

INVESTMENT DECISIONS

Question 1

Define Modified Internal Rate of Return method.

(PCC-May 2007)(2 marks)

Answer

Modified Internal Rate of Return (MIRR): There are several limitations attached with the concept of the conventional Internal Rate of Return. The MIRR addresses some of these deficiencies. For example, it eliminates multiple IRR rates; it addresses the reinvestment rate issue and produces results, which are consistent with the Net Present Value method.

Under this method, all cash flows, apart from the initial investment, are brought to the terminal value using an appropriate discount rate (usually the cost of capital). This results in a single stream of cash inflow in the terminal year. The MIRR is obtained by assuming a single outflow in the zeroth year and the terminal cash in flow as mentioned above. The discount rate which equates the present value of the terminal cash in flow to the zeroth year outflow is called the MIRR.

Question 2

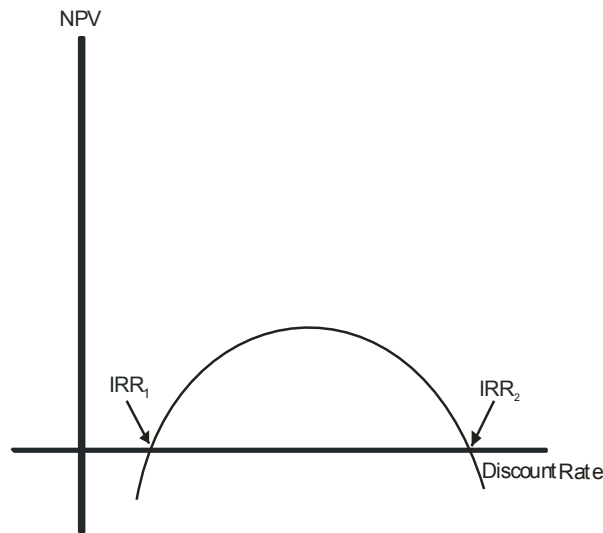
Explain the concept of Multiple Internal Rate of Return.

(PCC-Nov. 2008)(3 marks)

Answer

Multiple Internal Rate of Return (MIRR)

In cases where project cash flows change signs or reverse during the life of a project for example, an initial cash outflow is followed by cash inflows and subsequently followed by a major cash outflow, there may be more than one internal rate of return (IRR). The following graph of discount rate versus net present value (NPV) may be used as an illustration:



In such situations if the cost of capital is less than the two IRRs, a decision can be made easily, however, otherwise the IRR decision rule may turn out to be misleading as the project should only be invested if the cost of capital is between IRR_1 and IRR_2 . To understand the concept of multiple IRRs it is necessary to understand the implicit re-investment assumption in both NPV and IRR techniques.

Question 3

Explain the concept of discounted payback period.

(PCC-June 2009)(3 marks)

Answer

Concept of Discounted Payback Period

Payback period is time taken to recover the original investment from project cash flows. It is also termed as break even period. The focus of the analysis is on liquidity aspect and it suffers from the limitation of ignoring time value of money and profitability. Discounted payback period considers present value of cash flows, discounted at company's cost of capital to estimate breakeven period i.e. it is that period in which future discounted cashflows equal the initial outflow. The shorter the period, better it is. It also ignores post discounted payback period cash flows.

Question 4

Explain the term "Desirability factor".

(PCC-Nov. 2009)(1.5 marks)

Answer

Desirability Factor: In certain cases we have to compare a number of proposals each involving different amount of cash inflows. One of the methods of comparing such proposals is to work out,

what is known as the 'Desirability Factor' or 'Profitability Index'. In general terms, a project is acceptable if the Profitability Index is greater than 1.

Mathematically,

$$\text{Desirability Factor} = \frac{\text{Sum of Discounted Cash inflows}}{\text{Initial Cash Outlay or Total Discounted Cash outflows}}$$

Question 5

XYZ Ltd. is planning to introduce a new product with a project life of 8 years. The project is to be set up in Special Economic Zone (SEZ), qualifies for one time (at starting) tax free subsidy from the State Government of Rs. 25,00,000 on capital investment. Initial equipment cost will be Rs. 1.75 crores. Additional equipment costing Rs. 12,50,000 will be purchased at the end of the third year from the cash inflow of this year. At the end of 8 years, the original equipment will have no resale value, but additional equipment can be sold for Rs. 1,25,000. A working capital of Rs. 20,00,000 will be needed and it will be released at the end of eighth year. The project will be financed with sufficient amount of equity capital.

The sales volumes over eight years have been estimated as follows:

Year	1	2	3	4–5	6–8
Units	72,000	1,08,000	2,60,000	2,70,000	1,80,000

A sales price of Rs. 120 per unit is expected and variable expenses will amount to 60% of sales revenue. Fixed cash operating costs will amount Rs. 18,00,000 per year. The loss of any year will be set off from the profits of subsequent two years. The company is subject to 30 per cent tax rate and considers 12 per cent to be an appropriate after tax cost of capital for this project. The company follows straight line method of depreciation.

Required:

Calculate the net present value of the project and advise the management to take appropriate decision.

Note:

The PV factors at 12% are

Year	1	2	3	4	5	6	7	8
	.893	.797	.712	.636	.567	.507	.452	.404

(PCC-Nov. 2007)(8 marks)

Answer

(Rs. '000)									
Year	Sales	VC	FC	Dep.	Profit	Tax	PAT	Dep.	Cash inflow
1	86.40	51.84	18	21.875	(5.315)	—	—	21.875	16.56
2	129.60	77.76	18	21.875	11.965 – (5.315) = 6.65 After adjustment of loss	1.995	4.655	21.875	26.53
3	312.00	187.20	18	21.875	84.925	25.4775	59.4475	21.875	81.3225
4–5	324.00	194.40	18	24.125	87.475	26.2425	61.2325	24.125	85.3575
6–8	216.00	129.60	18	24.125	44.275	13.2825	30.9925	24.125	55.1175

Rs.	
Cost of New Equipment	1,75,00,000
Less: Subsidy	25,00,000
Add: Working Capital	<u>20,00,000</u>
Outflow	<u>1,70,00,000</u>

Calculation of NPV

Year	Cash inflows (Rs.)	PV factor	NPV (Rs.)
1	16,56,000	.893	14,78,808
2	26,53,000	.797	21,14,441
3	81,32,250 – 12,50,000 = 68,82,250	.712	49,00,162
4	85,35,750	.636	54,28,737
5	85,35,750	.567	48,39,770
6	55,11,750	.507	27,94,457
7	55,11,750	.452	24,91,311
8	55,11,750 + 20,00,000 + 1,25,000 = 76,36,750	.404	<u>30,85,247</u>
Net Present Value			<u>2,71,32,933</u>

NPV	2,71,32,933
Less: Out flow	<u>1,70,00,000</u>
Saving	<u>1,01,32,933</u>

Advise: Since the project has a positive NPV, therefore, it should be accepted.

Question 6

C Ltd. is considering investing in a project. The expected original investment in the project will be Rs. 2,00,000, the life of project will be 5 year with no salvage value. The expected net cash inflows after depreciation but before tax during the life of the project will be as following:

Year	1	2	3	4	5
Rs.	85,000	1,00,000	80,000	80,000	40,000

The project will be depreciated at the rate of 20% on original cost. The company is subjected to 30% tax rate.

Required:

- Calculate pay back period and average rate of return (ARR)
- Calculate net present value and net present value index, if cost of capital is 10%.
- Calculate internal rate of return.

Note: The P.V. factors are:

Year	P.V. at 10%	P.V. at 37%	P.V. at 38%	P.V. at 40%
1	.909	.730	.725	.714
2	.826	.533	.525	.510
3	.751	.389	.381	.364
4	.683	.284	.276	.260
5	.621	.207	.200	.186

(PCC-May 2008)(8 marks)

Answer

Project	Outflow				
	Rs. 2,00,000				
Year	1	2	3	4	5
	Rs.	Rs.	Rs.	Rs.	Rs.
Profit after depreciation but before tax	85,000	1,00,000	80,000	80,000	40,000

Tax (30 %)	25,500	30,000	24,000	24,000	12,000	
PAT	59,500	70,000	56,000	56,000	28,000	Average = Rs.53,900
Add: Dep	40,000	40,000	40,000	40,000	40,000	
Net cash inflow	99,500	1,10,000	96,000	96,000	68,000	Average = Rs.93,900.

Average = Rs.93,900

(i) Calculation of pay back period 1.91 years

(ii) Calculation of ARR

Initial investment	2,00,000	1,60,000	1,20,000	80,000	40,000	
Depreciation	40,000	40,000	40,000	40,000	40,000	
Closing investment	1,60,000	1,20,000	80,000	40,000	0	
Average investment	1,80,000	1,40,000	1,00,000	60,000	20,000	Average=1,00,000

ARR = Average of profit after tax / Average investment = 53.90%

(iii) Calculation of net present Value 10%

Net cash inflow	99,500.00	1,10,000.00	96,000.00	96,000.00	68,000.00	
	0.909	0.826	0.751	0.683	0.621	
Present value	90,445.50	90,860.00	72,096.00	65,568.00	42,228.00	3,61,197.50
Net present value = Rs. 3,61,197.50 – Rs. 2,00,000 = Rs. 1,61,197.50						
Net present value index = Rs. 1,61,197.50 / Rs. 2,00,000 = 0.81						

(iv) Calculation of IRR

Present value factor-Initial investment / Average annual cash inflow

2,00,000 / 93,900 = 2.13

It lies in between 38 % and 40%

Net Cash Inflows	99,500.00	1,10,000.00	96,000.00	96,000.00	68,000.00	
Present Value Factor @ 38%	0.725	0.525	0.381	0.276	0.200	
Present value @ 38% (P1)	72,137.50	57,750.00	36,576.00	26,496.00	13,600.00	Total = 2,06,559.50
Net Cash Inflows	99,500.00	1,10,000.00	96,000.00	96,000.00	68,000.00	

Present Value Factor @ 40%	0.714	0.510	0.364	0.260	0.186	
Present value @ 40% (P2)	71,043	56,100	34,944	24,960	12,648	Total = 1,99,695

IRR is calculated by Interpolation:

$$\begin{aligned}
 \text{IRR} &= \text{LDR} + (\text{P1} - \text{Q}) / \text{P1} - \text{P2} (\text{SDR} - \text{LDR}) \\
 &= 38 + (2,06,559.50 - 2,00,000) / (2,06,559.50 - 1,99,695) \times (40 - 38) \\
 &= 39.911137\%
 \end{aligned}$$

Question 7

A company wants to invest in a machinery that would cost Rs. 50,000 at the beginning of year 1. It is estimated that the net cash inflows from operations will be Rs. 18,000 per annum for 3 years, if the company opts to service a part of the machine at the end of year 1 at Rs. 10,000. In such a case, the scrap value at the end of year 3 will be Rs. 12,500. However, if the company decides not to service the part, then it will have to be replaced at the end of year 2 at Rs. 15,400. But in this case, the machine will work for the 4th year also and get operational cash inflow of Rs. 18,000 for the 4th year. It will have to be scrapped at the end of year 4 at Rs. 9,000. Assuming cost of capital at 10% and ignoring taxes, will you recommend the purchase of this machine based on the net present value of its cash flows?

If the supplier gives a discount of Rs. 5,000 for purchase, what would be your decision? (The present value factors at the end of years 0, 1, 2, 3, 4, 5 and 6 are respectively 1, 0.9091, 0.8264, 0.7513, 0.6830, 0.6209 and 0.5644). (PCC-Nov. 2008)(7 marks)

Answer

Option I : Purchase Machinery and Service Part at the end of Year 1.

Net Present value of cash flow @ 10% per annum discount rate.

$$\begin{aligned}
 \text{NPV} &= -50,000 + \frac{18,000}{(1.1)} + \frac{18,000}{(1.1)^2} + \frac{18,000}{(1.1)^3} - \frac{10,000}{(1.1)} + \frac{12,500}{(1.1)^3} \\
 &= -50,000 + 18,000 (0.9091 + 0.8264 + 0.7513) - (10,000 \times 0.9091) + (12,500 \times 0.7513) \\
 &= -50,000 + (18,000 \times 2.4868) - 9,091 + 9,391 \\
 &= -50,000 + 44,762 - 9,091 + 9,391
 \end{aligned}$$

$$\text{NPV} = -4,938$$

Since, Net Present Value is negative; therefore, this option is not to be considered.

If Supplier gives a discount of Rs. 5,000 then,

$$NPV = +5,000 - 4,938 = +62$$

In this case, Net Present Value is positive but very small, therefore, this option may not be advisable.

Option II : Purchase Machinery and Replace Part at the end of Year 2.

$$\begin{aligned} NPV &= -50,000 + \frac{18,000}{(1.1)} + \frac{18,000}{(1.1)^2} + \frac{18,000}{(1.1)^3} - \frac{15,400}{(1.1)^2} + \frac{27,000}{(1.1)^4} \\ &= -50,000 + 18,000 (0.9091 + 0.8264 + 0.7513) - (15,400 \times 0.8264) + (27,000 \times 0.6830) \\ &= -50,000 + 18,000 (2.4868) - (15,400 \times 0.8264) + (27,000 \times 0.6830) \\ &= -50,000 + 44,762 - (15,400 \times 0.8264) + (27,000 \times 0.6830) \\ &= -50,000 + 44,762 - 12,727 + 18,441 \\ &= -62,727 + 63,203 \\ &= +476 \end{aligned}$$

Net Present Value is positive, but very low as compared to the investment.

If the Supplier gives a discount of Rs. 5,000, then

$$NPV = 5,000 + 476 = 5,476$$

Decision: Option II is worth investing as the net present value is positive and higher as compared to Option I.

Question 8

A company is required to choose between two machines A and B. The two machines are designed differently, but have identical capacity and do exactly the same job. Machine A costs Rs. 6,00,000 and will last for 3 years. It costs Rs. 1,20,000 per year to run.

Machine B is an 'economy' model costing Rs. 4,00,000 but will last only for two years, and costs Rs. 1,80,000 per year to run. These are real cash flows. The costs are forecasted in rupees of constant purchasing power. Opportunity cost of capital is 10%. Which machine company should buy? Ignore tax.

$$PVIF_{0.10, 1} = 0.9091, PVIF_{0.10, 2} = 0.8264, PVIF_{0.10, 3} = 0.7513. \quad (PCC-June 2009)(7 \text{ marks})$$

Answer

Advise to the Management Regarding Buying of Machines

Statement Showing Evaluation of Two Machines

Machines	A	B
Purchase cost (Rs.): (i)	6,00,000	4,00,000

Life of machines (years)	3	2
Running cost of machine per year (Rs.): (ii)	1,20,000	1,80,000
Cumulative present value factor for 1-3 years @ 10%: (iii)	2.4868	-
Cumulative present value factor for 1-2 years @ 10%: (iv)	-	1.7355
Present value of running cost of machines (Rs.): (v)	2,98,416	3,12,390
	[(ii) × (iii)]	[(ii) × (iv)]
Cash outflow of machines (Rs.): (vi)=(i) +(v)	8,98,416	7,12,390
Equivalent present value of annual cash outflow	3,61,273.93	4,10,481.13
	[(vi)÷(iii)]	[(vi) ÷(iv)]

Recommendation: The Company should buy Machine A since its equivalent cash outflow is less than Machine B.

Question 9

A hospital is considering to purchase a diagnostic machine costing Rs. 80,000. The projected life of the machine is 8 years and has an expected salvage value of Rs. 6,000 at the end of 8 years. The annual operating cost of the machine is Rs. 7,500. It is expected to generate revenues of Rs. 40,000 per year for eight years. Presently, the hospital is outsourcing the diagnostic work and is earning commission income of Rs.12,000 per annum; net of taxes.

Required:

Whether it would be profitable for the hospital to purchase the machine? Give your recommendation under:

(i) Net Present Value method

(ii) Profitability Index method.

PV factors at 10% are given below:

Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
0.909	0.826	0.751	0.683	0.621	0.564	0.513	0.467

(PCC-Nov. 2009)(8 marks)

Answer

Advise to the Hospital Management

Determination of Cash inflows

Sales Revenue	40,000
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Less: Operating Cost	<u>7,500</u>
	32,500
Less: Depreciation (80,000 – 6,000)/8	<u>9,250</u>
Net Income	23,250
Tax @ 30%	<u>6,975</u>
Earnings after Tax (EAT)	16,275
Add: Depreciation	<u>9,250</u>
Cash inflow after tax per annum	25,525
Less: Loss of Commission Income	<u>12,000</u>
Net Cash inflow after tax per annum	13,525
<i>In 8th Year :</i>	
New Cash inflow after tax	13,525
Add: Salvage Value of Machine	<u>6,000</u>
Net Cash inflow in year 8	<u>19,525</u>

Calculation of Net Present Value (NPV)

Year	CFAT	PV Factor @10%	Present Value of Cash inflows
1 to 7	13,525	4.867	65,826.18
8	19,525	0.467	<u>9,118.18</u>
			74,944.36
Less: Cash Outflows			<u>80,000.00</u>
	NPV		<u>(5,055.64)</u>

$$\begin{aligned}\text{Profitability Index} &= \frac{\text{Sum of discounted cash inflows}}{\text{Present value of cash outflows}} \\ &= \frac{74,944.36}{80,000} = 0.937\end{aligned}$$

Advise: Since the net present value is negative and profitability index is also less than 1, therefore, the hospital should not purchase the diagnostic machine.

Note: Since the tax rate is not mentioned in the question, therefore, it is assumed to be 30 percent in the given solution.