Engineering Economic Analysis
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Lecture 26
Problem Solving Based on Depreciation and Depletion

Welcome to the lecture on problem solving on depreciation and depletion. So in this lecture we will solve problems based on depreciation methods as well as depletion methods.

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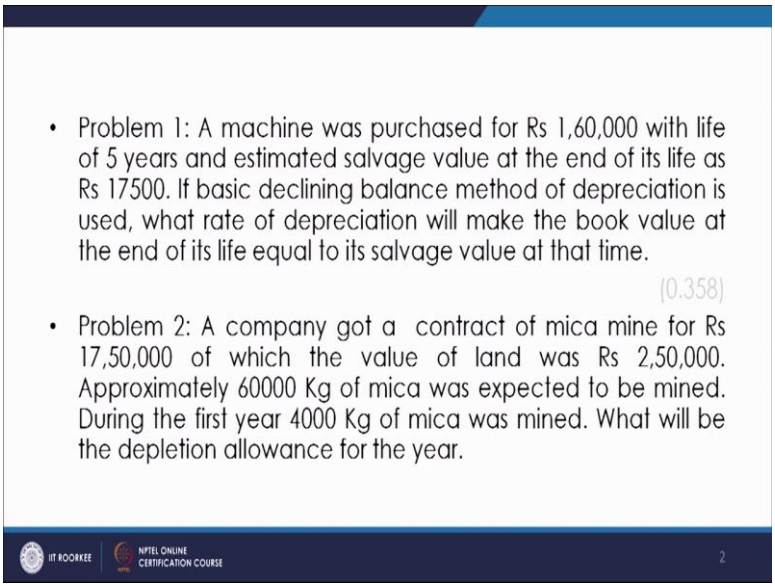

Let see the first problem, the problem is like this that a machine was purchased for Rs. 1,60,000 with life of 5 years and estimated salvage value at the end of its life as Rs. 17,500. Basic declining balance method of depreciation is to be used. So we have to find what should be the rate of depreciation which will make the book value at the end of its life equal to its salvage value at that time.

So we have studied the basic depreciation method in which we **sss** know that there is a fixed percentage of the first cost of the asset that is used as a depreciation in the first year and every time the book value is calculated, that percentage times the book value at the end of previous year will be the depreciation charge during that year. So if we solve this problem, let us see what are the data which are given to us.

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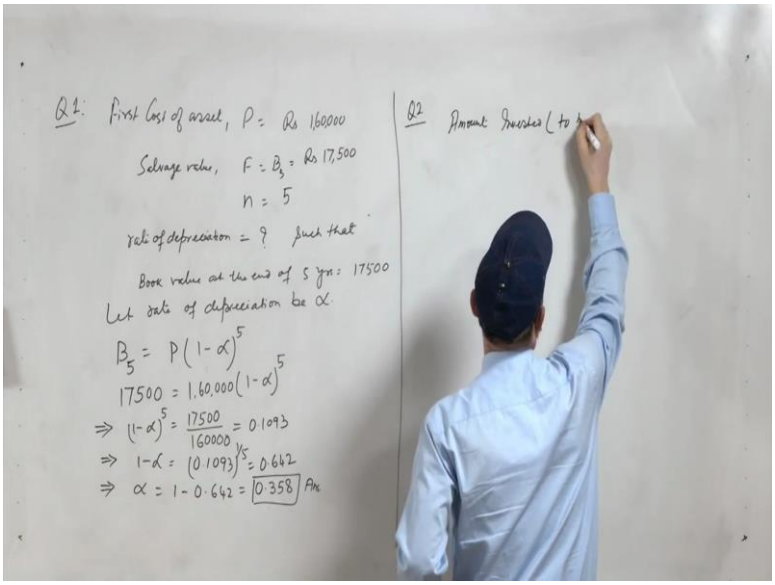

So we have first cost of the asset that is P given as Rs. 1,60,000. Then estimated salvage value at the end of 5 years F is given as that is also can be written as B5 book value at the end of 5 years and it is given as Rs. 17,500. Life is 5 years so n is 5 and rate of depreciation, it is given as point 1 10% that is 0 point 1, so this is alpha.

Now we have to find this rate of depreciation, I am sorry this rate is not given, we have to basically find this rate such that you get the book value at the end of 5 years as 17,500. Now what we see, if alpha is the rate of depreciation so let rate of depreciation be alpha. So what we see from the formula of declining balance method B5 will be P times 1 - alpha raised to the power 5 and B5 is given as the salvage value at the end of 5 years.

So you can substitute the values, so 17,500 will be equal to 1,60,00 multiplied by 1- alpha raised to the power 5. So one - alpha raised the power 5 becomes equal to 17,500 divided by 1,60,000 that is equal to point 1093. So if we get the value of one - alpha, it will be point 1093 to the power 1 by 5 and this comes out to be 0 point 642. So we get the alpha value that is rate of depreciation as 1 - 0 point 642 that is 0 point 358.

So basically this is the rate of depreciation that is 35 point 8%, if that percentage of depreciation is used you will get the first cost to depreciate at the value of 17,500. So this is our answer.

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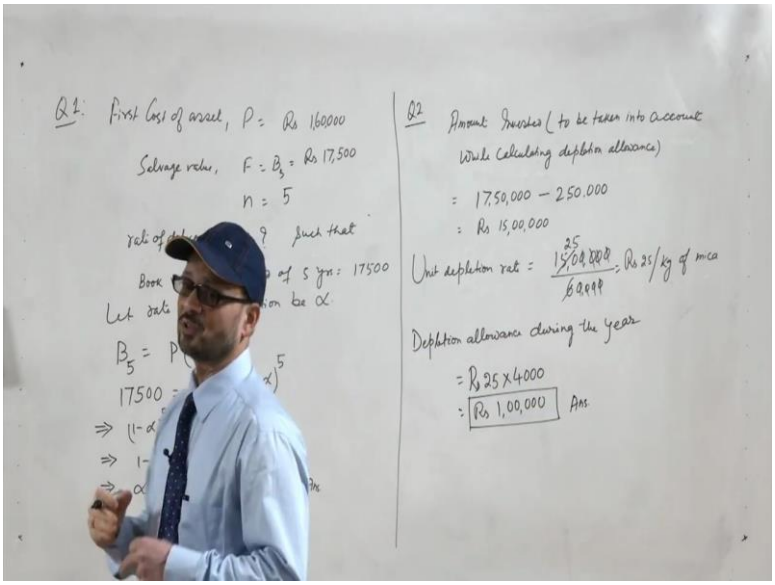

Let us move to second question, the second question is, a company got a contract of mica mine for Rs. 17,50,000 of which the value of land was Rs. 2,50,000. Approximately 60,000 KG of mica was expected to be mined.

So the company has got this contract, it has bought it and it expects that of this mine, 60,000 kg of mica will be mined during the contract period or so. During the first year 4,000 kg of mica was mined, what will be the depletion allowance for the year? So this is a problem based on depletion, in this there are two cost, one is the contract cost that is of 17,50,000 and obviously the land value was 2,50,000.

So basically the land is non-depreciable, so this will not be considered while calculating the depletion charge. So in this question your amount which was initially invested that is to be taken into account while calculating depletion allowance. So the cost of land **is** will be subtracted so it will be 17,50,000 - 2,50,000 because land is not depreciable, so it will be Rs. 15,00,000.

Now the company expects that it will mine 60,000 kg of mica during the period, whole period. So your unit depletion rate will be 15,00,000 multiplied by 60,000 that is 25, so it will be Rs. 25 per kg of mica produced. So this is the unit depletion allowance which the company can claim for every kg of mica it mines. Now it has mined 4000 kg of mica so depletion allowance during the year will be 25 multiplied by 4000 rupees, so it will be Rs. 1,00,000.

So this Rs. 100,000 is the depletion allowance which have been taken as the answer for this question. Here it is similar to the cost percentage basis of depletion and also the same concept

as unit of production method is adopted, it has been used here to find the answer. Let us go to the next question.

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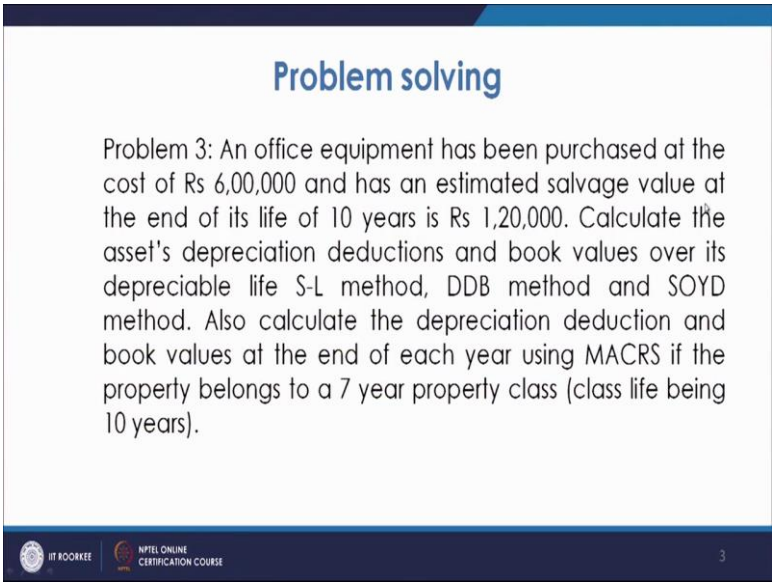

Now in this question it is written that an office equipment has been purchased at the cost of Rs. 600,000 and has estimated salvage value at the end of its life of 10 years is Rs. 120,000. Calculate the assets depreciation deductions and book values over its depreciable life using straight-line method, double declining balance method and SOYD methods.

Also calculate the depreciation deduction and book values at the end of each year using MACRS if the property belongs to a seven year property class, class life being 10 years. So basically in this question, we will try to have the deduction of depreciation charges calculation of depreciation charges for every year using the four methods which we have studied so far. So we will solve this question.

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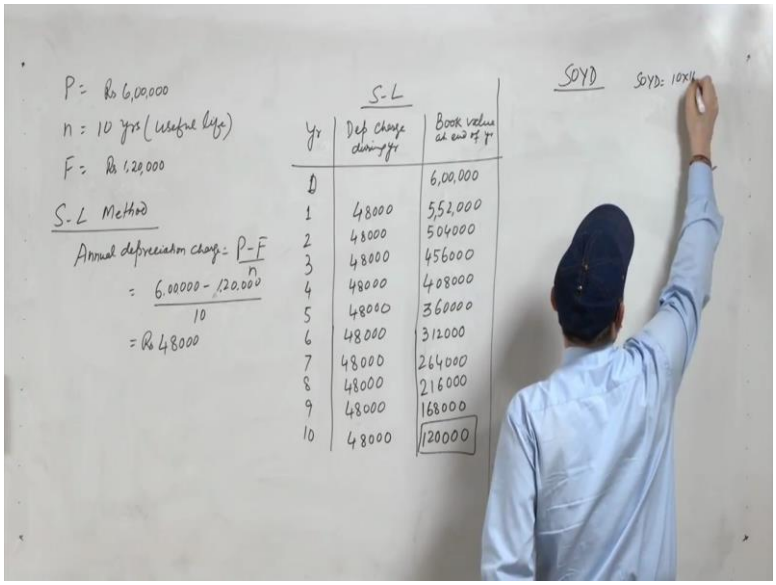

Yr	Dep charge during yr	Book value at end of yr
0		6,00,000
1	48000	5,52,000
2	48000	504000
3	48000	456000
4	48000	408000
5	48000	360000
6	48000	312000
7	48000	264000
8	48000	216000
9	48000	168000
10	48000	120000

Now in this question it is given as P as Rs. 6,00,000, n as 10 years, useful life of the asset is 10 years. This life will be used for the 3 methods straight line, declining balance ans SOYD methods. However it is a 7 year property class so MACRS will use the 7 year property class and based on that the calculation should be carried out. Salvage value at the end of 10 years is written as 1,20,000.

Now if we take, so let us calculate the depreciation charges during the year and also the book values at the end of each year. So for straight-line method, for straight-line method we know that annual depreciation charge will be will be P - F upon n. So it will be 6,00,000 - 1,20,000 divided by it has a 10 years life so 10 so it is 48,000. So every year, we can decrease this amount from the book value at the end of previous year and we will get the values.

So if we calculate the depreciation schedule year, depreciation charge and book value at end of year, depreciation charge during year. So this is straight-line method, in that we go in the first year, initially we take 0 year, the value is 6,00,000. Now if you go to first year, depreciation every year is constant so it will be 48,000, so it will be 5,52,000.

So this way we will go 2, 3, 4, 5, 6, 7, 8, 9 and 10. So every year the charge will be same that is depreciation charge will be same, here it will be 48,000, so it will be 5,04,000. Again 48,000 so it will be 4,56,000 then again 48,000 so it will be 4,08,000. 48,000 so 3,60,000, then 48,000 we get 3,12,000, again 48,000 so it will be 2,64,000. 48,000, it will be 2,16,000, then in the ninth year again 48,000 it will be 168,000.

And in the tenth year again 48,000 and it comes out to be 1,20,000. So this is what you get, you have the salvage value at the end of tenth year as 1,20,000, you got it here. So this is done using the straight-line method. Now let us see using the SOYD method. So in SOYD method SOYD can be calculated as 10 into 11 by 2, so it is 55. Now we will calculate **as** in the same way, we have year, depreciation charge during year and book value at the end of year.

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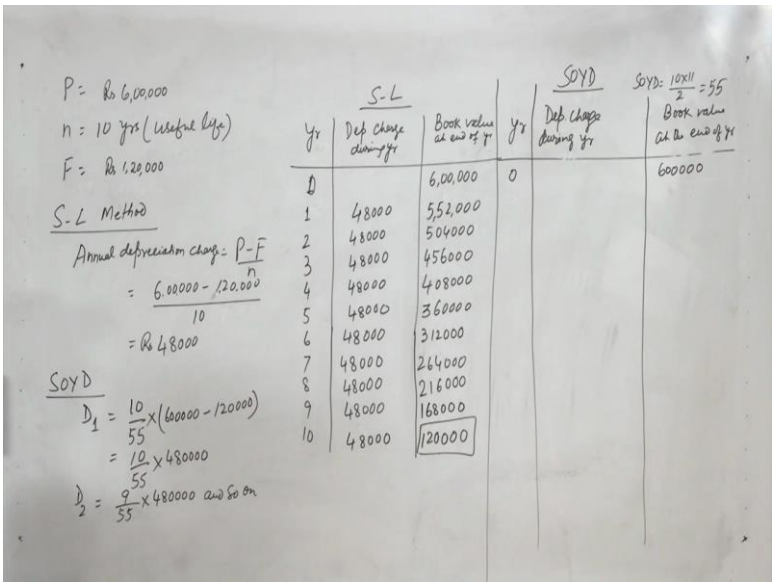

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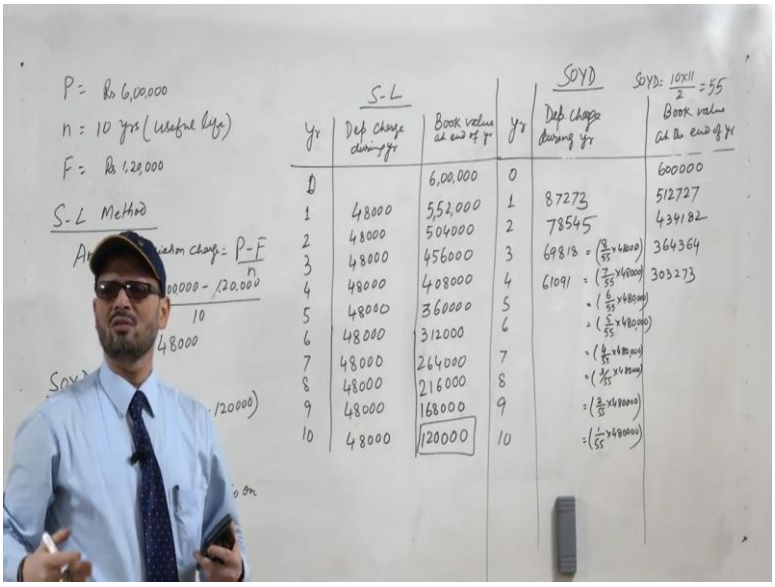

Now in this case again at 0 time you have 6,00,000. Now in this case using the SOYD method, depreciation charge during the first year will be 10 upon 55 into P - F that is 6,00,000 - 1,20,000, so it will be 10 by 55 into 4,80,000. Now in the second year it will be 9

by 55 into 4,80,000 and so on. So ultimately you will be having the book value at the end of 10 year as same as 1,20,000.

So in the first, second, third, fourth, fifth, sixth, seventh eighth, ninth and tenth, now in this case we will have the first year depreciation charges 10 upon 55 into 4,80,000 so this is 87,272 point 72, so it is here, so it will be 5,12,727. We can take it as three, so it comes like this. Now we will have the second year depreciation, the second year depreciation will be 9 by 55 into 6,00,000 so it will be 9 divided by 55 multiplied by 4,80,000 so it will be 78,545.

So 5,12,727 - 78,545 it will come as 4,34,182. Now third is D3 that will be 8 by 45 so it will be 8 by 55 into 4,80,000, so it will be 69,818. So 4,34,182 - this amount 3,64,364. Then in this fourth year you have 7 by 55 into 48,000 it will be 61,091. 364364 - 61091 will be equal to 303273. So this year will 6 by 55 into 4,80,000, so this way you can go and calculate the different values and ultimately by subtracting it you can get the values.

Now in the similar it will be 5 by 55 into 4,80,000, this will be 4 by 55 into 4,80,000, this will be 3 by 55 into 4,80,000, this will be 2 by 55 into 4,80,000 and last will be in the tenth year 1 by 55 into 4,80,000. So this way you can calculate the values and have this. Once we have the depreciation amount here, this can be subtracted from this to get the book value at this time. So this is how you solve the depreciation problem based on a SOYD.

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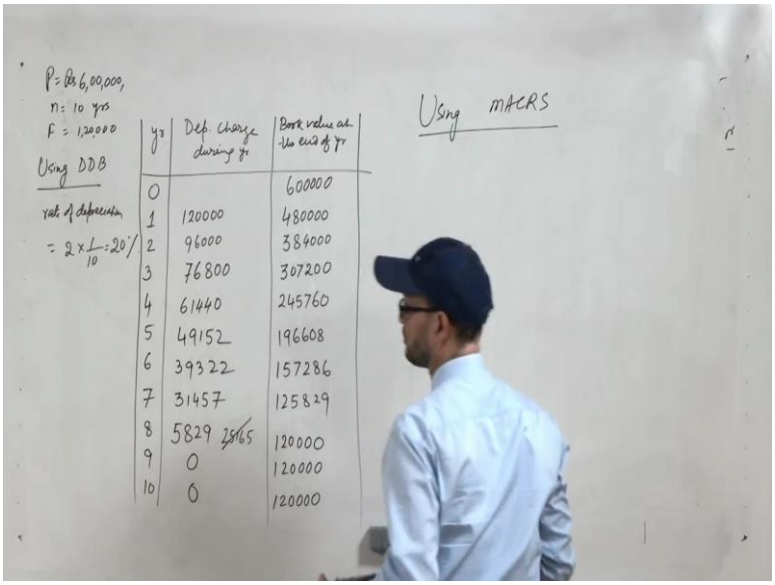

We will solve it using a declining balance method as well MACRS. Now using the declining balance method and that too double declining balance method, so P it is Rs. 600,000, n is 10 years, F is 1,20,000. Now using DDB, double declining balance method, date of the

depreciation will be will be 2 times 1 by 10 will be 20%. It comes out to be point 2 that is 20%.

Now we will use the table again, we have year, depreciation charge during year and book value at the end of year. We are again at zero year and the value is 6,00,000. Now rate of depreciation is 20%, so in the first year, 20% of 6,00,000 that is 1,20,000. So it comes out, the book value comes out to be after the end of first year 6,00,000 - 1,20,000, this is for 4,80,000. Then in the second year, 20% of this amount, so this will be 96,000.

So this comes out to be 3,84,000, 4,80,000 - 96,000 3,84,000. So in the third year depreciation charge will be 20% of 3,84,000, that is 76,800. So it comes out to be, the book value at the end of third year comes out to be 3,07,200. So in the fourth year, 20% of this amount, so this will be 61,440 and this will be 2,45,760. Then in the fifth year you get 20% of this, so point 2 times 245760, it will be 49,152 and book value comes out to be 1,96,608.

Now the 20% of this will be the depreciation charge during the year 6, it will be 39,322. So 196608 - 39322, it will be 157286. Now in the seventh year, the depreciation charge will be 20% of this, it will be 31457, so 157286 - 31457 that is 125829. Now if we calculate that the precision charge during the eight year it should be 20% of this amount and this comes out to be 25165.

So if we take 25156 165 then it is decreasing to a value something close to 1,04,000 or close so. Now the salvage value at the end of its life was said to be 1,20,000 only, so the book value cannot go beyond this salvage value. So basically we have to use the adjustment basis so that the salvage value comes out to be not less than 120,000 or it should be coming as 1,20,000.

So in that case this will be not be used, basically we will use the depreciation amount as only 5829 and that is why it will come as 1,20,000. So this is basically the adjustment what we had earlier discussed in the case of declining balance method so that you get this value. Later on during the two periods your depreciation will be and the book value remains out to be 1,20,000 at the end of 10 years.

So this is the depreciation schedule schedule for the double declining balance method. Now let us go to the method of MACRS. So as we had discussed that the MACRS uses the recovery period, so in the case of that, now using MACRS, you have recovery period as 7

years. Now for that we can compute the table and we that what percentage of the first cost will be used as the depreciation charge. Now if we go for the year end, it will go for 8 years.

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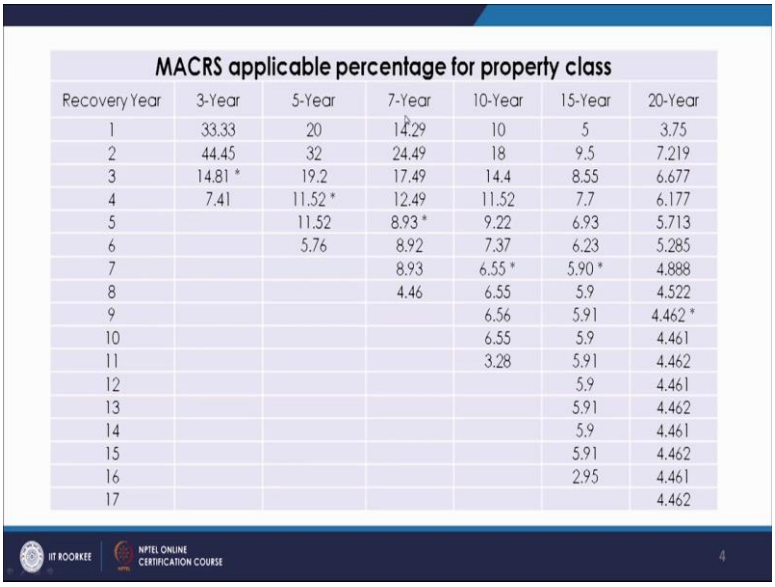

MACRS applicable percentage for property class

Recovery Year	3-Year	5-Year	7-Year	10-Year	15-Year	20-Year
1	33.33	20	14.29	10	5	3.75
2	44.45	32	24.49	18	9.5	7.219
3	14.81 *	19.2	17.49	14.4	8.55	6.677
4	7.41	11.52 *	12.49	11.52	7.7	6.177
5		11.52	8.93 *	9.22	6.93	5.713
6		5.76	8.92	7.37	6.23	5.285
7			8.93	6.55 *	5.90 *	4.888
8			4.46	6.55	5.9	4.522
9				6.56	5.91	4.462 *
10				6.55	5.9	4.461
11				3.28	5.91	4.462
12					5.9	4.461
13					5.91	4.462
14					5.9	4.461
15					5.91	4.462
16					2.95	4.461
17						4.462

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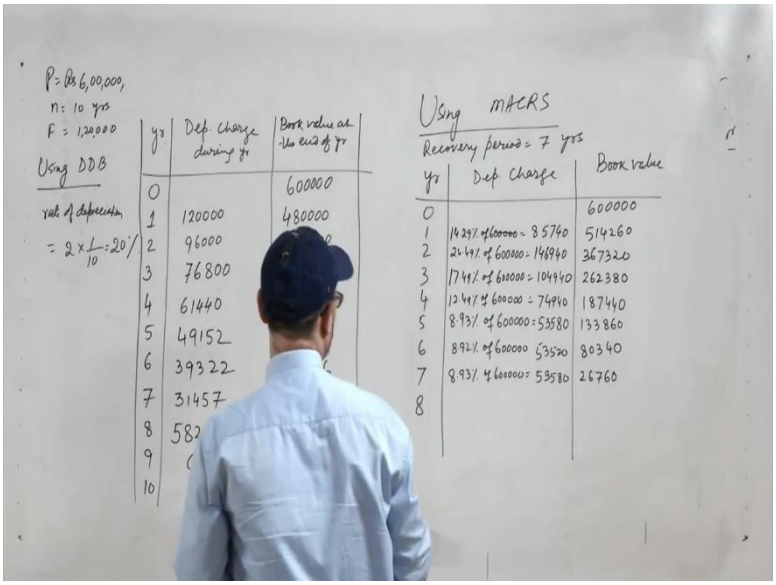

MACRS uses the half year convention and DDB with switching to straight line. So anyway our the amount is 14 point 29% of the first cost of the asset. So it goes for **sss** 8 years because this is half year convention. We can get this table by calculating the values, so the star shows the switching to straight line. So in the first year, it will be 14 point 29% of 6,00,000, so it will be 85740.

And you can get as 514260 as book value at the end of first year. Then in the second year, it is 24 point 49% of 6,00,000, so it will be 146940, so once subtracted from 514260, it comes out to be 367320. So the third year it will be 17 point 49% of 6,00,000, so it will be 104940 subtracted from 367320, it comes out to be 262380. So in the fourth year it will be 12 point 49% of 6,00,000, it is 74940 subtracted from 262380, 187440.

Next is 8 point 93%, 53580 - so 187440 - this amount 133860. From here there is switching occurring, so point 0892 multiplied by 6,00,000, this will be the amount 53520. 8 point 92% of 6,00,000, so it is 80340. Now we see that this 8 point 92 is going for 8 point 93 again percent so 8 point 93% again, it will be 53580, 80340 - 53580, that is 26760. And it is nothing but the half of this, so this is 4 point 46% 6,00,000, this is 26760, so it will be 0.

So in the MACRS as you see that the whole cost is recovered and you get the final salvage value is zero. So this is how the MACRS system works. We solve the problems based on MACRS for any property class using this table. Thank you.