Project Management for Managers
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Lecture - 16
Capital Budgeting Techniques – I

Hello friends and welcome you all in this session. In previous session we discussed payback period method and ARR these 2 are non discounting capital budgeting techniques we will continue with ARR. So, average rate of return also known as accounting rate of return there are large number of measures of ARR why because ARR is ratio of in layman's term I can say it is the ratio of income to investment. Since you can measure income in several ways and investment in several ways that is why you have got large number of ways of calculating ARR we will see couple of those methods.

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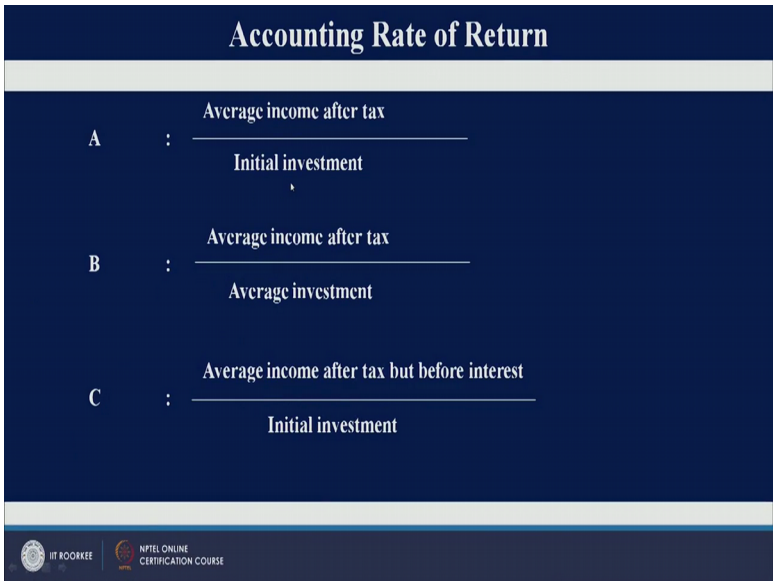

So, the first is this average income after tax divided by initial investment you can have average income after tax divided by average investment right. So, here it is initial investment here it is average investment. So, you are measuring investments in 2 different ways right.

The third one is average income after tax, but before interest divided by initial investment right, similarly you can have average income after tax, but before interest divided by average investment.

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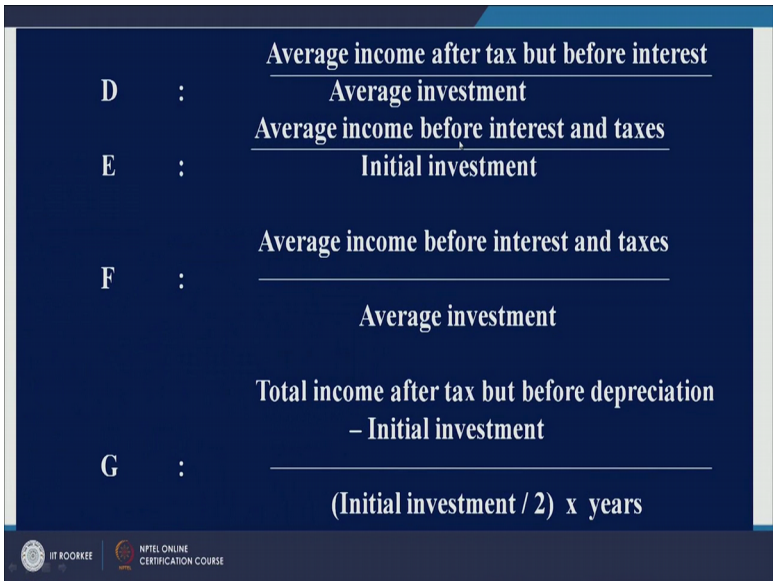

The fifth measure is average income before interest and taxes right and this one was after tax, but before interest, while in case of e it is average income before interest and taxes divided by initial investment here it was average investment right. The next measure is average income before interest and taxes divided by average investment you have got this measure also total income after tax, but before depreciation minus initial investment divided by initial investment by 2 into number of years right. So, so these are you can say 7 measures right. Let us look at an example and calculate all these measures right. So, this is the question.

So, there is a project the initial investment is one. So, you have got depreciation year wise its 0.2 every year its income before interest and taxes.

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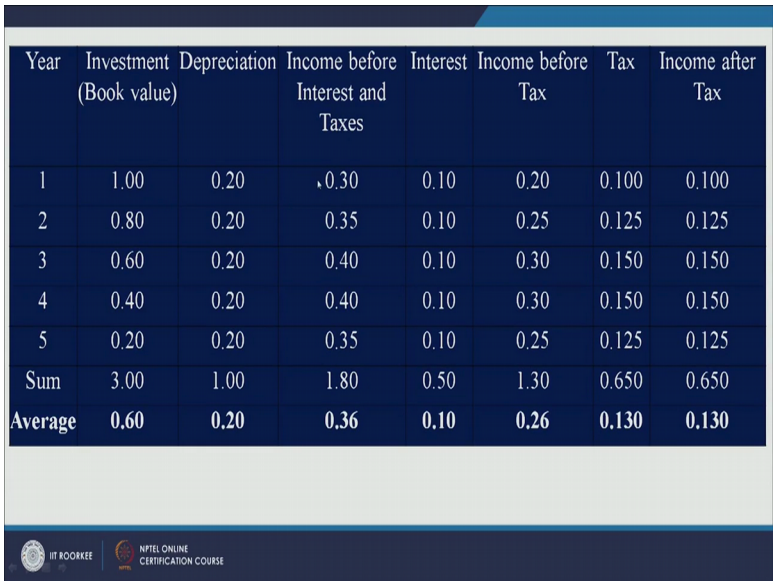

Year	Investment (Book value)	Depreciation	Income before Interest and Taxes	Interest	Income before Tax	Tax	Income after Tax
1	1.00	0.20	0.30	0.10	0.20	0.100	0.100
2	0.80	0.20	0.35	0.10	0.25	0.125	0.125
3	0.60	0.20	0.40	0.10	0.30	0.150	0.150
4	0.40	0.20	0.40	0.10	0.30	0.150	0.150
5	0.20	0.20	0.35	0.10	0.25	0.125	0.125
Sum	3.00	1.00	1.80	0.50	1.30	0.650	0.650
Average	**0.60**	**0.20**	**0.36**	**0.10**	**0.26**	**0.130**	**0.130**

So, first year is 0.3 next year 0.35 fifth year 0.35 right interest is same in all these years 1 to 5. So, this total interest income before tax, how would you calculate this. So, this column minus this column right income before tax right what is tax; tax is 0.10 in first year 0.1 to 5 in fifth year and this the sum of all these taxes right income after tax this is 0.1; 0.125 this and other values are also given here right. So, you have been given income after tax this is the sum and this is the average right. So, average value for all these columns are also given right. So, average investment is 0.6 average depreciation is 0.2 income before interest tax 0.36 interest 0.10 income before tax this tax and income after tax right. So, if I ask you to calculate this measure average income after tax divided by initial investment what that value would be can you calculate?

Average income after tax divided by initial investment and this is your question. So, initial investment is what one, right.

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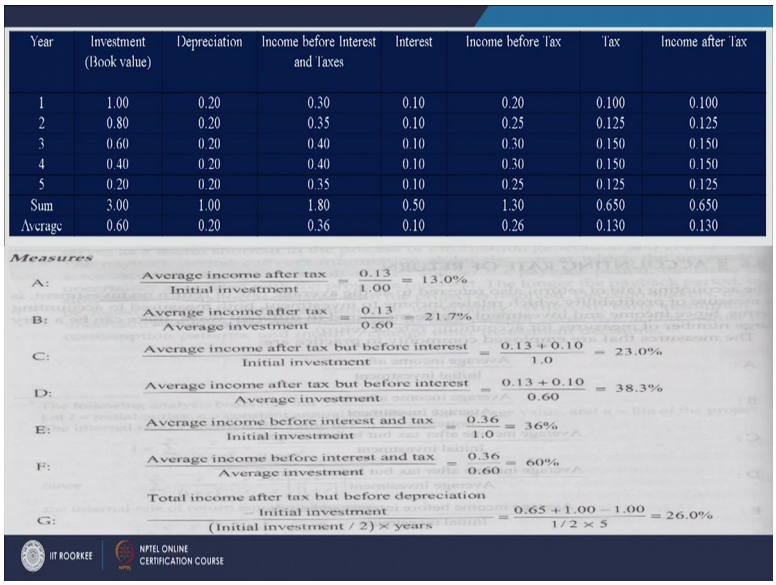

And what is this average income after tax average income after tax where it is where is average income after tax its point one 3 right. So, average income after tax is point one 3 divided by initial investment this is one right, let us look at second measure average income after tax 0.3 divided by average investment. So, in first formula it was initial investment. Now it is average investment which is 0.6, similarly you can calculate other measures all these are nothing, but ARR different ways of calculating average rate of returns right and why there are so many because you are measuring income and investment differently.

Let us look at couple of demerits of this method though this method is better than payback period method, but there are couple of drawbacks.

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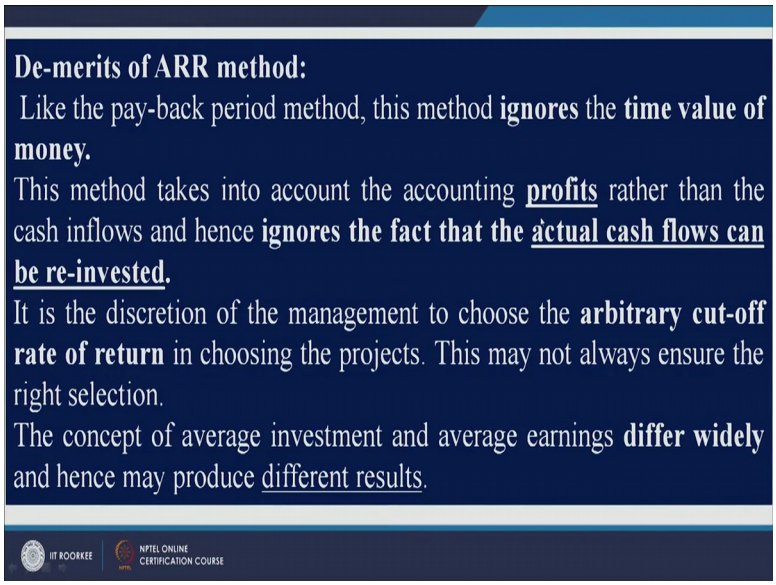

This method ignores time value of money just similar to payback period method this method takes into account accounting profit rather than cash inflows and hence ignores the fact that actual cash flows can be reinvested. So, this is the drawback right ARR can be arbitrarily fixed for example, ARR is 10 percent good for me, but may not be good for you right. So, manager skin arbitrarily set ARR which is also a drawback and as I said the concept of average investment and average earnings differ widely. So, you will have different results right. So, this is again one of the drawbacks.

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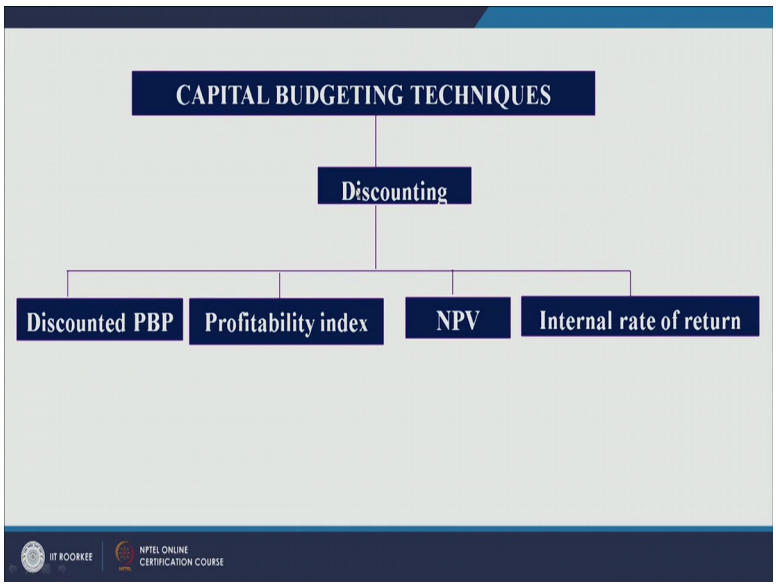

Let us look at now some discounting techniques. So, far we have seen non discounting techniques right namely payback period and ARR let us look at discounting techniques right and the first one is discounted payback period method right discounted payback period method then you have got profitability index you have got NPV you have got internal rate of return right. So, we will see discounted payback period method before this.

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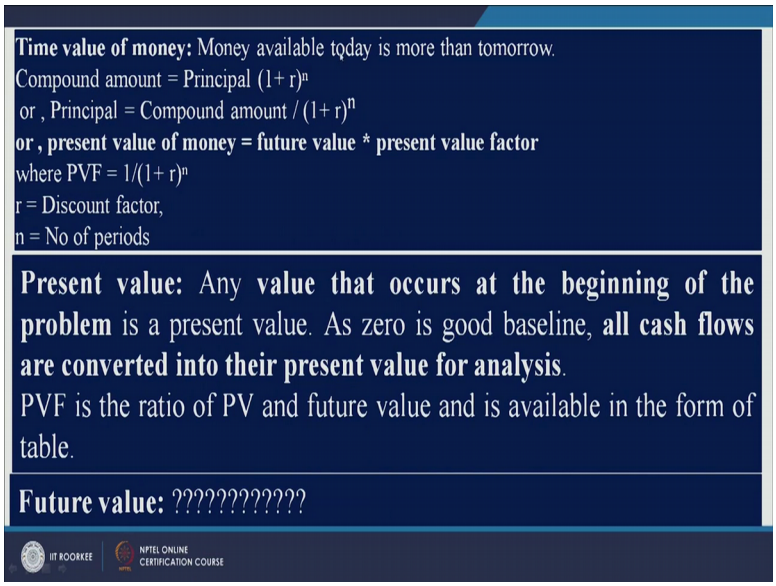

Let us look at once again the concept of time value of money right. So, we are we are saying that money available today is more than money available tomorrow right. So, we will we will define some terms over here right. So, there is something called present; present value, what is present value any value which occurs at the beginning of the project is known as present value and generally we take 0 as a baseline. So, we convert all cash flows in their present value for analysis purposes right let us one once again define present value factor what is present value factor you can easily calculate from here right present value factor is nothing, but present value divided by future value right. So, it is the ratio of future value is the ratio of present value and future value and it and this present value factor is available in the form of table in any of the books on project management or accounting management right. So, we defined present value right.

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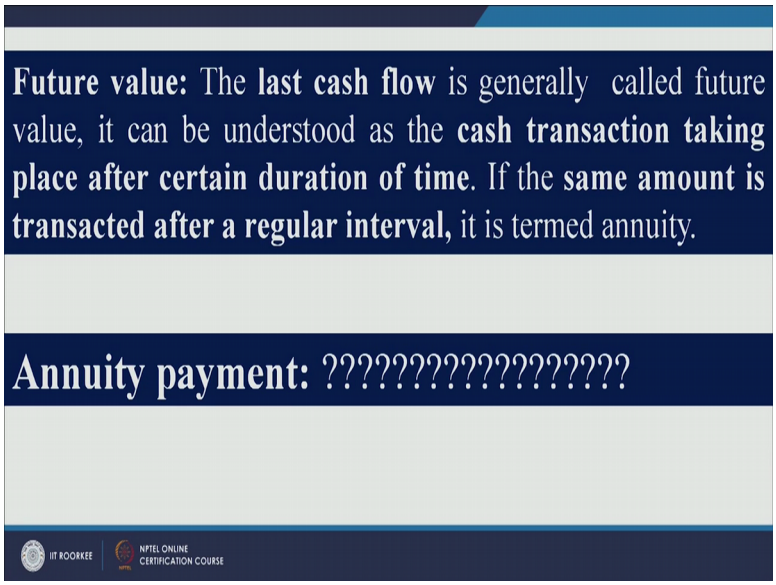

Now, let us define what is future value future value is the last cash flow is generally called future value. So, so it can be understood as the cash transaction taking place after certain duration of time if the same amount is transacted after a regular interval then it is termed as annuity right.

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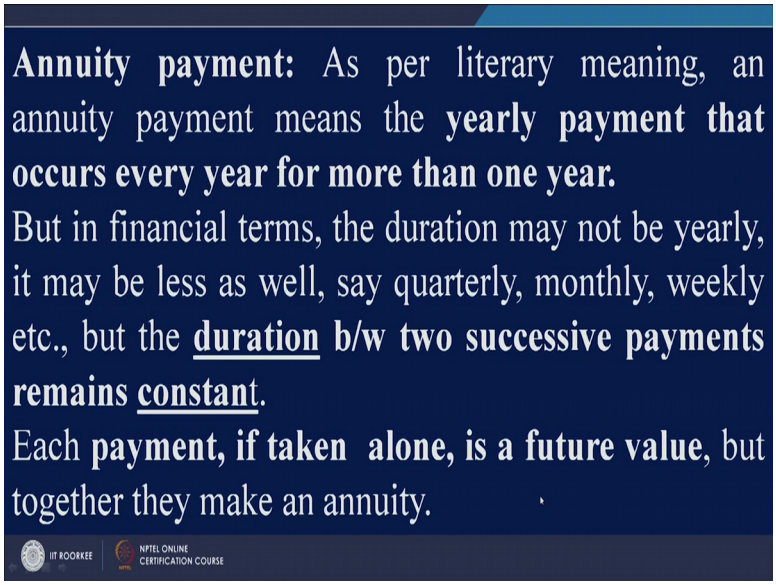

So, what is annuity payment? So, if you go by literary meaning the yearly payment that occurs every year for more than one year that is annuity payment, but it is not necessary that that may occur on yearly basis you may have quarterly basis or monthly basis or

weekly basis also right, but the duration between 2 successive payments remains constant right.

So, that is annuity payment right as I said each payment if taken a loan its future value otherwise it is a annuity right.

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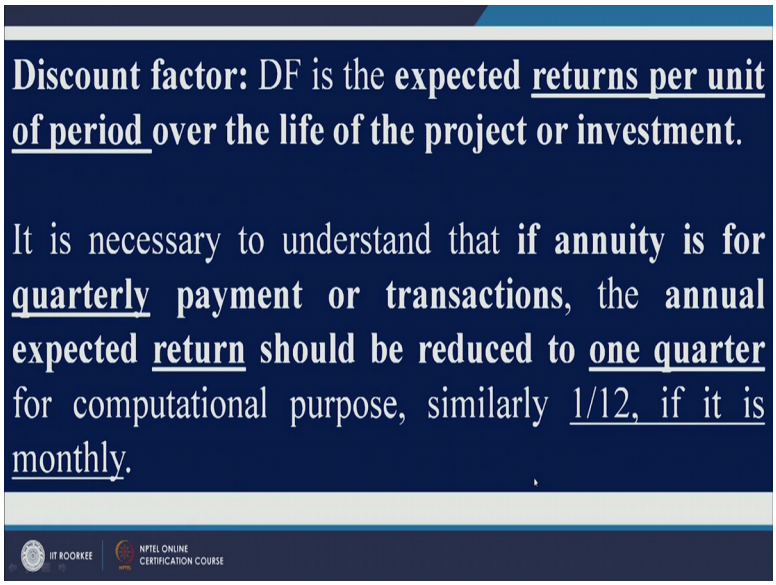

There is something called discount factor discount factor is the expected returns per unit of period or the life of the project right. So, it is necessary to understand that if any if annuity is for quarterly payment they annual expected return should be reduced to one quarter for computational purposes. If annuity is for let us say monthly payment then it is to be adjusted accordingly the return should be reduced to 1 by 12, if it is monthly right number of periods of course, what is the total number of periods which are there in the project is its number of periods.

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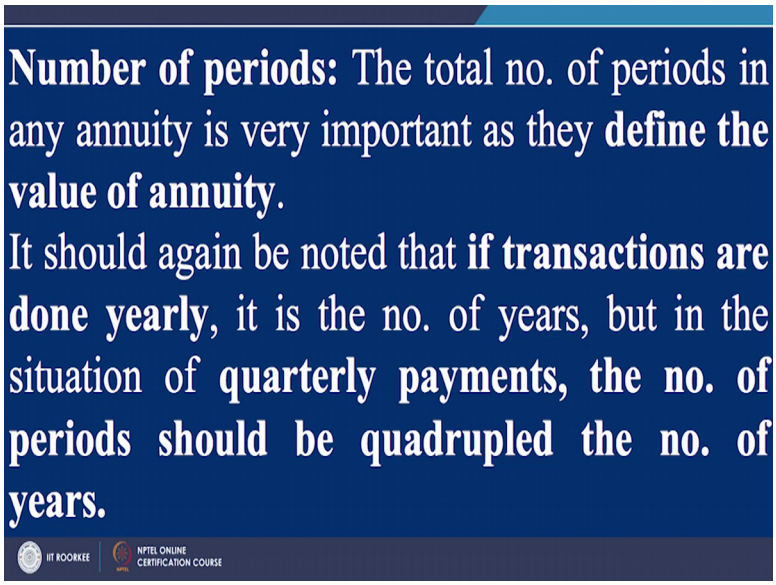

It should again be noted that if transactions are done yearly it is the number of years, but in the situation of quarterly payment the number of period should be quadrupled the number of years this is important point you should keep in mind right.

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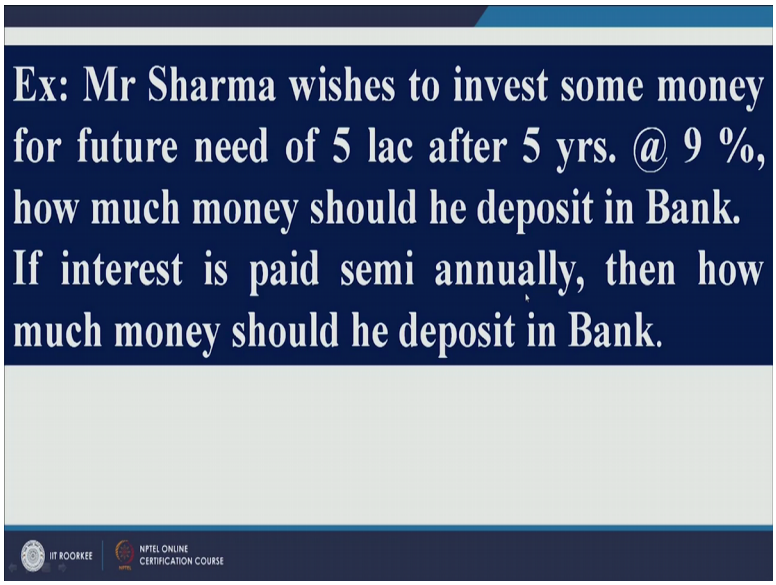

Let us look at this question very simple question Mr. Sharma wishes to invest some money for future need of 5 lakh after 5 years right at the rate of nine percent how much money should he deposit in bank. So, the first question is if let us say if I want 5 lakh rupees after 5 years and the interest rate is nine percent. So, how much should I deposit

today this is the first part of the question and second part is if interest is paid semiannually then how much money should be deposited in bank. So, there are 2 parts in this question right. So, how to solve this question just try this.

Let me solve this question it is a simple one right. So, present value is 5 lakh right divided by 1 plus this is your 9 percent right its 0.09 to the power n right.

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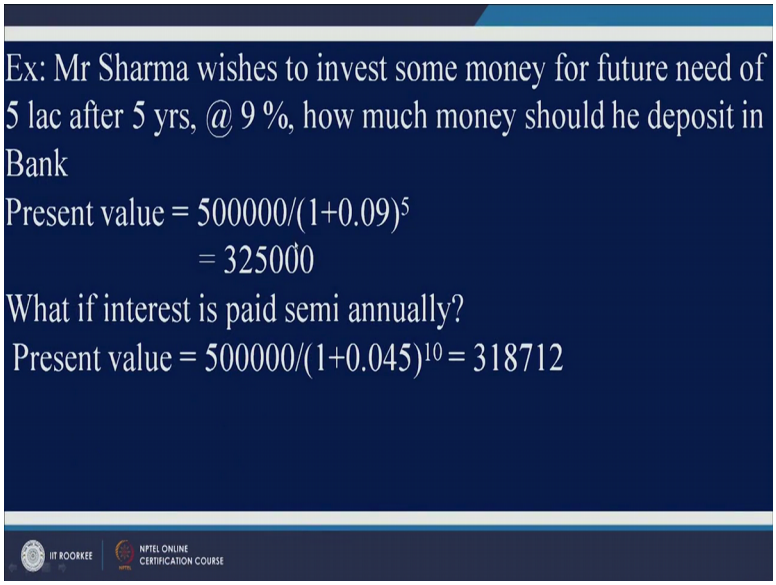

A n is number of years right. So, it is 5. So, this value is 325000. So, if I want 5 lakh rupees after 5 years then I will have to deposit 325000 in the bank at the rate of nine percent right the second part of the question is what if interest is paid semiannually right. So, you need to multiply n by 2 and is to be divided by 2. So, thus 5 lakh divided by 1 plus 0.045 to the power 10. So, this is 318712 rupees a very simple question right.

Let us try this question let us say Mr. X wants to receive 120000 every year for next 10 years how much should he deposit.

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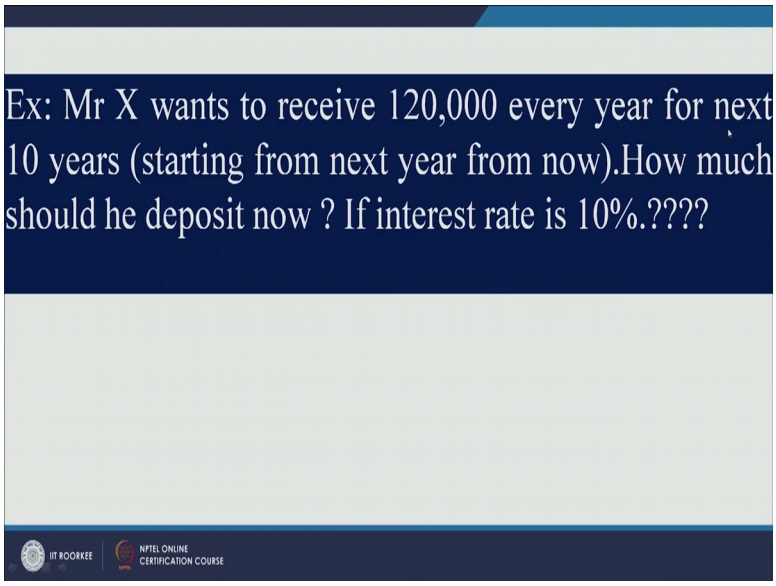

Now, if interest rate is 10 percent question is Mr. X wants to receive 120000 every year for next 10 years starting from next year from now right how much should he deposit if interest rate is 10 percent let me solve this question. So, you have got this present value of annuity of 1 rupee for period t.

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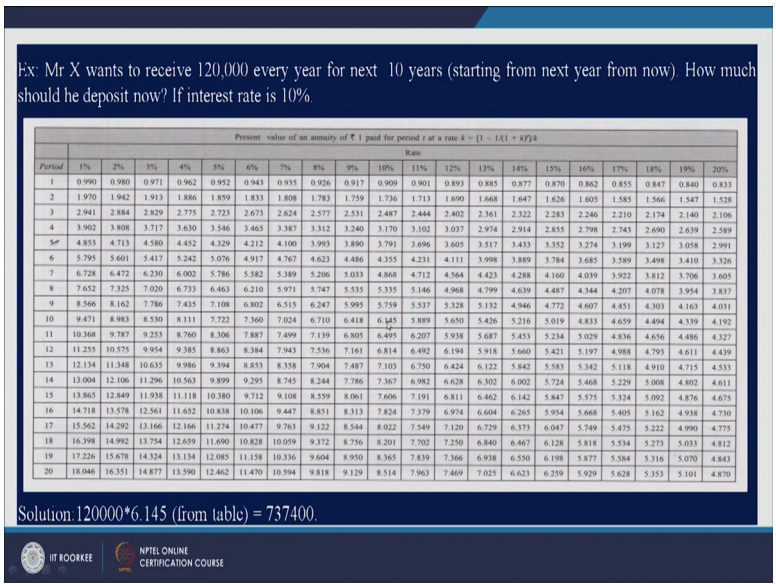

Present value of an annuity of ₹ 1 paid for period t at a rate $k = [1 - 1/(1 + k)^t]/k$

Period	Rate																			
	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%	13%	14%	15%	16%	17%	18%	19%	20%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909	0.901	0.893	0.885	0.877	0.870	0.862	0.855	0.847	0.840	0.833
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736	1.713	1.690	1.668	1.647	1.626	1.605	1.585	1.566	1.547	1.528
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487	2.444	2.402	2.361	2.322	2.283	2.246	2.210	2.174	2.140	2.106
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170	3.102	3.037	2.974	2.914	2.855	2.798	2.743	2.690	2.639	2.589
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791	3.696	3.605	3.517	3.433	3.352	3.274	3.199	3.127	3.058	2.991
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355	4.231	4.111	3.998	3.889	3.784	3.685	3.589	3.498	3.410	3.326
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868	4.712	4.564	4.423	4.288	4.160	4.039	3.922	3.812	3.706	3.605
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335	5.146	4.968	4.799	4.639	4.487	4.344	4.207	4.078	3.954	3.837
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759	5.537	5.328	5.132	4.946	4.772	4.607	4.451	4.303	4.163	4.031
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145	5.889	5.650	5.426	5.216	5.019	4.833	4.659	4.494	4.339	4.192
11	10.368	9.787	9.253	8.760	8.306	7.887	7.499	7.139	6.805	6.495	6.207	5.938	5.687	5.453	5.234	5.029	4.836	4.656	4.486	4.327
12	11.255	10.575	9.954	9.385	8.863	8.384	7.943	7.536	7.161	6.814	6.492	6.194	5.918	5.660	5.421	5.197	4.988	4.793	4.611	4.439
13	12.134	11.348	10.635	9.986	9.394	8.853	8.358	7.904	7.487	7.103	6.750	6.424	6.122	5.842	5.583	5.342	5.118	4.910	4.715	4.533
14	13.004	12.106	11.296	10.563	9.899	9.295	8.745	8.244	7.786	7.367	6.982	6.628	6.302	6.002	5.724	5.468	5.229	5.008	4.802	4.611
15	13.865	12.849	11.938	11.118	10.380	9.712	9.108	8.559	8.061	7.606	7.191	6.811	6.462	6.142	5.847	5.575	5.324	5.092	4.876	4.675
16	14.718	13.578	12.561	11.652	10.838	10.106	9.447	8.851	8.313	7.824	7.379	6.974	6.604	6.265	5.954	5.668	5.405	5.162	4.938	4.730
17	15.562	14.292	13.166	12.166	11.274	10.477	9.763	9.122	8.544	8.022	7.549	7.120	6.729	6.373	6.047	5.749	5.475	5.222	4.990	4.775
18	16.398	14.992	13.754	12.659	11.690	10.828	10.059	9.372	8.756	8.201	7.702	7.250	6.840	6.467	6.128	5.818	5.534	5.273	5.033	4.812
19	17.226	15.678	14.324	13.134	12.085	11.158	10.336	9.604	8.950	8.365	7.839	7.366	6.938	6.550	6.198	5.877	5.584	5.316	5.070	4.843
20	18.046	16.351	14.877	13.590	12.462	11.470	10.594	9.818	9.129	8.514	7.963	7.469	7.025	6.623	6.259	5.929	5.628	5.353	5.101	4.870

So, this table and you can find in all the books related to project management in most of the books not in all the books and the e-books of let us say financial accounting and so on. So, what is the solution it is for 10 years and interest rate is 10 years. So, you just see

period is 10 years right this and interest rate is 10. So, this is 6.145. So, just multiply 120000 by 6.14. So, you will get this value right it is 737400. So, this is the answer to this question.

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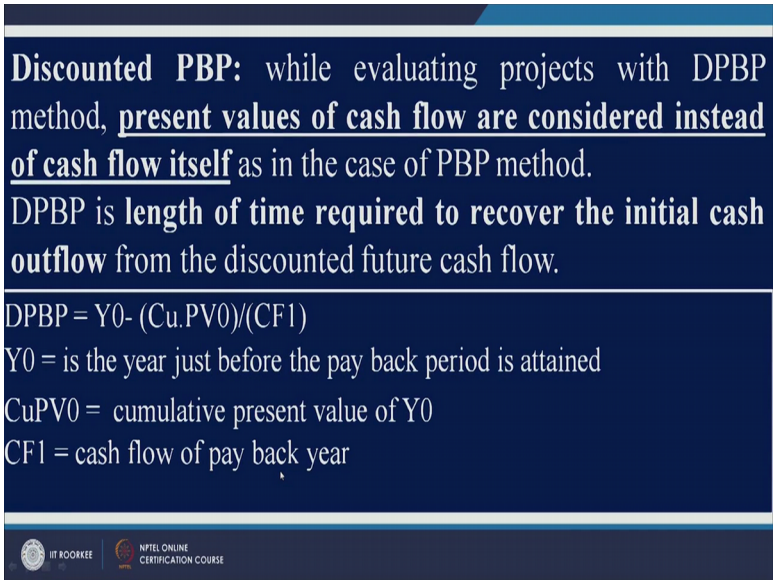

Let us now move on to the first discount first discounted capital budgeting techniques which are discounted payback period. So, it is similar to what we have seen in non discount capital budgeting technique, but here we discount the payback period right we would we discount the cash which we are receiving by discounting factor right. So, while evaluating projects with this particular method present value of cash flow is considered instead of cash flows itself right this is this is the important point right.

So, let us say if I am receiving 10 thousand rupees next year. So, what would be the present value of that 10,000 rupees. So, that is what we do in this particular method. So, discounted payback period method is the length of time required to recover the initial cash outflow from the discounted future cash flow right formula is similar to what we have seen. So, this is Y 0 is the year just before the payback period is a trend cumulative present value of Y 0 this is c u PV0 right.

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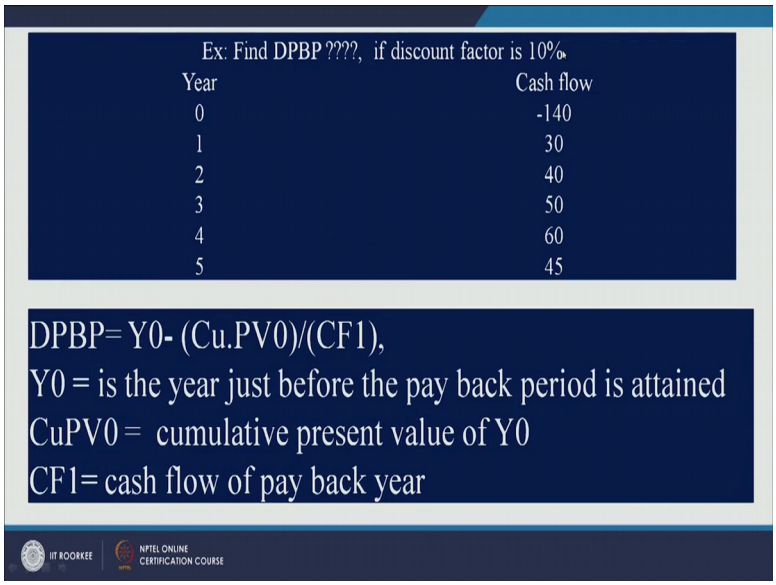

So, this is cumulative present value of Y 0 CF1 is cash flow of payback year right let us look at this question.

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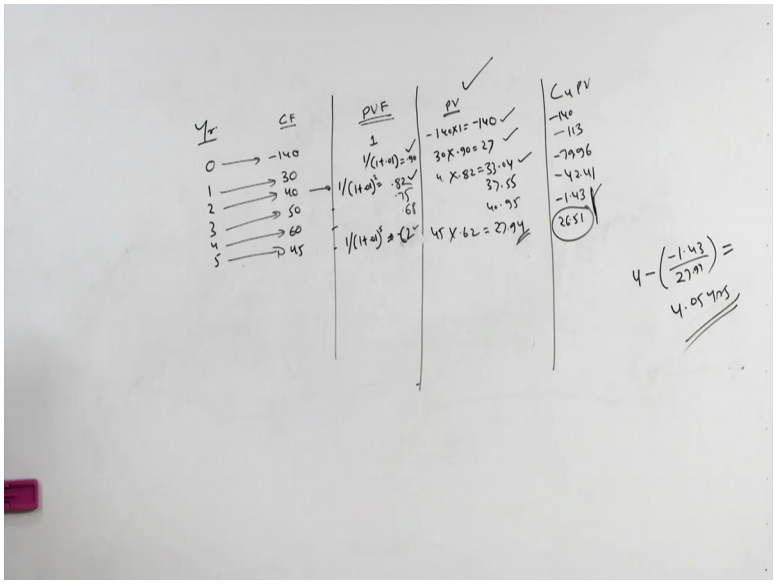

So, find out discounted payback period if discount factor is 10 percent how would you solve this question cash flow is minus 140 30 40 50 60 and 45 right. Now what we should do we should find out discounted cash flow right you can you can do 2 things right either you can calculate first cumulative cash flow and then go for discounting our first you go for discounting and then calculate cumulative cash flow right. So, in this

method let us first we will calculate present value factor right. So, this is PVF which is 10 percent right. So, this is.

So, initially this is your cash outflow minus 140 you present value factor is one right. So, present value is just multiplied these 2 is minus 140 multiplied by 1 this is minus 140 right now this present value factor is 10 percent right. So, this 1 divided by 1 plus 0.01 right and this is equal to 0.90right. So, let me draw table like this. So, this is 0.9 now what is present value of 30 rupees this 30 into 0.90 which is equal to 27 right. So, this is present value factor which is 10 percent in this case this is present value right.

So, you need to convert all these cash flows into their present values right for this what it would be is 1 divided by 1 plus 0.01 square this becomes 0.82 right and 40 into 0.82 this becomes it is 33.04 right similarly for third year fourth year and fifth year. So, you can do it for third and fourth year let me do it for fifth year. So, one divided by 1 plus 0.012 the power 5 which is equal to 0.62, it is 0.62. So, what how would we get PV; this 45 into 0.62 this is equal to 27.94 right. So, this is the present value of 0 th year first year second year third and fourth of course, you can calculate. So, these values are nothing, but 37.55 and 45 and 40.98.

Now, since you have got present values you can easily calculate cumulative present value right. So, this is minus 140 plus 27. So, minus 113 plus 33.04, so, you will get minus 79.96 right plus 37.55 minus 1.43 and finally, this plus this. So, you will get some 26.51 right. So, what is discounted payback period here what you have to do? So, this is this is the why your value from negative to positive right in these 2 years. So, this discounted payback period would be between fourth and fifth year right. So, how it would be? So, this is Y 0 value right. So, Y 0 is 4 right 4 minus minus 1.43 divided by its 27.94 right its 27.94 this value right and the answer is 4.05 years very simple method only the difference between payback period and this method is you need to calculate this present value by using discount factor right. So, I hope you can solve similar questions.

Let us try this question now the discount the discounting factor here is 10 percent and cash flows are like this. So, can you solve this question I hope you can easily solve this question. So, let us look at this solution. So, present value factor its one here. So, minus 300 into 1 minus 300 and cumulative present value is minus 300 right the since this is discounting factor is 10 all these values are remain as it is right.

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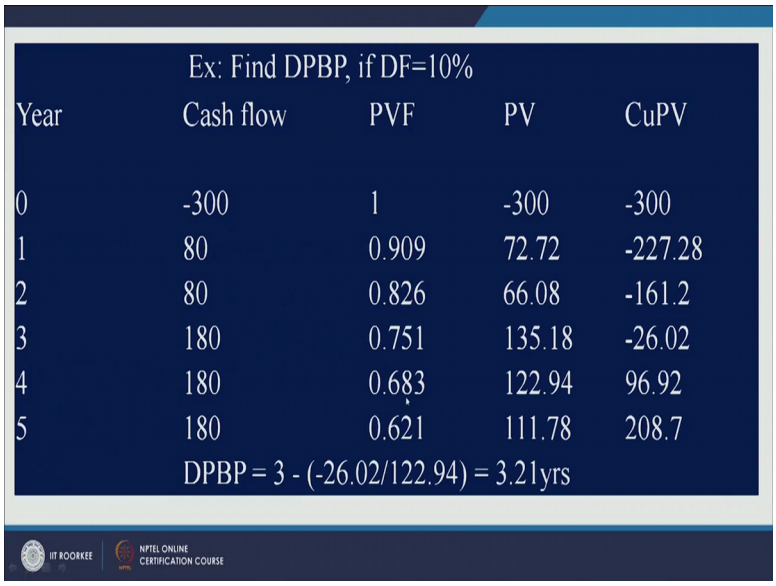

What we have seen in previous case right. So, 0.90; the 0.82 right the 0.75; just check these values right 0.90; 0.82 then for fifth it is 0.621 right and similarly if you want for third and fourth year it is 0.75 and for fourth year it is 0.68 rights. So, these values are same as it was there in previous example right because discounting factor is 10 right e. So, how to find out discounted payback period here.

Discounted payback period is 3 minus right. So, here it is moving from negative to positive right. So, 3 minus minus 26.02 divided by 122.94; right. So, discounted payback period is 3.21 years right. Now let us look at couple of other capital budgeting techniques there is the first one is the money and another one is profitability index.

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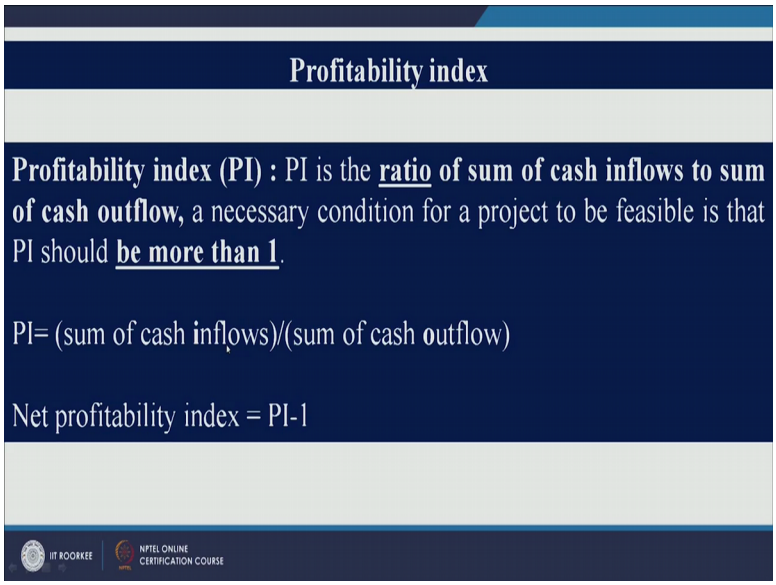

So, profitability index is ratio of cash inflows to cash outflows right. So, this ratio if it is if it is one or more than one then we will we should go for that particular project will say that project is good project right. So, you can calculate PAS sum of all cash inflows divided by cash outflows right do not interchange these values right. So, at the in the denominator you have got out flows and in flows is numerator right.

So, in flows have to be more than outflows right then only you will say project is profitable right. So, and the net profitability index is profitability index minus one right. So, this is profitability index now let us look at next method its NPV net present value its one of the most widely used methods right. So, it is very simple to use and evaluate on the basis of wealth maximization objective. So, what is net present value? So, it is the difference between present value of cash inflows and present value of cash outflow P I was what it was the ratio of cash inflows to cash outflows here it is difference of present value of cash inflows and present value of cash outflow. So, that is the major difference between P I and NPV let us look at couple of advantages of net present value over earlier methods right. So, the first is it considers all cash flows even those cash flows which we receive after attain payback period right.

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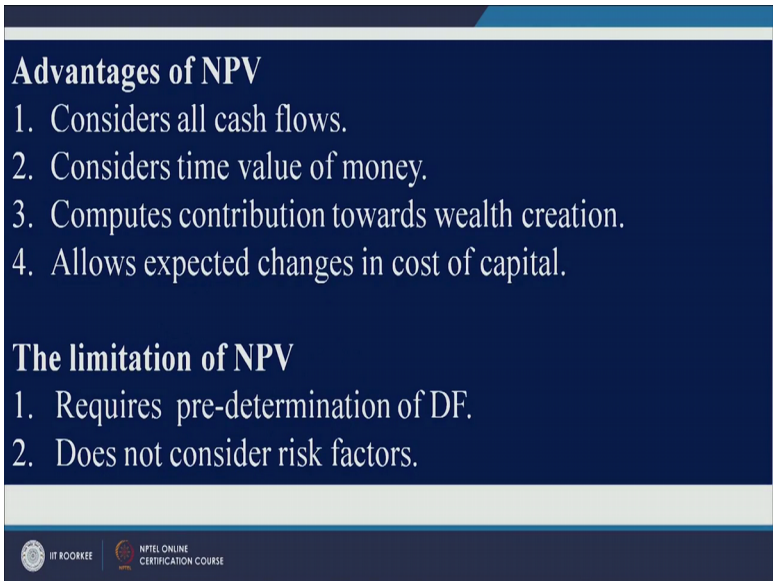

So, it considers all cash flows time value of money which is again and important point it was a drawback in earlier methods like payback period and average rate of return right.

Computes contributions towards wealth creation allows expected change in cost of capital, but there are certain limitations also and the limitations are requires predetermination of discounting factor. So, a priory you should know what is your discounting factor and the second limitation is does not consider risk factors while in a project you need to consider risk is also right.

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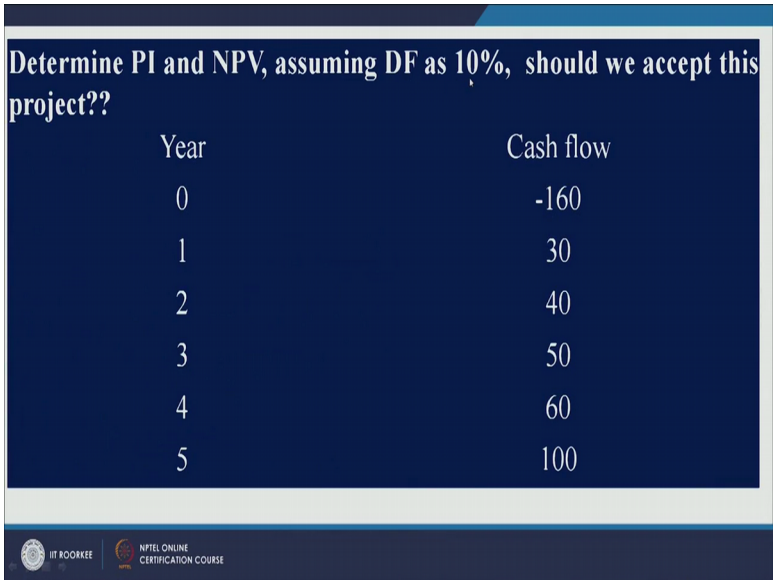

So, let us try to solve this question find out profitability index and net present value assuming discounting factor as 10 percent and you need to also tell me should we accept this project is it a good project on the basis of these 2 criteria and NPV and P I.

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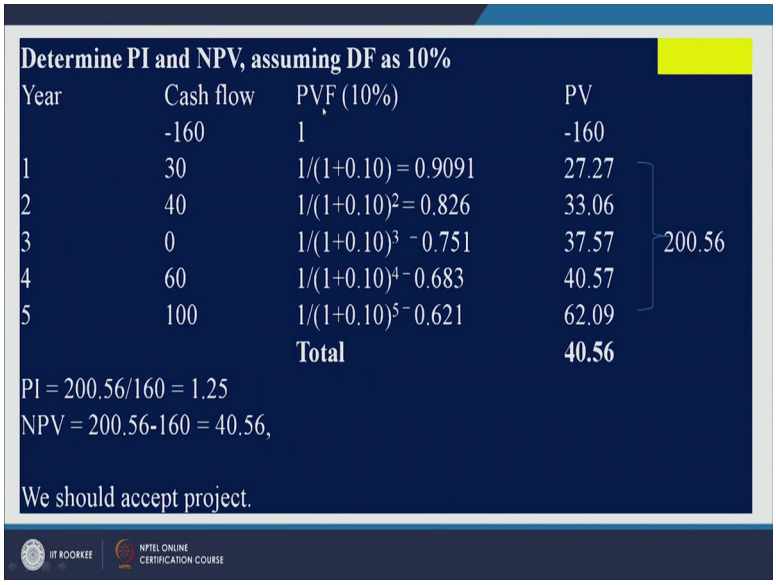

So, let us solve this question. So, first of all you just you have got discounting factor as 10 percent. So, cash flow is 160 in the in the 0 th year right. So, this is one 6 minus 160 into 1 right then 30 into 0.9. So, again these values are same right. So, present value factors are 1.9, 0.82; 0.7568 and 0.621 right, so 30 into 0.9091; this is 27 right. So, just calculate present value present value for all these years right 1 to 5 and of course, this 0 th year right.

So, this is your cash outflow and all these are your cash inflows right and these are nothing, but present value of future cash which you would be receiving. So, the sum of all these positive cash flows is 200.56. So, what is this total present value is this value minus 160 are just you just add all these values you will get 40.56 right. So, what is present value; what is NPV of this question NPV of this particular project is what its 40.56 why what is NPV is the difference between cash inflows and cash outflow right. So, this is 200.56 minus 160 right what is profitability index in this project what is the divorce the definition of profitability index what is the formula is the sum of all cash inflows divided by cash outflow right. So, inflows this one right 200.56 divided by 160,

so this is 1.25. So, profitability index is 1.25, which is more than 1. So, we should accept this project.

So, with this let me complete this session in next session we will see some other capital budgeting techniques.

Thank you very much.