Financial Management for Managers
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Lecture 23
Capital Budgeting Part VII

Welcome all. So, in the process of learning about the capital budgeting process, now we are moving towards the completion of discussion of this particular topic or in this particular concept. But still we have some two, three important things to be discussed or to be known about.

And another important thing which I am going to talk to you about is that in the discounted criteria, we discussed the three methods till now that is NPV, Benefit Cost Ratio and the Internal Rate of Return, and we saw that, in the previous class itself we discussed that the internal rate of return, though it is very good, very means appreciable mod of evaluating the capital investment proposals. But it has some inherent limitations and these inherent limitations are in terms of say, non-conventional cash flows or mutually exclusive projects how can you evaluate them?

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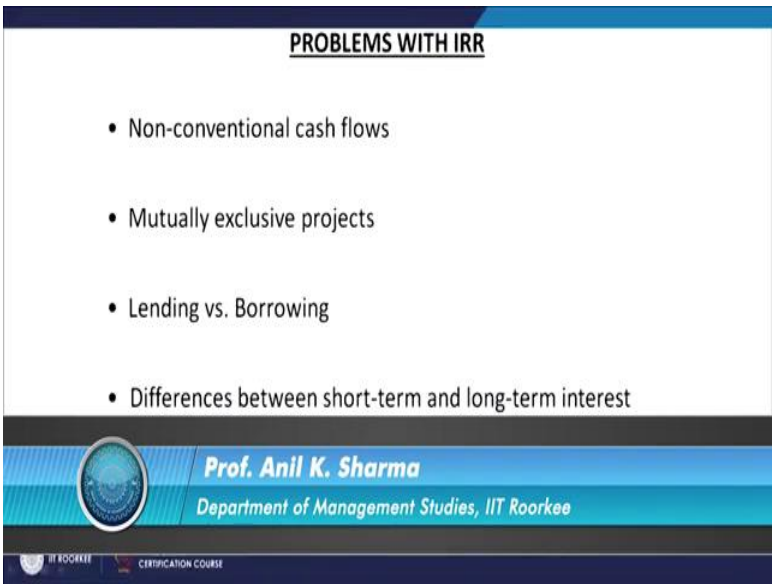

Or whether the rate given by any evaluation is the lending rate or the borrowing rate and sometimes we have the different rates of interest like short term and long term borrowings interest rates are different?

So, there are some inherent limitations of the internal rate of return. So, if these limitations are there then it, say creates the problem or it creates the handicaps. While using the internal

rate of return as the, say very important discounting criteria or the discounted criteria for evaluating any capital investment proposal.

So, in that case to remove those limitations or to do away with all the limitations of the internal rate of return we have one more way of, evaluating the proposals.

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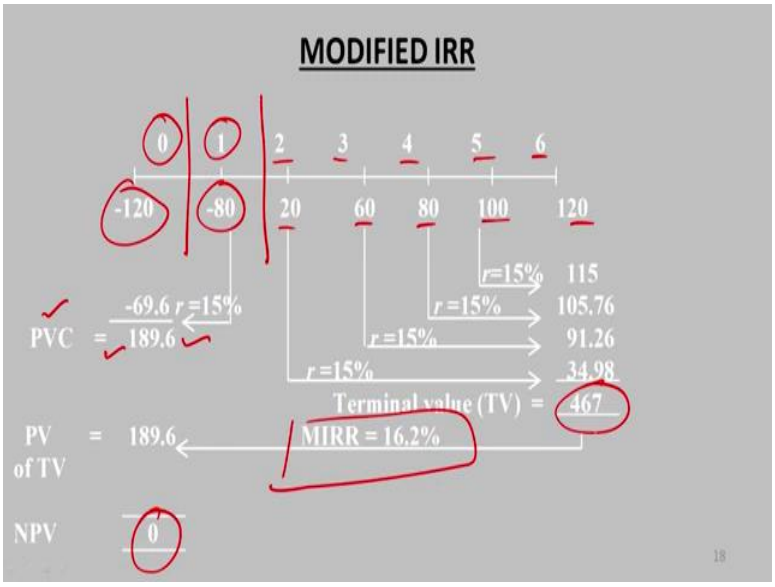

Capital investment proposals or the new projects with the help of not IRR but with the help of MIRR, MIRR is basically the Modified Internal Rate of Return. It is the Modified Internal Rate of Return. So, we can say, calculate the internal rate of return which is considered as a modified internal rate of return, not as a pure internal rate of return and for say, calculating the modified internal rate of return we say, we have to follow certain processes or certain steps.

And these steps are required because, one major limitation of the say, IRR was that if there are the non-conventional cash flows, especially that when the cash outflows occur not at one point of time but at the multiple points of time then how to take care of that?

And because normally in the NPV we consider that outflow occurs in the 0 period of time or in the current period and inflows occur over the subsequent years where as in case of say, internal also, internal rate of return also we are considering like that, that outflow is occurring only at the current period of time and inflow is occurring over the subsequent years, the future years. So, if that is the case that is the conventional cash flow.

But the non-conventional cash flow is that when the cash outflow occurs time and again. So, as we have seen the first year there is cash outflow, then inflow then outflow, so we have to

calculate now there some values of those outflows which are occurring, because one outflow is occurring at the 0 period, then other is occurring at 2 years down the line, then 3 years down the line so it means we have to count for all those.

So, we will have to apply the concept of not internal rate of return but the modified internal rate of return and if we apply the modified or we use the modified internal rate of return so what we can do? We can, we can means take care of the, cash outflows also at the multiple levels, at the multiple points and inflows are automatically taken care of. So, we can follow the process and we can calculate MIRR.

So, we have explained it with the help of this particular say, structure, Modified Internal Rate of Return and in this case what we are assuming here is that is the say, the outflow is occurring not at the 0 period but at the, this is the 0 period and the outflow of this 120 lakhs or the crores is not occurring in the one period, in the 0 period but in the next year also.

In the year 1 also there is outflow and again the 80 crores are going out. So, you are investing the total sum of 200 crores at the 2 different points or the in the 2 different years, in the current year as well as in the, in the next year, in the first year also there is outflow because building of the project takes time. And inflows start coming after that.

So, after that second, third, fourth, fifth and sixth years, the inflows are occurring and these are the inflows which are coming back to us. But what is happening? These inflows are again reinvested back into the business. Nothing is means taken out of the business. They are again reinvested back into the business.

So, there is a clear-cut demarcation that the first two years, 0 and 1 year there is a cash outflow and then the subsequent, next how many, 5 years there is inflow so total 6 years of the life of the project is given to us. Whereas in case of the IRR what was given to us is that only cash flow is occurring in the 0 period. Cash outflow is occurring in the 0 period.

After that the subsequent years, first year onwards till the sixth year or fifth year or fourth year there are the inflows. So, it means outflows are not occurring at the, means say future points or at any future year and very generally you can think about, that outflows occur at the different points of time in future also because sometimes the maintenance of the project is required, sometimes the up keeping of the project is required.

So, you need to spend money on running the say, plant or equipment properly or efficiently. So, all the times it does not happen that in the 0 period only once you construct the plant and then you keep on using for the next 10 years that does not happen.

Sometimes we have to say, incur the capital expenditure, revenue expenditure we have to incur, every year no doubt about that, but capital expenditure also we have to incur sometimes, may be some part of the plant goes out of order. So, you have to change that, you have to replace that with a new, this component. That is a capital expenditure.

Or sometimes to say, keep it going on we have to maintain it. So, we maintain the capital expenditure. So, this is a very practical situation that capital expenditure does not occur only or does not take place only in the first year or in the current period but sometimes in the future years also.

Even once the project has started working or the plant has been commissioned, after that also, first year you use the plant for, the one full year. Second year also we use the plant for one full year. Third years we need to, say invest something in terms of up keeping say, maintenance or may be any other kind of expense for up keeping, for maintenance or any other kind of the say, expense that has to be incurred and for those expenses if they are large in the amount, in the quantum then they are called capital expense.

So, it can occur means you incurred the expense for the first year. We used a plant for two years and then third year we have to incur some huge expenses and then the inflows again start coming up. May be sometimes we have to shut the plant for maintenance and that remains shut for days together, so and when any expenditure is incurred for maintaining the plant, it is that expenditure is called as the capital expenditure.

So, outflow is there, means very natural it is that outflow also occurs and after the inflow has started coming in, so how to take care of that? So, there we go for the modified internal rate of return. In this modified internal rate of return we have to follow certain steps.

First step here is that we have to calculate the present value of the cost. All the outflows which are occurring at any point of time, we have to calculate the present value of all those outflows. We have to calculate the present value of all those outflows and those outflows, their present value has to be worked out and for calculating the, the present value of those outflows we have to, means follow certain process.

And when we follow certain process we have to, because in the 0 period, in the current period whatever the investment we are making that is equal to 100 percent, but in the subsequent years when we are incurring any investment, further investment so that investment which will be incurred 3 years down the line, may be in the third year, so it means third year investment is going to incur but it is the present value of that ,what is the present value of that, what is the present value of that cost.

So, we have to calculate the present value of the cost and then at the same time we have to do one thing is that we will have to calculate the present, say this terminal value of all the benefits. This is the second step that whatever the benefits are going to be there, here, whatever the benefits, so benefits are going to be there in this case.

For example, this is the project. In the first year there is a cash outflow of 120 crores. Second year also the cash outflow of say 80 crores is taking place. So, total investment we have made in the first two years and that is to the tune of 200 crores and after that, over the say, next second year onwards there are the inflows coming up.

But the 20 crores which we earned, which is the inflow in the second year, this is reinvested back. Then in the third year we got 60 crores, reinvested back. Then 40 crores, reinvested back, 100 crores in the fifth year, reinvested back and in the sixth year, that 120 crores inflow is available.

So, when this amount is getting reinvested back what you have to do is you have to calculate all these terminal values, add the discount rate of the 15 percent, add the discount rate of the 15 percent and we are discounting these. So, sorry not discounting but we have to calculate the say, compounded value of the future benefits. We have to compound them.

So, we have to, now because we are reinvesting them back. So, it is not discounting. This is the process of compounding so we have to compound them at the cost of capital or the rate of interest which is expected to be available. So, it means when we are going for compounding it means that 20 crores which is earned in the second year reinvested back for how many years, that is for the 5 years, no for the 4 years, 1,2,3,4, for 4 years when we are investing, that after compounding it becomes 34.98 crores.

Then in the third year, at the end of third year any amount which is earned 60, reinvested back at 15 percent, this amount becomes 91.26 crores, and then 40 which is, sorry 80 crores

which is earned in the fourth year and invested back, reinvested back into business at the 15 percent compounding, it becomes 105.76.

Then the 100 crore earned that becomes 115 crore at the end of the, after one year at the end of the sixth year and then sixth year whatever the amount we are earning as a cash flow that is 120 that is 120. So, if you sum it up that becomes a terminal value, means at the time when the project will be terminated, will be closed down, at that time whatever the, terminal value of the benefits is available, that will be calculated and summed up and this value has been calculated.

This value is here with us that is the 467 we have calculated and in this case when you try to find out here that the total amount which is available after say this, calculating the terminal value that is a 467 crores, the total amount is available with us and here it is.

Now, we have to calculate the present value of this. 467 crores which is going to be earned over a period of 6 years we have calculated and when you discount it, this 467 crores when they are discounted so we have to calculate the present value of the terminal value.

So, first we calculated the present value of the cost and that present value of the cost became, that is 189.6. So, what we have done is we have taken the 120 as 120 for calculating the present value of the cost, 120 is 120 but the remaining is, that is the 80, if you discount this 80 at rate of 15 percent for the period of 1 year this amount becomes here as the say, 69.6.

So, 120 plus 69.6 becomes 189.6. So, against the total investment of the 200 crores we are making if you calculate the present value of that cost that works out as 189.6 crores and when you calculated the present value of all the present value of the terminal value, terminal value of all the cash inflows coming over the subsequent years reinvested back and compounded at the rate of the, at the given cost of capital.

So, they are, the total terminal value becomes 467 as a result of the compounding of the, calculating the compounded value, future compounded value so this becomes 467 and when you discounted it at the rate of the same, this some rate means just to make it equal to this 189.6 so that the NPV becomes 0 here so that MIRR has come up here as the 16.2 percent.

So, it is means when we have discounted it, this 467 has become 189.6 at the 16.2 percent. So, modified internal rate of return available here from this project is the 16.2 percent. I will

explain it to you in a say, further in a more transparent as well as in a better manner how this all works.

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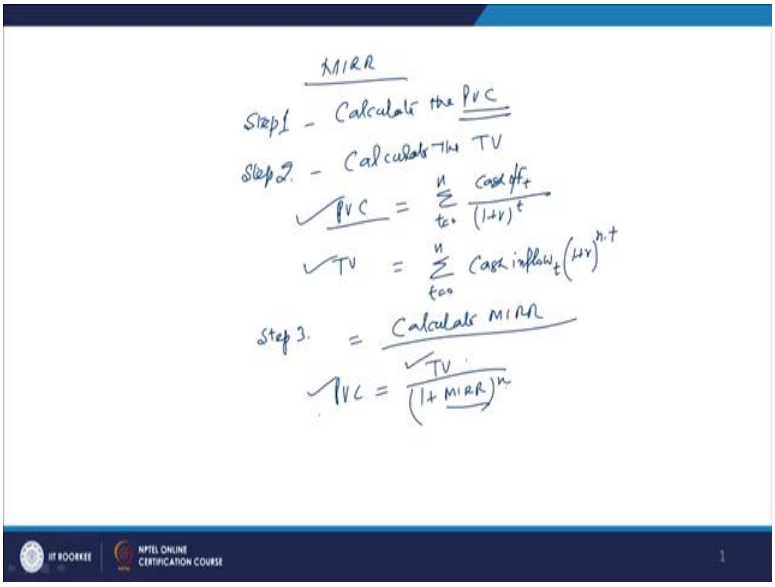

So, for calculating the Modified Internal Rate or Return MIRR you have to follow certain steps and different steps we will follow and then will do one problem also, one exercise so that the entire process is clear to you.

So, what you have to do is step 1, there are different steps are involved, so step 1 is first of all you have to calculate, what you have to calculate is the present value of the cost. First of all you have to calculate the present value of the cost. So, whatever the cost we are incurring in the, at the different points of time, we have to calculate the, so calculate the present value of the cost.

Cost means the investment we are making in any project over the different durations. It may be in the current period, it may be in the third year, it may be in the fifth year so current period is equal to 100 percent but the investment made over the subsequent years has to be discounted back and we have to sum it up so that the present value of the total cost can be calculated. So, this is the first step.

Then is the step number 2, step number 2 is now we have to calculate the, say terminal value. We have to calculate, calculate the terminal value TV of the future cash flows which are expected from the project, the terminal values of the future cash flows expected from the project we have to calculate the terminal value.

So, for calculating this PVC, Present Value of the Cost, for calculating this what you have to do is present value of the cost is, you can calculate like this, sigma total number of years which is the life of the project and t is equal to 0 and here you have to take n sigma t is equal to 0 and this is, you have to take this cash flow, cash outflow we are talking about, cash outflow occurring over the number of years and this we are taking here the t, that in which year the cash flow is occurring, and then it has to be discounted for 1 plus r divided, sorry power t.

So, with the help of this model, present value of the cost can be calculated. So, for example cash outflow occurring at the year t, if it occurring in the 0 period, so the value will be equal to 100 percent. If it is occurring in the third year, so it means the year t will become year 3 so cash flow occurring in 3, so you have to discount for the, if it is taking place in the beginning of the third year you have to discount it for the two years, first and the second year you have to discount it.

So, you have to take that say, t value and after this you have to calculate the terminal value of the, as I told you second step terminal value of the future cash flows expected from the project and for that what you have to do is, this is the model here, that is the sigma n, t is equal to 0 again and then it is the cash inflow. This is the cash inflow which is occurring over a period of time, cash inflow over the number of years and you have to calculate because you have to calculate the terminal value.

So, you have to calculate the compounded value, future compounded value of these expected cash flows and this is n minus t, total number of years n is the total number of years means the life of the project for which the cash inflows are occurring and t is that particular year for which the compounding of the cash flow is taking place, for which the compounding of the cash flow is taking place.

So, n minus t if you are taking say, for example in the third year so it will be, total number of years are 6. So, it will become the 6 minus 3, so it means the power accordingly you can work out. So, the power 3 will become here. So, we have to calculate the terminal value of all these, means after compounding it at the given cost of capital or the rate of return, you have to compound the future cash flows expected from the project and then you have to calculate the, step 3 we will have to go for, what you have to do is we have to calculate the number 3, step number 3.

Step number 3 here is, calculate the MIRR, calculate MIRR, Modified Internal Rate of Return and for calculating the modified rate of return what you have to do is you have to use this model PVC is equal to TV divided by 1 plus MIRR power n. This is the model with the help of which the MIRR can be calculated. This present value of the cost we have already calculated, this is with us, then the terminal value of all the future cash flows with the help of compounding we have done.

It is available with us and then only this thing we have to find out, so if you know this value, if you know this value, if you know the number of years then easily the MIRR can be worked out after say, solving this, means all the values given here, after solving the say, this model or with the help of this model we can easily calculate the modified internal rate of return. Let us now do a problem so that you are very clear about that how we can calculate the modified internal rate of return.

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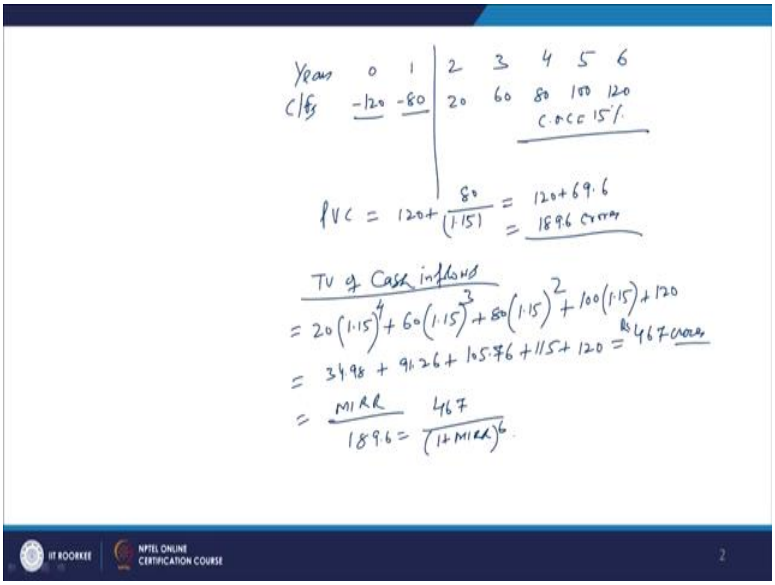

For example, we have here the say, 6 number of years. We take here as the years, and years here are 0, 1, 2, 3, 4, 5 and 6. These are the 6 years. Now, we talk about the cash flows. These are the cash flows in the 0 year, 120 crores we are investing here, then it becomes the, minus 80, again the investment minus 80 means these two are the cash outflows, 120 in the 0 and the 80 is in the, 80 crore in the first year. So, these are the two outflows.

So, this is the demarcation clear here. And the inflows coming up here are 20 in the second year, 60 in the third year, then it is the 80 in the fourth year, then it is 100 in the fifth year then is 120 in the sixth year. So, these are the inflows occurring.

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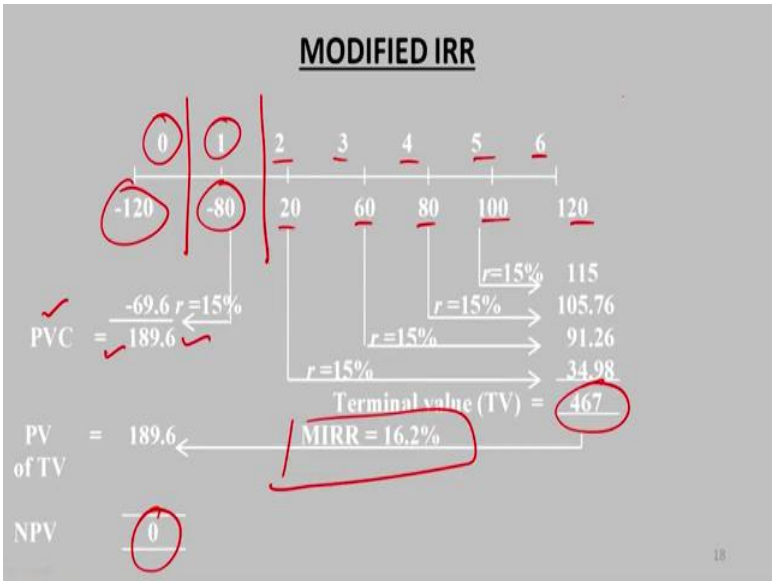

So, means the entire thing what we have done here is I have shown in the particular calculation, I am doing it now personally and then we will show it how this entire calculation will work and will be giving us the results.

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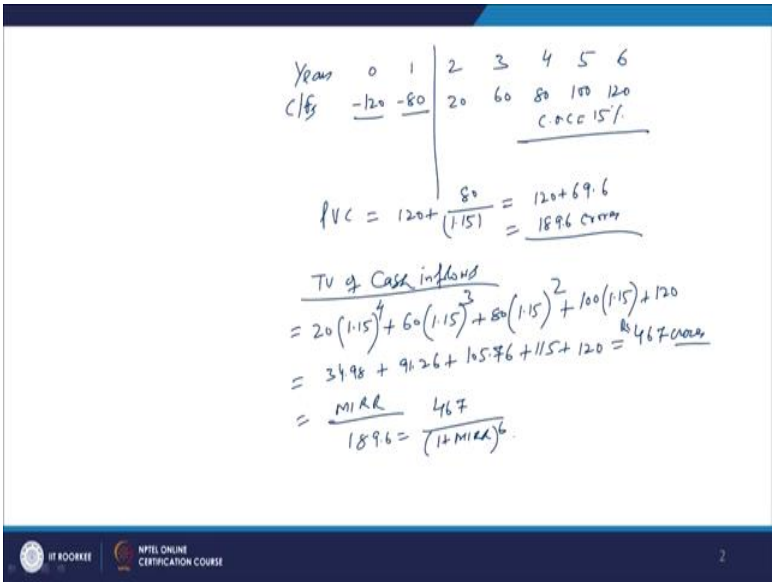

So, now what you have to do here is, in this case first of all we have to calculate the present value of the cost. We have to calculate the present value of the cost and the present value of the cost can be calculated how?

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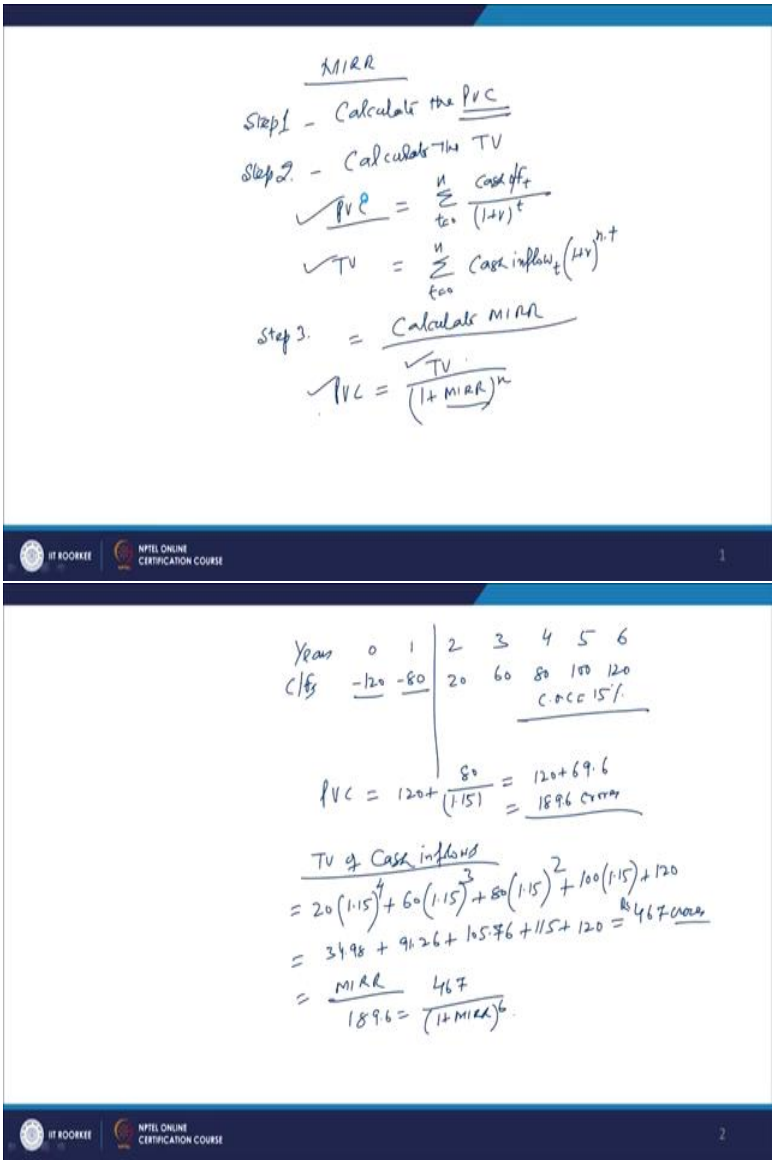

We have seen here the in this formula we have (())(21:05) to calculate the present value of the cost we have to use this cash outflows over a period of t and then divided by 1 plus R power t the number of years. So, in this case if you try to calculate the present value of the cost, so how you can do it that will be possible that 120 is 120 in the current year in the 0 period that is 120.

And then plus and what is it next cash flow is 80 but 80 is we are investing 80 when at the end of the or during the first year. So, this means this is the 80 and 80s value which is going to take place after 1 year is not 80 it is something less than that, so we have to discount it and we are discounting means we are assuming here as the cost of capital we have assumed here is COC Cost of Capital here is, is equal to 15 percent.

So, that is why I am discounting it with a 15 percent 1.15, so 80 divided 1.15. So, if you solve this so this becomes how much? 120 plus 80 discounted at the rate of 15 percent this total amount becomes means 120 is 120 plus this amount becomes as 69.6 80 has come down to means 80 invested after 1 year is equal to 69.6 of the say current value and if you calculate this this amount becomes here as 189.6 crores this is the value and this is a total investment we are calculating.

So, we have calculated the first thing here which is given to us in the model that is the present value of the cost we have calculated. Now, we will go for calculating the terminal value of the cash inflows, so we have to calculate the terminal value of the cash inflows which is occurring from the second year onwards.

Cash inflows terminal value of the cash inflows we have to calculate here, so what is the coming in the first year we are getting in the first year is 20 and it is 1.15 compounded for cost of capital so it is 1.15 and number of years are how many if you are investing at the end of the second year.

So how many years are left 1, 2, 3, 4 so the power here will be the 4 we are taking the power 4 then plus 60 into then it is becoming how much 1.15 but the power will be 3 because this investment in the business of this 60s inflows 60 crore inflows will be only for 3 years because only 3 years left now.

Plus the remaining amount here is we have 80, 80 into 1.15 and power here is 2 you are investing this amount only for the 2 years plus the compounding for the this 100 which is in the next year has to be done or for how many years the compounding of this has to done only for 1 year.

So, it is 1.15 and last amount last cash inflow that is of the 120 crores is equal to 120 crores because it is occurring at the end of the sixth year and you are going to terminate the project now. So, this value of the 120 crore will be equal to the 120 crores, so if you solve this you will find out the values here these values are going to be 34.98 crores then this going to become 91.26 crores.

Next value is going to become this value is going to become 105.76 crores, this is a 105.76 crores this value is going to become 115 very clear and this value is already 120, this values are available, so it means now you have to calculate next thing is MIRR, our next job is to calculate the MIRR Modified Internal Rate of Return, and which will be calculated how?

It will be calculated with the help of this model that is PVC is equal to TV divided by 1 plus MIRR power n. So, for calculating this, now what you have to do is, PVC. Present Value of the Cost is how much? Present Value of the Cost is 189.6 and that is equal to how much? If you calculate this total sum this total sum becomes how much?

If you total this up, this becomes 467 crores, rupees four hundred and, this is the Rupees 467 crores, so this amount is this much. So, this is the present value of the cost and this amount is 467 crores divided by 1 plus MIRR power number of years are how many? If you take here as the MIRR is going to be the 6.

So, this is the total number of years are 6. It is, now the finally we have put the values in the model, 189.6 is equal to 467 which is the terminal value of the benefits, this is the present value of the costs 1 plus MIRR power 6. If you solve this, so this will become something like, how it will be?

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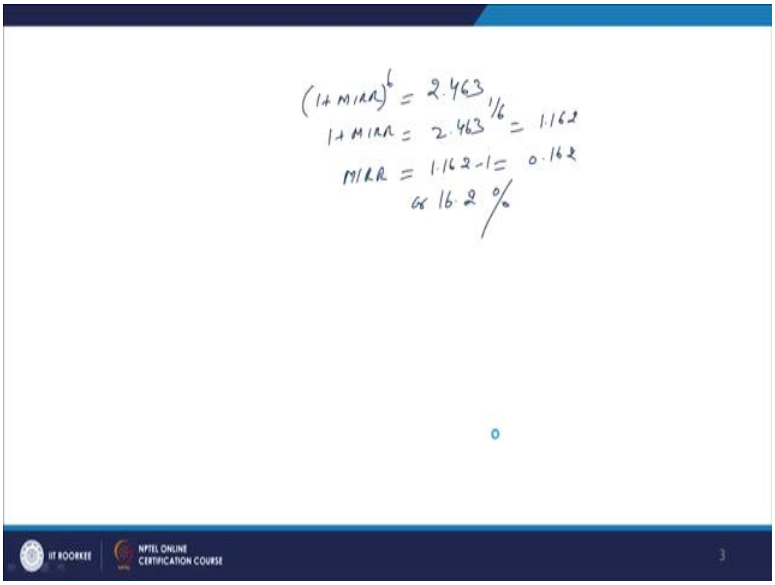

It will be 1 plus MIRR, power 6 is equal to this if you subtract this, this value will come as, if you divide 467 by 189.6, so this value will become 2.463. This is 2.463, so finally it will be 1 plus MIRR is equal to 2.463, it is 2.463 but now the power will become because it has come this side, 1 by 6 and if you resolve this, this amount will become how much? 1.162. This amount will become 1.162.

So, this is equal to, means this is the 1 by 6, if you calculate it, 2.463 power 1 by 6. This will become 1.162 and finally if you want to calculate from this calculation the MIRR you can say that is 1.162 minus 1 is equal to 0.162 and if you convert that into the percentage term so you

call it as it is 16.2 percent. It is 16.2 percent. So, MIRR Modified Internal Rate of Return available from this project is the 16.2 percent.

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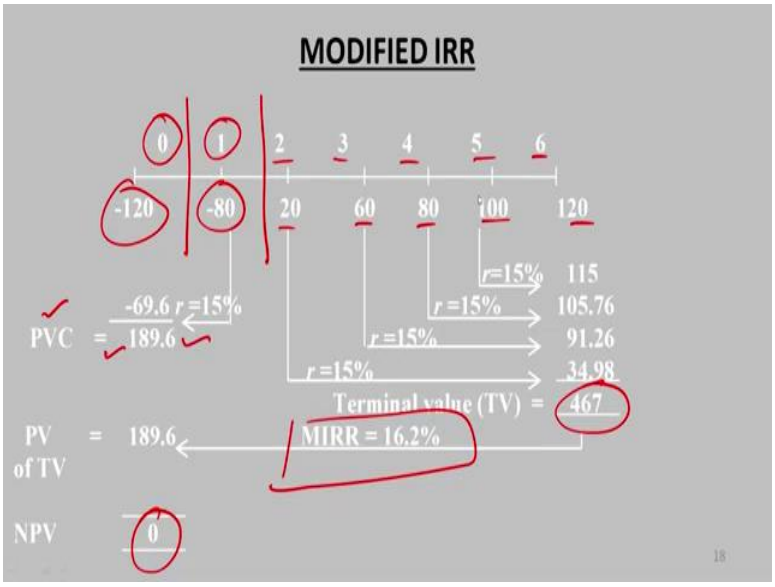

And that is what we have calculated here. If you look at this entire say, structure here, this pictorial presentation here, we have calculated the present value of the cost. So, how this 189.6 is calculated? 120 is taken as 120 and the remaining 80 which is invested in the next year so they are discounted for 1 year so total amount becomes, so that value becomes discounted 80 at 15 percent becomes 69.6.

So, total becomes 120 plus 69.6 becomes 189.6 we have seen that how it has been worked out. Then we got all the cash inflows over the subsequent years and when we say, calculated the terminal value, means after compounding these cash inflows against the cost of capital or using the cost of capital as the rate of return, so we compounded them that is the 15 percent.

So, we found out the total terminal value total of the terminal value, we got is 467. Total amount is the 467 we have found out, and then we had, means calculated the present value of the terminal value. In this case we have calculated the present value of the terminal value. If you calculate the present value of the terminal value then at the 16.2 percent it will become equal to 189.6 and this is the present value of the cost, this is the present value of the terminal value, so finally the NPV is 0.

So, means ultimately we want to find out that rate of return where the, say present value of cash outflows is equal to the present value of the cash inflows. So, this way we have, means calculated. So, 16.2 percent is the internal rate of return which has come up as the discount

rate at which we are going to discount the terminal value of the, cash flows, terminal value calculated on the basis of compounding of the cash inflows.

If you are going to discount it for the 6 years then it is going to be at the rate of 16.2 percent going to be equal to 189.6 percent and NPV is going to be 0. This is one way of means doing the things, you are looking at the things but I have explained it to you how this entire process has worked.

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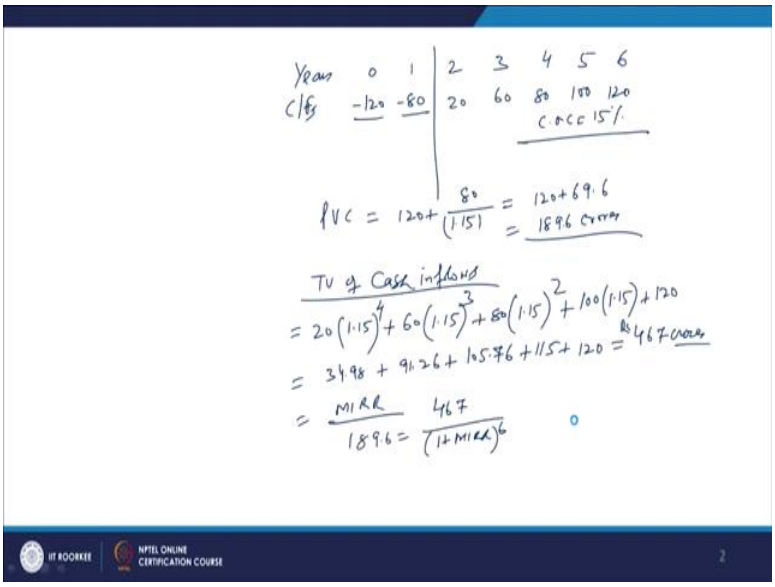

Here we have taken the same example here again back. Cost of capital we have taken here is that is 15 percent. The cost of capital we have taken here is again 15 percent. So, if you look at this, COC Cost of Capital it is 15 percent so it means number of years we have taken is 6, 0 to 6 cash flows we have taken, first two years we have taken as the, outflows, 120 and 80 and remaining 5 years we have assumed there are the inflows.

Then we calculated, we followed the same process. We calculated the present value of the cost which became 189.6. Then we got the terminal value of cash inflows which finally, total amount became 467 crores. Then we applied the model of the MIRR which I just discussed with you and that model is, that is the present value of the cost is equal to the terminal value divided by the 1 plus MIRR power the number of years that is 6.

And then when you solve this entire process, we got here, after solving it, we got here some say, value and that value was 0.162 and in the percentage terms it comes out as, that is 16.2 percent. So this calculation has helped us find out something which is called as modified internal rate of return.

So, if you have this modified internal rate of return of 16.2 percent then whatever the investment we are going to make here, this investment of 200 crores which is now finally after discounting has come down to 189.6 crores will be the total, future value of all these cash flows which is coming and when after calculating the terminal value when you discount that terminal value of the future cash flows then that value of that, 467 crores.

If you discount it as 16.2 percent, say in term rate of return, then it will be equal to 189.6 crores so present value of the cost is 189.6 crores. Present value of the, say the benefits which are available from the project, means all the inflows, present value of all the inflows is equal to the 189.6. So, outflows value is equal to inflows value, discounted value of the outflows is equal to the discounted value of the inflows and finally the NPV available here at this rate of 16.2 percent is 0.

So, it means we want to, means find that rate in the internal rate of return also where the, the NPV, NPV of any project becomes 0. We want to find out that. So, the limitations of internal rate of return can be done away with the help of the modified internal rate of return. Process is little, say cumbersome, little tedious but it is a very good solution and all the limitations which are there, all the shortcomings which are there in the internal rate of return, they can be done away by using the concept or the method of the modified internal rate of return.

So, with discussion I complete the discussion on the discounted criteria where we discussed three methods but in fact four methods. One was the net present value method, then was the benefit cost ratio, then was the internal rate of return and because of limitations of the internal rate of return we have to sometimes use the modified internal rate of return.

And when we use the modified internal rate of return, all the limitations, shortcomings of the internal rate of return can be done away, and internal rate of return is the largely use way of, comparing any capital investment with the, other with the inputs, with the outputs and for evaluating the capital investment proposals as compared to the other two criteria.

Internal rate of return is widely used because it is in the percentage terms and comparison of any return available from any investment with other important parameters like growth rate of the project, the rate of interest in the market, the inflation rate is possible.

That is why, it being, internal rate of return being in the percentage terms, we largely make use of internal rate of return this is the most widely used mode of evaluating the, or

discounted criteria of evaluating the capital investment proposals. These are the three methods.

After this I will have some discussion on the non-discounted criteria where I have discussed already, means some part of that with you, just I have given you a feeling about that what are the non-discounted criteria. These are the two, payback period and accounting rate of return. So, a detailed discussion about the non-discounted criteria I will have in the next class. Thank you very much.