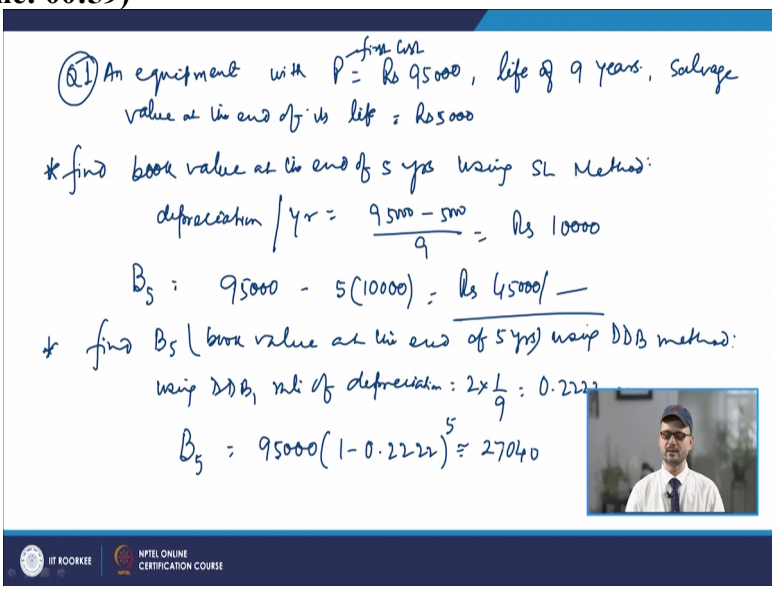
Financial Mathematics
Prof. Pradeep K. Jha
Department of Mechanical and Industrial Engineering
Indian Institute of Technology – Roorkee

Lecture – 35
Problem Solving on Depreciation and Depletion

Welcome to the lecture on problem solving on depreciation and depletion. So, in this week we have discussed about this chapter in which we discussed about depreciation and depletion and we will solve few problems to get us you know acquainted with the type of problems which we are going to face in these chapters like depreciation depletion.

(Refer Slide Time: 00:59)



So, coming to the first problem suppose you have an equipment and it has a first cost of you know with P so the first cost is 95000 rupees and it has basically life of 9 years. So, you are supposed to find the you know book values but also it is given that salvage value at the end of its life that is rupees 5000 this is the first cost, so P is first cost so this is the usual type of question which you are supposed to get that you have with an equipment or personnel equipment with first cost of rupees 95000 life is 9 years and salvage value is at the end of its life is 5000.

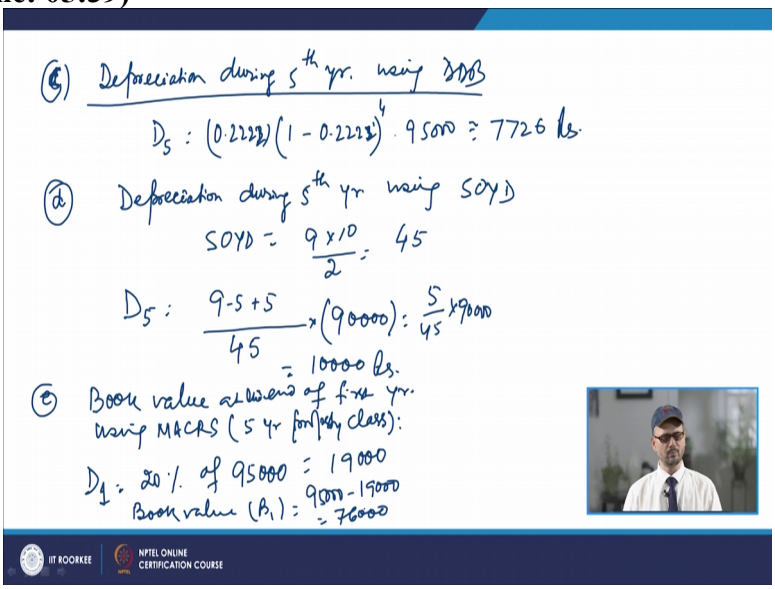
So, if you are told that you know find so find to find the book value at the end of 5 years book value at the end of 5 years using straight line method. Now if you are calculating using straight line method we know that in the straight line method the you know amount of depreciation which is there every year will be con and so the depreciation amount every year in the case of a straight line will be depreciation per year will be 95000 - 5000 / 9.

So it will be rupees 10000 so now book value at the end of 5 years be 5 it will be first cost 95000 - 5 times the depreciation per year so that is 10000 so it will be you know 50000, 95000 - 50000 so it will be rupees 45000 so this way you can calculate the book value at the end of 5 years. Now you may be asked this maybe little question one you may be asked to find the book value at the end of 5 years using double declining method.

So, find B 5 that is book value at the end of 5 years using DDB method so if you are told to find the double declining balance method of depreciation you are told to find the depreciation so we know that the life is 9 years so using DDB so using DDB your rate of depreciation will be 2 times the reciprocal of the life of the assets 1/9. So, it will be 0.222 like that so this is your alpha now we know that when we are trying to calculate to the book value book value will be the first cost of the asset 95000 and 1 - alpha that is 0.2222 and whole raised to the power 5.

So this is how you are going to calculate the book value of the asset and it will be something close to 27014 so that way you are going to calculate the book value of the asset using the double declining method of depreciation.

(Refer Slide Time: 05:39)



Then if you are told to calculate the you know depreciation so it will be see depreciation during 5th year using the DDB so using the whole declining balance method you want to calculate the depreciation during the 5th year and we know that in that it was alpha * 1 - alpha to the power 4 and then multiplied by the first cost so it will be so the depreciation using the 5th year will be alpha, so alpha is 0. 2223 you can say.

Then let us say 1 - 0.2223. So, 222 and you can have raised to the power in the 4 and then multiplied by 95000 so this way you get the depreciation during the 5th year and if you

calculate that it will be something like 7726 so now this way you can calculate these depreciation during any year. Suppose you are you are told to calculate the depreciation during the 5th year using SOYD the depreciation during 5th year using a SOD or SOYD method.

Sum of years digit method of depreciation if you are told to calculate now how to calculate in that? So we know that in the case of the SOYD method first of all you have to calculate the SOYD so why the sum of years digit will be 9 * 10 / 2 so that will be 45, 9 year is the life of the asset now during the 5th year if you look at so in the first year it will be 9 so that way it will move 9 8 7 6 and 5 so that way you will have the original calculation of the depletion the depreciation charge.

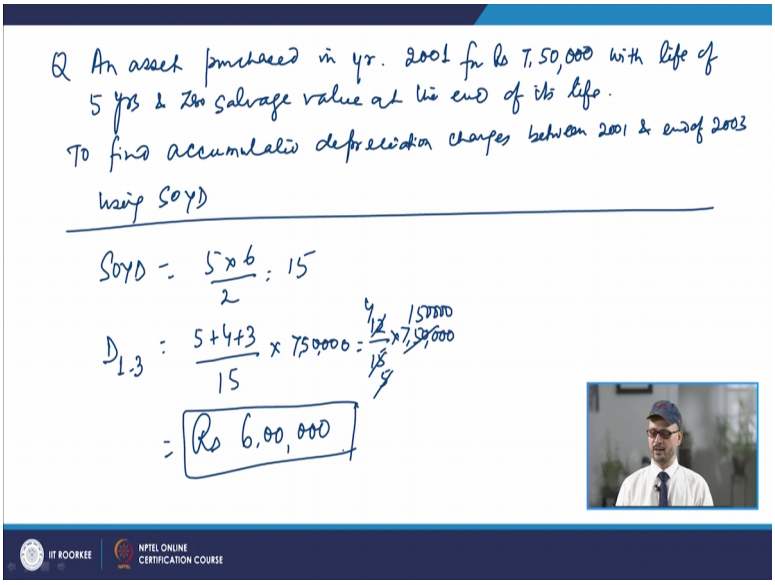
And its method is that it will be 9 - 5 + 1 so that way recharged so the precision charge during the 5th year will be 9 - 5 + 1 that is 5 by the SOYD will be 45 and then multiplied by the present value of the first cost of the asset minus its salvage value so that is your 90,000. So, it will be you know 5 / 45 into 90,000 so you will get it as 10000. So, using the SOYD method of depreciation you are getting this depreciation as 10000 rupees.

Now this is about all these methods of depreciation now if you are told that you have to calculate it using the tax depreciation method that is mockers method of depreciation and you are told to calculate the a book value at the end of first year. So, book value at the end of first year using mockers and you assume the property to be if you know has the recovery life of recovery period of 5 years.

So it is the 5 year property class so we know that in the case of the mockers what we do is that we apply the double declining balances method switching to straight-line. So, in the first year anyway the switching is not going to come so if it is a 5 year property then in that case its rate of depreciation will be 0.2 and using the double declining balance method it will be 0.4 so, 40% will be the depreciation in the first year.

But since it is a half year convention so it will be you know the 20% of the you know amount so you will have depreciation during the first year will be 20% of 95000 so it will be 19000 rupees, so 19000 will be depreciation so book value if you calculate book value will be B 1 will be 95000 - 19000 so it will be 76000 so this way we calculate the we used different methods of depreciation and try to calculate the depreciation charges.

(Refer Slide Time: 11:19)

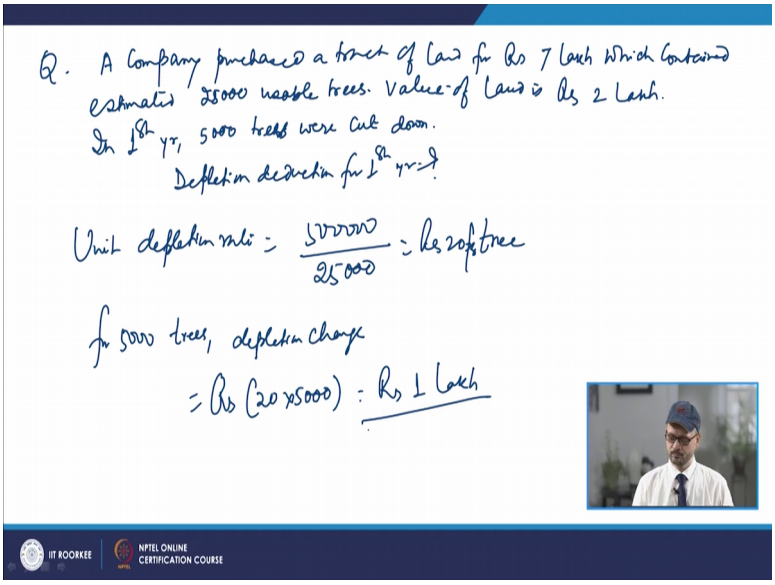


We will move to the next question the next question is that the suppose there was an asset and as it is there which is purchased in year 2001 so that is for rupees 750000 and it has a life of with life of 5 years and 0 salvage value at the end of his life. So, now as you know that we asset was purchased year 2001 we force rupees 7.5 lakhs life is 5 years and 0 salvage value at the end of its life.

Now fine to find accumulated depreciation charges so that is you have to find from 2001 between 2001 and end of 2003. So, this you have to find using SOYD now if you find using SOYD method of depreciation so we know that in the case of SOYD method of depreciation your SOYD becomes 5 * 6 / 2 so that is your 15 then of 2000 1 2 and 3 so you have 3 years so your depreciation you know charge the 1 2 3 will be 5 + 4 + 3 and divided by 15 and into P - F or C - S whatever we can say the first cost minus the salvage value.

So anyway that is 0 so it will be 750000 so it will be 12 / 15 * 750000 and this amount will be so it will be 4 and 5 and this will be 150000 so it will be rupees 6 lakh so the accumulated you know depreciation charges for the asset which has been purchased in year 2001 and from 2001 to 2003 the accumulated depreciation charge is computed to be rupees 6 lakh how we get that that is clear.

(Refer Slide Time: 14:38)

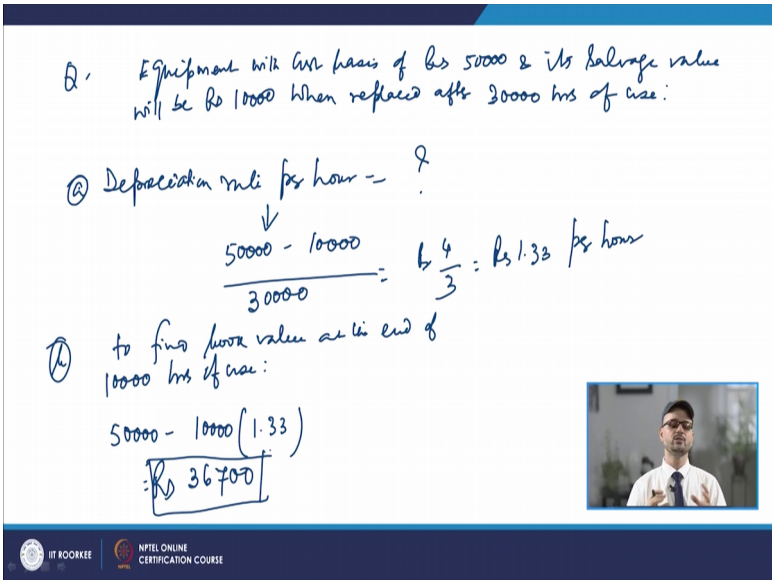


Now we come to the problem of depletion let us say there is a problem where which tells that a company purchase a tract of land has been you know taken and for rupees 7 lakh and in that you have which contained estimated 25000 useable trees so it has purchased the land with 25000 trees now value of land is 2 lakh rupees. Now the thing is that in first year it has cut down so in the first year you know 5000 trees were cut okay.

So, now what will be the; you know depletion deduction for the first year so depletion deduction will be how much for first year. Now this is to be calculated now we know that you have 7 lakh rupees value is there for land plus the trees now value of land is 2 lakh and the land is not said to be depreciated you know item land does not depreciate. So, basically depreciation is only depreciation charge or depletion charge will be only for the trees.

And the price for these 25000 trees will be 5 lakhs now if you take the depletion unit depletion rate for the trees so unit depletion rate will be 5 lakh divided by you have a 25000 trees so it will be Rs 20 per tree. Now if you have cut down 5000 trees so for 5000 trees depletion charge will be rupee so rupees 20 * 5000 so it will be rupees 1 lakh. So, this way we; so this is basically the method that is cost method of depreciation depletion calculation where we know that you have 25000 trees and you have cut down to 5000 trees so this will be your depletion charge which is allowable or admissible that is 20 multiplied by you know 5000 so that will be rupees 1 lakh.

(Refer Slide Time: 17:59)

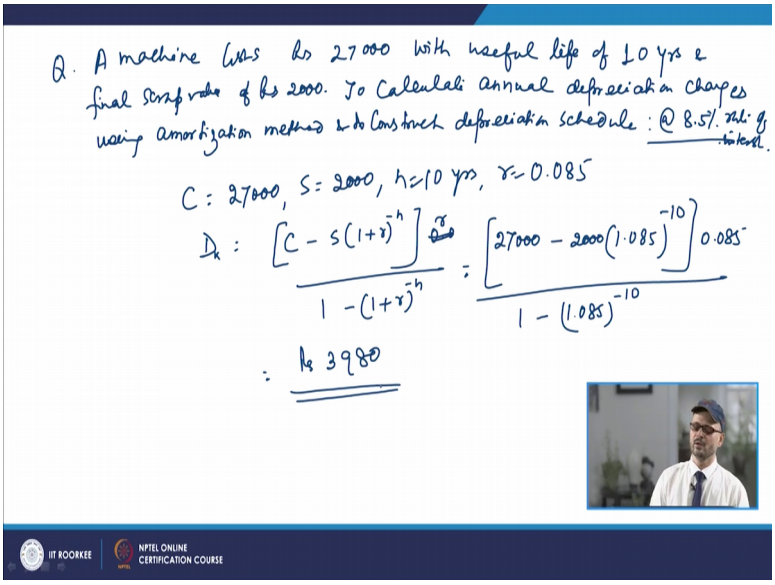


Similarly we can have another question is based on again depletion. So, suppose you have an equipment so equipment of which cost basis of 50000 equipment with cost basis of rupees 50000 so you have purchased that you know equipment and its salvage value will be rupees 10000 if so I mean when replaced after 30000 of hours of use. Now in this case also now you have the instrument which is depreciated because of its use how many hours of use is being my you know this machine is being subjected to.

So, you know if you take that so this is a unit of production method of depreciation. Now in this case depreciation rate per hour now depreciation rate per hour if you are calculating how much so it will be basically you have first cost is 50000 and its salvage value is 10000 and that divided by how many hours 30000 hours so it is basically 4/3 per hour of you know use so rupees 1.33 per hour. So that basically will be the depreciation charge.

Now based on that if you are told that you know some hours of operation has been done what will be the book value. So, if you know if you are told to find the book value so to find book value at the end of 10000 hours of use so what you do is you will be your first cost is 50000 - 10000 and multiplied by 1.33 so that way because this is the depreciation for that much hours of use so it will be 13300 so it will be you know you can calculate it it will be 36700 rupees will be your book value which will be remaining for such cases. So, this way you can calculate these depreciation charges.

(Refer Slide Time: 21:30)



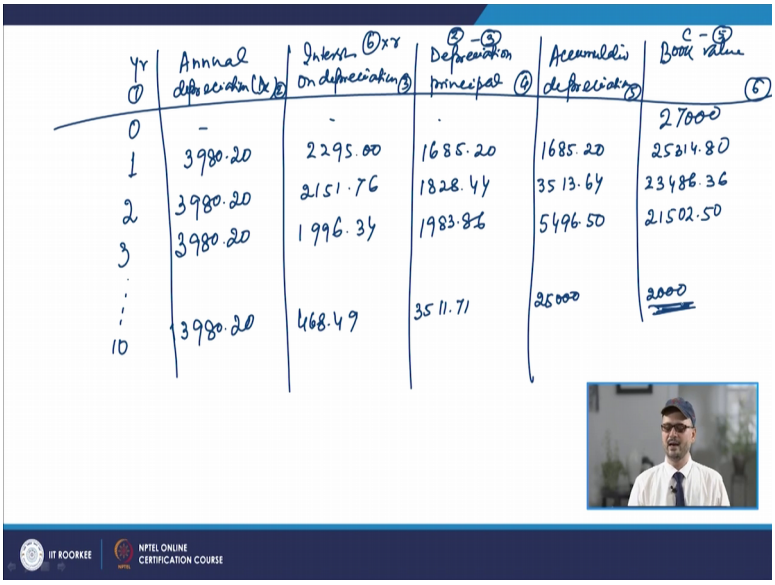
Now we are going to have the question based on amortization method of depreciation and in that basically we have a question which tells that you have a machine which costs rupees 27000 with useful life of 10 years now in that and final scrap value or final salvage value is said to be rupees 2000. Now in that you have to calculate these annual depreciation charges so to calculate annual depreciation charges.

Now for that so this we are using this amortization method. So, and to construct the depreciation schedule and you are given that rate of interest is 8.5% rate of interest so we know that in the case of amortization method we have to take into account this time value of money and this rate of interest comes into picture to find these you know depreciation charges per year.

So in this case as we know that we are given C as 27 000 and S is 2000, n is 10 years and R is 0.085. So, now as we know that we get these depreciation charge and that will be B that is basically being calculated as C – S * 1 + R raise to power -n and then you are calculating doing with R so this will be 0 so this is basically R divided by 1 - 1 + R it is about -n so you know what you will do is you are going to compute that so that will be 27000 - 2000 * 1 + so 1.085 raised to the power -10 and that is being multiplied with 0.085 and divided by 1 -1.085 raised to the power -10.

So that is what we are going to calculate here so this value when it is computed this comes out to be rupees 3980 so this is your annual depreciation charge being computed.

(Refer Slide Time: 24:52)



Now we are going to calculate the depreciation schedule for th is and for that we make these you know column where we find these so we have one column as year, then we have the annual depreciation which we have calculated so this is annual depreciation D K that we have computed out to be 3980. Then we have the interest on depreciation so this is basically depending upon the book value you calculate this based on the percentage rate of interest.

So based on that we are calculating then we have the depreciating C as principle and we have the accumulated depreciation and we have book value now if you can calculate yourself what we will do 1 or 2 for your reference. So, now as you move in the 0 here you have nothing this and your book value is 27000 in the end it has to be 2000. Now you come to 1, now in this case and well depreciation charge we have already computed out to be 3980.20.

Now what we have to see is that this is your if you take this as 1 this as 2 this as 3 this as 4 this as 5 and this as six so the annual depreciation charge we have computed. Now interest on depreciation this will be nothing but whatever book value we have that will be multiplied with the; you know rate of interest. So, it will be nothing but it will be 6 multiplied by R that is 0.085. So, here it is 27000 and if you multiply it with 0.085 it will be 2295.

So, you will have 2295 here now depreciation principle it will be nothing but it will be 2 - 3 so it will be 2 - 3 so you have to you know you have to subtract this minus this so it will be coming out to be 1685.20 so this is your accumulated depreciation at this stage this will be 1685.20 and your book value will be subtracted so it will be basically this much -5. So, this will be C – 5.

So, these C minus it will be 5 whatever you calculate that amount will be calculated now when you subtracted so you are getting 25314.80 so that is how you are going to calculate

this depreciation schedule. Now you can go to the second here so in the second year this amount is anyway constant now the interest on depreciation it will be basically 8.5% of this amount that is 6*R is .085 so this amount will be 2151.61 and then once you calculate 2 - 3 so this amount will be coming out to be 1828.44.

So, now that will be added so the accumulated depreciation will be and the addition of this now that will be 3513.64 and your book value will be 27000 - 3513.64 so it will be 23486.36 so that is how your depreciation schedule will go and you have to calculate these depreciation. So, further you can go for the 3rd year and the 3rd year again you are going to get these 3980.20 so now in this year again you have to calculate this interest on depreciation that will be 8.5% of this amount.

So that will be 1996 so it will be 1996 then this is .34 and this minus this will be further 1983.86 and accumulated depreciation charge will be further addition of this so no 3513 + 1983 so it will be 5497.50 so that to 27000 – 5496.50 that will be again 21502.50 so this way it will move and in the 10th year if you do in the 10th year again it will be 3980.20 in the 10th year it comes out to be 468.49 then it will be coming at 3511.71 this will be coming as 25000 and this will be coming as 2000.

So, that is what you get the final salvage value at the end of the 10th year you are getting this 2000 as the book value of the asset. So, this is the depreciation schedule in the case of amortization method of the depreciation and this should be practiced so you can practice for more and more you know problems and get more and more acquainted with the calculations of the depreciation schedule and the depreciation amounts. So, that it will help you deal with such questions when they are coming in front of you, thank you very much.