Depreciation, Alternate Investment and Profitability Analysis.
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Lecture-13.
Alternative Investment – Rate of Return Method.

Welcome to the course Depreciation, Alternate Investment and Profitability Analysis. We are continuing with module two which is alternative investment. In the present lecture, I will be dealing a method which is called rate of return method, basically this is not a pure method, this can be applied on any method. We have seen that all our calculations are based on time value of m1y, that means rate of return and that is why if the rate of return changes the decision of selection also changes.

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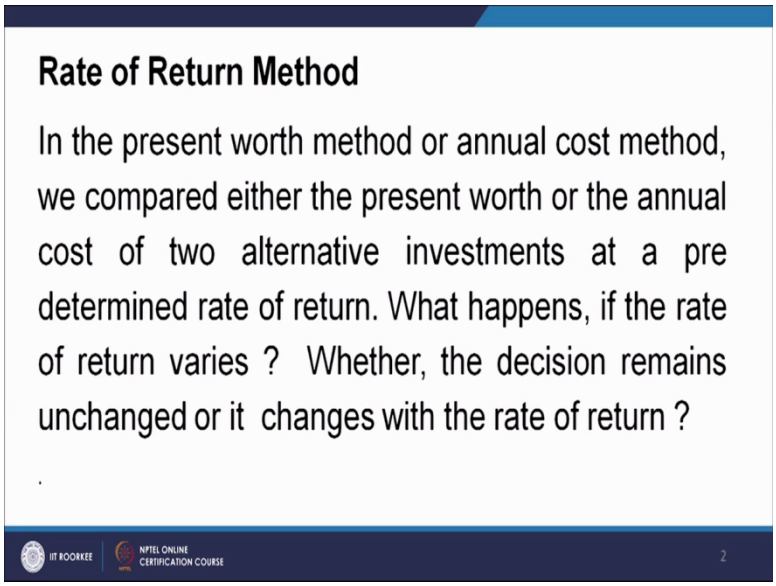

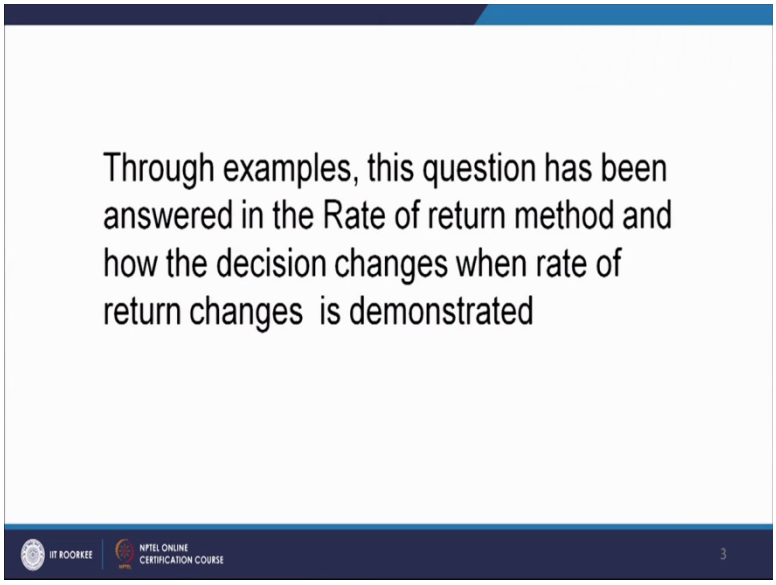

This is what we are exactly going to see in this lecture. The rate of return method, in the present worth method or annual cost method, we compared either the present worth or the annual cost of two alternative investments at a predetermined rate of return. What happens, if the rate of return varies? Whether, the decision remains unchanged or it changes with the rate of return?

This is what we are going to investigate in this lecture and we will see that when rate of return changes the decision will also change. Through examples this question has been answered in the rate of return method and how the decision changes when rate of return changes is demonstrated.

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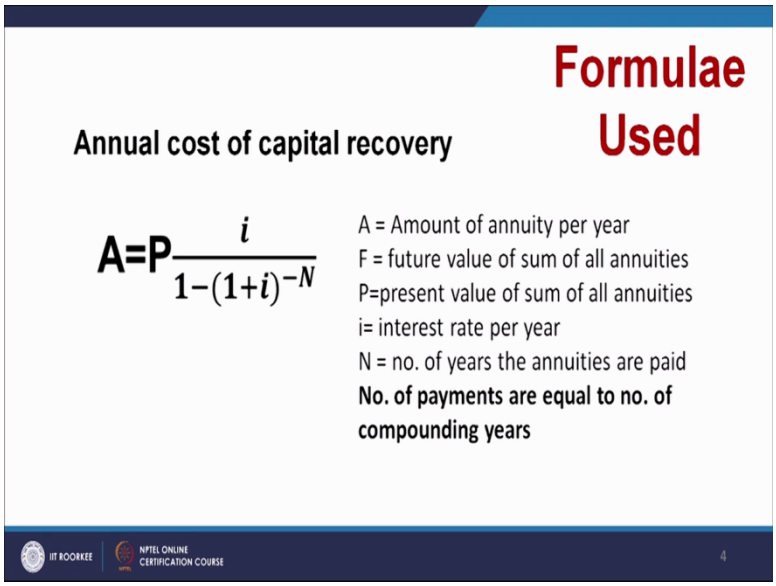

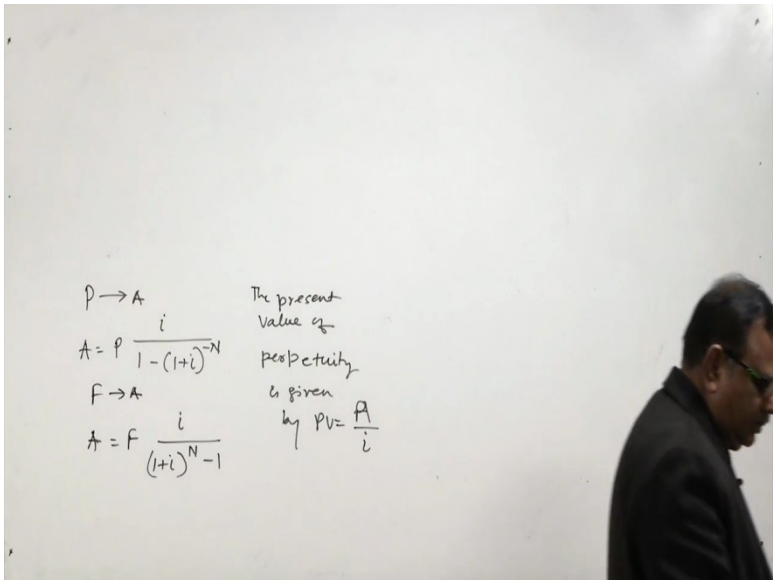

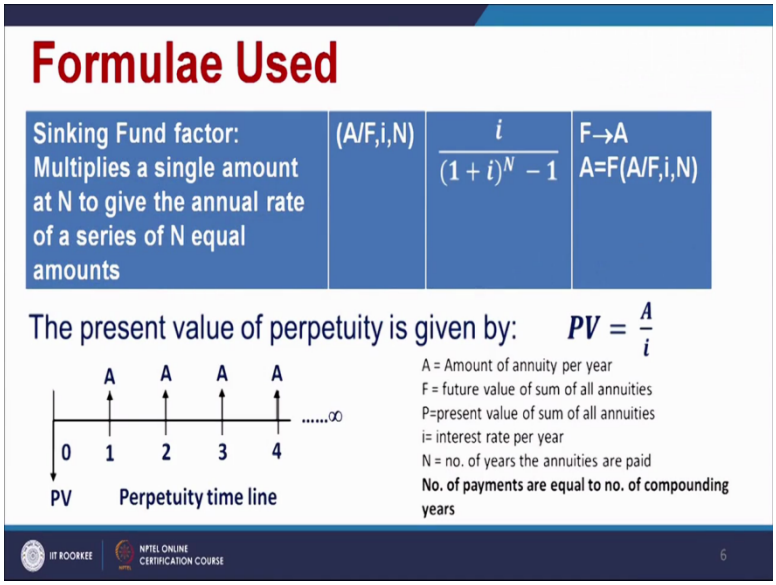

Now we have, we will be using some formulas that if present value is being converted into annuity A, so this is the formula A is equal to P i 1 - 1 + i to the power - N and if you are changing F to A, the formula is A is equal to F into i 1 + i to the power N - 1 and the present value of perpetuity is given by PV is equal to A divided by i.

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Objective-1:Given the capital investments, zero salvage values, same estimated life spans, compare two different investments based on annual cost method for different values of minimum acceptable rate of return (MARR)

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Example-1: Data for two machines A & B are given below. Plot how the annual cost for both machines A & B vary with variation in minimum acceptable rate of return(MARR) from 6% to 30%

	Machine "A"	Machine"B"
Capital investment ,Rs.	Rs.10,000	Rs.8,000
Estimated useful life, year	10	10
Salvage value, Rs.	0	0
Operating cost(labor, material, maintenance, depreciation, insurance, etc) Rs. per year	Rs.3000	Rs.3500

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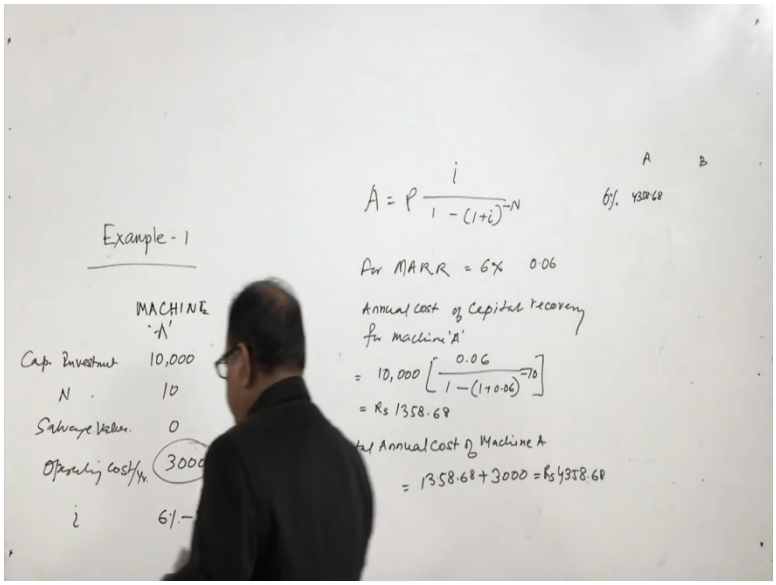

Now let us see through examples, how the rate of return affects the decision. So this is the formula, this is also the formula. Now objective 1 given the capital investment, 0 salvage value, same estimated life spans, compare two different investments based on annual cost method for different values of minimum acceptable rate of return.

So we will be using annual cost method to demonstrate this is rate of return method. Now let's see the example 1 data for two machines A and B are given below. Plot how the annual cost of both machines A and B vary with variation in minimum acceptable rate of return that is MARR from 6 to thirty percent. Now we have the following data with us machine A, machine B capital investment 10000, this is 8000, N that is useful life is 10 years, 10 years, salvage value is equal to 0, 0, operating cost 3000 and 3500.

This is the value and we will see how the annual cost varies if I vary the value of i from 6% to 30% and then plot it and see that what percentage, that means at what value of i the decision will change. Now let us compute, our formula will be A P i 1 - 1 + i to the power - N because we will be converting the present worth, this is the present worth to annuity.

So for MARR equal to 6% or is 0.06, now annual cost of capital recovery for machine A is equal to the cost 10,000 into this formula 0.06 divided by 1 - 1 + 0.06 - 10. This comes out to be the rupees 1358.68. So, total annual cost of machine A is equal to 1358.68 + this value, which is the operating cost per year 3000, this comes out to be rupees 4358.68, so, at 6% I have these value. So 0.this is 6% this is machine A, this is machine B, the annual cost is 4358 4358.68.

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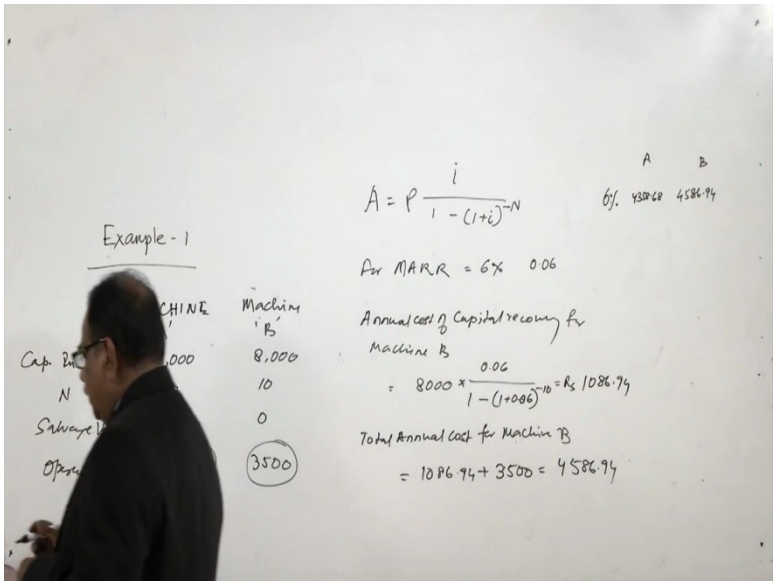

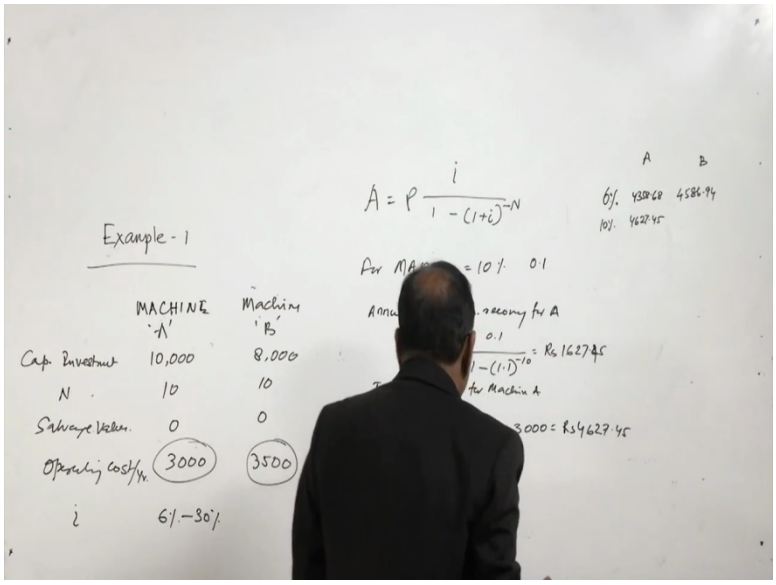

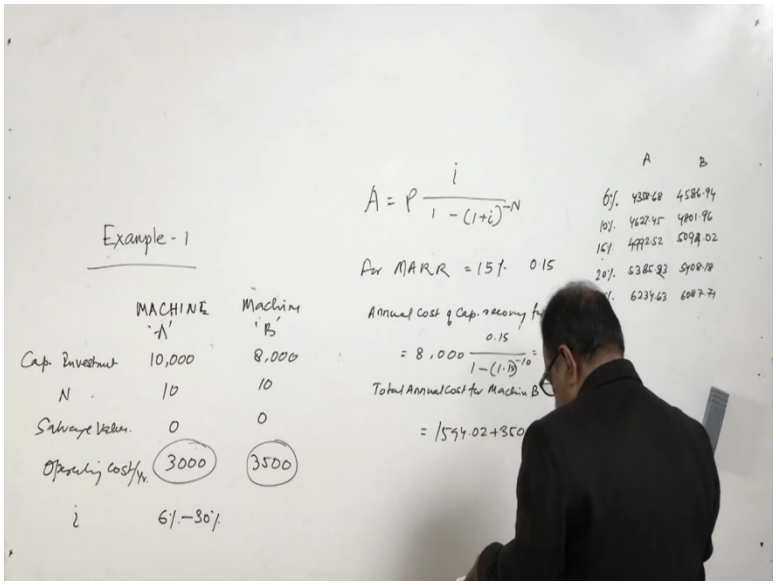

Now if computing for B machine at MARR is equal to 6%, so, annual cost will be cost of capital recovery for machine B will be, the cost is 8000, we have this formula now 0 6 1 - 1 + 0.06 to the power - 10. This comes out to be rupees 1086.94, so total annual cost for machine B is equal to 1086.94 + this value 3500 which comes to be 4586.94 this is 4586.94. So, what we have to do, we have to repeat this many a times this computation to find out the values.

So let us do this for 10%, so this becomes 0.1. So for machine A, annual cost of capital recovery for A is equal to 10,000 into 0.1 divided by 1 - 1.1 - 10 comes out to be 1627.45 and so total annual cost for machine A is equal to 16271.45 + 3000, it comes out to be rupees 4627.45 so this is 10%, 4627.25. Now the same thing for B machine, for B machine this will be 8000 and this value is 1301.96.

This is B machine and this is 1301.96 + 3500 comes out to be 4801.96. So this is 4801.96, now you can go for 15%, this is 15%, this is 15, this is A, this is 15, this is 15, this is 10, this comes out to be 1992.52 this is A, this is 1992.52 + 3000, comes to be 4992.52, so this is 4992.52. Now if you go for B this is 8000, 8000 this comes out to be 1594.02 this is 1594.02 + 3500 comes out to be 5094.02. Similarly we have to compute up to thirty percent.

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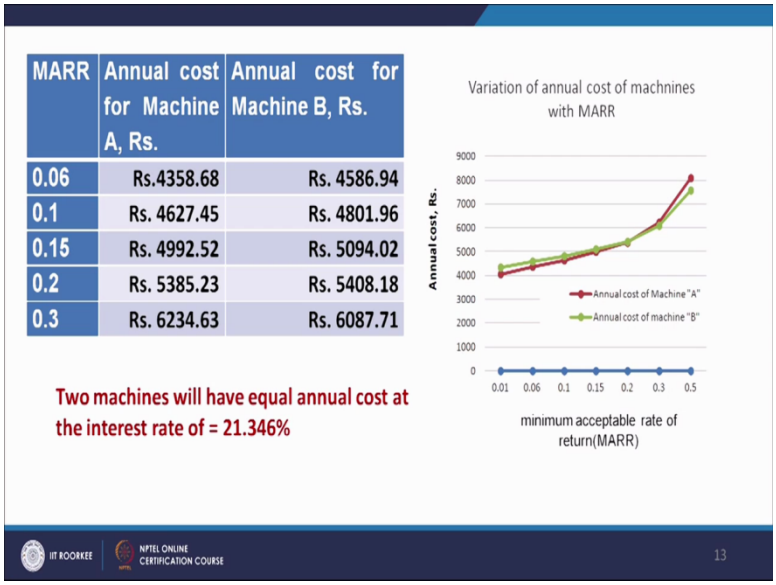

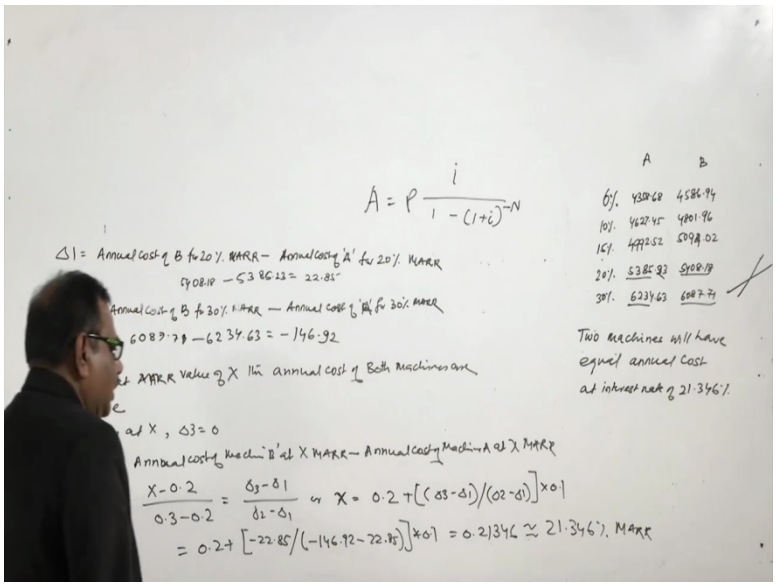

Let me see whether I can give the values. So this is 20% the value is 5385.33, 23 sorry 23, and this is 5408.18, 30% this is 6234.63, this is 6087.71. Now what we see here now this is the table and this is the graph which shows now here we see the A value is less than the B value here, but for 30% this is more than the B value here, that means the crossing of decision takes place somewhere in between this.

Now is there a method to calculate, answer is yes. Two machines will have equal annual cost, we will find that two machines will have equal annual cost at interest rate of 21.346%. Now how to calculate this? The here from the table we have seen that the annual cost of machine A becomes higher than machine B after 20% MARR thus both the machines will have same annual cost between 20% and 30%.

So if I define delta 1 is annual cost of B for 20%, MARR - annual cost of A for 20% MARR then it becomes 5385.23 - 5408.18, so it becomes - 22.85. Now delta annual cost of B or 30% MARR - annual cost of B, A sorry A for 30% MARR. This sorry this has to be reverse, this has to be reverse, this - this B - A so 5408 - 538523 is equal to 22.85, now this is equal to 6087.74 sorry 71 - 6234.63 comes out to 146.92. Let at MARR value of X the annual costs of both machines are same okay.

So thus at X, if I call this delta three this is 0, that means delta t three is annual cost of machine B at X MARR - annual cost of machine A at X MARR. Now I can write down X - 0.2 divided by 0.3 - 0.2 is equal to delta three - delta 1, delta two - delta 1 of X is equal to, X is equal to 0.2 + delta three - delta 1 divided by delta two - delta 1 into 0.1.

This gives value 0.2 + - 22.85 divided by in bracket 146.92 - 22.85 into 0.1, this gives 0.21346 is 21.346 percent MARR. So in this way we can find out the value, so up to 20% A will be selected or I should say up to 21.346% A or B, A will be selected and after that B will be selected. The plot for this MARR are also given at the side of the table.

Let us summarize the whole lecture, in this lecture we saw the rate of return method basically the rate of return method is not a method in actual actual sense, it can be applied on any method of alternative investment. We have seen that all our methods of alternative investments are based on time value of money, that means based on the rate of interest. So the decision is also based on rate of interest and we have seen that rate of interest fluctuates a lot.

So as it is based on rate of interest, decisions are also based of interest. So to know how the decision will change based on rate of interest this method rate of return can be utilized. So we can speculate that what will be the rate of return after five years or after 10 years and you can see the scenario, that what will happen whether our decision which I am taking today will be valid after 10 years or not, for this we have taken a numerical, we have seen that after 21.346% interest rate, the decision is changing. So, thank you.