Depreciation, Alternate Investment and Profitability Analysis.
Professor Dr. Bikash Mohanty.
Department of Chemical Engineering.
Indian Institute of Technology, Roorkee.
Lecture-16.
Profitability Analysis – Introduction to Profitability Analysis and Payback Period.

Welcome to the course Depreciation, Alternate Investment and Profitability Analysis. Today onwards we will start module 3 that is profitability analysis and this is the last module, today's lecture is introduction to profitability analysis and payback period, payback period is a profitability analysis method. Resource required to carry out a project are often less than that available for it, it is a known fact. Hence, all investments must be carried out carefully and should be evaluated towards its economic feasibility based on some profitability standards.

The cost of capital which is the amount to be paid for the use of the capital, such as bonds, preferred stocks, loans etcetera is generally used as a basic profitability standard. The underlying principle is that the project must earn at least that rate which is required to repay the cost of capital. A number of methods are employed for computation of profitability in the economic analysis. Primarily two types of methods are used, methods that do not use time value of money and those which use the time value of money.

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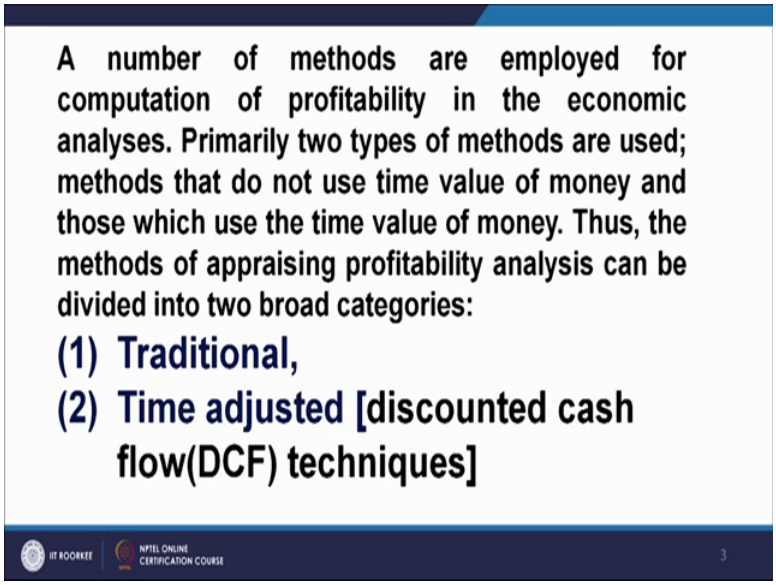

Thus, the methods of appraising profitability analysis can be divided into two broad categories, the first one is traditional and the second one is time adjusted, so time adjusted Discounted Cash Flow DCF techniques. The second category of methods are popularly

known as Discounted Cash Flow DCF techniques as they take time value of money into account. The first category which does not take time value of money in into account includes payback period, return on investment, average rate of return and Net return. The second category includes Net present value method, internal rate of return method, Net terminal value method and profitability index.

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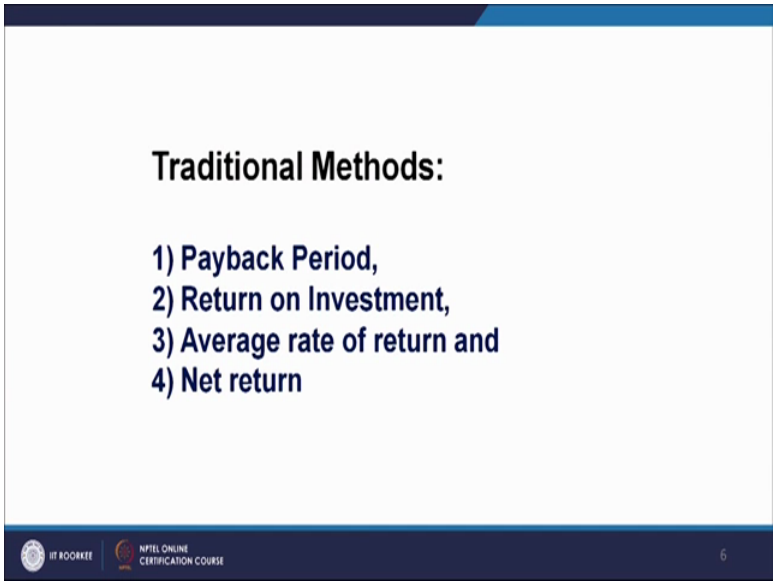

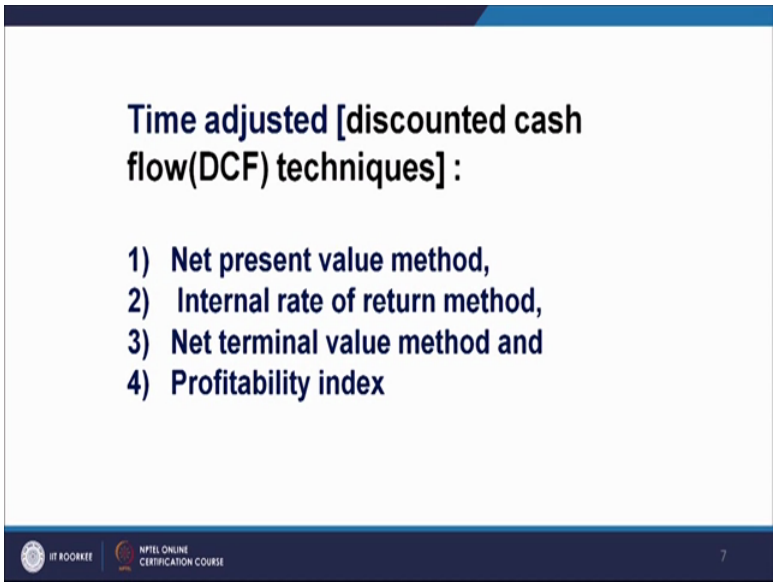

The popularity of these methods depend on the size of the company, for example, about 10 percent of this some small companies is discounted cash flow rate of return whereas, 80 percent of the large companies use it. The present module demonstrate how to apply these methods for analysis, now these traditional methods which we will cover are payback period, return on investment, average rate of return and finally the Net return. And the time adjusted

discounted cash flow DCF techniques which we will study are Net present value method, internal rate of return method, Net terminal value method and profitability index.

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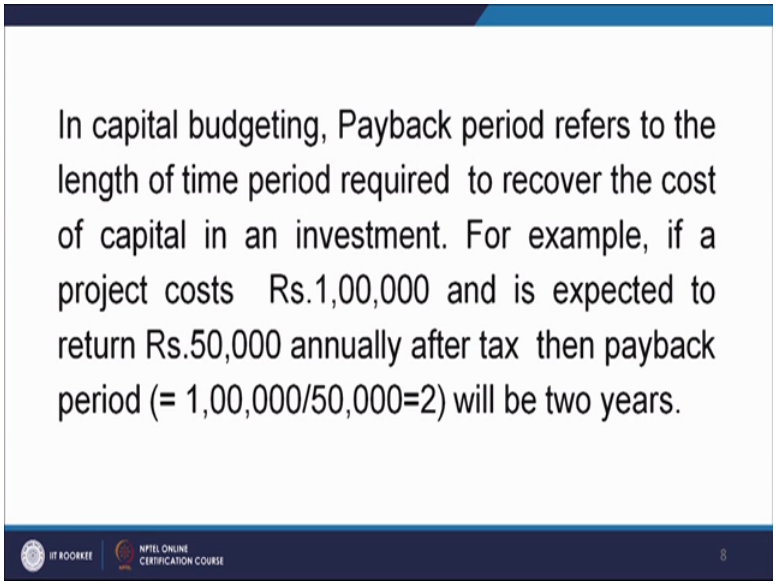

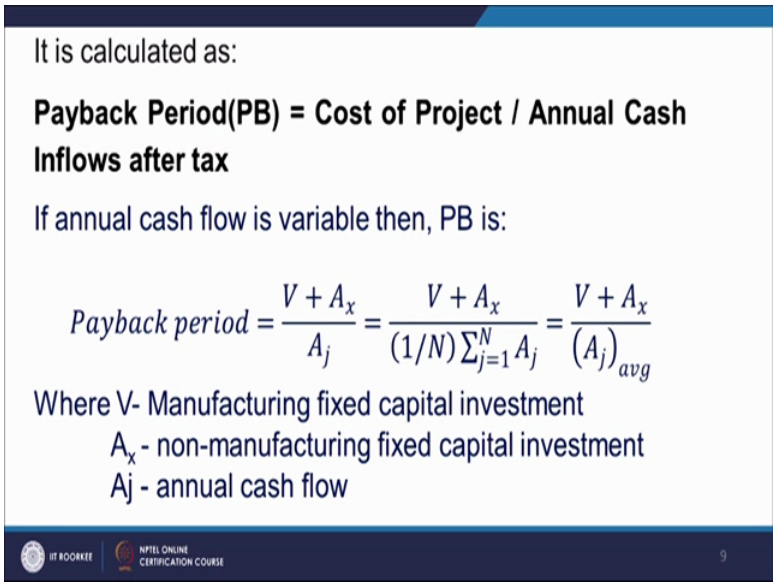

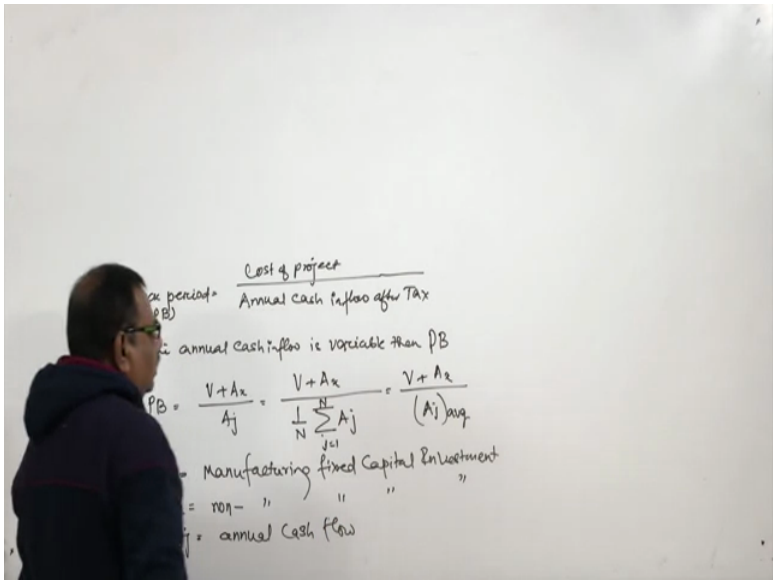

In capital budgeting, payback period refers to the length of time period required to recover the cost of capital in an investment, for example if a project costs 1,00,000 and is expected to return 50,000 annually after tax, then payback period will be 1,00,000 divided by 50,000 is equal to two years. It is calculated as Payback Period PB is cost of the project divided by annual cash flow after tax. Now if the annual cash flow is variable then PB that is Payback Period, Payback Period is designated as PB is equal to V + Ax divided by Aj is equal to V + Ax divided by 1 by N summation j equal to 1 to N, Aj is equal to V + Ax divided by Aj average.

Where, V is equal to manufacturing fixed capital investment Ax is equal non-manufacturing fixed capital investment and Aj is equal to annual cash flow. Let us demonstrate the computation of payback period using examples. The payback period can be used as an accept or reject criterion the payback period has some merits, it is simple and easy to use, it is better than average rate of return where average rate of return is equal to average annual profit after taxes into hundred divided by average investment over the life of the project.

It is better because it uses cash in flow analysis however, the payback period suffers from some serious limitations too. The first major limitation is that it completely ignores all cash flow entries after payback period and this limitation can be misleading, for example if there are two projects A and B having payback periods of 3 and 3.5 years respectively, then according to the payback period of the project A is better. However, if after 3 years the cash inflow of project A stops completely, whereas the cash flow of project B continues up to 6 years then obviously the selection of project A based on payback period is misleading.

Thus, it does not consider cash inflows for the entire life of the project as a result of it the project which offers significantly large cash inflows in the later part of the life maybe rejected in comparison to those projects which are less profitable, if complete life spans are considered. Another limitation of the payback period is that it does not use the concept of time value of money and thus treats a rupee received in third and fourth year same as that received in the first year.

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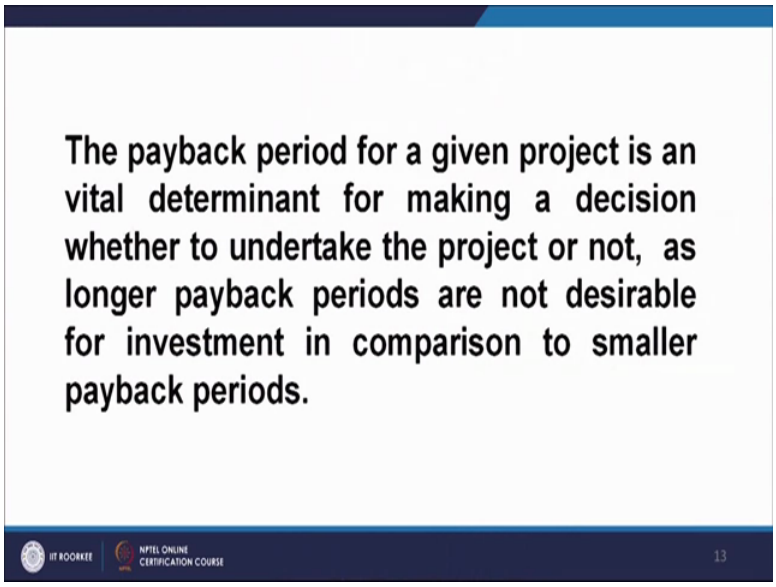

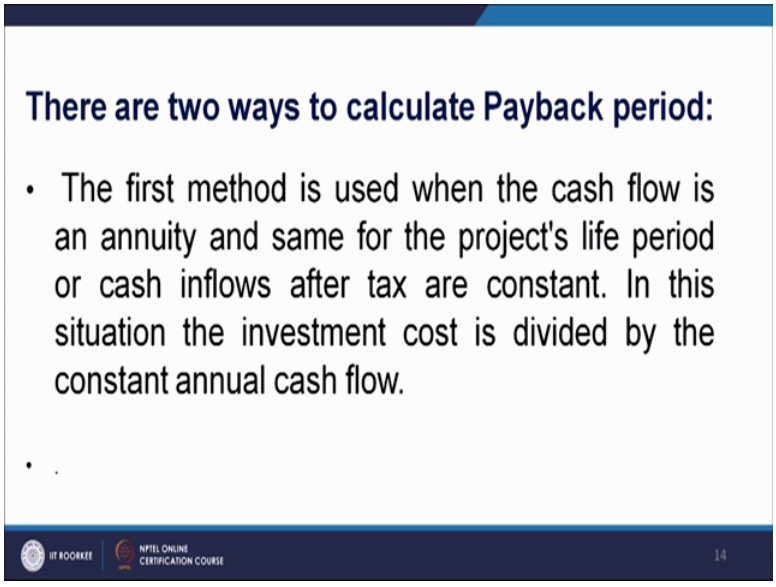

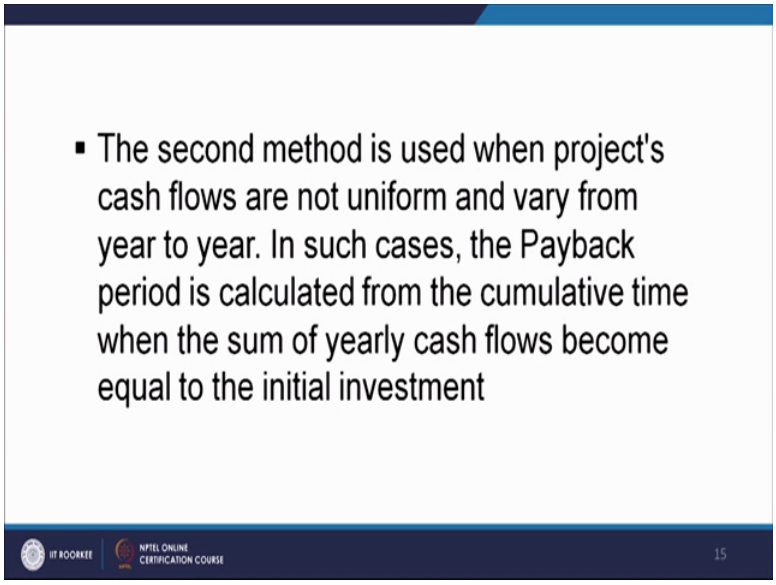

The payback period for a given project is an vital determinant for making a decision whether to undertake the project or not as longer payback periods are not desirable for investment in comparison to smaller payback periods. There are two ways to calculate payback period, the first one, the first method is used when the cash flow is an annuity and same for the project's life period or cash inflows after tax are constant.

In this situation the investment cost is divided by the constant annual cash flow. Now the second method is used when the project cash flows are not uniform and vary from year to year. In such cases the payback period is calculated from the cumulative time when the sum of the yearly cash flows become equal to the total investment.

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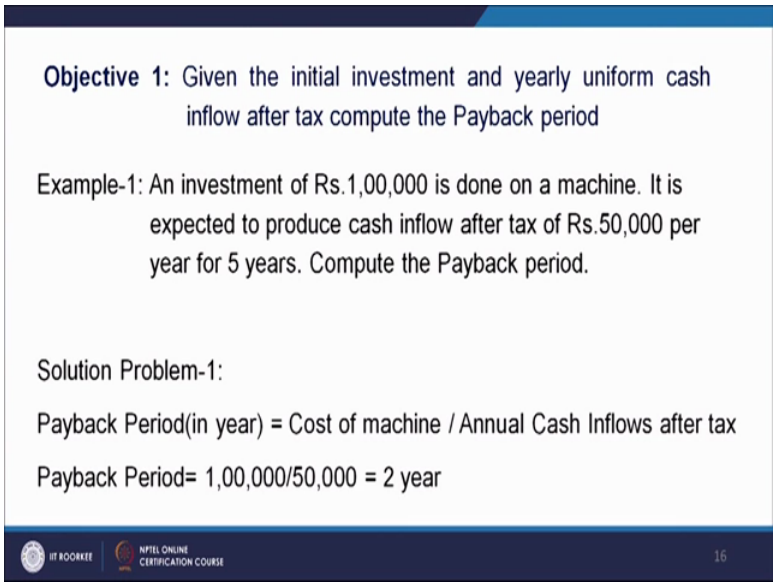

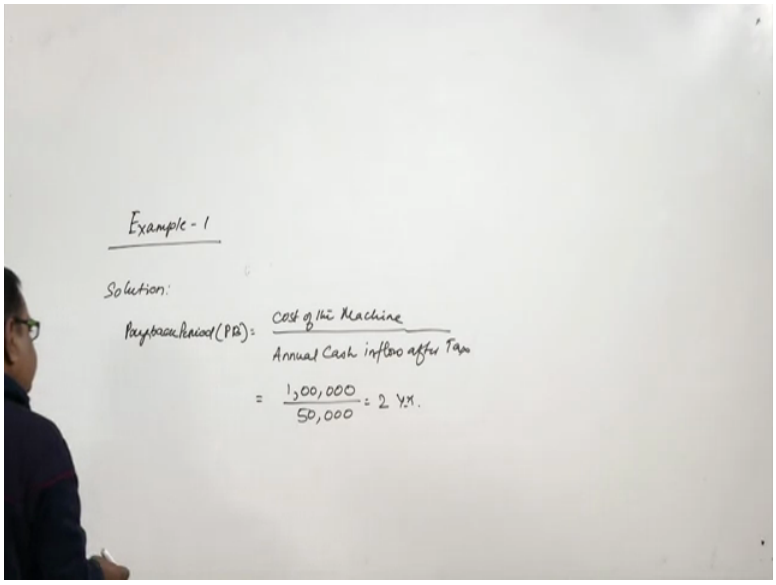

Now let us take example 1 and compute it. Now the objective of the example 1, given the initial investment and yearly uniform cash inflow after tax compute the payback period. And example 1 is, an investment of rupees 1,00,000 is done on a machine. It is expected to produce cash inflow after tax of rupees of rupees 50,000 per year for 5 years. Compute the payback period. So the payback period, this is called PB is equal to cost of the machine divided by annual cash inflow after tax, now this is equal to 1,00,000 divided by 50,000 this comes out to be 2 years.

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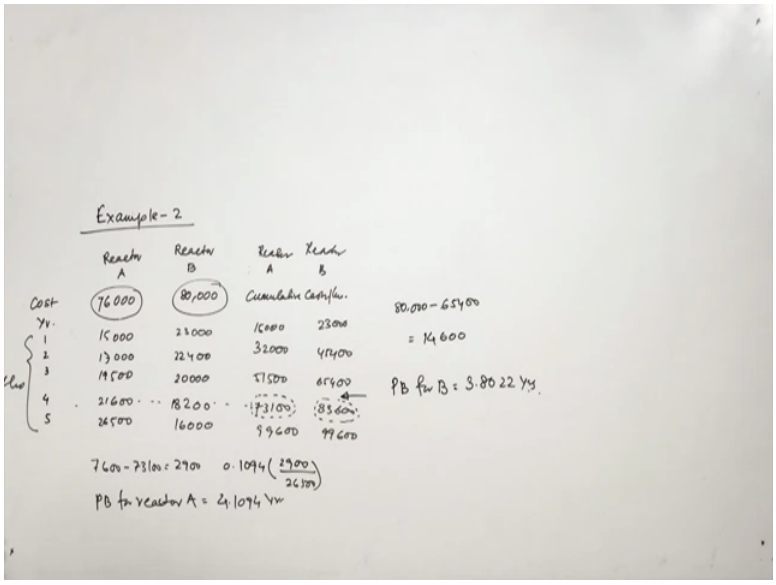
Objective 2: Given the initial investment and yearly non-uniform cash inflow after tax compute the Payback period.

Example-2: Two reactors "A" and "B" are to be used in an industry. The cost of reactor "A" is Rs.76000 and that of "B" is Rs.80000. The expected annual non-uniform cash inflow after tax from the machines are given below. Find out the Payback period for the machines ?

Year	Annual cash inflow after tax		Cumulative cash inflow after tax	
	A	B	A	B
1	15000	23000	15000	23000
2	17000	22400	32000	45400
3	19500	20000	51500	65400
4	21600	18200	73100	83600
5	26500	16000	99600	99600

* Cash inflow after tax in 5th year includes salvage value of Rs.4000 also



Let us take the question number 2, the objective of the question number 2 is given the initial investment and yearly non-uniform cash inflows here in this question we are getting non-uniform cash inflow after tax compute the payback period.

Two reactors A and B are to be used in an industry, example 2 reactor A, reactor B now reactor A is 76,000, its cost is 76,000 and reactor B is 80,000. Now these reactors are producing cash inflows 1, 2, 3, 4, 5 this is cash inflows, this is year cash inflow, this is 15,000, this is 17,000, this is 19,500, 21,600 and 26,500, this is 23,000, 22,400, 20,000, 18,200, 16,000. Now if I do this cumulative cash flow, this is reactor A, reactor B then these cumulative cash flows are 18,000, 32,000, 51,500, 73,100, 99,600 and this is 23,000, 45,400, 65,400, 83,600, 99,600.

As the cost of the reactor is 76,000, its payback period will be more than 4 years. Now at 4 years the cumulative cash inflow is 73,100 which is less than this price and hence the payback period will be more than 4 years and less than 5 years. So if I deduct 76,000 - 73,100, it comes out to be 2900. Now this 2900 has to be recovered. So this can be recovered in 0.1094 years and this can be calculated as 2900 divided by 26,500 comes out to be thus the payback period for machine A for reactor A is equal to 4.1094 years. Similarly you can calculate it for B, B cost is 80,000 obviously somewhere here it falls between the 4 and 5.

Now if you want to calculate the payback period of the B and we see the cumulative figures in close, we find that this is more than 80,000 rupees and this is less than 80,000 rupees. So my payback period will fall somewhere here, that is 3 and 4, between 3 and 4. Now if we deduct 80,000 - 65,400, 65,400 it comes out to be 14,600. So if I convert this 14,600 into

years, the payback period for B comes out to be 3.8022 years, this is the done similarly as I have computed for A.

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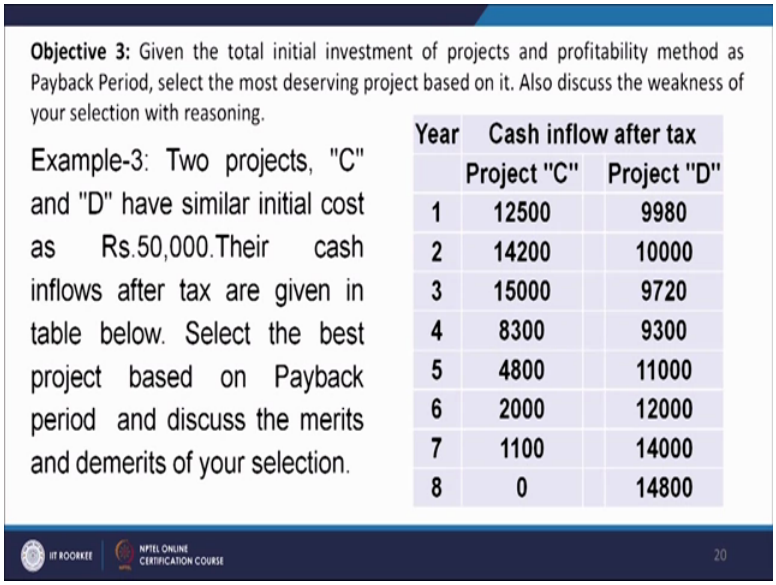

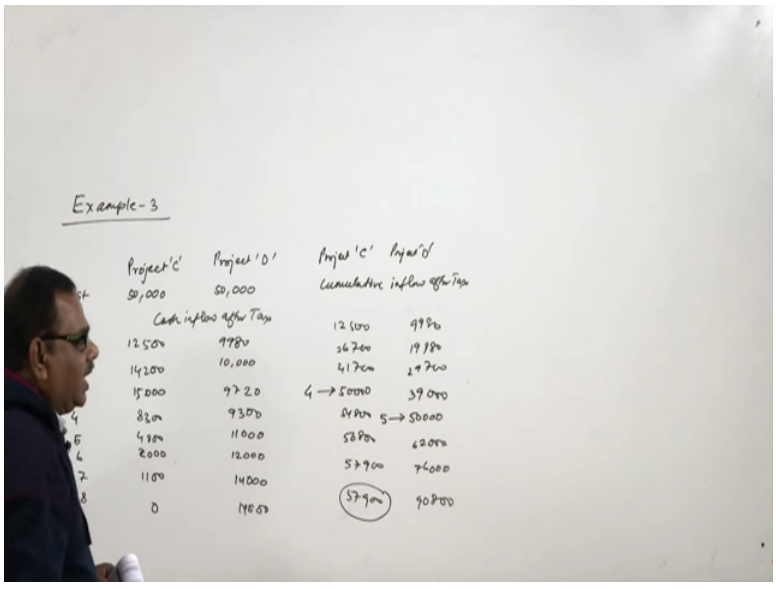

Now example number 3, now the objective of the example 3 is given the total initial investment of project and profitability method as payback period select the most deserving project based on it. Also discuss the weakness of your selection with reasoning. Now here we have 2 projects, project C and project D, initial cost is 50,000 , now cash inflow after tax is, for 8 years this is years 1, 2, 3, 4, 5, 6, 7, 8 years, 8 years this is 12,500, this is 14,200, 15,000, 8,300, 4,800, 2,000, 1,100, and 0.

Whereas, this is 9,980, 10,000, 9,720, 9,300, 11,000, 12,000, 14,000, 14,850. Now if you see the cash flows of projects C and project D, what I find that this is 15,000 onwards this is

decreasing and the value has decreased too substantially whereas, this is increasing. Now if we calculate the cumulative cash inflows after tax, the cumulative inflow, cash inflow after tax they are 12,500, 26,700, 41,700, 50,000, 54,800, 56,800, 57,900, 57,900 and this is 9,980, 19,980, 29,700, 39,000, 50,000, 62,000, 76,000, 90,800.

Now if you see this, then what we find based on payback period, C is adjust better because it pays here and it pays here. So, C has a payback period of 4 years and this has got a 5 year payback period. So what we will adjust that the project C is a better project, but if we see the cumulative cash inflows after tax, then we find that the project C is only giving 57,900 into the total life period of the project, it is paying only 57,900, whereas, project B is giving 90,800 and hence the natural selection will be project D rather than project C and this decision, if I take a decision based on the payback period, then probably my decision will be wrong because I will select project C in place of project D.

So this is a weakness of the payback period computation and the decision based on payback period. Now to summarize this lecture, resources required to carry out a project are often less than that available for it, hence all investment must be carried out carefully and should be evaluated towards the economic feasibility based on some profitability standards The present lecture introduces the concept of profitability analysis and contents of this module, that is module 3, it also demonstrates how to select the best economic option amongst a number of mutually exclusive alternative investments using payback period and it also tells that what are the weakness of the payback period and how the selection should be carried out, thank you.