]Engineering Economic Analysis
Professor Dr. Pradeep K Jha
Department of Mechanical and Industrial Engineering
Indian Institute of Technology Roorkee
Lecture 40
Problem Solving Based on Income Tax Analysis

Welcome to the lecture on problem solving on tax analysis. So in this lecture we are going to solve the problem based on the tax calculations and the associated changes in the cash flow diagrams.

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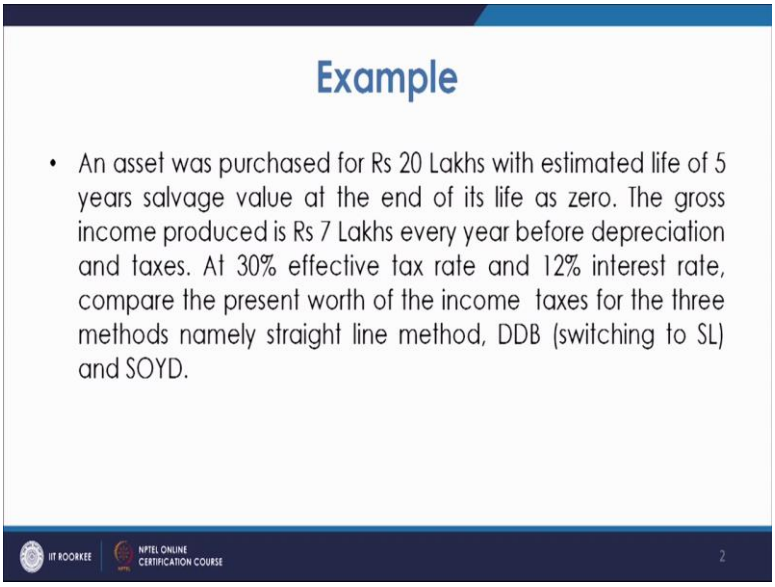

So we are going to discuss about a problem in which the asset is said to be purchased for a Rs. 20,00,000 with an estimated life of 5 years, salvage value at the end of its life as 0. So you are taking the first cost of the asset as 20,00,000 and life is five years. Then gross income produced is Rs. 7,00,000 every year so income every year is Rs. 7,00,000. Effective tax rate is 30% and the internal rate of return, interest rate is given as 12%.

So basically we have to find the present worth of income taxes for the three methods. The three methods are Straight Line Method, Double Declining Balance Method Switching to Straight Line and Sum of Years Digit Method. So with the three methods we will calculate the income taxes and associated cash flows and based on that we will have the present worth values of the income tax values and then we will try to compare them.

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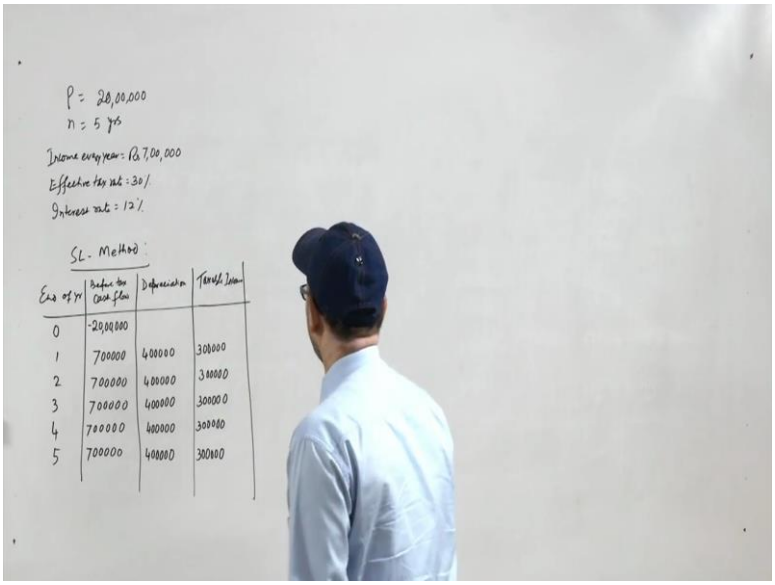

So let us say, if we have the Straight Line Method, the equipment will have the cash flow before tax will be like this you have end of year and before tax cash flow, you have depreciation. So in the 0 year, you are having 20,00,000 of the first cost. First, second, third, fourth and fifth year, you are having an income. So this is minus and income is 7,00,000 every year.

Now, if you look towards the depreciation charges, being the five year property, the depreciation amount every year will be 4,00,000. So taxable income we can have because these depreciation charges will be deducted from the, so it will be 3,00,000. Then after-tax cash flows we can calculate, so in the after-tax cash flows you will have 20,00,000 in the beginning, it is minus value.

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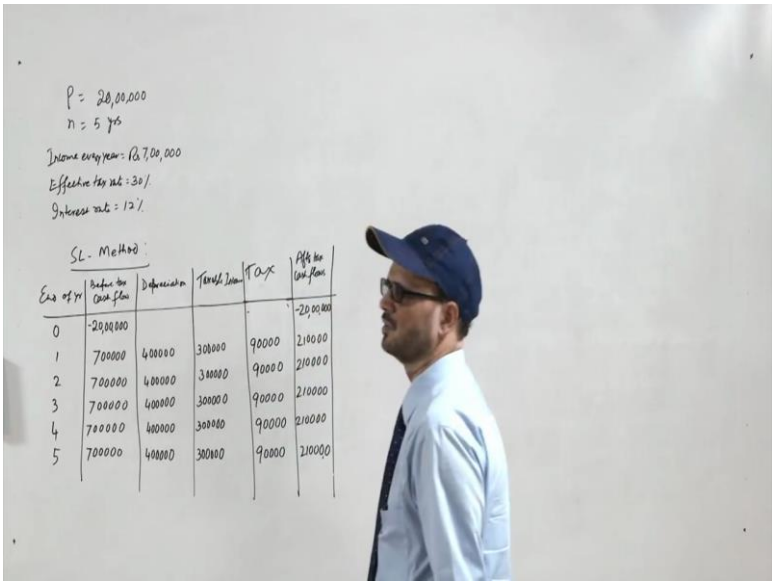

And then you will have before that basically we have to compute the tax, so we have to compute the tax. Effective tax rate is 30%, so it is 90,000 in every case. Then in the end you have after-tax cash flows, so you have this much as the tax. Basically not on the 7,00,000 but basically you are giving the tax on 3,00,000 so that is coming as 90,000.

The after-tax cash flows comes out to be, you have -20,00,000, then this will be 2,10,000, so this is how the after-tax cash flow will look like.

Ya, one modification is there, basically we have this amount as the tax, so after-tax we have the income as the before tax income - this tax, so this will be 6,01,000. In every case it will be 6,01,000, instead of 2,01,000, you have 6,01,000. So this is how your after-tax cash flows will look like using the Straight Line Method.

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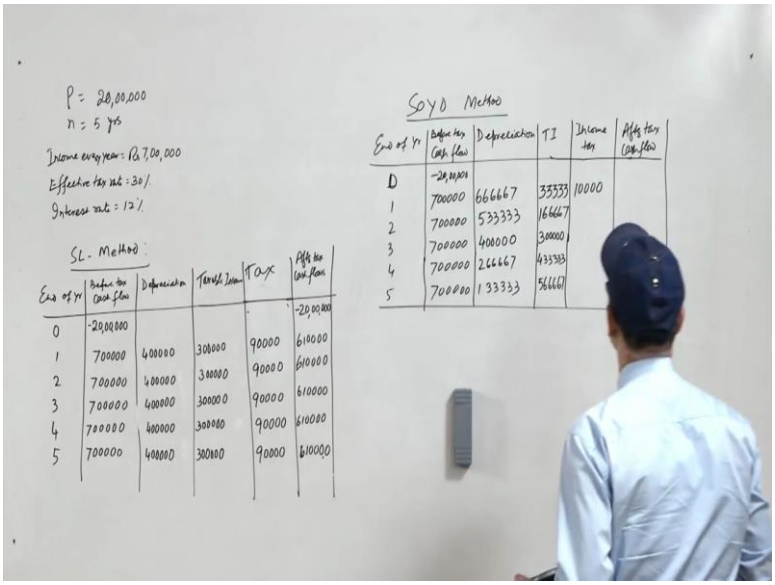

Now let us see for the SOYD method, in the SOYD method again we will have the same table, end of year, before tax cash flow and we have depreciation, we have taxable income, we have income tax and after-tax cash flow. So in the first year, now let us see, our this is 0, so we have -20,00,000 and then for the five years we have income as 7,00,000. So 7,00,000 is the income every year.

Now in the case of SOYD, we know that the depreciation during the first year will be 5 upon sum of years digit, so some of years digit is basically nothing but 5 into 6 by 2, so it is 15. So 5 by 15 into 20,00,000, so it will be 666667, 6,66,667. Then next time it will be 4 by 15 into 20,00,000, so it is 80,00,000 divided by 15, it will be 533333. Then next will be 3 by 15 into 20,00,000, so it will be 4,00,000.

Next will be 2 by 15 into 20,00,000, so it will be 266667 and similarly in the end it will be 1333333. So this is how there will be changing the depreciation as compared to the Straight Line Method.

Now taxable income will be basically the difference of the income and the depreciation charge. So 7,00,000 - this amount this is 33333, then in the second year- 533, it will be 166667, then further 3,00,000 and then - 266667, that is 433333 and then it is 7,00,000 - 133333 will be 566667. So this is how your taxable income will be calculated.

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Then you have to find the income tax. Income tax will be 30% is the effective tax rate, so 30% of this amount. So this will be basically 10,000, this will be 50,000, this will be 90,000 and this will be 1,30,000 and this will be 1,70,000. Then after-tax cash flow will be shown as -20,00,000 and now your income will be 7,00,000 - 10,000 so 6,90,000. 7,00,000 - 50,000 so 6,50,000.

We have 7,00,000 - 90,000 to 6,10,000, we have 7,00,000 - 130,000, so 5,70,000 and this is 7,00,000 - 170,000 so 5,30,000. So this is how the after-tax cash flow will look like in the case of SOYD method.

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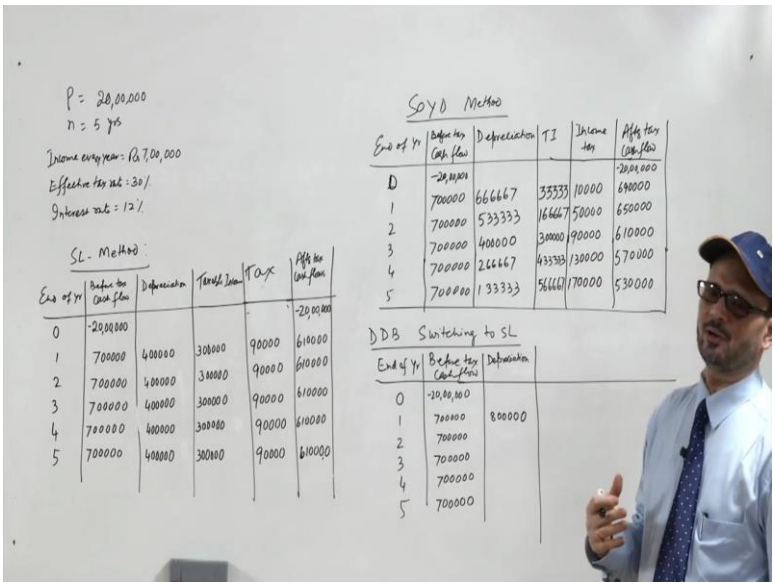

Now let us see with the DDB switching to straight line. Now in the case of DDB switching to straight line, we will have the table. So in that again we have, the before tax cash flow -20,00,000 at 0 time and then 7,00,000 as income every year. Then you have the depreciation, so the depreciation in the first year, it will be basically, if you are using the double declining balance, the rate of depreciation is 1 by 5 into 2, so 40%, so it will be 8,00,000.

Second time it will be 40% of 60, that is the book value, so that is 24% and that will be 4,80,000. Further in the third year, so if we take the DDB with switching, you have in the first year as 40%, second year as 24%, no switching third year as 14.4%, fourth year as 10.8% and fifth year as 10.8%. That we had done earlier, so you get 14.4% of 20,00,000, so it will be 2,88,000. Further it will be 2,16,000 and 2,16,000 during the last two years.

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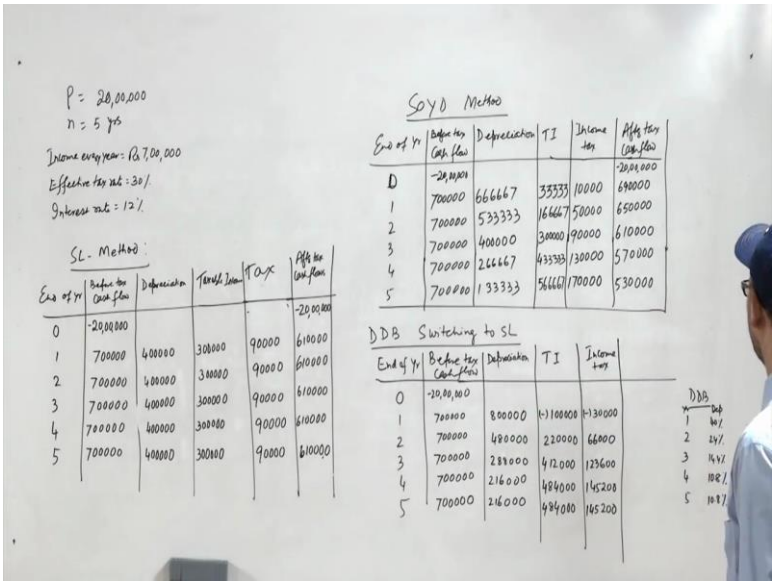

Then if we look at here, the taxable income is basically, what we see is, we have to get the tax benefit here in this case so you get -1,00,000 and then in these cases you are getting 2,20,000. It will be 4,12,000, this will be 4,84,000 and 4,84,000. So if you look at the income tax, in this case you will have income tax saving and if you take the tax rate as 30% unless it is said there is percentage of it is being taken, if we take the same data, we have a tax saving of 30,000.

Here it is 66,000, this is 1,23,600, this is 1,45,200 and 1,45,200. After tax cash flow, so this can be seen as -20,00,000, here it will increase by 730,000, you have 7,00,000 - 66,000 6,34,000. You have 5,76,400, then 5,54,800, and 5,54,800.

So this is how the depreciation schedule. Now we have to see what is the present worth of the income tax which is paid? So if we calculate the present worth of the income taxes using the three methods, present worth of income tax straight line, so what we get is, you are the paying the tax of 90,000 every year. So at zero time 90,000 will be multiplied with P by A and rate of interest is 12%, so 12 5.

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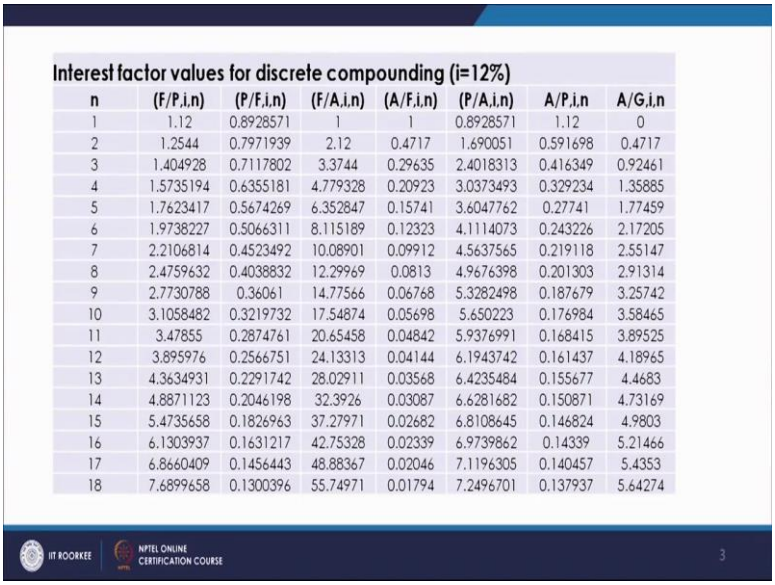

Interest factor values for discrete compounding (i=12%)

n	(F/P,i,n)	(P/F,i,n)	(F/A,i,n)	(A/F,i,n)	(P/A,i,n)	A/P,i,n	A/G,i,n
1	1.12	0.8928571	1	1	0.8928571	1.12	0
2	1.2544	0.7971939	2.12	0.4717	1.690051	0.591698	0.4717
3	1.404928	0.7117802	3.3744	0.29635	2.4018313	0.416349	0.92461
4	1.5735194	0.6355181	4.779328	0.20923	3.0373493	0.329234	1.35885
5	1.7623417	0.5674269	6.352847	0.15741	3.6047762	0.27741	1.77459
6	1.9738227	0.5066311	8.115189	0.12323	4.1114073	0.243226	2.17205
7	2.2106814	0.4523492	10.08901	0.09912	4.5637565	0.219118	2.55147
8	2.4759632	0.4038832	12.29969	0.0813	4.9676398	0.201303	2.91314
9	2.7730788	0.36061	14.77566	0.06768	5.3282498	0.187679	3.25742
10	3.1058482	0.3219732	17.54874	0.05698	5.650223	0.176984	3.58465
11	3.47855	0.2874761	20.65458	0.04842	5.9376991	0.168415	3.89525
12	3.895976	0.2566751	24.13313	0.04144	6.1943742	0.161437	4.18965
13	4.3634931	0.2291742	28.02911	0.03568	6.4235484	0.155677	4.4683
14	4.8871123	0.2046198	32.3926	0.03087	6.6281682	0.150871	4.73169
15	5.4735658	0.1826963	37.27971	0.02682	6.8108645	0.146824	4.9803
16	6.1303937	0.1631217	42.75328	0.02339	6.9739862	0.14339	5.21466
17	6.8660409	0.1456443	48.88367	0.02046	7.1196305	0.140457	5.4353
18	7.6899658	0.1300396	55.74971	0.01794	7.2496701	0.137937	5.64274

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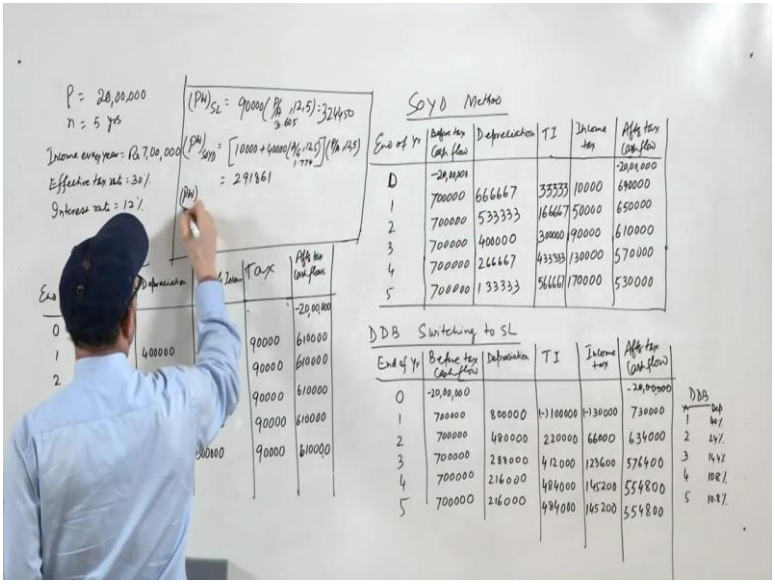

P by A 12 5 can be seen here and P by A 12 5 is coming out to be 3.605. So the amount of tax what you are paying, that is worth of 3.605 multiplied by 90,000 and this is 3,24,450, using the Straight-Line Method.

If you go with SOYD, SOYD will be calculated just look at the taxes, there is 40,000 of increment every time, so we can have the annual equivalent first of all for all that or even we can get it all them as 10,000 multiplied by P by F 15 1 12 1+ 50,00 multiplied by P by F 12 2 90000 multiplied by P by F 12 3130,000 multiplied by P by F 12+ 170,000 multiplied by P by F 12 5.

So this can be done by using the geometrical gradient series, uniform gradient series basically. So it will be 10,000 + 40,000 A by G 12 5 and once we get, this will be multiplied. So this will be the equivalent annual series and its equivalent at the present time for that you have to multiply by P by A 12 5. A by G 12 5 A by G 12 5 is coming out to be 1.774. So it will be 40,000 multiplied by 1.774 + 10,000 multiplied by P by A 12, 5 that is 3.605.

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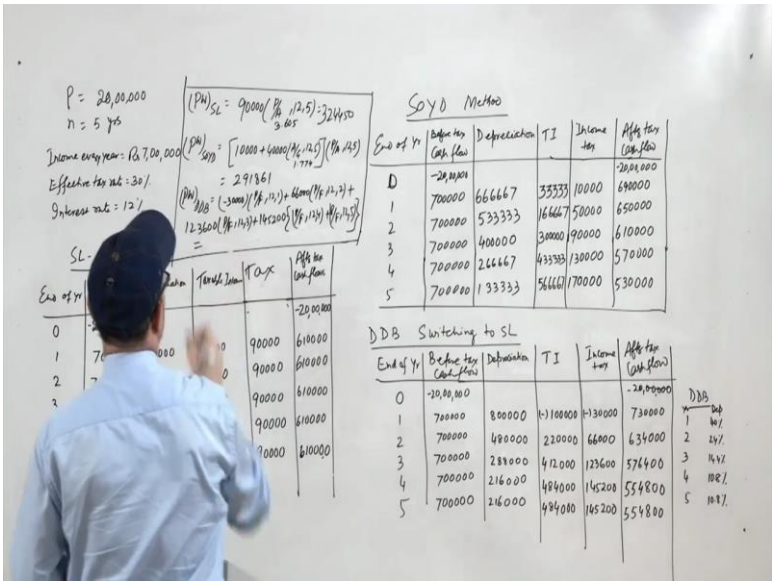

So it is coming out to be 2,91,861. So in the case of straight-line method we have paid the present worth value of the income tax as 3,24,000. In case of SOYD it is 2,91,861. Now in the case of DDB, we see here we have - of 30,000 multiplied by P by F 12 1 + 66,000 multiplied by P by F 12 2 + 1,23,600 multiplied by P by F 12 3 + 1,45,200 multiplied by P by F 12 4 + P by F 12, 5.

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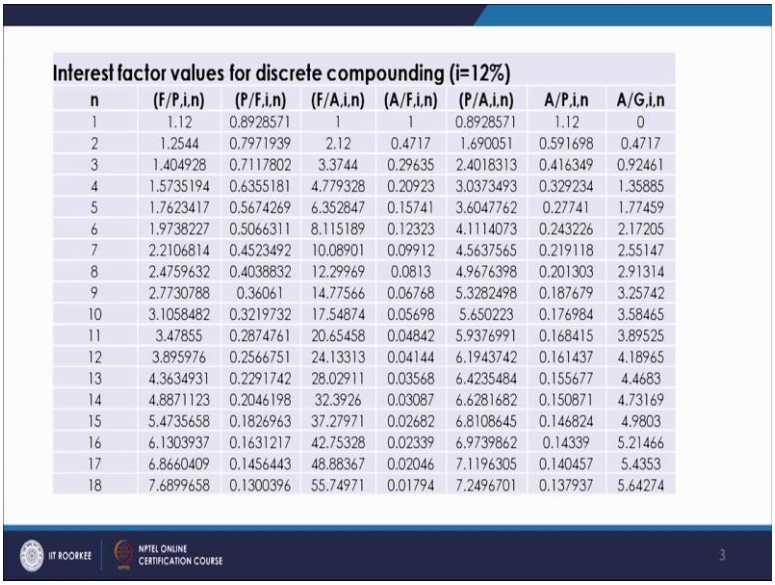

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So we have to calculate this P by F 12 1 is P by F 12 1 is .893, so 30,000 multiplied by .893 26790 + 6000 multiplied by P by F 12, 2 that is .797 that is 52602 + 123600 multiplied by P by F 12 3 .7712 that is 88003 + P by 12 4 P by F 12 5 so P by F 12 4 is .635 and this is .567, so if we add them it will be 1.2 so so point 635 + .567 that is 1. 1.202 multiplied by 145200.

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So it is 174530 so which will be added with 88003, 56202 - 26790 so it is coming out to be 288345. So these are the three values of present worth of the income tax which is paid using these three methods of income taxes, I mean three methods of depreciations cited and the resultant cash flow is also shown.

And it is seen that using the double declining balance method switching to straight-line, it gives you the minimum value of the present worth value of the income tax paid followed by SOYD and then the maximum is paid by the straight-line methods. So we can solve more questions based on the tax analysis and our confidence will increase as we increase in the number of questions solved.

So this is the end of this lecture and this is also the end of the course, the last lecture has finished. I hope you have enjoyed, I feel that more and more you solve the problems based on this economic analysis you will get be having more and more confidence. I hope you also solve the tutorial and assignment questions and maybe I am I am quite sure that you might have got a lot of confidence.

So I hope that you will do well if you are appearing in the exam, do better and best of luck for the exam if you are willing to get the certification for this course. Thank you very much.