Depreciation, Alternate Investment and Profitability Analysis.
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Lecture-20.
Profitability Analysis – Discount Cash Flow II.

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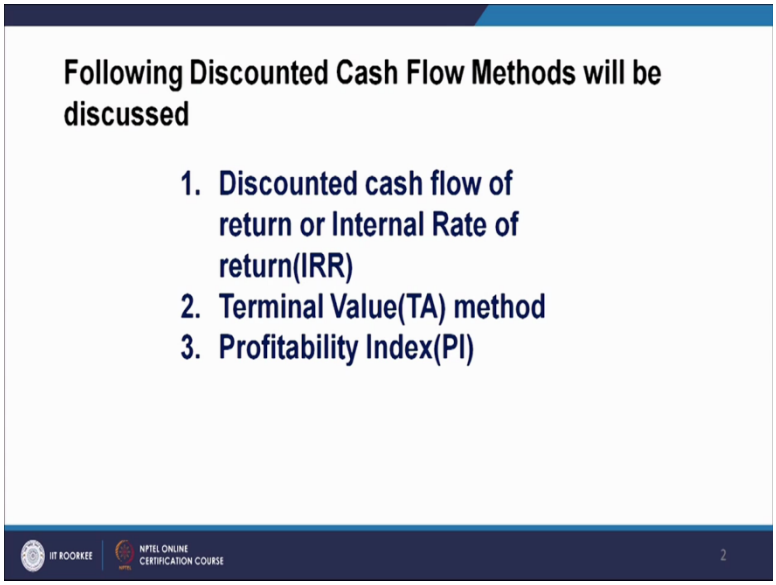

Welcome to the course Depreciation, Alternate Investment and Profitability Analysis. We are continuing with the module three which is profitability analysis and this is the last lecture in the series of 20 lectures. Here, we will discuss the rest profitability analysis methods under discounted cash flow. The discounted cash flow methods are a set of methods which use time value of money. Following discounted cash flow methods will be discussed, Discounted cash flow of return or internal rate of return IRR, terminal value TA method and profitability index.

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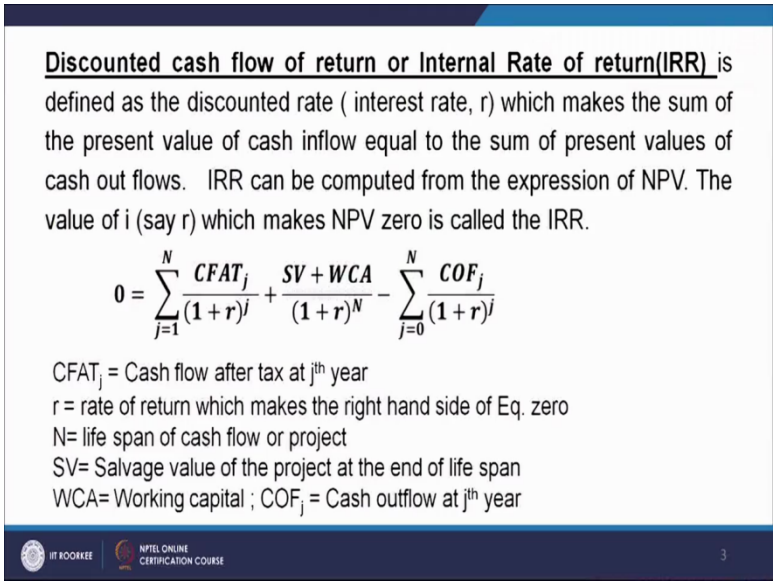

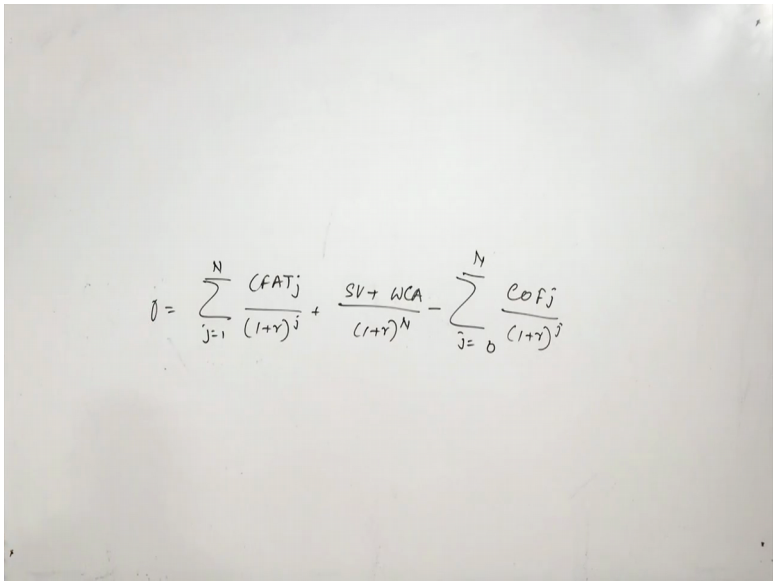

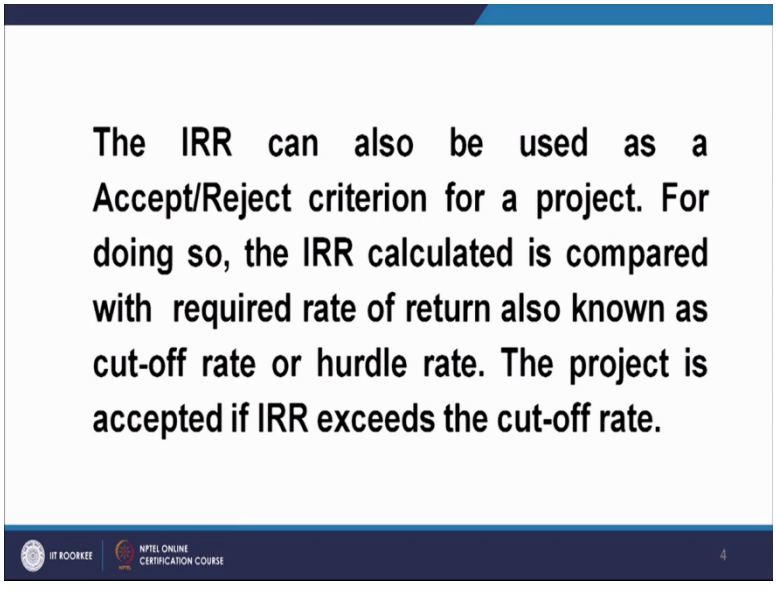

Now, let see the formula of discounted cash flow of return or internal rate of return. The discounted cash flow of return or internal rate of return is defined as the discounted rate, interest rate r which makes the sum of the present value of the cash inflow equal to the sum of the present value of the cash out flow. IRR can be computed from the expression of NPV which we have already seen. So, this is the NPV equation.

Now, if I put zero in place of NPV that means the value of I if I put value of I is equal to r then this equation, this left hand side of equation becomes zero. So, IRR can be computed from the expression of NPV, the value of I say r which makes NPV zero is called IRR, that is the internal rate of return. Now, with the examples we will do this, so it becomes more clear to you. The IRR can be used as a accept or reject criteria for a project, for doing so the IRR calculated is compared with the required rate of return also known as cut-off rate or hurdle rate. The project is acceptable if IRR exceeds the cut-off rate.

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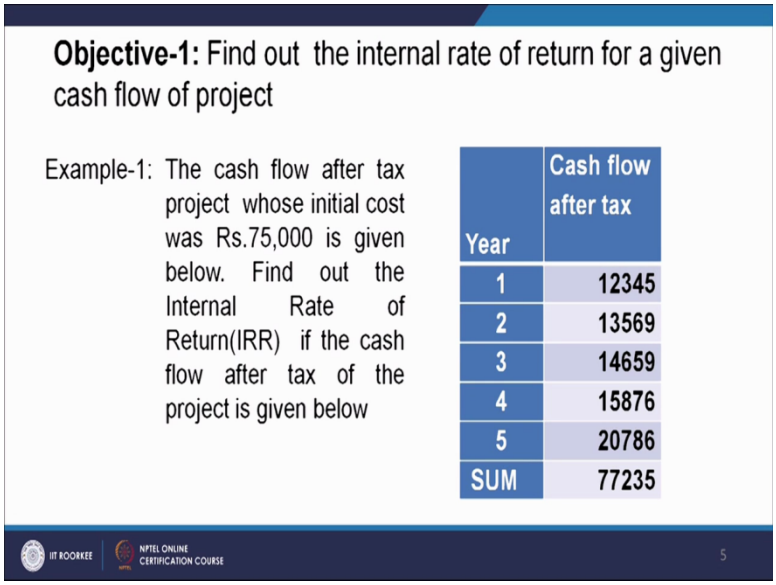

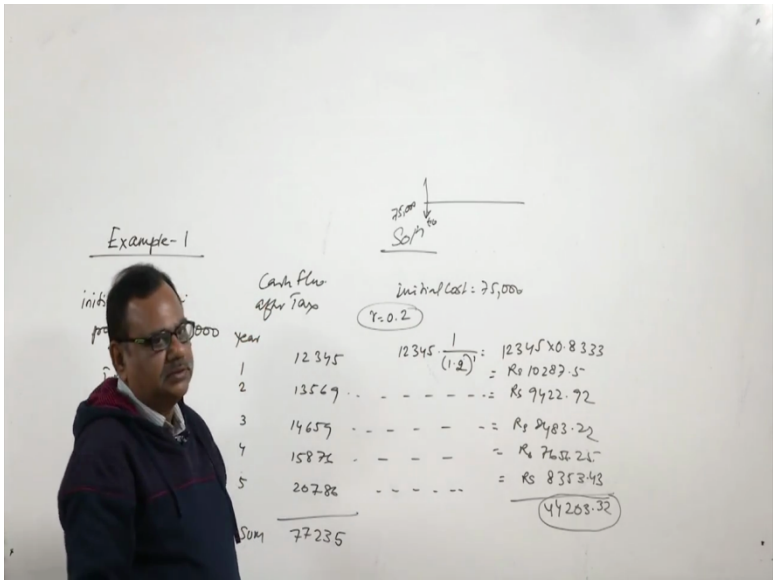

Now, let us take this first example, the objective of this first example is find out the internal rate of return for a given cash flow of project. Now, the initial cost of the project is, initial cost of the project is 75000. Find out the internal rate of return. So, I have to find out what is IRR equal to r, what is the value of r, which we will make the NPV equation equal to zero. Now, what are the cash flows available after tax, this is year, so this is 1, 2, 3, 4, 5, this is 12345, 13569, 14659, 15876, 20786 and if I do the sum, this is 77235.

Now, solution, so, initial cost of the machine was 75,000. So, as this cash flow in the time line at t equal to zero. This cash flow takes place 75,000. So, this is the present value we have not to change this because this is the present value, whereas the cash inflows here, we have to convert them to the present value. Now, if I use r is equal to 0.2 then these values will and try to convert this. So, this will be converted for r equal to 2. This will be 12345 into 1 by 1.2 to the power 1. This comes out to be 12345 into 0.8333 comes out to be Rupees 10287.5.

Now, similarly for r equal to 2 if I calculate this one, this comes to be Rupees 9422.92, this comes to be Rupees 8483.22, this will come Rupees 7656.25 and this comes as Rupees 8353.43 and if I sum this, this comes out to be 44203.32. So, what I find that if I am taking r is equal to 2 that is 20 percent, this value is 44000 whereas my initial cost is 75,000. So, the present value of the cash flow is less than the cash outflow. Hence, the value of r should be increased.

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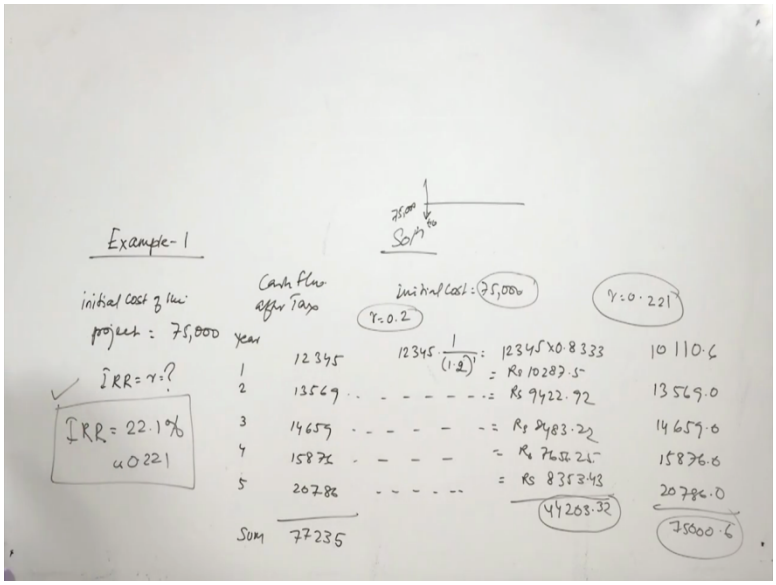

Now, if I am going for 70, if I going for r is equal to 0.221 then I am getting these values 10110.6, 13569.0, 14659.0, 15876.0, 20786.0 and this comes out to be 75000.6. So, if I am taking this to be r value is to be 0.221, this value matches with this value, that means the difference is zero. For the present problem when I take r is equal to 0.221 that is 22.1 percent the sum of present value of the cash inflow becomes equal to 75000.6, which is almost equal to the cash outflow which is 75000 and thus, the internal rate of return IRR for this problem is 22.1 percent or 0.221, this is my answer.

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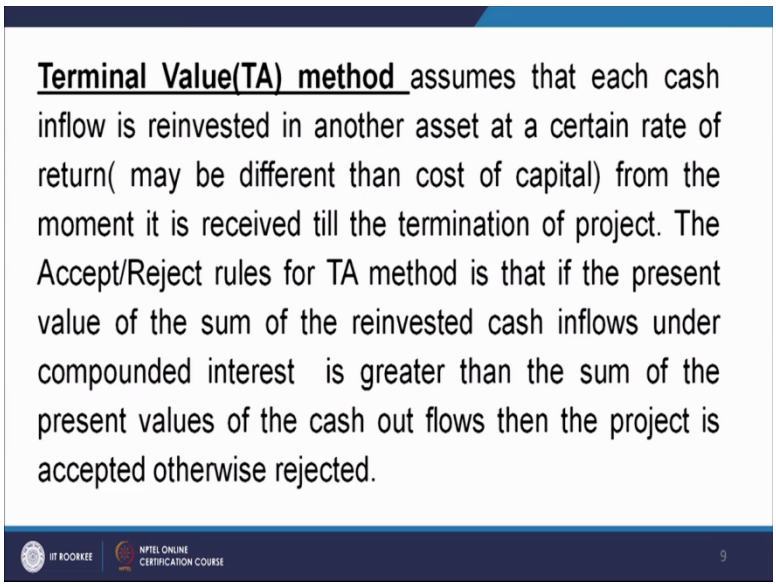

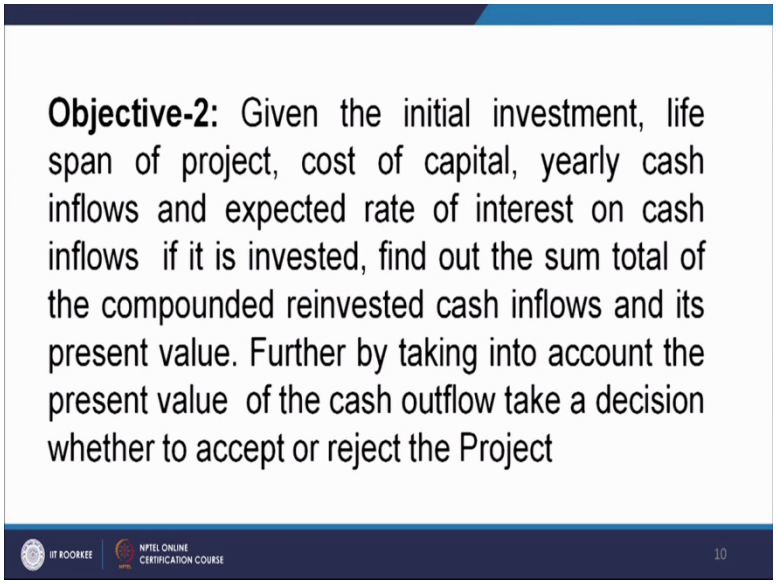

Now, let us take terminal value TA method. TA method assumes that each cash flow is reinvested in another asset at a certain rate of return and this rate may be different than the cost of capital, from the moment it is received till the termination of project. This the accept/reject rule for TA method is that if the present value of the sum of the reinvested cash inflows under compounded interest is greater than the sum of the present value of the cash outflows then the project is accepted, otherwise rejected.

The objective is given the initial investment life span of the project, cost of the capital, yearly cash inflows and expected rate of interest on cash inflows, if it is invested, find out the sum total of the compounded interest cash flows and its present value. Further by taking into account, the present value of the cash outflows take a decision whether to accept or reject the project. Now, let us take the example number two to demonstrate this. Basically what it is doing?

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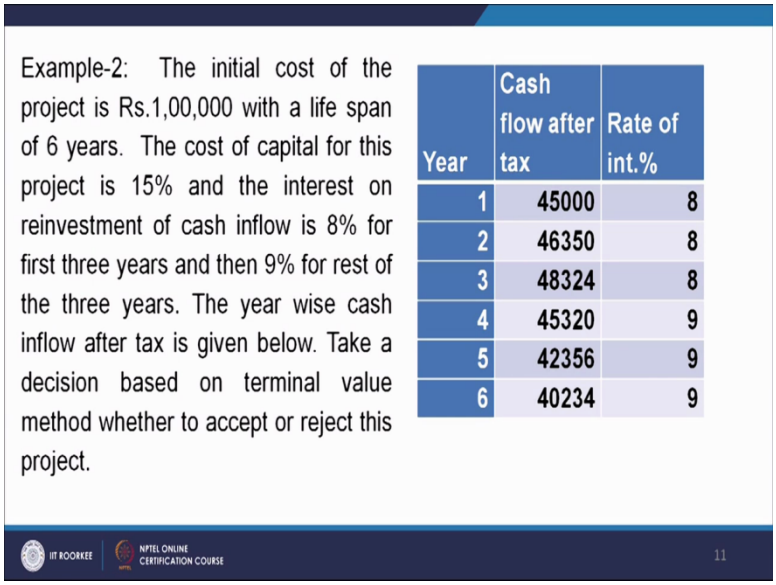

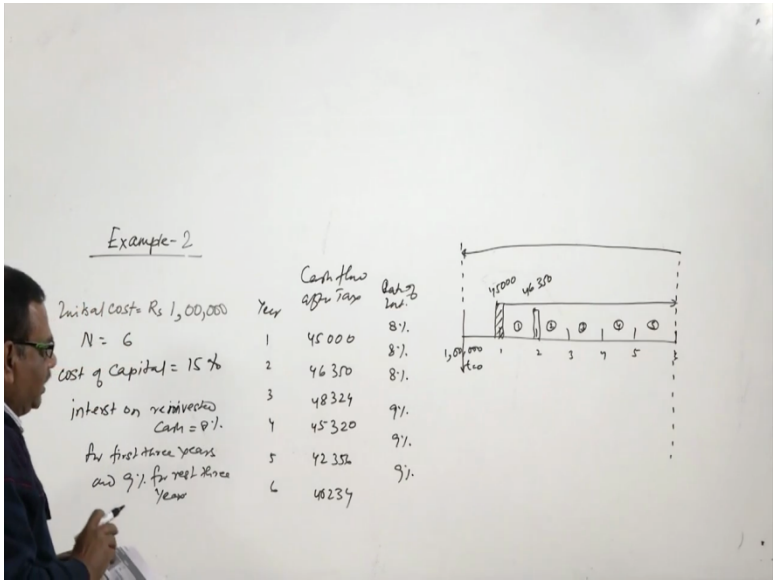

Now, we take example number two, the initial cost Rupees 1 lakh, life span of the project is 6 years, cost of capital is 15 percent, interest on reinvested cash is equal to 8 percent for first three years and 9 percent for rest three years. Now, if we see the cash flow after tax, if this is the year, this 1, 2, 3, 4, 5, 6 and if this is the rate of interest. For first three years I have 8 percent and for the next three years I have 9 percent. This is the question.

If I want to make you understand what is the difference between the earlier one and this. In the time line t equal to zero I am sinking some amount here, in this case 1 lakh and then each year, I am getting some value like here 45000, 46350, 48324, 45320, 420356, 40234. So, this value is 45000, this value is 46350 and this is the end of my period. Now, cash flow, if the cash flow of the first year is invested up to end of the project.

Now, if this amount is invested and the interest is taken up to the end of the period that means it will earn interest up to this. Now how many years in the first year? This is one year, two, three, four, five. This will be invested for five years and how I arrive at five, this is 6 - 1 is equal to 5 and for this, this is 6 - 2 for 4 years. For this 6 - 3 equal to 3 years, this 6 - 4 equal to 2 years and for this 6 - 5 is equal to 1 year like this.

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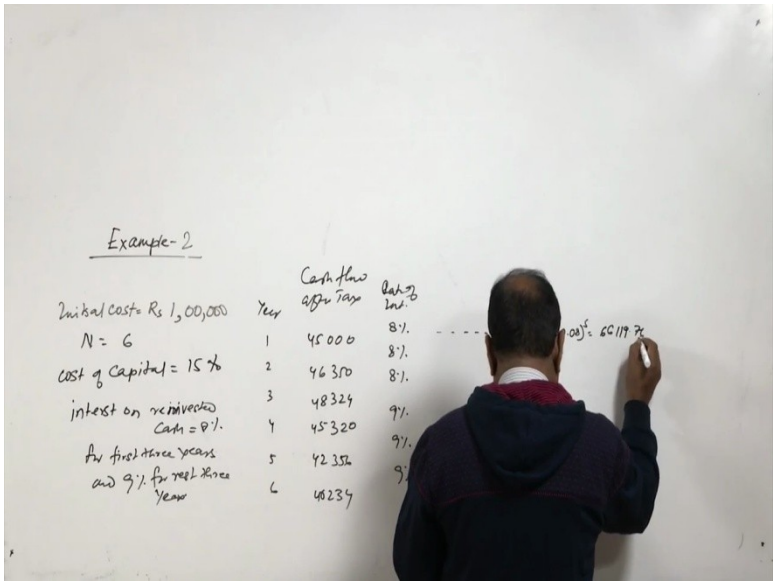

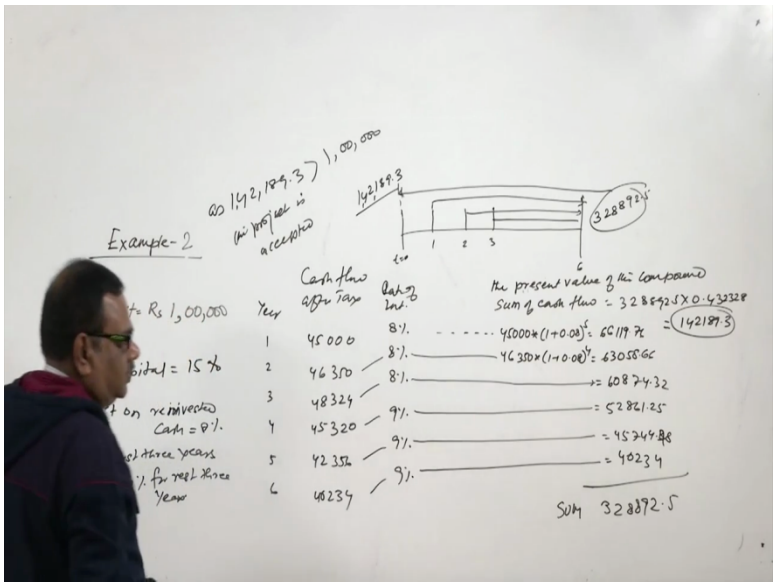

So, this will earn money when it will be invested and then I add up all the final values and then the whole final value is transported back to this. This is the method. Now, let us see this, physically how I am doing. So, the first investment will go up to five years. So, my this investment will grow with 8 percent. So, this will be 45000 into 1 + 0.08 to the power five and this comes out to be 66119.76.

Now, similarly this one will grow 46350 into 1 + 0.08 to the power 4 and this will grow to 63058.66. So, these values will grow, this will grow to 60874.32, this will grow to 52861.25, this will grow to 45744.48 and this will grow because here, this will be zero, so the same value will grow, it will be 40234 and when we add them up the sum is 328892.5. So, in the time value, so, this is t equal to zero at 6 years, the all these values are invested up to 6 years. So, when we add them up then this addition gives you 328892.5, this value.

Now, this value is has to be taken back here, that means present value of this value. So, the present value of the compounded sum of cash flow. The present value of the compounded sum of cash flow is equal to 328892.5 into 0.432328 is equal to 142189.3. So, when it goes here, it becomes 142489.3. Now, this value is more than the present value of the investment and hence, this project is accepted as 142189.3 is greater than 1,00,000, the project is accepted. So, this is the answer.

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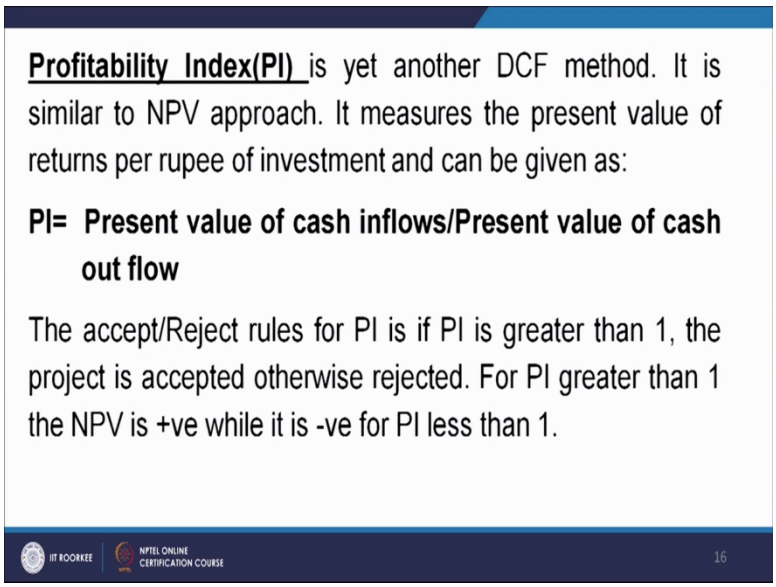

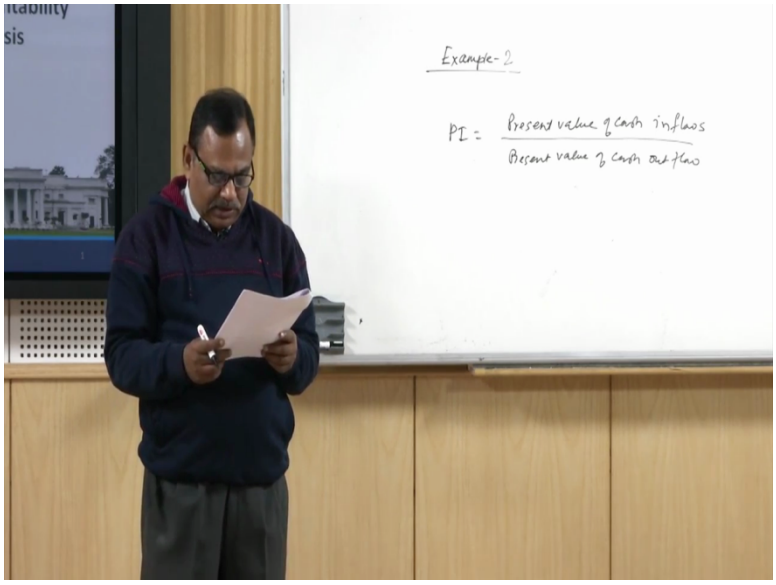

Now, we go for the third method which is called profitability index. PI is yet another DCF method. It is similar to NPV approach. It measures the present value of the return per rupee of investment and can be given as PI is equal to present value of cash inflows divided by present value of cash outflow. The accept/ reject rule for PI is if PI is greater than 1 the project is accepted otherwise rejected. For PI greater than 1 the NPV is positive while if it is less than 1, it is negative for PI less than 1.

Now, the objective three is for this PI, it tells given the initial investment cost of capital yearly cash inflow, find out profit profitability index and take a decision whether to accept or reject the project based on PI. So, here the example number three is diverted to this PI method. Find out the discounted cash flow present value of the two different machines from the data given.

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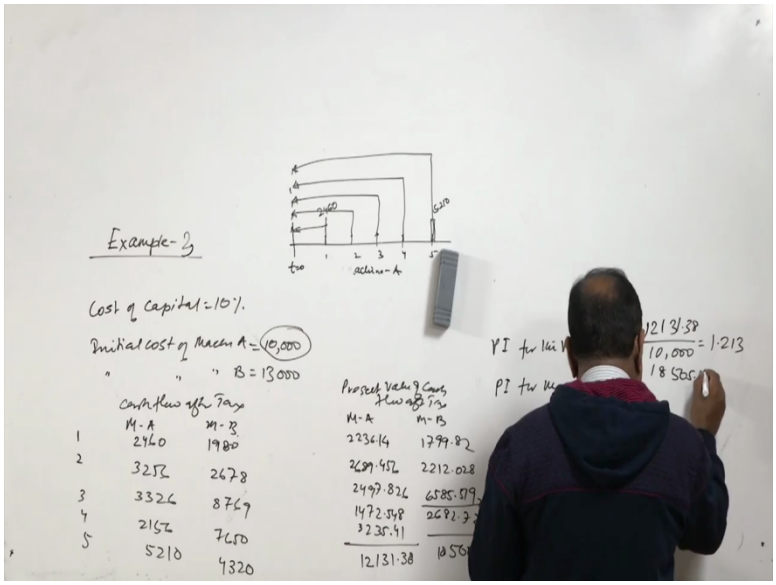

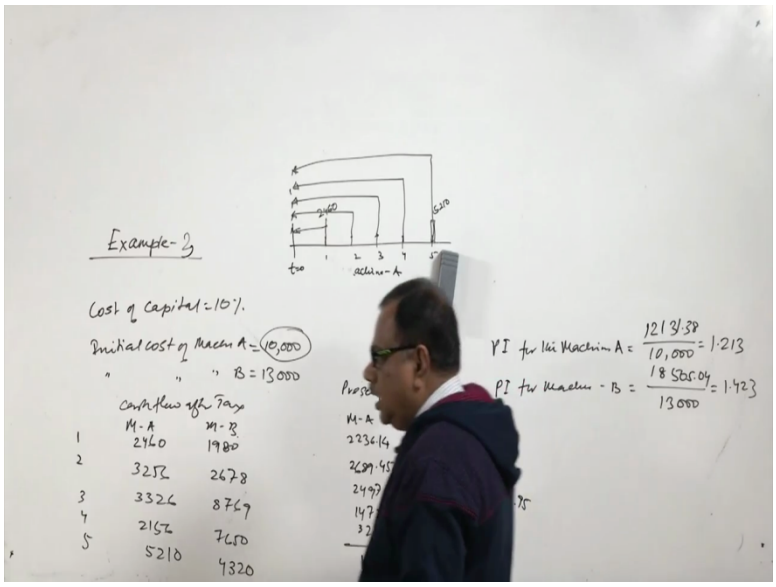

So, cost of capital given is 10 percent, initial cost of machine A is 10000,initial cost of machine B is 13,000 and cash flow after tax machine A, machine B, 12345, this is 2460, 3256, 3326, 2156, 5210, 1980, 2678, 8769, 7650, 4320.

Now, if you calculate the present value of this because this if you see the machine one, this is the time line, machine A 1, 2, 3, 4, 5. Now, here the payment is 5210 and here the payment is 2460. So, what we have to we have to find out the present value of all this and then add it up. So, so first year investment, cash flow, present value of cash flow after tax. Now, if we calculate here, the first year cash flow present value of first year cash flow will be equal to 2460 divided by 1 + r is equal to 2460 into 0.909 is equal to 2236.14.

So, this would be machine A machine B, this is 2236.14. Similarly, PV of second year cash flow is equal to 2460 divided by 1 + r whole square. This is equal to 32 no no this is, this value is 3256 into this comes out to be 2689.46. Now, if we calculate for these two so I can note down this will 2236.14 this is 14. This is 2689.456, 2497.826, 1472.548 and 2335.41 and total comes out to be 131.38. Similarly, if I convert this, this becomes 1799.82, 2212.028, 6585.519, 2682.724, I missed something. Now, there is a entry here 5224.95 and if I take this one, this is 18505.037.

So, once we have calculated all this for the machine A is equal to this value 12131.38 divided by this value 10,000, comes out to be 1.213 and PI for machine B is equal to 18505.04 divided by 13,000 comes out 1.423, as PI of the machine A and B both are greater than 1 both machines can be selected or we can take the B machine if we want more profit.

Now, to summarize the resources required to carry out a project are often less than that available for it. Hence, all investment must be carried out carefully and should be evaluated towards its economic feasibility based on some profitability analysis. In the present lecture, we have demonstrated the internal rate of return, net terminal value and profitability index methods which are discounted cash flow methods, time adjusted and we have selected a number of examples to show how this method works. I hope you have enjoyed this lecture series which are on engineering economic. Good luck. Thank you.