Project Management for Managers
Dr. M. K. Barua
Department of Management
Indian Institute of Technology, Roorkee

Lecture - 17
Capital Budgeting Techniques- II

Good morning friends. I welcome you all in this session. In previous session we discussed capital budgeting, and there are several techniques of capital budgeting. Broadly we can classify them as discounting techniques and non-discounting techniques. So, we have seen non-discounting techniques like payback period and ARR and there are several drawbacks of those two methods.

In previous session we have also seen a couple of discounting techniques as well. The first one was discounted payback period. We will quickly go through some of the discounted techniques, so as I said discounted payback period.

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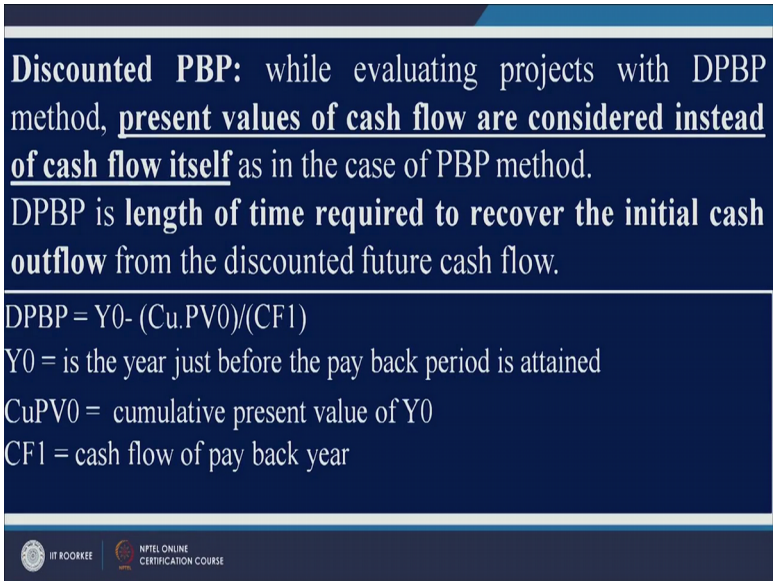

So, here what we do we will calculate the present value of money which we would be receiving in future and there would be some discounting factor. And this is the way in which you can calculate discounted payback period.

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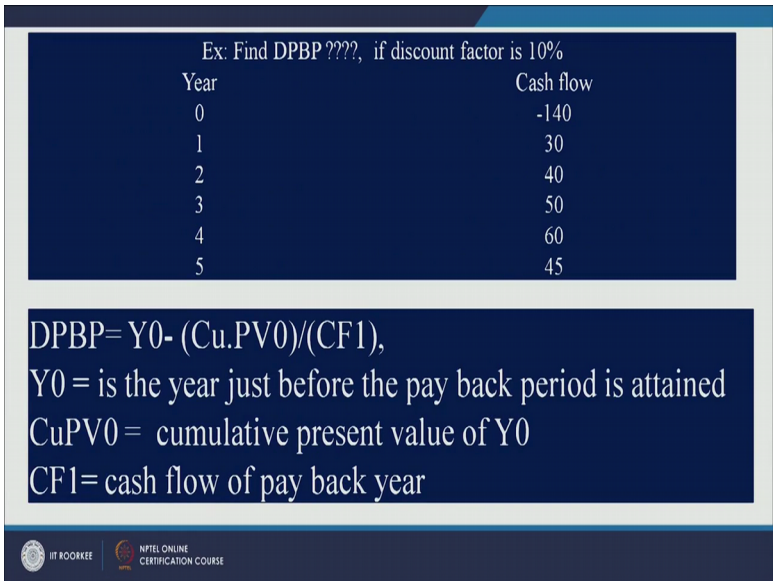

We have also seen this example wherein you have been given cash flows over here, this was cash outflow and these are cash inflows, and discounting factor is 10 percent.

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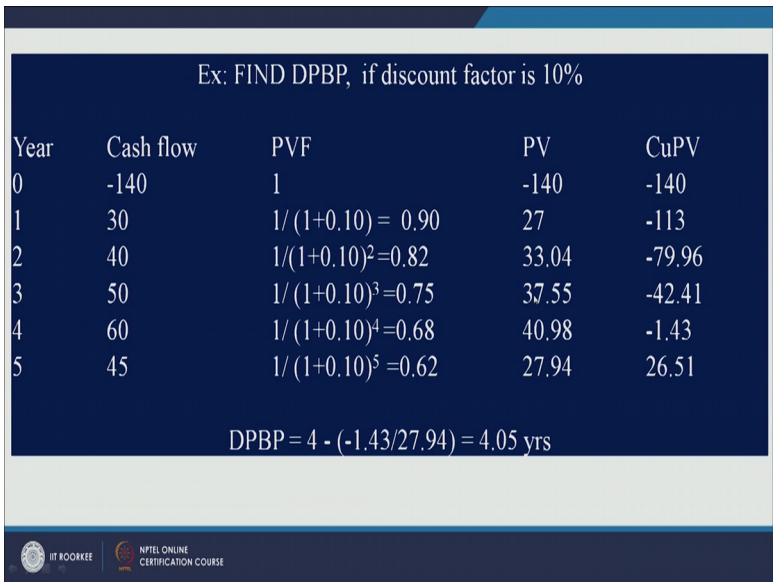

So, we did solve this question in previous session. So in the very initial year present value factor is 1 right. And in first year it is 1 upon 1 plus 0.10 because discounting factor is 10 percent. So, present value factor for first year is 0.90. So, you just multiply 30 in to 0.9 you will get 27.

Similarly, you can do all other calculations. So, what we are seeing at the end of the day this is your payback period which is a discounted one. So, discounted payback period is 4.05 years.

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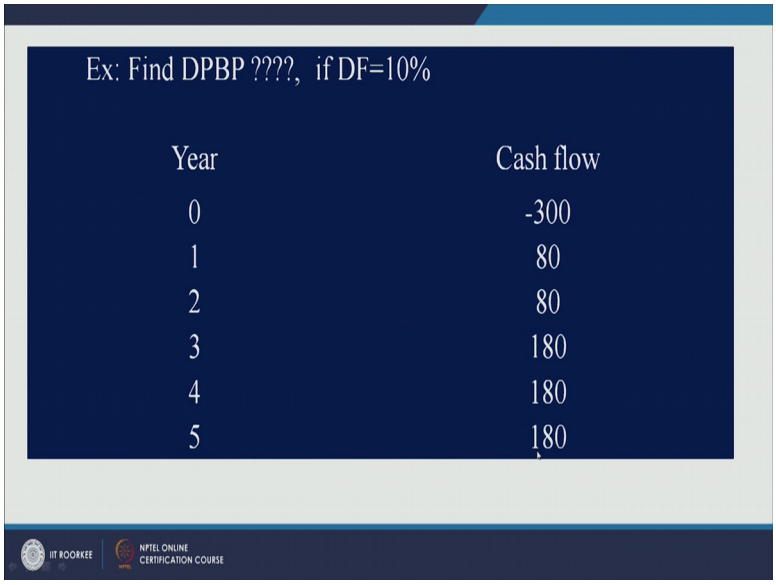

You can solve this question also discounting factor is 10 percent.

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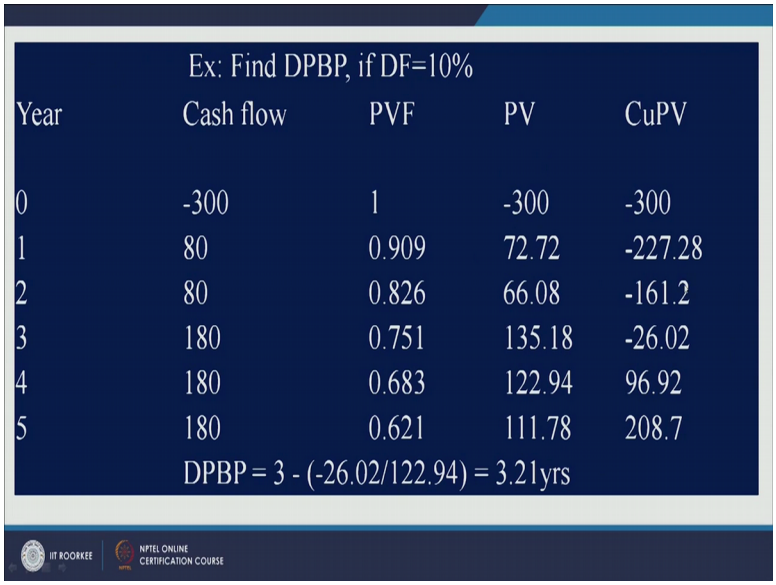

And when we solve this question our discounted payback period was 3.21 years. So, this is again a very simple method.

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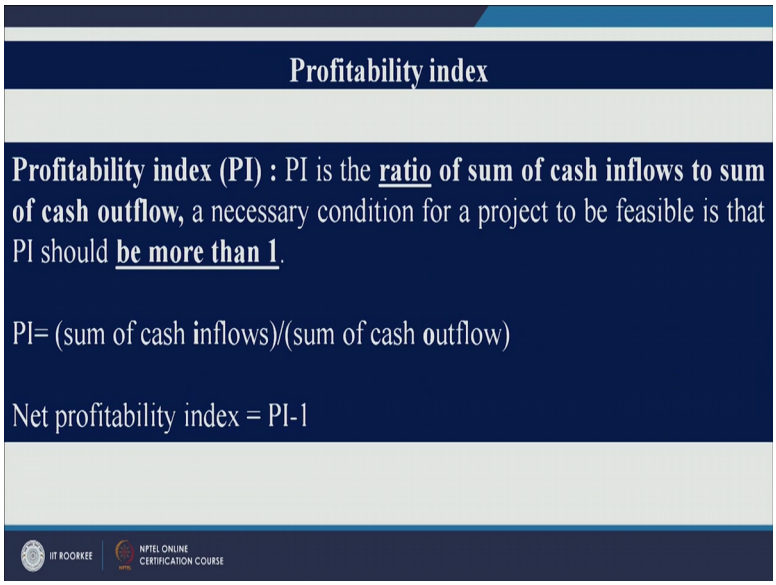

Let us look at profitability index. Profitability index is basically I will tell you whether you should select a project or not. See what happens profitability index is basically a ratio of a present value of cash inflows to present value of cash outflows. So, if profitable index is 1 or more than 1 it is a profitable project.

Net profitability index is profitability index minus 1.

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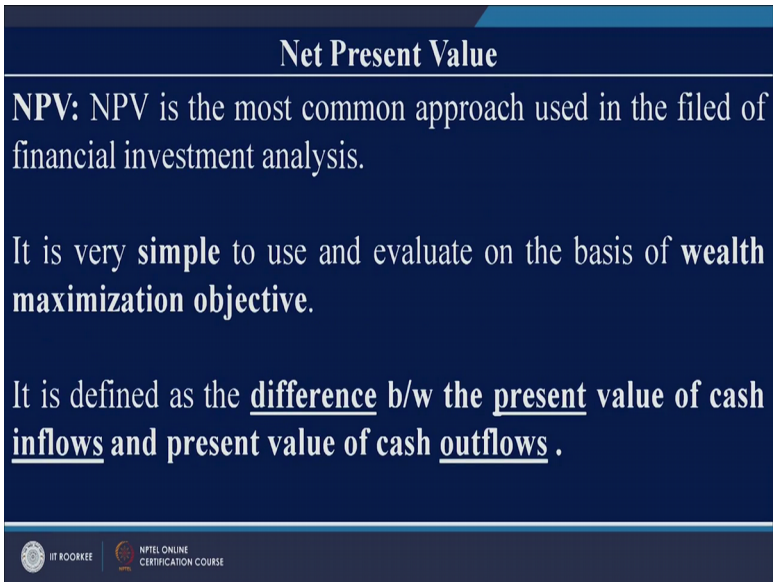

Let us look at NPV. NPV is the third discounted capital budgeting technique. So, in NPV what we do? NPV is the difference between present value of cash inflow and present

value of cash outflow, while PI was the ratio of these two. And is the most common used approach it is very simple and the objective is to maximize wealth of the stakeholders.

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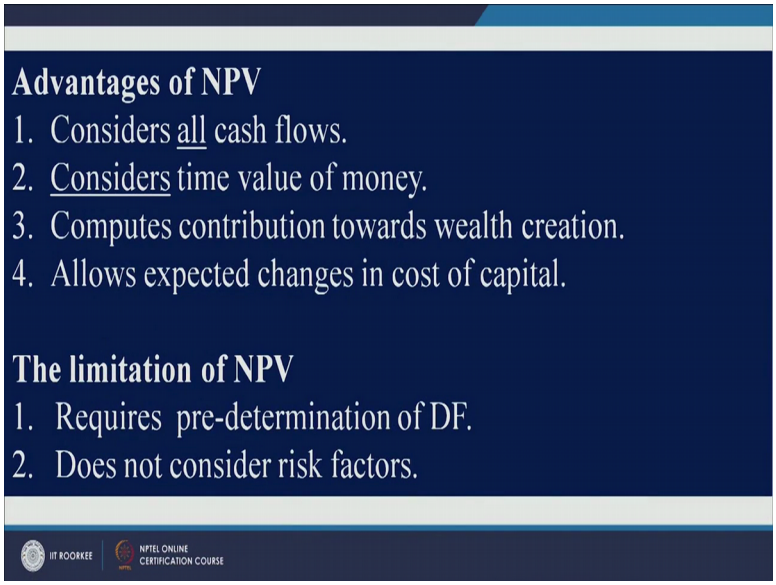

There are couple of advantages: it considers all cash flows even those cash flows which we receive after payback periods, but considers time value of money. Biggest advantage of this method, but there are certain limitations as well. You need to know a priori the discounting factor. So, that is a limitation of this method.

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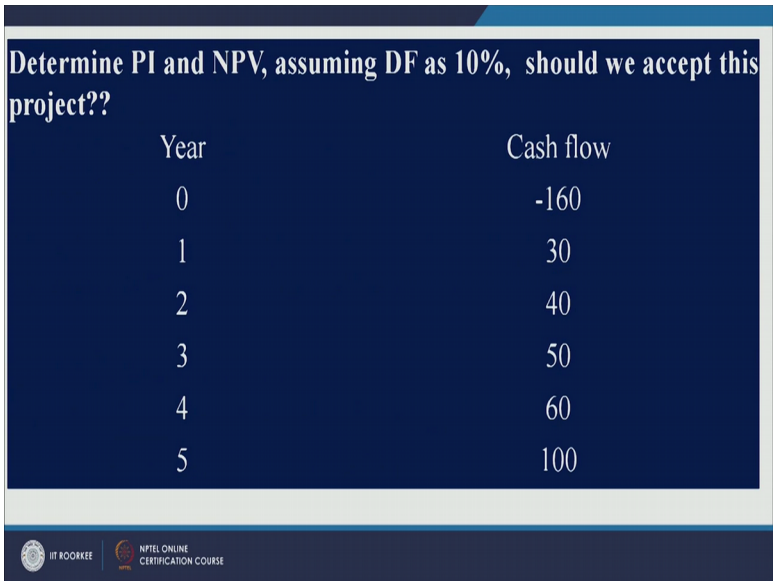

We can solve this question: this PI you need to calculate PI and NPV and you are you are given discounting factor as 10 percent. So, it should we accept or reject this particular project.

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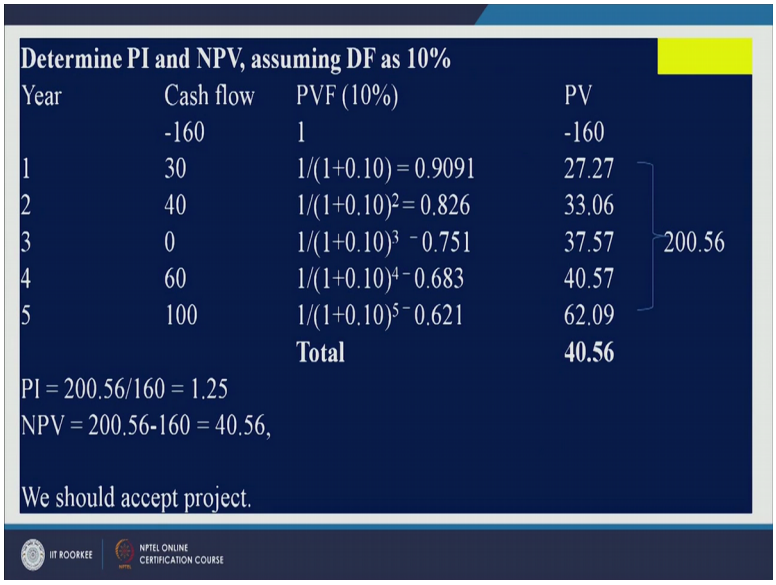

Now, first of all what you need to do is you need to find out what is present value factor for all these years. So, this is this is your zeroth here, this is 0 here. So, discounting factor in first year is 0.90, 0.82, 0.75, 0.68 and 0.62. So, you just add all these values over here in this column you will get present value as 40.56. So, this value is positive.

As far as profitability index is concerned is the ratio of what; is the profitability index is ratio of cash inflows and cash outflows. So, cash inflows is this right this total cash inflow this cash outflow. So, profitable index is 1.25. So, you should accept this pressure.

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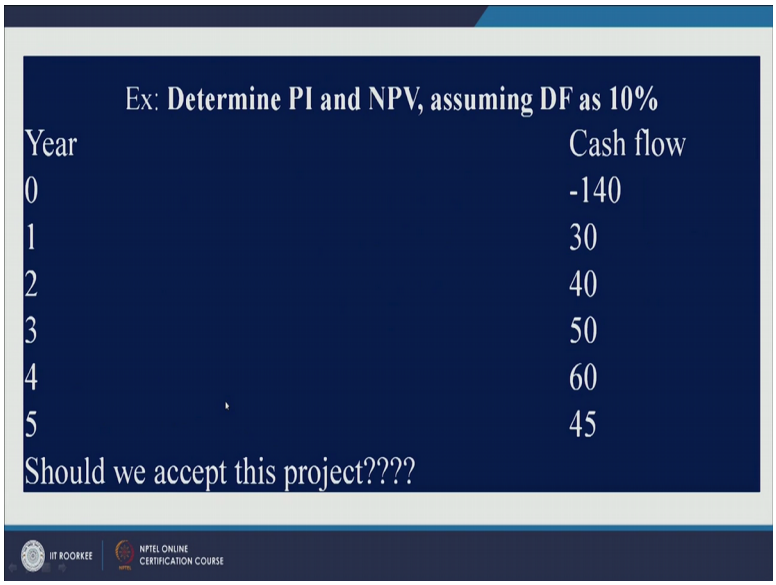

You can also work out this example similar to what we have just seen right.

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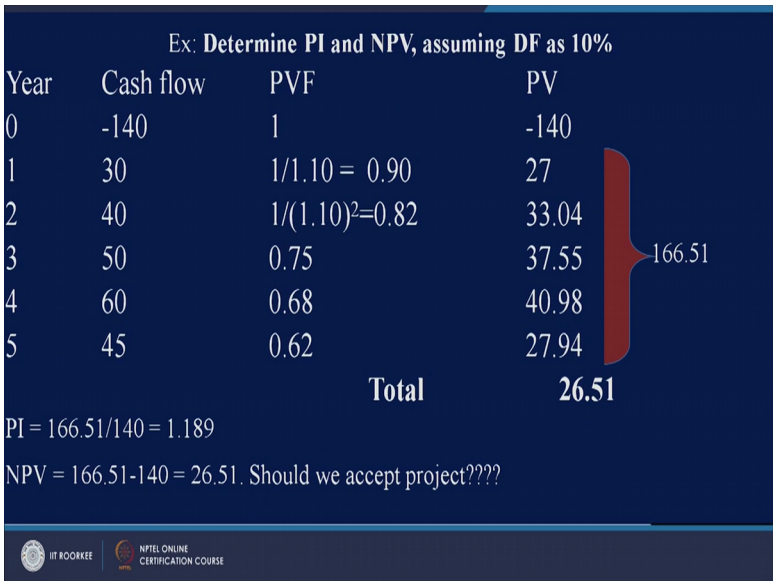

So, for this question profitability index is 1.189 and NPV is 26.51. So, should be accept this project? Yes or no? We should accept this project.

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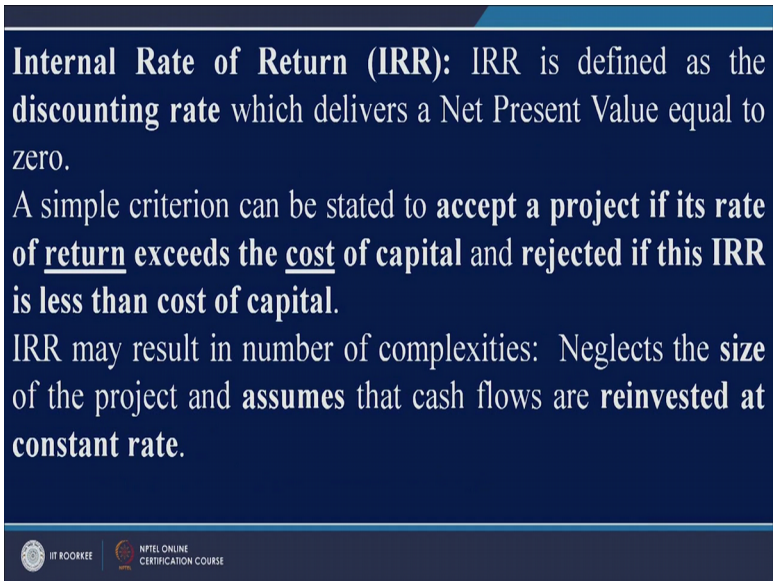

Let us look at another method of capital budgeting which is at a discounted type right, IRR- Internal Rate of Return. So, IRR is defined as the discounting rate at which NPV is 0. So, we have to increase or decrease discounting rate in such a way that we get in NPV equal to 0 and that would be IRR. A simple criterion can be stated to accept a project if its rate of return exceeds the cost of capital. So, if the cost of capital is more than IRR then you should not reject that project, otherwise it should be accepted.

So yes, it is written very clearly here rejected if this IRR is less than cost of capital. IRR may result in number of complexities. Actually the problem with IRR is that it does not include size of the project. For a small project also you will be finding someone IRR, in for large project also you will be finding some IRR also. So, you cannot compare those two IRRs. And the other problem is we assume that cash flows are reinvested at constant rate, but it is not in the case in real life. You can invest cash at different rates, it is not constant.

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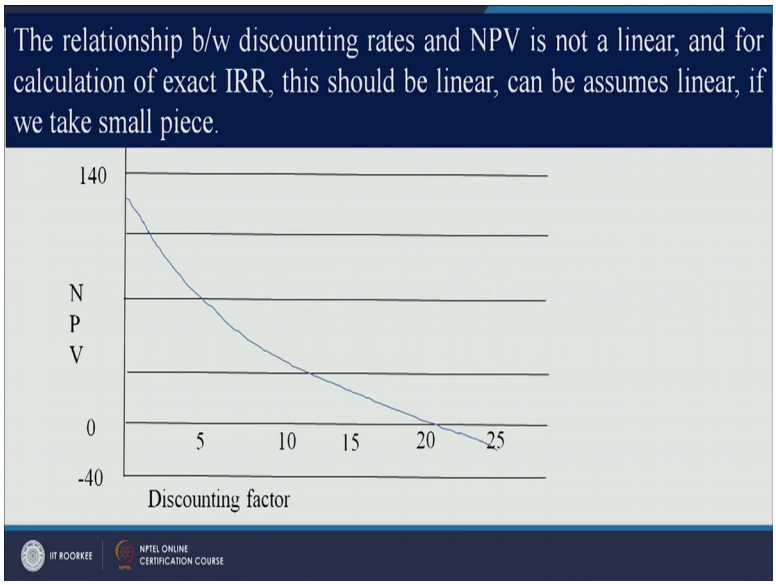

So, this is the relationship between discounting rate and NPV. So, just look at this graph here on y axis you have got NPV and on x axis you have got discounting factor. So, when you increase discounting factor from 5 to 10 your NPV comes down. And you need to increase discounting factor until that point when you reach NPV equal to 0.

So, that is the relationship between these two. And this relationship is not linear, but for the calculation of IRR you can take a small segment of this particular non-linear curve and that small segment would be a linear one. So, what is the relationship between these two? As we increase discounting factor NPV approaches towards 0. So, let us look at this slide which deals with how to calculate IRR.

Calculation of IRR is quite a tedious process it should be done with the help of trial and error method. As we have seen in previous slide so that when we continuously increase r NPV decreases; so you need to increase r such that NPV reaches its 0 value, and that is your IRR.

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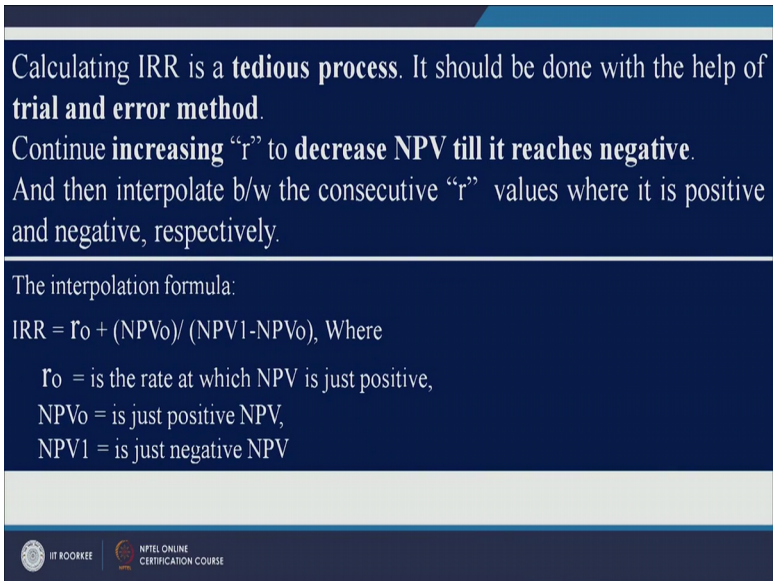

So, let us calculate IRR. So, you have got value of r where NPV is positive and value of r where NPV is negative. So, once you have got these two values, you need to do something called interpolation between these two consecutive values of r. And this is the formula for interpolation.

So, IRR is equal to r 0 NPV 0 divided by NPV 1 minus NPV 0. Let us look at what these terms are in this particular equation. So, r 0 is the rate at which NPV just positive. NPV 0 is just positive NPV; the value of NPV is just positive right. NPV 1 is that value where NPV is just negative. So, you will have NPV just positive and NPV just negative; if you have got these two then you calculate IRR.

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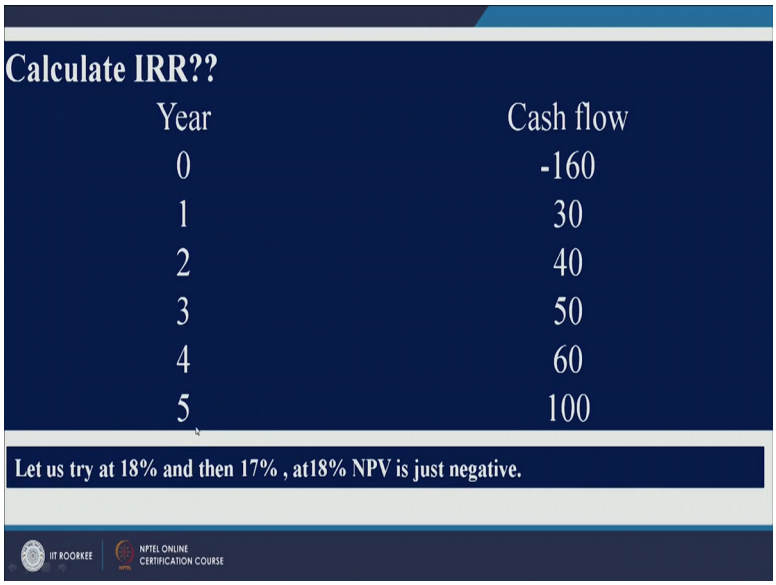

So, let us look at this example. In this example you have to calculate IRR the duration of the project is 5 years and you have been given cash flows like this. So, let us try this question for IRR. First take discounting rate is 18 percent and then 17 percent and then we will try to interpolate the value of IRR.

So, let me solve this question. So, the duration of the project is 5 years.

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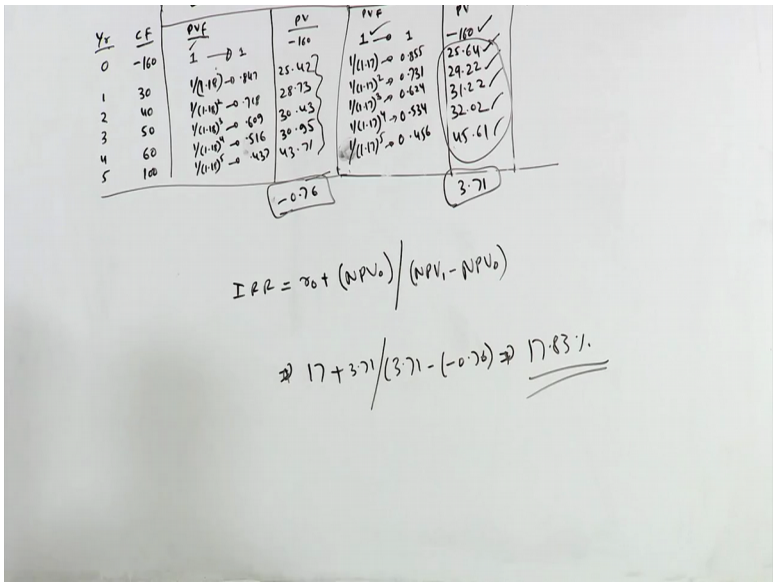

So, here you have got year column. So, this is 0, 1, 2, 3, 4, and 4, and you also been given cash flows. So, initially it is minus 160 cash outflow, then you have got first year

30, second year 40, third year 50, fourth year 60 and fifth year 100. Now let us calculate the present value factor for all these years by taking discounting factor as 18 percent first. So, the present value factor first zeroth year would be 1, for first year it would be 1 by 1 plus; let me directly write it like this- 1 upon 1.18.

(Refer Time: 12:23) second year what it would be, 1 upon 1.18 square. Third year 1 upon 1.18 cube, 1 upon 1.18 to the power 4, 1 upon 1.18 to the power 5. So, this would be this is present value factor right p v f. So, for first year it is it is 1, for first zero th year it is 1, for first year it is 0.847, for second year it is 0.718, for third year it is 0.609, fourth year it is 0.15, 0.516, 0.516 and finally, that is 0.437.

If you look at this particular trend this is continuously decreasing right. Now let us calculate what is present value? Multiply these two columns right. So, here it would be minus 160 right. So, initially it is 1 into minus 160. So, this is minus 160, 30 into 0.847 this is 25.42 then 40 into 0.718, this is 28.73 then you have got 30.43, then 30.95 and 43.71. So, if you look at the sum of all these and when you add this term, you will get present value as minus 0.76 this is minus 0.76.

This is the present value with discounting factor at 18 percent. Now you need to do this similar calculation for 17 percent also. So, how would you do that? So, for 17 percent let me extend this table. So, first of all present value factor right. So, initially one just like this, one one then 1 upon 1.17 for first year, 1 upon 1.17 square for second year, 1 upon 1.17 cube for third year, 1 upon 1.17 to the power 4 for fourth year and finally, 1 upon 1.17 to the power 5. So, now, you can calculate these values and initially it is one right 1 upon 1.17 is 0.855, then 0.731, 0.624 then you have got 0.534, 0.45 and 6.

So, these are what present value factors, now calculate present value for 17 percent. So, initially you have got 160 minus 160 into 1. So, this is minus 160 for zeroth year then 30 into 0.455. So, this is 25.64, then 40 into 0.731, this 29.22, then 31.22, 32.02 and finally, 45.61. So, this is for zeroth year first second third fourth and fifth, if you grade all these positive values and subtract it from here or if you take the summation of this particular column, then you will have value as equal to 3.71. So, at 17 percent NPV value is just positive at 18 percent NPV value is just negative.

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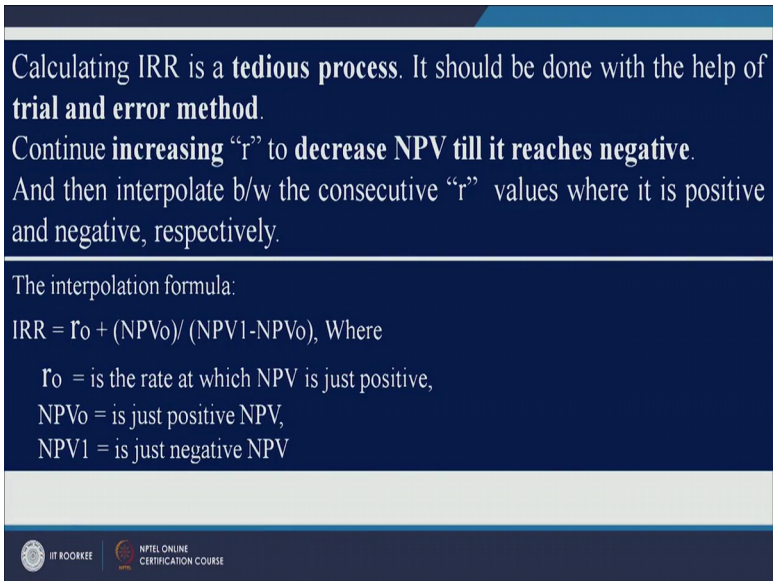

Now, we know the formula for interpolation right and what is the formula this is the formula. So, we will keep, we will put all these values in this particular formula and we will get IRR. So, let us look at IRR, IRR is equal to we know the formula is r 0 plus NPV 0 divided by NPV 1 minus NPV 0 right. So, this you can write like this, this is 17 plus 3.71 divided by 3.71 minus 0.76; this is equal to 17.83 percentage. So, as far as this particular question is concerned the internal rate of return is 17.83 percentage.

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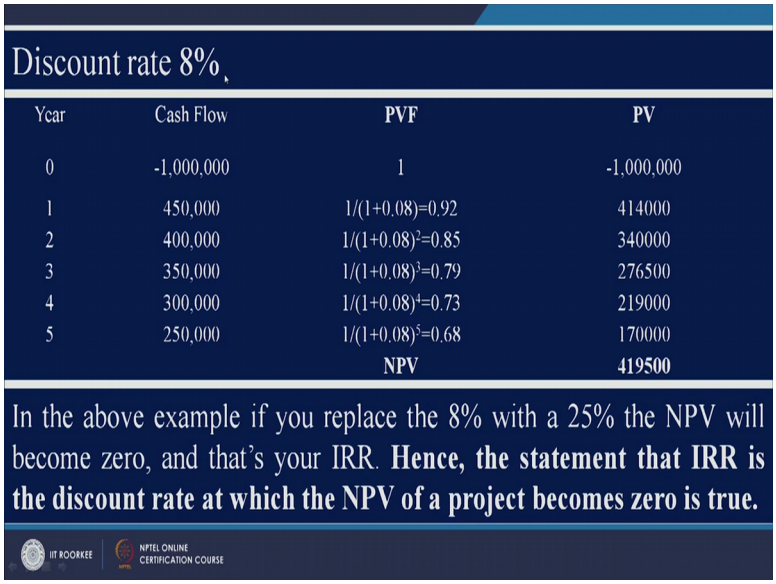

Let us look at this question, let us take discounting rate is 8 percent right discount rate is 8 percent, when we solve this question our NPV is 4, 19,500. So, this is your initial cash outflow and this is present value discounting rate is 8 percent. So, this is this your discounting present value factor, discounted present value factor for this and multiply this column with this particular column and add all these values right. So, you will get NPV is equal to positive right. So, can we say that this is IRR of the project, no because NPV is not zero right or it had been 0 we would have said this is IRR right? So, if you change if you replace 8 percent by let us say by 25 percent then NPV will become 0 and that would be your IRR.

So, let us check whether this statement is correct or not then this statement is this statement that IRR is discounting rate at which NPV of a project becomes 0. So, we will check whether the statement is correct or not. So, what we should do let us replace this value by 25 percent, what will happen? It is 1.1 plus 1.25 right 1.25, 1.25, 1.25, 1.25. So, its square cube to the power 4 to the power 5. Get all these present value factors multiply present value factors with cash flows and find out whether this value is zero or not.

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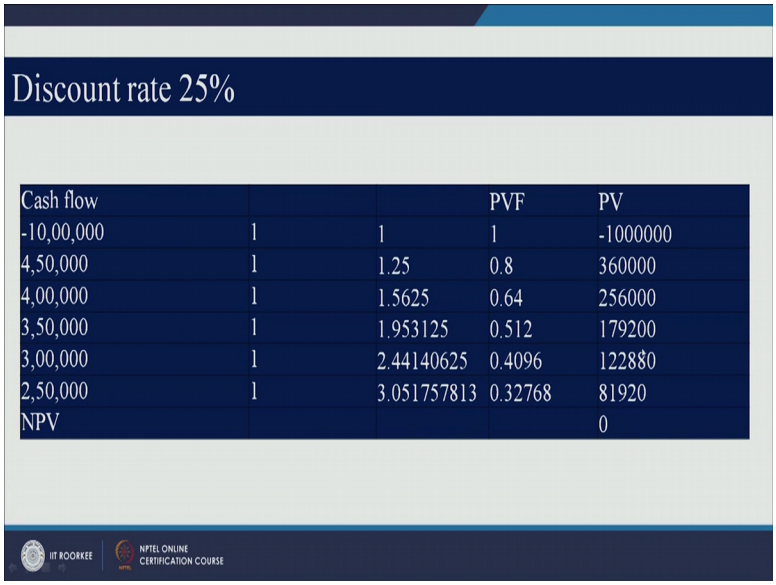

And this is what is the solution right. So, this is minus value and all these are plus values right and when you add all this NPV becomes 0.

So, it means this statement. So, we will say that this statement that IRR is that point where NPV becomes 0 right.

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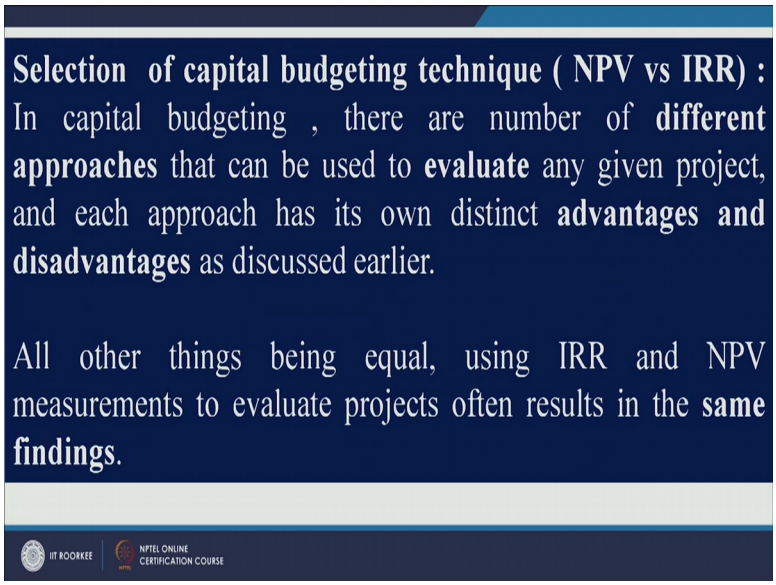

Now we have seen several techniques right, several discounting and several non-discounting techniques, but how to select the best. In fact, there is no best method or there is no single method, but there are some methods which perform better than other methods right. So, if you compare these two NPV and IRR, then if you rank them then we can say that NPV tops the list and there are certain reasons for that also and there are some. In fact, that this is also true that if you keep all other things equal then IRR and NPV might give same findings right. But you can do some more research and you can find out which is the best right but you can do some more research and you can find out which is the best right.

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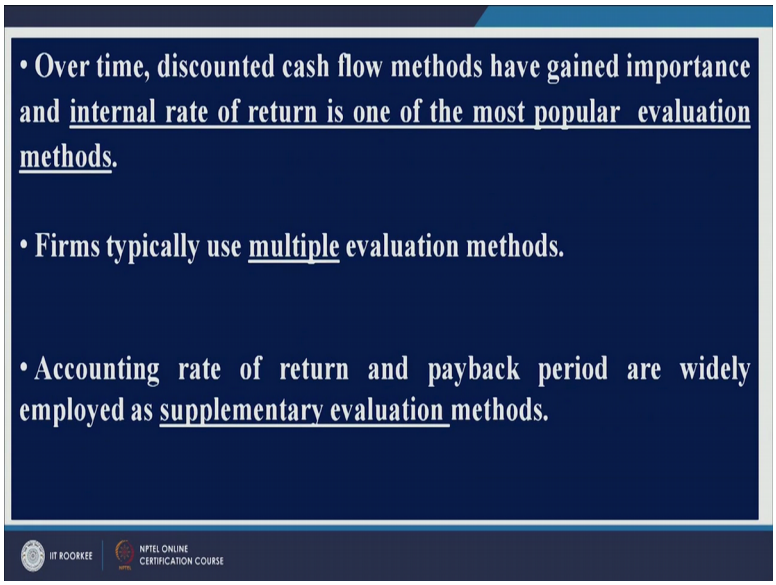

So, over a period of time, firms are using more of discounting techniques rather than non-discounting techniques. And IRR is one of the most popular methods of evaluation and firms typically use multiple evaluation methods that they do not go for just one particular method. So, there are some you know screening level methods, then you can do some secondary level of screening is not it or the second level of screening.

So, at the end of the day you need to have a have a mix of these methods. So, ARR and payback period were widely employed as supplementary evaluation methods.

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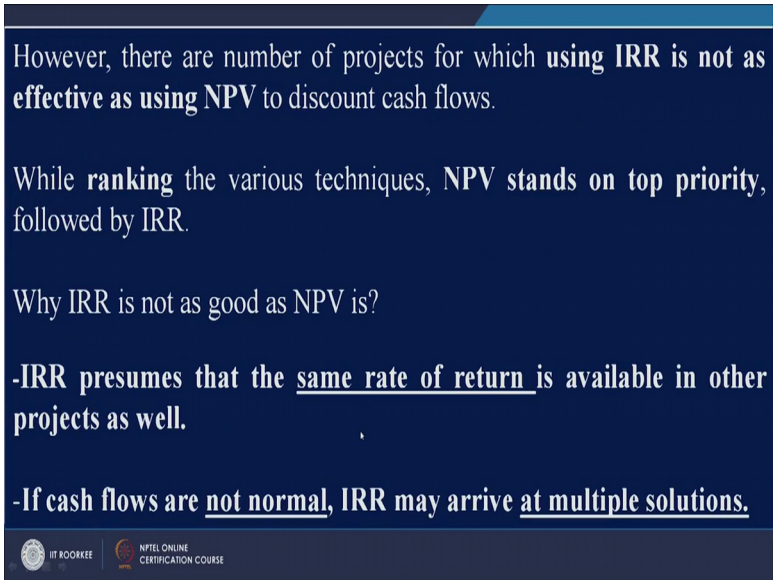

So, why NPV is better than IRR? When we compare NPV and IRR, NPV is better because of a couple of reason. The first reason is that the IRR presumes that the same rate of return is available in other projects as well. So, if there are several projects then IRR would assume that the rate of return is same and if cash flows are not normal then IRR may lead multiple solutions right. So, these are two reasons why IRR is not preferred over NPV.

Let us look at the assessment of basic evaluation methods. So, you can compare these methods on several theoretical and practical criteria right.

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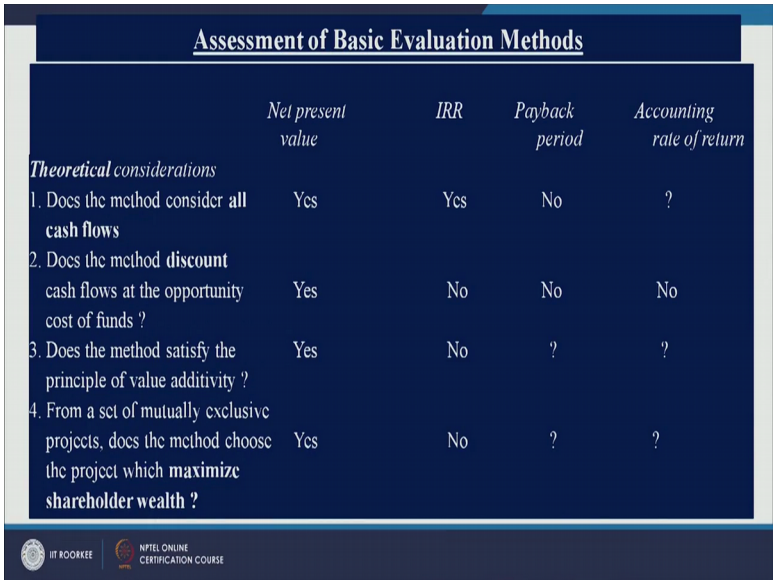

So, if you look at theoretical consideration and we have taken four methods here. So, does the method consider all cash flows yes this method considers all cash flows IRR also, but payback period it does not consider right. Does the method discount cash flows at the opportunity cost of fund? NPV does no other methods do that right. Does the method satisfy the principle of validity value additivity? Yes NPV does that and this is most important. Are you maximizing wealth of stakeholders or shareholders? This method does that NPV does that right.

So, if you look at all these four criteria NPV is positive in all these right while RR, IRR is positive only on this particular criterion right. So, these are couple of theoretical considerations right.

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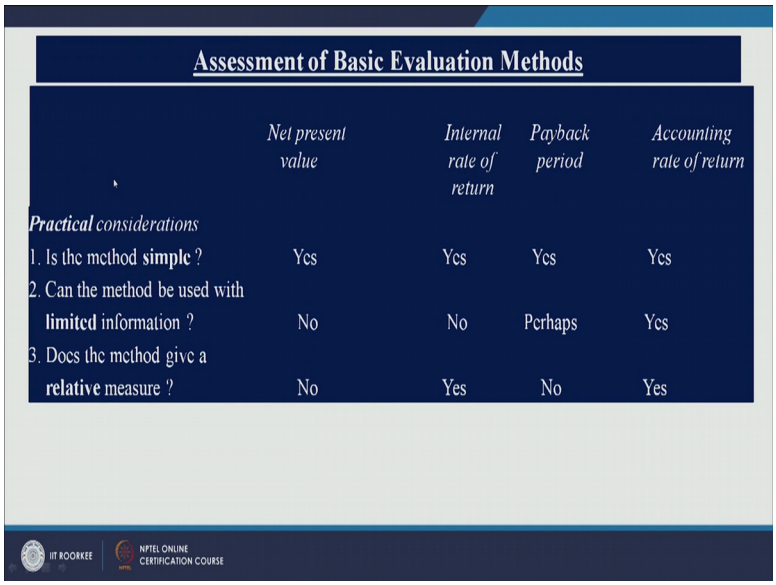

Let us look at some practical considerations is this method simple? Yes this is simple IRR is also simple payback period most simple right. Can the method be used with in limited information? NPV you cannot, IRR you cannot perhaps you can use payback period right ARR definitely you can use right. Does the method you relative measure? Only IRR and accounting rate of return these two methods give relative measure right.

So, if you look at all these 7 criteria, 4 this and 3 this right. So, total 7 criteria, on 7 criteria NPV has got yes in 5 criteria right.

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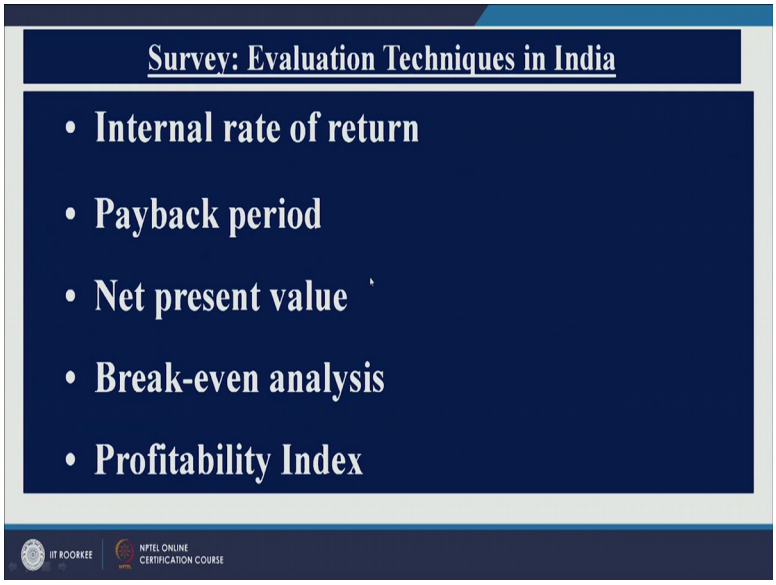

So, we will say NPV is the best amongst this right. So, you can solve this question and in fact, you can do a survey also and the survey is like this you can visit several firms and you can ask them which kind of capital budgeting techniques they are using. So, you can give them list of all those techniques which we have just covered in this session as well as in previous session.

So, you just give them a list of these methods and ask them which is most widely being used right. So, they let them from run from 1 to 10 or 1 to 5 whatever means how many number of methods you are giving you let them right. So, I think we have seen total how many 2 plus 4 I think. So, total 6 or 7 methods we have seen is there in slide. So, you can do a survey by taking these 6 methods to different forms and ask them whether which of them is being used most widely right. So, with this we come to an end of this particular session.

Thank you very much.