$$NPV_y = \left\{\frac{28,000}{1.14} + \frac{12,000}{(1.14)^2} + \frac{10,000}{(1.14)^3} + \frac{10,000}{(1.14)^4} + \frac{10,000}{(1.14)^5}\right\} - 45,000$$

$$= (24,561 + 9,234 + 6,750 + 5,921 + 5,194 - 45,000$$

$$= 51,660 - 45,000 = \textbf{Tk. 6,660}$$

Decision : Since the net present value of project X in higher than that of project Y, project X should be accepted.

৮.১২॥ সমস্যাবলী ও সমাধান (PROBLEMS WITH SOLUTION)

Problem 1

An Engineering company is considering an investment proposal to instal new equipment facility. The project will cost Tk. 50,000. The facility has a life expectancy of 5 years and no salvage value. The company's tax rate is 40 percent. The firm uses straight line method of depreciation. The estimated gross cash inflow from the proposed investment proposal are as follows :

Year	Gross Cash Inflow (Tk.)
1	10,000
2	15,000
3	14,000
4	15,000
5	20,000

You are required to compute the following :

(A) Pay back period

(B) Average rate of return

(C) Net present value at 10 percent discount rate

(D) Internal rate of return

(E) Profitability index at 10 percent discount rate

Solution

To solve the problem, let us first calculate the Net Cash Benefit (NCB) as under :

Year	Gross cash inflow	Depreciation*	Net profit before tax	Tax (40%)	Net profit after tax	Net cash benefit (NCB)
1	2	3	4 = (2–3)	5	6 = (4—5)	7 = (3+6)
	Tk.	Tk.	Tk.	Tk.	Tk.	
1	10,000	10,000	0		0	10,000
2	15,000	10,000	5,000	2,000	3,000	13,000
3	14,000	10,000	4,000	1,600	2,400	12,400
4	15,000	10,000	5,000	2,000	3,000	13,000
5	20,000	10,000	10,000	4,000	6,000	16,000
Total					14,400	64,400

Note :

*(a) = Depreciation Per year $= \frac{\text{Cost of the equipment — Salvage Value}}{\text{Expected life of the project}}$

$= \frac{\text{Tk. } 50,000 - 0}{5 \text{ year}} = \text{Tk. } 10,000$

(A) Payback Period :

To determine the number of years required to recover the initial investment the folloing table can be presented :

Year	NCB Tk.	Cumulated (NCB) (Tk.)
1	10,000	10,000
2	13,000	23,000
3	12,400	35,400
4	13,000	48,400
5	16,000	64,400

From the table we can see that to recover initial capital of Tk. 50,000 it, will take more than 4 years, but less than 5 years.

$$\text{Payback period} = A + \frac{NCO - C}{D} = 4 \text{ years} + \frac{50,000 - 48,400}{16,000}$$

$$= 4 \text{ years} + \frac{1,600}{16,000} = 4 \text{ years} + \cdot 10 \text{ year} = \mathbf{4 \cdot 10 \text{ years}}$$

(B) Average Rate of Return :

$$ARR = \frac{\text{Average Annual net Income}}{\text{Average Investment}} \times 100$$

$$= \frac{\text{Tk. } 14{,}400 \div 5 \text{ years}}{\text{Tk. } (50{,}000 + 0) \div 2} \times 100 = \frac{2{,}880}{25{,}000} \times 100 = \mathbf{11.52\%}$$

(C) Net present value at 10% discount rate (NPV) :

$$NPV = \left[\frac{10{,}000}{1.10} + \frac{13{,}000}{(1.10)^2} + \frac{12400}{(1.10)^3} + \frac{13000}{(1.10)^4} + \frac{16{,}000}{(1.10)^5}\right] - 50{,}000$$

$$= \left[\frac{10{,}000}{1.10} + \frac{13{,}000}{1.21} + \frac{12400}{1.331} + \frac{13000}{1.4641} + \frac{16{,}000}{1.61051}\right] - 50{,}000$$

$$= [\ 9{,}091 + 10{,}744 + 9{,}316 + 8{,}879 + 9{,}935\ ] - 50{,}000$$

$$= 47965 - 50{,}000 = \text{Tk. } \mathbf{(2{,}035)} \text{ Negative}$$

(D) Internal Rate of Return (IRR) :

Since the NPV at 10% discount rate is negative we should take a lower dicounting rate. Let us assume 8% discount rate :

$$NPV = \left[\frac{10{,}000}{1.08} + \frac{13{,}000}{(1.08)^2} + \frac{12{,}400}{(1.08)^3} + \frac{13{,}000}{(1.08)^4} + \frac{16{,}000}{(1.08)^5}\right] - 50{,}000$$

$$= \left[\frac{10{,}000}{1.08} + \frac{13{,}000}{1.1664} + \frac{12{,}400}{1.2597} + \frac{13000}{1.3605} + \frac{16{,}000}{1.4693}\right] - 50{,}000$$

$$= [\ 9{,}259 + 11{,}145 + 9{,}844 + 9{,}555 + 10{,}890\ ] - 50{,}000$$

$$= 50{,}693 - 50{,}000 = \text{Tk. } 693 \text{ (Positive)}$$

$$IRR = .08 + \frac{693}{50{,}693 - 47{,}965} \times (.10 - .08)$$

$$= .08 + \frac{693}{2728} \times .02 = .08 + .0005 = .0850 \text{ or, } \mathbf{8.5\%}$$

(E) Profitability Index (at) 10% Discounting rate :

$$PI = \frac{\text{Present value of all Net Cash Benefits}}{\text{Present value of Initial Investment}} = \frac{\text{Tk. } 47965}{.50{,}000} = \mathbf{.9593} \text{ which is less than 1.}$$

Problem 2

Turners Ltd is considering the purchase of a new machine which is expected to save labour cost on an existing project. The estimated data for the two machines available in the market are as follows :

= {17·85714 + 23·91582 + 21·35343 + 15·88815 + 11·3486} – 100
= Tk. (90·36269) – 100
= Tk. (9·63,731) lakh = **Tk. 9,63,731** (Negative)

Decision : Since the Net present value is negative, the etc project should not be accepted.

Problem 8

Panna company is thinking of investing in a new project. A machine costing Tk. 50,000 has to be procured to implement this project. The estimated life of the machine would be 5 years having no salvage value. The tax rate of the company is 55% and does not get any investment allowance. The companys cash flow before tax (CFBT) would be as follows :

At the year end	CFBT (Tk)
1st	10,000
2nd	11,000
3rd	14,000
4th	15,000
5th	25,000

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Required :

(i) Payback Period.
(2) Average Rate of Return.
(3) Net persent value at 10% discount rate.
(4) Internal Rate of Return

Solution Calculation of Cash Flow after Tax (CFAT)

Year	1	2	3	4	5
Cash Flow before Tax (CFBT)	10,000	11,000	14,000	15,000	25,000
Less : Depreciation*	10,000	10,000	10,000	10,000	10,000
Profit before tax	0	1,000	4,000	5,000	15,000
Less : Tax (55%)	0	550	2,200	2,750	8,250
Profit after tax.	0	450	1,800	2,250	6,750
Add : Depreciation	10,000	10,000	10,000	10,000	10,000
Cash flow after Tax (CFAT)	10,000	10,450	11,800	12,250	16,750

*Depreciation Per Year = Tk. 50,000 ÷ 5 years = 10,000

(1) Payback Period :

Cumulative cash flow after tax. (CCFAT)

Year	CFAT	CCFAT
1	10,000	10,000
2	10,450	20,450
3	11,800	32,250
4	12,250	44,500
5	16,750	61,250

Payback Period : 3 years - $\frac{50,000-44,500}{16,750}=4+\frac{5500}{16,750}=4.33$ years

(2) Average Rate of Return (ARR) = $\frac{\text{Average Annual Net Profit}}{\text{Average Capital}}$

$$=\frac{(0+450+1800+2250+6750)\div 5 \text{ years}}{(50000+0)\div 2}\times 100$$

$$=\frac{11250\div 5 \text{ years}}{2500}\times 100 = \frac{2250}{25000}\times 100 = 9\%$$

(3) $$NPV=\left[\frac{A_1}{(1+R)}+\frac{A_2}{(1+R)^2}+\frac{A_3}{(1+R)^3}+\frac{A_4}{(1+R)^4}+\frac{A_5}{(1+R)^5}\right]-C$$

$$=\left[\frac{10,000}{1.10}+\frac{10,450}{(1.10)^2}+\frac{11,800}{(1.10)^3}+\frac{12,250}{(1.10)^4}+\frac{16,750}{(1.10)^5}\right]-50,000$$

$$=[9,091+8,636+8,866+8,367+10,400]-50,000$$

$$=45,360-50,000=(4640)\text{ Negative}$$

Profitability Index (PI) = $\frac{\text{Pv of all cash flows after tax}}{\text{Net Cash outlay}}=\frac{45,360}{50,000}=.9072$

(4) Internal Rate of Return (IRR)

Since the NPV at 10% discounting rate is negative, let us take a lower discounting rate (6%)

$$NPv=\left[\frac{10,000}{1.06}+\frac{10,450}{(1.06)^2}+\frac{11,800}{(1.06)^3}+\frac{12,250}{(1.06)^4}+\frac{16,750}{(1.06)^5}\right]-50,000$$

$$=\left[9434+\frac{10,450}{1.1236}+\frac{11,800}{1.191}+\frac{12,250}{1.2625}+\frac{16,750}{1.3382}\right]-50,000$$

$$= \left[9434 + 9300 + 9908 + 9703 + 12,517\right] - 50,000$$

$$= 50,862 - 50,000 = \text{Tk. } 862$$

$$IRR = A + \frac{C}{D}(B - A) = .06 + \frac{862}{50,86 - 245,360}(.10 - .06)$$

$$= .06 + \frac{862}{5502} \times .04 = 0.6 + .0063 = .0663 \text{ or } 6.63\%$$

Problem 9 Your company is considering investing in a project of which capital outlay is Tk. 200,000. Depreciation should be charged at 20 percent per annum, corporate tax rate is 25 percent. Estimated cash flows before depreciation are given below :

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

You are required to calculate -

(A) Payback period

(B) Rate of return on original investment

(C) Net present value (NPV) assuming 15 percent discounting rate.

(D) Internal rate of return (IRR) D.U.M.Com. Accounting 1996

Solution

Calculation of Net Cash Inflow (Net Cash Benefit NCB)

1	2	3	4 = (2-3)	5	6 = (4-5)	7 = (6+2)	8
Year	Cash flow before Depreciation	Depreciation	Cash flow tax before	Tax (25%)	Net profit After tax	Net Cash Benefit (NCB)	Cumulative NCB
1	1,00,000	40,000	60,000	15,000	45,000	85,000	85,000
2	1,00,000	40,000	60,000	15,000	45,000	85,000	170,000
3	80,000	40,000	40,000	10,000	30,000	70,000	240,000
4	80,000	40,000	40,000	10,000	30,000	70,000	310,000
5	40,000	40,000	0	0	0	40,000	350,000
Average Annual Net Profit after tax					30,000		

(i) Depreciation per year = Tk. 200,000 x .20 = **Tk. 40,000**

(A) Payback Period : $A + \frac{NCO - C}{D}$

Where ;

NCO = Net cash outflow :

A = The year in which the cumulative net cash flow is nearer to NCO = 2nd year.

C = Cumulative Net cash flow of year A = Tk. 170,000

D = Net cash flow of the year following the year A = Tk. 70,000

Payback period = $2+\frac{200,000-170,000}{70,000} = 2+\frac{30,000}{70,000} =$ **2.43 years**

(B) Rate of Return on Original investment (Average Rate of Return)

$$(ARR) = \frac{\text{Average annual net profit after tax}}{\text{Original investment}} \times 100 = \frac{30,000}{2,00,000} \times 100 = 15\%$$

(C) $NPV = \left[\frac{A_1}{1+R}+\frac{A_2}{(1+R)^2}+\frac{A_3}{(1+R)^3}+\frac{A_4}{(1+R)^4}+\frac{A_5}{(1+R)^5}\right] - NCO$

$$= \left[\frac{85,000}{1.15}+\frac{85,000}{(1.15)^2}+\frac{70,000}{(1.15)^3}+\frac{70,000}{(1.15)^4}+\frac{40,000}{(1.15)^5}\right] - 200,000$$

$$= \left[\frac{85,000}{1.15}+\frac{85,000}{1.3225}+\frac{70,000}{1.5209}+\frac{70,000}{1.749}+\frac{40,000}{2.0114}\right] - 200,000$$

$$= [73913+64272+46025+40,023+19887] - 200,000$$

$$= 244,120 - 200,000 = \textbf{Tk. 44,120} \text{ (Positive)}$$

(D) Internal Rate of Return : (IRR) : Since the NPV at 15 percent discounting rate is positive, let us take higher (30 percent) discounting rate :

Therefore,

$$PV = \frac{85,000}{1.30}+\frac{85,000}{(1.30)^2}+\frac{70,000}{(1.30)^3}+\frac{70,000}{(1.30)^4}+\frac{40,000}{(1.30)^5}$$

$$= \frac{85,000}{1.30}+\frac{85,000}{1.69}+\frac{70,000}{2.197}+\frac{70,000}{2.8561}+\frac{40,000}{3.7129}$$

$$= 65,385 + 50,296 + 31,861 + 24,509 + 10,773 = 1,82,824$$

$$IRR = A + \frac{C}{D}(B - A)$$

$$= .15 + \frac{44,120}{2,44,120 - 1,82,824} \times (.30 - .15) = .15 + \frac{44120}{61,296} = .15 + .108 = .258 \text{ বা } 25.8\%$$