appreciation charge as this.

So once you find you have to calculate the depreciation charge using the declining balance method as well as using the straight-line method. And at that time you see that the straight-

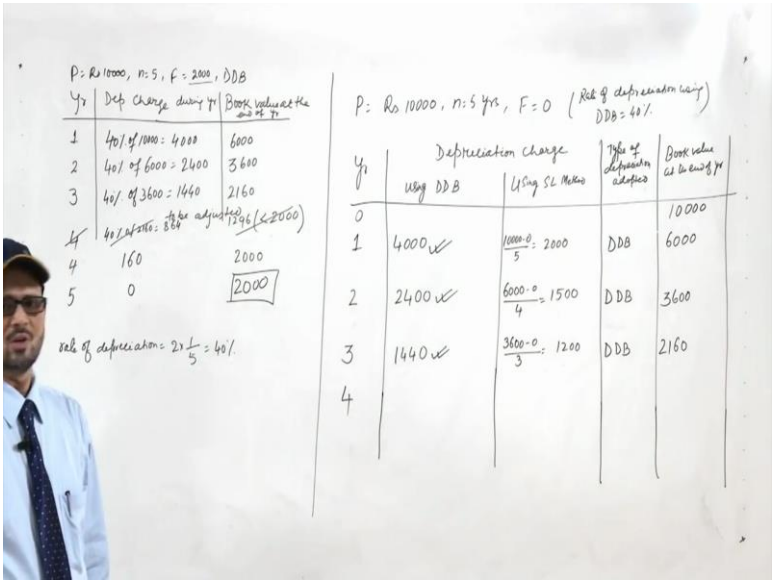
line method of depreciation gives you larger value of depreciation, you have to switch, so this is known as switching method to straight-line depreciation type. Let us see an example where this is the example of switching.

(Refer Slide Time: 09:03)




So in that you have to use the DDB method of depreciation for P as Rs. 10,000, you have n as 5 years and final salvage value is given a 0. Now in this case using the normal double declining balance method of depreciation which was coming out to be 778, so that was the book value, so book value is more than the estimated salvage value. So in this case basically you have to switch to the straight-line method. How to switch?

(Refer Slide Time: 14:57)

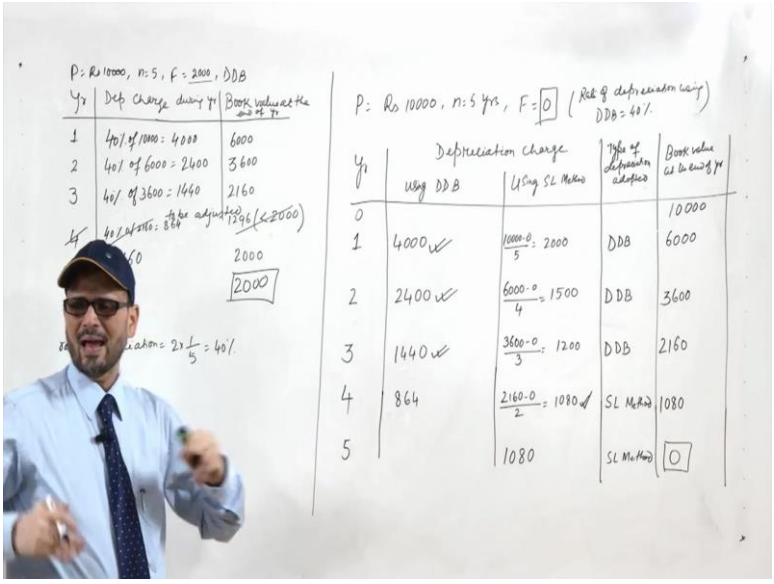


So let us see, you have the year and you calculate the depreciation charge using double declining balance method and using straight-line method then you will find the type of depreciation adopted and your book value at the end of year. Now let us say during the first year, now if we say 0 year, at the end of year you have value as 10,000.

So during the first year, during the first year if we calculate the double declining balance your rate of depreciation using DDB is 40%. So in the first year it will be 40% of 10,000 so it will be 4000. If we calculate the straight-line method of depreciation, the straight-line method of depreciation tells that amount of depreciation will be 10,000 - 0 and you have 5 years of life left so it will be 10,000 - 0 by 5 that is 2000.

So you see that the amount of depreciation is more using double declining balance method and that is why you go for this one and you the this is DDB and your book value will be 10,000 - 4000 so it will be 6000. Now in the second year, so now in the second year using double declining balance method this will be 40% of 6000 so it will be 2400.

(Refer Slide Time: 17:09)




Now at this time, the book value is 6000 and the remaining life is 4 years, so using the straight-line method, the amount of depreciation will be 6000 - 0 by 4 that is 1500. What we see is, that still the amount of depreciation calculated using the DDB is larger and that is why we still go for the double declining balance method of depreciation and the book value at the end of year 2 will be 3600. So there is no need of switching at present.

Let us go to the third year, during the third year of a book value is 3600 so using the double declining balance method it will be 40% of 3600, so it will be 1440. Now if we take the

straight-line method we have 3 more years of life left, so using straight-line method your amount of depreciation will be 3600 - 0 by 3 that is 1200. So we still see that the amount of depreciation using the DDB is still larger and that is why we will further go to DDB.

And our book value will be 2160. Now we will go to fourth and fifth year, during the fourth year we have the book value at the end of year is 2160 4 using double declining balance method of depreciation 40% of 2160 so it is 864. Now we have two more years of left so using straight-line method of depreciation the depreciation charge will be 2160 - 0 by 2 that is 1080.

What we see is that at this juncture, the amount of depreciation calculated using double declining balance method is smaller than that calculated using the straight-line method so this is the time we will switch over to this straight-line method and this is known as switching to straight-line method. So your book value will be 2160 - 1080 that will be 1080.

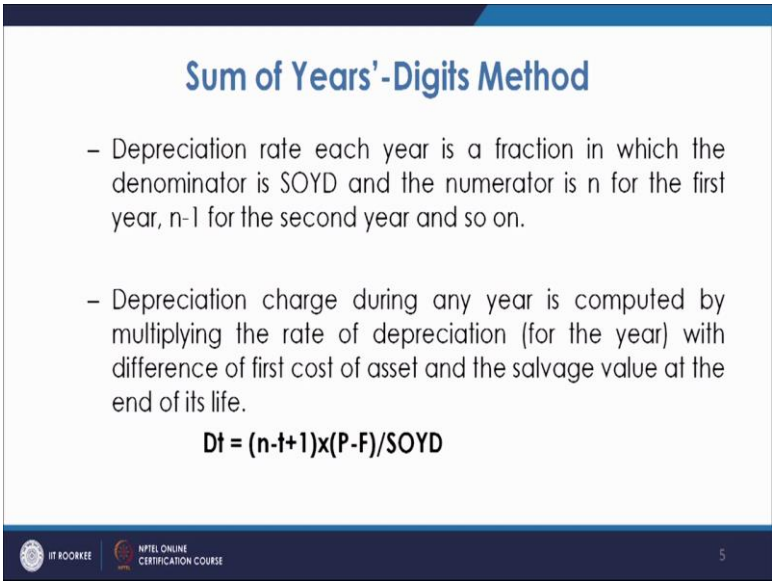
Once we switch to straight-line method, automatically if we calculate the amount of depreciation using the DDB and using the straight-line method we will see that this value of depreciation calculated using straight-line method will be always larger. So basically we will move to straight-line method, we have only one year left.

In that year we have 1080 as the depreciation charge and finally we will use the straight-line method and we will have the book value is zero. So basically be achieved the book value of 0 at the end of fifth year that is your salvage value.

So this is an example how to adjust the depreciation schedule by switching to straight-line from declining balance and this is basically used while we go for calculating the amount of depreciation in certain tax depreciation methods.

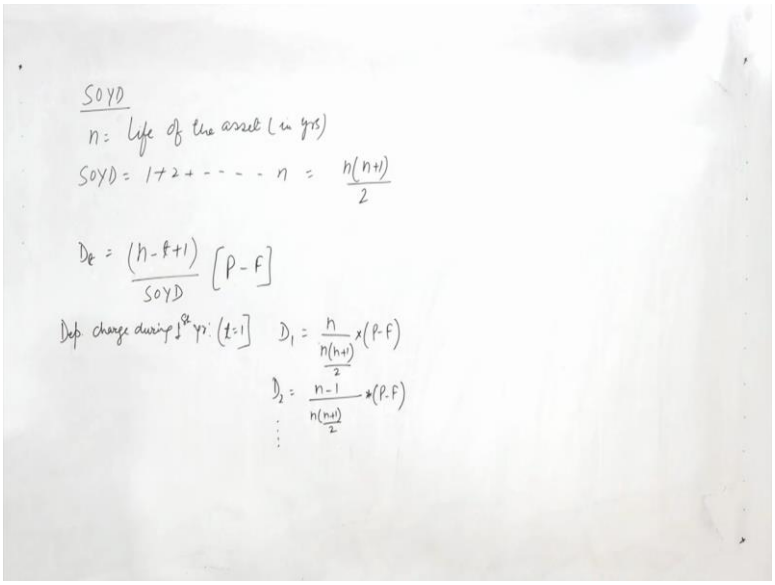
So we will see that in many cases we have to solve the problems of similar type and we have to to switch at the appropriate time when we calculate the two values of depreciation and find how the value of final salvage value has to be matched at the end. Next to the method of depreciation which we will discuss is Sum of Years Digits Method.

(Refer Slide Time: 17:58)




So sum of years digits method basically it is also a type of accelerated method where the depreciation charge during the early time is larger and as we move ahead, the charge of depreciation slows down, it decreases. In this case some of years digits mean the sum of the number of years from 1 to that year that is calculated and that comes in the denominator.

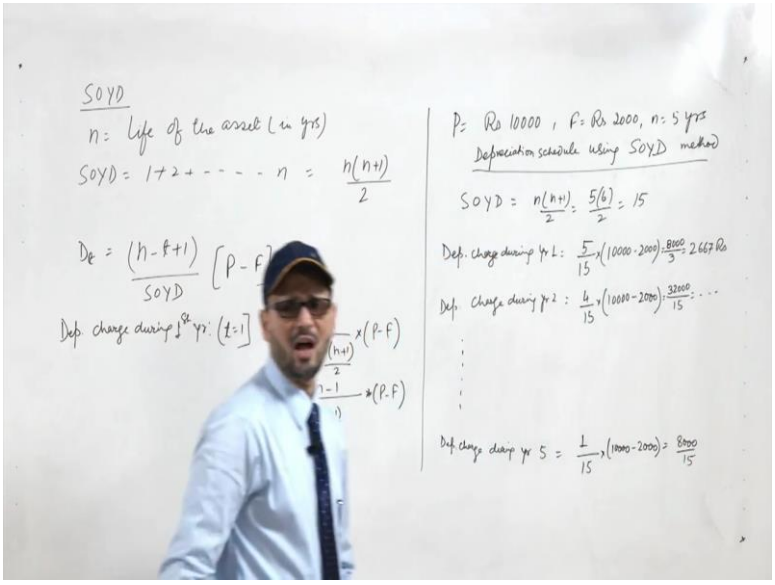
(Refer Slide Time: 20:48)




So as you see is a fraction in which denominator is SOYD, SOYD sum of years digits method so if n is the life of the asset in years, in that case some of years digits is nothing but 1 + 2 + up to n. So we know that this value is nothing but n into n + 1 by 2. Now this will be in the denominator and the numerator is n for the first year, n - 1 for the second year and so on.

So basically what we see is Dt is given as n - t + 1 by SOYD into present cost - final salvage value. So if you see depreciation charge during first year, so n equal to 1, this t equal to 1, so in that case D1 will be if you put t equal to 1 here, it will be n upon SOYD that is n into n + 1 by 2 into P - F. So similarly D2 will be n - 1 upon n into n + 1 by 2 into P - F.

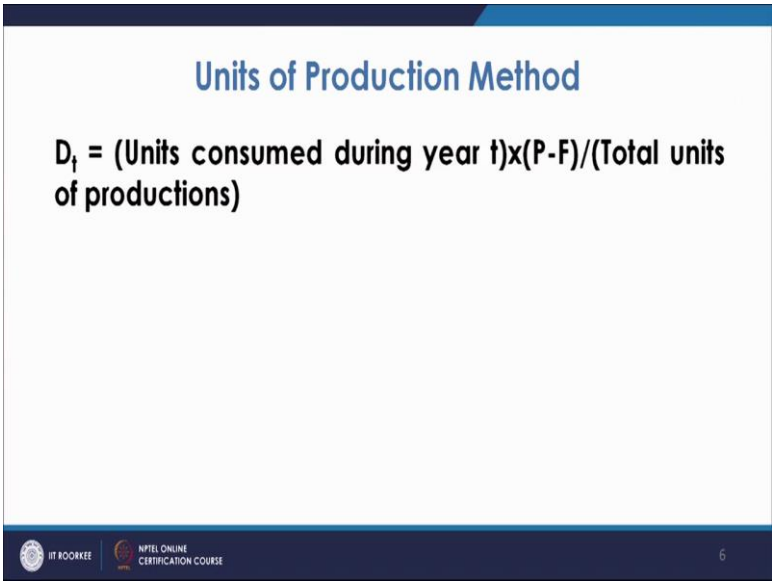
(Refer Slide Time: 23:27)




So this way you go and you can find in the final nth year it will be nothing but 1 by n into n + 1 by 2 into P - F. So if you calculate suppose you are given P as Rs. 10,000, F as Rs. 2000, n as 5 years, depreciation schedule using SOYD method. So if suppose you have to calculate this we know that SOYD will be n into n + 1 by 2 so that is 5 into 6 by 2 15. So depreciation charge during first year, during year 1 will be 5 upon 15 into 10,000 - 2000.

So it will be 5 upon 15 into 8000, so 8000 by 3 Rs. 2667. Depreciation charge during year 2, so it will be 4 upon 15 into 10,000 -2000, so it will be 32,000 upon 15, so this will be like you can calculate the depreciation charge during year 1, year 5 basically, it will be nothing but one upon 15 into 10000 - 2000 so it will be 8000 by 15. So this is how you calculate the depreciation charge for this method SOYD.

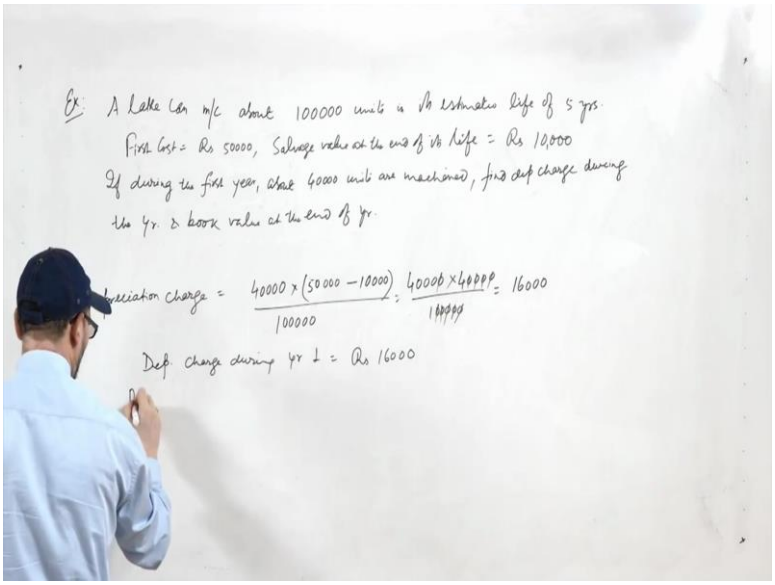
(Refer Slide Time: 23:46)



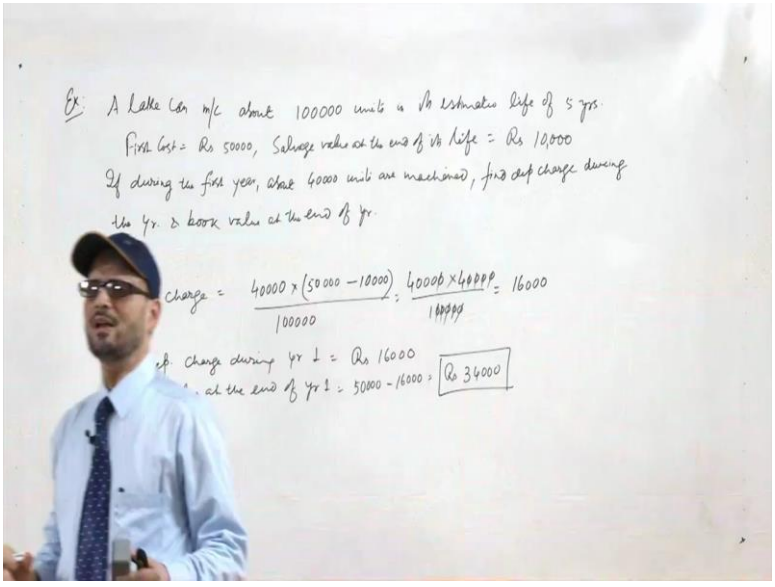

We will have other methods of depreciation, the next method of depreciation is Units of Production Method. Now many a times we buy the machine which has certain capacity to produce, so the appreciation calculated during any year will be based on how much it produces. So in in that case the depreciation charge during any year t will be units consumed during year t multiplied by the - F divided by total units of production.

So basically it is applicable for those machines were basically the depreciation is because of wear and tear of the machine elements. Now in that case, larger the machine will be used for production runs, larger and will be its depreciation and the smaller the run it, the smaller the produce, the smaller will be the depreciation charges. So we can see one example how can you solve if you have such cases.

(Refer Slide Time: 28:52)




(Refer Slide Time: 29:15)




So if we are given an example that a lathe is there can machine about 1,00,000 units in its estimated life of 5 years. It has first cost given as Rs. 50,000 and salvage value at the end of its life as Rs. 10,000. Now in this case if during the first year about 40,000 units are machined, find depreciation charge during the year and book value at the end of year.

So suppose we deal with similar cases where the capacity is given, first cost and salvage value is given, life is given, in that case basically the unit of production method will be used. Now in this case basically the lathe machine is designed on an average to work for 1,00,000 by 5 that is 20,000 units. Now in that case, it has machine about 40,000 units.

So basically in this case depreciation charge, the appreciation charge will be calculated as units consumed during the year that is 40,000 multiplied by the present cost - final salvage value so it is 1,00,000 - so present cost is sorry it is 50,000 and its salvage value is given as 10,000 and the total units of production that is its capacity 1,00,000 units, it will be divided. So it will be 40,000 multiplied by 40,000 divided by 1,00,000 so it is 16,000.

So 16,000 is the depreciation charge, so depreciation charge during year 1 is Rs. 16,000 and the book value at the end of year one will be you have book value of 50,000 initially, so 50,000 - 16,000 that is Rs. 34,000. So this 34,000 will be the book value of the assets. So that is how you calculate the depreciation charge using units of production method. Thank you.