Depreciation, Alternate Investment and Profitability Analysis.

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Lecture-11.

Alternative Investment Present Worth Method.

Welcome to the course Depreciation, Alternate Investment and Profitability Analysis. We are continuing with module two which is alternative investment. In this lecture I will discuss one of the alternative investment methods, that is present worth method.

In finance the net present value or net present worth of a prospective series of future money receipts is the present investment that the future receipt would just repay with interest, or it can be simply defined as the present value of cash inflows - the present value of cash outflows that is the net benefit to the organization. Economy studies for choosing between alternate projects and investments can thus also be made by comparing the present worth of the future of the funds necessary to endow service for a given number of years when the goal is to increase the value of the wealth.

In the annual cost method we have converted the money time series to an equivalent uniform annual cost whereas in the present worth method we shall convert the money time series to an equivalent single payment at some specific date the basic advantage of net present worth method is that it considers the time value of money.

The disadvantage is that it is more complex than other methods that do not consider present value of cash flow, furthermore it assumes immediate reinvestment of the cash generated by investment projects and that the inflow of cash other than the initial investment occur at the end of each period. This supposition may not always be reasonable due to altering economic environment.

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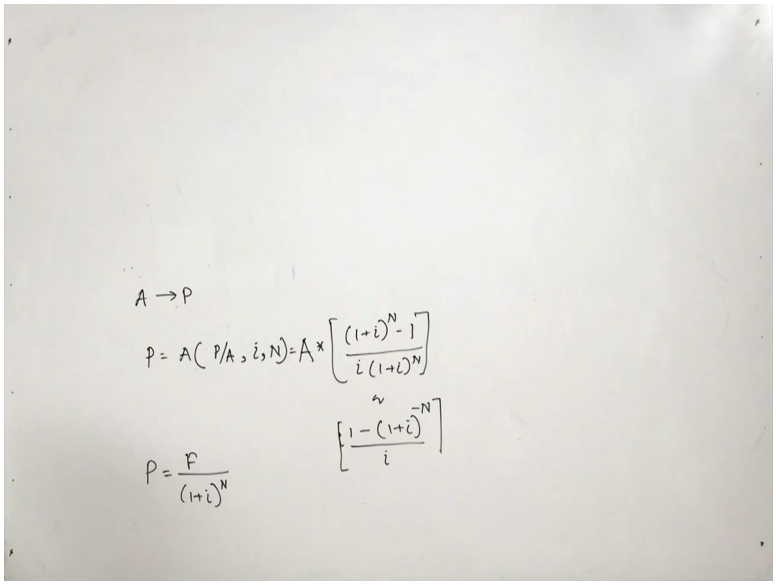

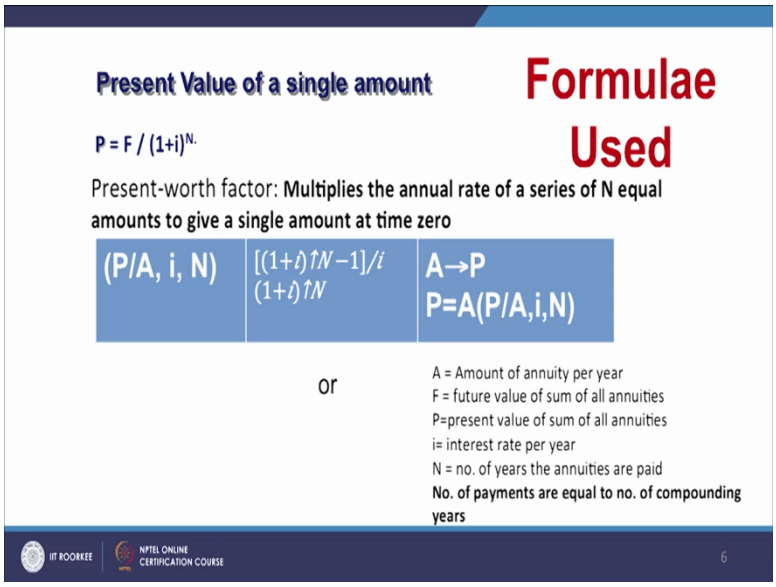

Now the formula which we will be using in this lecture are, now if I want to convert A to P that means a range of annuities to the present worth then my formula is P is equal to A P by A i N is equal to P into 1 + i to the power N - 1 divided by i 1 + i to the power N, or this factor can be simplified by writing 1 - 1 + i to the power - N divided by i so, the annuity this A is annuity here.

The present worth of the annuity, sorry sorry this is not P, this is A the present worth of annuity can be calculated like this, and then the present value of a future value is computed like this. So we will be extensively using this two formulas in this lecture.

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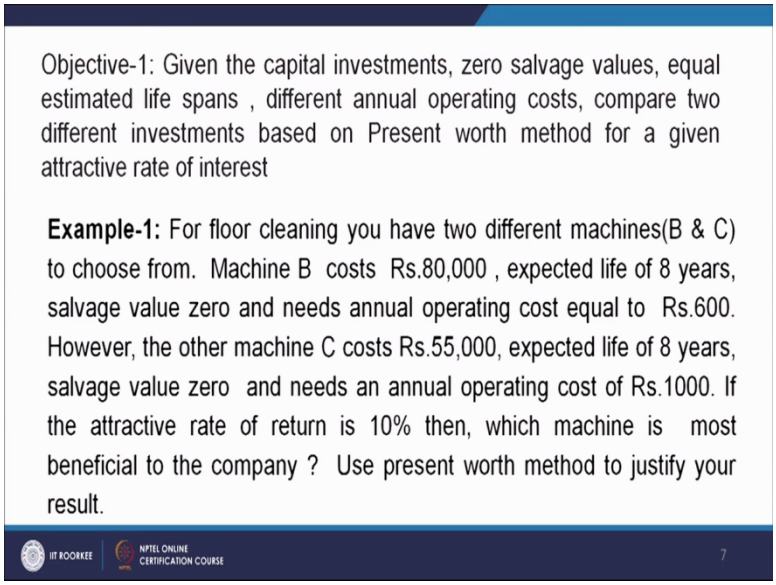

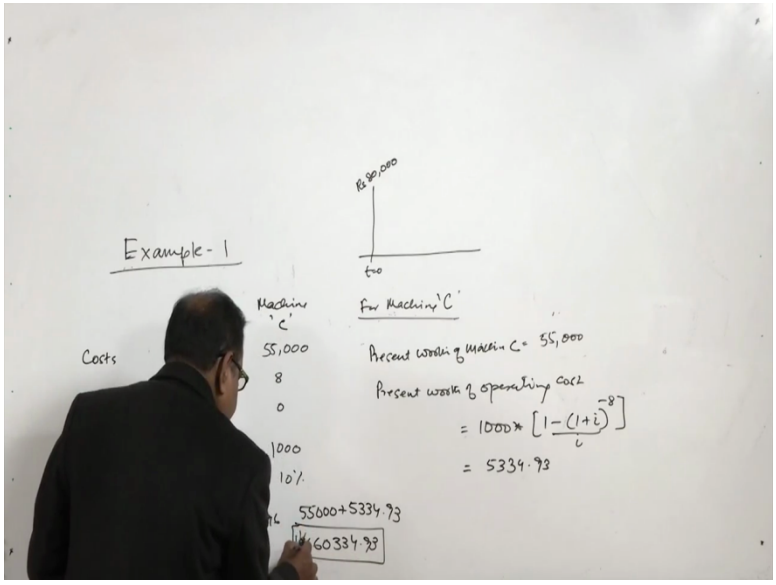

Now we take up the example one and the objective of example one is given the capital investments, zero salvage values, equal estimated life spans, different annual operating costs, compare two different investments based on present worth method for a given attractive rate of interest.

The example one is for floor cleaning you have two different machines, machine B and machine C, machine B costs 80,000 rupees and expected life is eight years, salvage value is zero, operating cost 600, whereas the machine C costs 55,000, expected life is 8 years, salvage value is zero and annual operating cost is 1000, at the attractive rate of return is 10 percent, then which machine is most beneficial to the company. Use present worth method to justify your results.

So this is our question lets solve it. Now the costs are basically put in zero line that means for machine A, B at t equal to zero I will invest rupees 80,000 similarly for machine B at t equal to zero I have to invest 55,000. Now this 600 has to be this basically annuity and for eight years the 600 rupees will be paid, that means t equal to zero, t equal one 600, t sorry this is 1, 2 this is again 600, 3 again 600 upto 8th year again 600 will be paid. Now we have to find out the present value of the 600 this is annuity every 600 has to be brought to this zero line.

So, by using the annuity formula the present worth for machine A, sorry for machine B this annuity, the present worth of operating cost is equal to 600 into 1 - 1 + i to the power - 8 divided by i. And this is the formula we have used I had already told you this is this formula is derived from here A 1 - 1 + i to the power N divided by i.

Now if you compute this value, well i is i is ten percent then this value comes out to be rupees 3200.96. So the total present worth is this value + this value so this is 80,000 + 3200.96 that comes out to be 83200.96, so this is the total present worth of machine B. Similarly, we can compute for machine C, for machine C, please note that this is a already the present worth this is already the present worth only we have to convert this value to its present worth and add it up.

So present worth of machine C is equal to 55,000, because the cost will be spend at time t equal to zero, and present worth of operating cost is equal to 1000 into 1 - 1 + i to the power - 8 divided by i and this comes out to be 5334.93. So present worth of machine B is 55,000 + 5334.93 which comes out to be 60334.93 as the present worth of the machine C is less, this is less, it is preferred.

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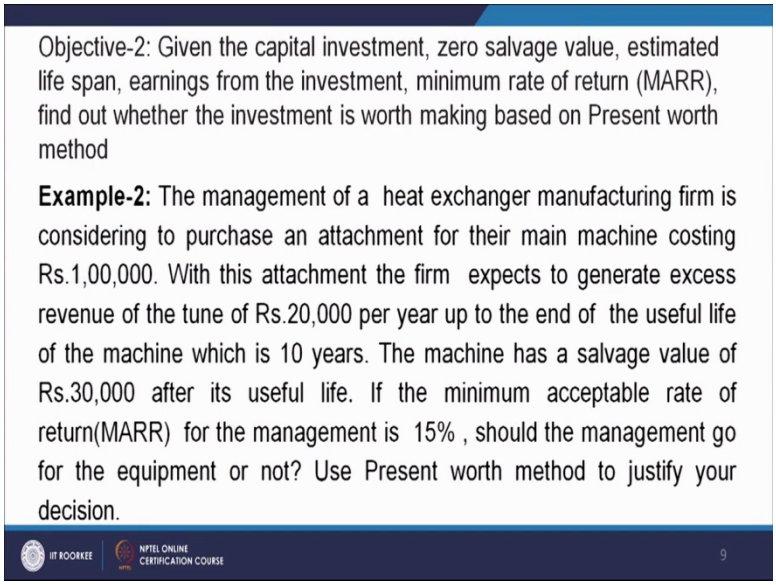

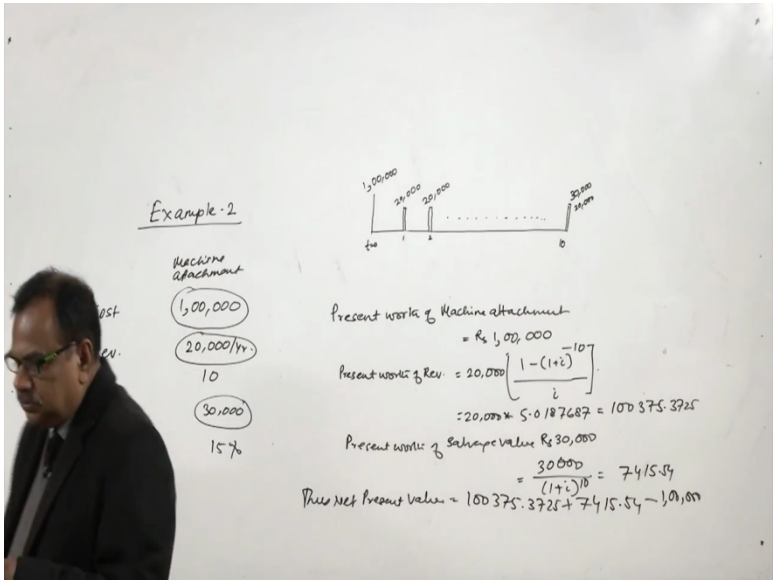

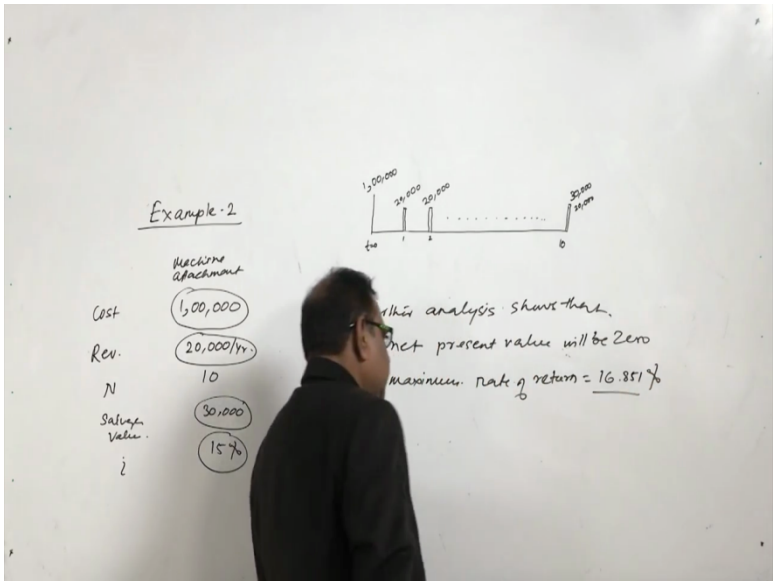

Now the objective two for this example is given the capital investment, zero salvage value, estimated life span, earnings from the investment, minimum rate of return, find out whether the investment is worth making based on present worth method.

Now the question is example two, the management of a heat exchanger manufacturing firm is considering to purchase an attachment for their main machine costing one lakh, So the cost is one lakh this is attachment, machine attachment with this attachment the firm expects to generate excess revenue of the tune of 20,000 per year. So we see the revenue is of the tune 20000 per year upto the end of the useful life of the machine which is 10 years so N is ten years.

The machine has salvage value of 30,000 after the useful life so salvage value is 30,000 after the useful life and if the minimum acceptable rate return of i is 15%, then try to find out using the present worth method whether I should go for this machine attachment or not. Now we see this is the present worth already cost this part is not present worth, I have to find out present worth because it is annuity every year up to 10 years I will get revenue as 20,000 rupees and this salvage value will be after at the end of tenth year.

So this has to be converted to present worth so if I see the timeline, so time t equal to zero I am investing one lakh and each year I am getting 20,000, now on this 10^{th} year I am getting an amount of 30,000 and over and above another 20,000 of this and this is 30,000. So this is annuity to find out the present worth I have to use annuity formula and for this I can directly convert it into present worth by dividing by 1 + i to the power N, so let us solve it.

So present worth attachment is equal to rupees one lakh, present worth of revenue is equal to 20,000 multiply by 1 - one + i to the power N that is ten divided by I, this comes out to be 20,000 into 5.0187687, comes out to be 3725. Now present worth of salvage value rupees 30,000 is equal to 30,000 divided by 1 + i to the power ten it comes to be 7415.54. So what I get is thus net present value is equal, what I am getting is this + this, so 100375.3725 + 7415.54 and what I am spending is this. So net present worth for this is rupees 7790.91, net present worth is positive and hence I can go for a purchase.

Whether the equipment should be purchased, the analysis is equipment should be purchased at the net present value is positive. The positive net present value ensures that a rate of return that is higher than the minimum acceptable rate of return required by management that is 15% in the present case can be achieved. That means a higher rate of return can be achieved

than specified as 15% and if actually you see a further analysis shows, a further analysis shows that the net present value will be zero at maximum rate of return is equal to 16.851 percent. That means this investment can achieve 16.851% return in place of 15% return, hence this is acceptable.

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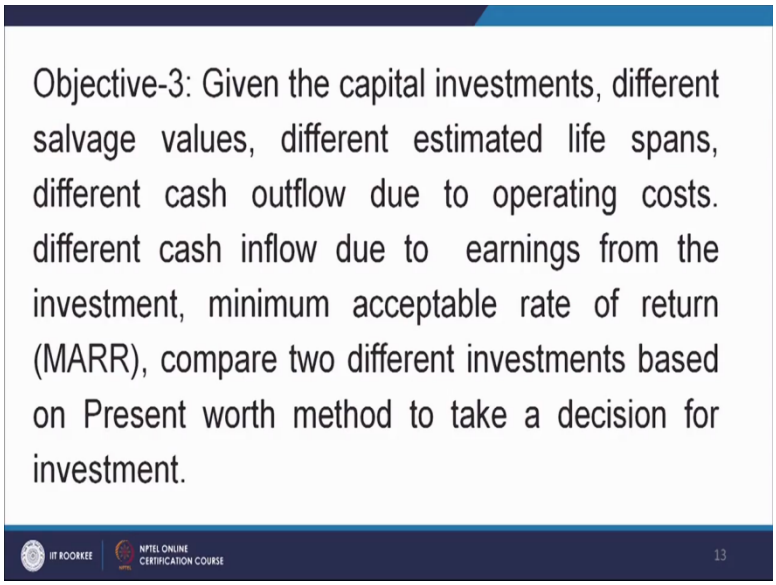

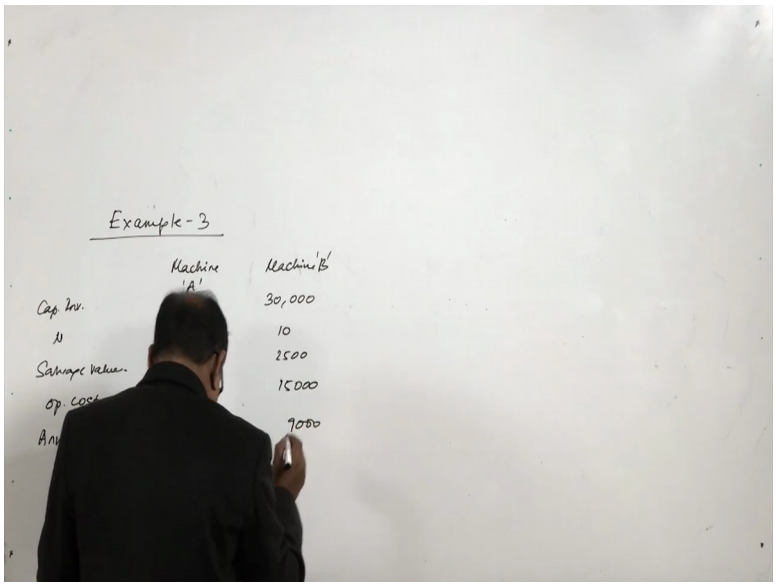

Example-3:

Data for two machines A & B are given below. Select the appropriate machine based on Present worth method.

	Machine "A"	Machine"B"
Capital investment ,Rs.	Rs.45,000	Rs.30,000
Estimated useful life, year	15	10
Salvage value, Rs.	Rs.5000	Rs.2500
Operating cost(labor, material, maintenance, depreciation, insurance, etc) Rs. per year	Rs.8000	Rs.15000
Annual earnings, Rs.	Rs.10000	Rs.9000
Minimum acceptable rate of return	10%	10%

Analysis:

In this problem salvage values of the machine are positive. It should be noted that salvage values and earnings should be deducted from the present worth of the machines to find net present worth. Further, as the estimated service life of both machines are different, the net present worth method can't be applied as it needs equal time window for comparison.

To circumvent this problem, in such cases a common time window which is the least common multiple of service lives is taken. In the present case least common multiple of 15 and 10 is 30 years of useful life is considered for the above problem.

Now let us go for a third example the objective is given the capital investments, different salvage values, different estimated life spans, different cash outflow due to operating cost, different cash inflow due to earnings from the investment, minimum acceptable rate of return, compare two different investments based on present worth method to take a decision for the investment. Now this is the problem this is example three.

Now I have machine A, machine B, now capital investment is 45,000, this is 30,000, useful life N is 15, 10 note this is different, salvage value 5000, 2500, operating cost 8000, 15000, annual earnings 10,000, 9000 and minimum acceptable rate of return i is ten percent. So we have to compare these two investments that is machine A and machine B and based on the present worth method tell which machine I should purchase.

Now we see here that the N values are different in this problem salvage value of the machine are positive, it should be noted that salvage values and earnings should be deducted from the present worth of the machine because these are earnings to find the net present worth. Further as the estimated service life of both the machines are different, the net present worth method cannot be applied as it needs equal time window for comparison.

Now if it is so then I cannot apply this net present worth method, so I have to find out a way how to do it. To circumvent this problem, in such cases a common time window, which is the least common multiplier multiple of service lives is taken.

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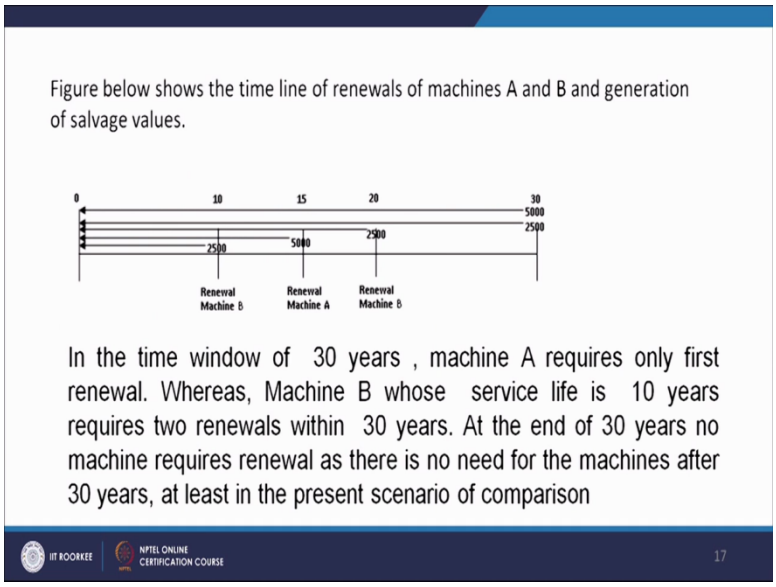

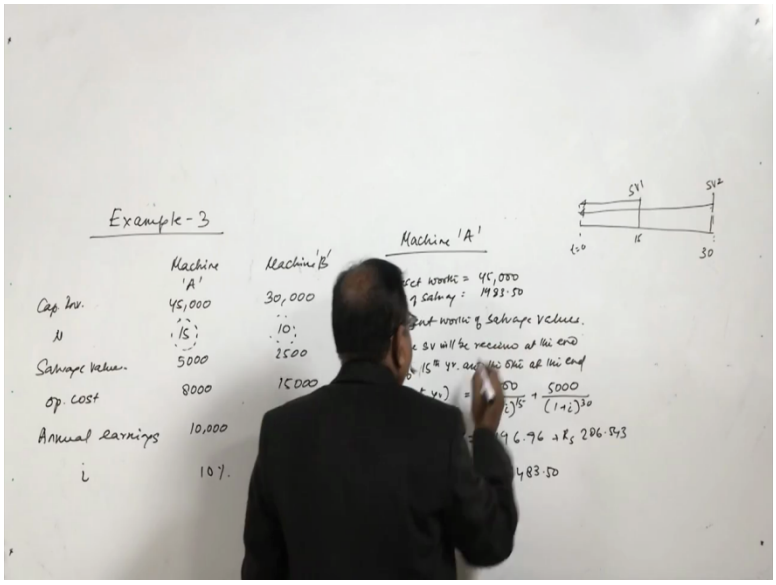

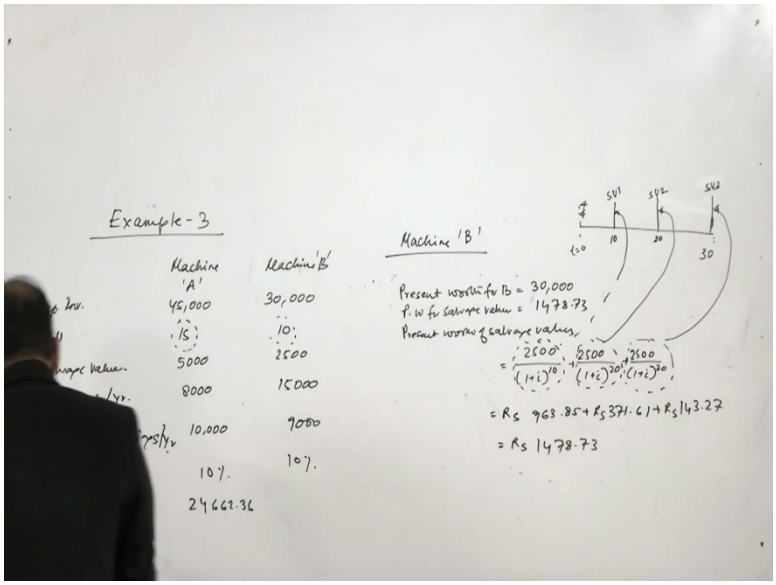

In the present case least common multiple of 15 and 10 is 30 years of useful life and hence 30 years of useful life is considered for the above problem. Now if you see this time window then machine A will be renewed once because it is 15 years I have purchased the machine A at t equal to zero after 15 years I will get a salvage value of that machine and after 15 years what I purchase goes up to 30 years. But there will be two renewals for machine B, that is first on tenth year and second on 28th year so this we have to keep in mind.

So let us go for the solution now machine A, now the present worth is equal to 45,000 because 45,000 will be spend at t equal to zero, that is initially, and hence we do not have find out the present worth of this, it is itself present worth. Present worth of salvage values, so one salvage value will be received at the end of 15th year and the other at the end of 38th year, now if you see the timeline t equal to zero I am taking a span of 30 years.

So here on 15th year I will get salvage values it is called SV1 and 30th year I will get another salvage value this is SV2 for machine A, whereas you for machine B, I will have three salvage values. So these two salvage values have to be converted into present worth, so this will be equal to salvage value is 5000 so 5000 divided by 1 + i to the power fifteen + 5000 divide by 1 + i to the power thirty.

So this is to convert this salvage value to t equal to zero, and this one is to convert this salvage value to present t equal to zero line. Now this comes out to be 1196.96 and this is rupees 286.543, total comes out to be rupees 1483.50. We should remember that this is earning, this is earning and now the present worth of earning see this is annual earning is 10,000.

I have to find out the present worth of this, now present worth of salvage is equal to 1483.50. What I have do I have to find out the present worth of this 8000, this is annuity because operating cost is per year, this earning is also per year, so these are two are annuities I have to find out present worth of this. So present worth of operating cost is equal to and this is for 30 years, for 30 years because time window I have taken to be 30 years, is equal to 8000 into 1 - 1 + i to the power - thirty divided by i.

And this comes out to be 75415.32 similarly present worth of earnings annual earnings is equal to 10,000 into this one, 1 - 1 + i to the power - thirty divided by I, this comes out to be rupees 94269.14. Now if I find out the net positive worth, net present worth this is 45,000 + 75415 - 1483.50 - 94269.14 and this comes out to be rupees 24662.36.

Now this is expenditure this is expenditure, this is the earning and this is the earning. So earnings are in the negative and expenditure are in positive, so this is my net present worth so I can write down here, net present worth is 24662.36. Similarly if I calculate for machine B, machine B the salvage value will be a ten SV1 twenty SV2 and thirty SV3, getting three salvage values for machine B.

So present worth for B is 30,000 because at t equal to zero I will spend this 30,000. Now present worth of salvage values is equal to 2500 divided by 1 + i to the power 10 + 2500 divided by one + i to the power twenty + two thousand five hundred divided by 1 + i to the power 30. Now this is for this salvage value, this is for this salvage value, and this is for this salvage value, where the amounts are rupees 963.85 + rupees 371.61 + rupees 143.27 and this comes out to be rupees 1478.73. So present worth of salvage values is equal to 1478.73.

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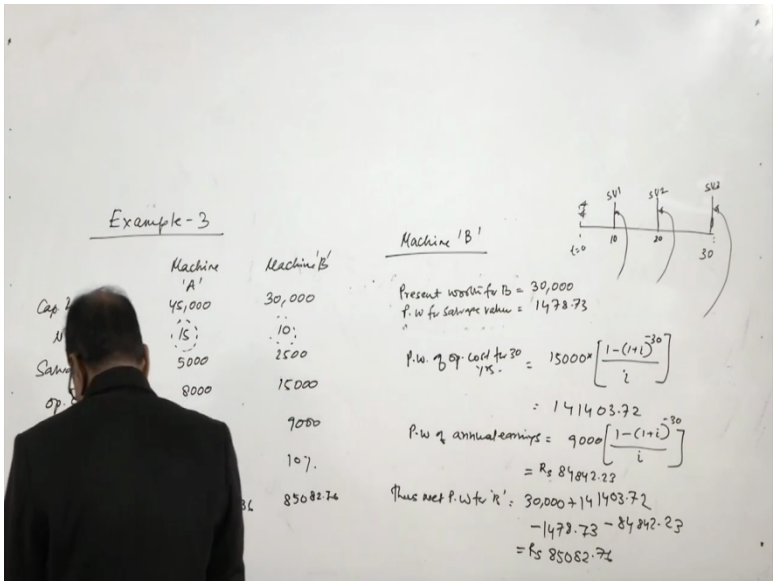

Now present worth of operating cost, present worth of operating cost for thirty years is equal to 15000 into 1 - i divided by I, this comes out to be 141403.72. Now present worth of annual earnings is equal to 9000, this 9000, 1 - 1 + i to the power - thirty divided by i comes out to be rupees 84842.23. Now net positive worth net positive worth for B is equal to 30,000 + 141403.72 - 1478.73 - 84842.23 this comes out to be rupees 85082.76.

So this is 85082.76, the present worth of machine A is minimum, thus it is selected in comparison to machine B. Summary, obviously in this lecture we have taken the present worth method for comparison of two exclusive alternatives and we have demonstrated through two numerical how this can be used. The last numerical was little bit complex and we can see that handling the last example, that is example three was little bit tedious because the life span of both the alternatives one or the same. So, present worth method is little bit tedious to apply, this we can conclude. Thank you.